PingFederate®

Version 8.0

Administrator’s Manual

Ping Identity®

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Preface

About This Manual

This manual provides information about using Ping Identity's PingFederate to deploy a secure single sign-on (SSO) solution based on the latest security and e-business standards.

Overview

The manual consists of:

- *Key Concepts* on page 12 — A discussion of central concepts needed to understand SSO, the WS-Trust Security Token Service (STS), and PingFederate deployment and administration.
- *System Administration* on page 43 — Information about maintaining the PingFederate server and deployment, using log files, managing users, and handling other administrative functions.
- *System Settings* on page 85 — How to configure your local PingFederate server settings.
- *IdP-to-SP Bridging* on page 115 — Configure advanced federation use cases, such as Adapter-to-Adapter Mappings (for Browser SSO), Token Exchange Mappings (for STS), and Connection Mapping Contracts (for Federation Hub).
- *OAuth Configuration* on page 127 — How to configure PingFederate to act as an OAuth Authorization Server.
- *Security Management* on page 161 — Information about importing, exporting, and maintaining certificates and keys in PingFederate.
- *Identity Provider SSO Configuration* on page 178 — How to configure PingFederate to act as an Identity Provider (IdP) and establish connections to Service Providers.
- *Service Provider SSO Configuration* on page 254 — How to configure PingFederate to act as a Service Provider (SP) and establish connections to Identity Providers.
- *WS-Trust STS Configuration* on page 324 — How to configure PingFederate to act as a Security Token Service for Web Service Clients and Providers in either an IdP or SP environment.
- *OpenToken Adapter Configuration* on page 364 — How to configure PingFederate to use the packaged OpenToken Adapter for interfacing with your Web applications.
- *HTTP Basic Adapter Configuration* on page 370 — How to configure PingFederate to use the packaged HTTP Basic Adapter.
- *HTML Form Adapter Configuration* on page 372 — How to configure PingFederate to use the packaged HTML Form Adapter.
- *Kerberos Adapter Configuration* on page 377 — How to configure PingFederate to use the packaged Kerberos Adapter.
- *Composite Adapter Configuration* on page 382 — How to configure PingFederate to use the packaged Composite Adapter.
- *Application Endpoints* on page 385 — Detailed information about using PingFederate connection endpoints for Web single sign-on and single logout.
- *OAuth 2.0 Endpoints* on page 398 — Detailed information about using PingFederate connection endpoints for the OAuth Authorization Server.
- *Web Service Interfaces* on page 408 — Information administrators and developers can use to automate connection-configuration management, runtime SSO partner discovery, and OAuth client configurations.
- *Using Attribute Mapping Expressions* on page 428 — How to enable and use expressions in conjunction with mapping attributes.
- *Troubleshooting* on page 439 — Solutions for difficulties that may be encountered.
- *Glossary* on page 441 — Definitions of terms used in the manual and in identity federation parlance.
- *List of Acronyms* on page 453

Intended Audience

This manual is intended for security and network administrators and other IT professionals responsible for identity management among business entities, both internal and external.

Note: The information in this manual is presented from the viewpoint of an administrative user with full permissions (see *Account Management* on page 62).

Text Conventions

This document uses the text conventions identified below.

Table 1: Text Conventions

Convention	Description
Fixed Width	Indicates text that must be typed exactly as shown in the instructions. Also used to represent program code, file names, and directory paths.
Blue text	Indicates hypertext links.
Italic	Used for emphasis and document titles.
u [text]	Used for procedures where only one step is required.
Sans serif	Identifies descriptive text on a user-interface screen. Example: “Print Document dialog”
Sans serif bold	Identifies menu items, navigational links, or buttons. For example: Click **Save**.

Other Documentation

The documents listed below are available under Product Documentation at *pingidentity.com*.

Tip: PingFederate provides context-sensitive Help. Click Help in the upper right portion of the administrative console for immediate, relevant guidance and links to related information.

Getting Started – Provides an introduction to secure Internet SSO and PingFederate, including background information about federated identity management and standards, product installation instructions, and a primer on using the PingFederate administrative console.

Integration Overview – A high-level description of options available for integrating identity-management systems and applications with PingFederate.

Server Clustering Guide – Describes how to deploy PingFederate in a cluster to increase throughput and availability.

SDK Developer’s Guide – Provides technical guidance for using the Java Software Developer Kit for PingFederate.

Quick-Start Guide – Provides instructions for deploying a preconfigured PingFederate server to run with demonstration Web applications. Newcomers to PingFederate may wish to follow this Guide as a first step to establishing a simple SSO identity federation between two Web applications and to become familiar with PingFederate. The Guide is contained in a separate quick-start package available for download on the Ping Identity *Web site*.

Web Resources – Ping Identity continually updates its *Resource Center* with general and technical information in the form of white papers, demonstrations, webinars, and other resources.

Note: If you encounter any difficulties with configuration or deployment, please look for help at the *Ping Identity Support Center*.

PingFederate documents may include hypertext links to third-party Web sites that provide installation instructions, file downloads, and reference documentation. These links were tested prior to publication, but they may not remain current throughout the life of these documents. Please contact *Ping Identity Support* if you encounter a problem.

Chapter

1

Key Concepts

This chapter provides background information and preparation to help administrators understand and use PingFederate.

ⓘ **Tip:** For an introduction to secure single sign-on (SSO), federated identity management, and Ping Federate product features, see *About Identity Federation and SSO* in *Getting Started*.

Connection Types

PingFederate features an integrated administrative console for configuring four kinds of connections to identity-federation partners:

- Browser-based SSO – Also called Browser SSO in the administrative console, this term is often used to refer to standards-based secure SSO, which generally depends on a user's browser to transport identity assertions and other messaging between partner endpoints (see *Supported Standards* in *Getting Started*).
- WS-Trust STS – Employs the PingFederate Security Token Service (STS), which enables Web Service Client and Provider applications to extend SSO to identity-enabled Web Services at provider sites, using another set of standards (see the next section, *About WS-Trust STS* on page 13). These standards, including WS-Trust, do not rely on the user's browser for message transport.
- OAuth SAML Grant – Exchanges a SAML assertion for an OAuth access token with the PingFederate Authorization Server (AS) (see *About OAuth* on page 15).
- Provisioning – Provides automated cross-domain inbound and outbound user management (see *User Provisioning* on page 33).

The types of connections can be configured together for the same partner or independently.

About WS-Trust STS

The PingFederate WS-Trust STS allows organizations to extend SSO identity management to Web Services. (For information about WS-Trust and the role of an STS, see *Web Services Standards* in the “Supported Standards” chapter of *Getting Started*.)

The WS-Trust STS can be configured for partner connections independently or in conjunction with browser-based SSO for either an IdP or an SP deployment. The STS is bundled with separate plug-ins for standard SAML (Security Assertion Markup Language) token processing and generation (see *Token Processors and Generators* on page 13).

Connection-Based Policy

For both the IdP and SP roles, PingFederate employs a partner-connection configuration, which enables the association of Web Services authentication policies with federation partners. For STS processing, these policies define configurations for handling WS-Trust requests and transferring identity information between security domains (see *Web Services Standards* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide).

IdP Configuration

In an IdP role, you use the administrative console to configure WS-Trust request-processing policy for your SP partner including:

- The type of SAML token to create—suitable for consumption by the intended Web Service Provider (WSP, at the SP site)—in response to an “Issue” request from a Web Service Client (WSC) application.
- The mapping of attributes to include within the issued SAML token.
- The key used to create a digital signature for the issued SAML token.

SP Configuration

In an SP role, you use the administrative console to configure WS-Trust request-processing policy for your IdP partner including:

- Whether to validate the incoming SAML token only, or to validate the incoming token and also issue a local token.
- The mapping of attributes to include in the locally issued token (when applicable).
- The certificate used to verify the digital signature for the incoming SAML token .
- The key used to decrypt the incoming SAML token (when needed).

Token Processors and Generators

PingFederate provides support for a variety of security-token formats, through token processors and generators that plug into the PingFederate server. These plug-ins deploy similarly to browser-based SSO *adapter*s (see *SSO Integration Kits and Adapters* on page 19).

For an IdP, token processors provide a mechanism through which PingFederate can validate an incoming token from a WSC and map attributes to be included in the issued SAML token.

For an SP, token generators provide a mechanism through which PingFederate can generate a local token based upon the incoming SAML token from a WSP and map attributes to be included in that token.

Only SAML 1.1 or 2.0 tokens are generated by PingFederate configured as an IdP for sending across trust boundaries to a federated SP partner. Likewise, only SAML tokens are accepted by PingFederate configured as an SP. Token plug-ins allow a modular approach for validating and producing the various token types used by different applications or systems within a conceptual trust domain. PingFederate provides bundled and separately available token plug-ins.

Tip: For direct STS token exchange within the same domain or trust boundary, you can also use the PingFederate STS to exchange one token type for another directly, without generating a transitional SAML token (see *Token Exchange Mapping* on page 120).

PingFederate also allows you to use a configuration of a token processor or generator as a parent instance from which you can create child instances (see *Hierarchical Plug-in Configurations* on page 21).

Bundled Token Plug-ins

PingFederate is installed with token processors for an IdP configuration that accept and validate SAML 1.1, 2.0 tokens, OAuth Bearer access tokens, JWT tokens, and Username tokens (see *Token Models and Management* on page 16). (SAML tokens are issued on the IdP side via built-in browser-based SSO capabilities.)

For an SP configuration, token generators are provided for issuing local SAML 1.1 or 2.0 tokens. (Incoming SAML tokens are validated, once again, by using built-in capabilities.)

Commercial Token Plug-ins

Ping Identity provides token plug-ins to work with various authentication systems and leading identity management systems. Available plug-ins, together known as *Token Translators*, may be *downloaded* from the Ping Identity Web site (`www.pingidentity.com/en/products/downloads.html`).

WSC and WSP Support

Ping Identity provides the Java client Software Development Kit (SDK) for enabling Web Service applications (WS clients or providers) to interact with the PingFederate STS.

In addition, for WSC STS clients PingFederate provides built-in protocol support for Windows Identity Foundation (WIF) applications based on the Windows Communication Foundation (WCF) framework.

Note: The WIF framework includes WS-* protocol support and can interact natively with PingFederate.

Client SDK

The STS Java client SDK provides interfaces that create the WS-Trust Request Security Token (RST) and Request Security Token Response (RSTR) messaging to interact with the PingFederate STS endpoints. Using the SDK library, applications are not responsible for forming these WS-Trust protocol messages, and instead interact only with the tokens themselves.

The SDK is available for download at the *Ping Identity Web site* (`www.pingidentity.com/en/products/downloads.html`).

Windows Identity Foundation Clients

PingFederate natively supports STS clients using *claims*-based WIF technology. Claims-based federated identity for Web Services is a part of the WS-Trust standard that permits client applications to make access-policy decisions, when specifically categorized user attributes are sent in the security token (see *STS Namespaces* on page 24).

The PingFederate STS supports the following bindings in the .NET federated-security scenarios with WS-Trust:

- `WSFederationHttpBinding`
- `WS2007FederationHttpBinding`

Additionally, the PingFederate STS supports the following bindings for RST and RSTR interactions with .NET. (Support for these bindings is limited to the Username, x509, SAML 1.1, and SAML 2.0 token types.)

- `WSHttpBinding`
- `WS2007HttpBinding`

Note: For token types such as Kerberos, where customizing default bindings may be necessary, the PingFederate STS supports the use of customBinding.

For more information about bindings, see Microsoft's *System-Provided Bindings* (`msdn.microsoft.com/en-us/library/ms730879.aspx`).

Developers can obtain metadata from PingFederate to expedite configuring their applications. PingFederate offers two varieties of metadata, which are often used together to arrive at functional WSC and WSP configurations:

- Federation Metadata, which contains details on the PingFederate public signing certificate and other information required to establish the trust relationship (see */pf/federation_metadata.ping* on page 396).
- Metadata Exchange, which contains connection details relating to the SP partner (see */pf/sts_mex.ping* on page 396).

For more information about claim-based federated identity, see Microsoft's *A Guide to Claims–based Identity and Access Control* (`msdn.microsoft.com/en-us/library/ff423674.aspx`).

STS OAuth Integration

PingFederate STS provides several ways to facilitate the use of issued tokens with an OAuth Authorization Server (AS) (see the next section, *About OAuth* on page 15).

OAuth Token Processor

This token processor provides a mechanism through which PingFederate STS can validate an incoming OAuth Bearer access token. The token processor reads and validates the access token and returns any additional user attributes defined (see *Configuring an OAuth Token Processor Instance* on page 329 and *Defining the Access Token Attribute Contract* on page 136).

SAML 2.0 Bearer Assertion Grant Type

```
urn:ietf:params:oauth:grant-type:saml2-bearer
```

This token request returns an encoded SAML assertion that a WSC can use to request OAuth access tokens from any OAuth AS that supports the *SAML 2.0 Profile for OAuth 2.0 Client Authentication and Authorization* specification (*`http://tools.ietf.org/html/draft-ietf-oauth-saml2-bearer`*). This capability provides a bridge between the WS-Trust client-STS relationship and the trust relationship the same client may have with an OAuth AS, allowing the client to obtain additional resources on behalf of already-authenticated users in follow-on transactions.

OAuth Access Token via SAML 2.0 Bearer Assertion

```
(oauth-v2:access:token:response|via|urn:ietf:params:oauth:grant-type:saml2-
bearer)
```

This proprietary token request is similar to the one above but returns an OAuth access token directly. Acting as an IdP, PingFederate generates the intermediate, encoded SAML assertion and requests an access token from the OAuth AS on behalf of the WSC. (The AS endpoint is obtained from the element <`AppliesTo`> of the WS-Trust RST message.)

About OAuth

PingFederate can be configured to act as an OAuth Authorization Server (OAuth AS), allowing a resource owner (typically, an end user) to grant authorization to an *OAuth Client* requesting access to resources hosted by a *Resource Server* (RS). (For information about OAuth and the role of an AS, see *OAuth 2.0* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide) The OAuth AS issues tokens to clients on behalf of a resource owner for use in authenticating a subsequent API call to the RS—typically, but not exclusively, a Representational State Transfer (REST) API call.

Note: OAuth AS capabilities are available under special licensing. If your license does not include the OAuth AS, please contact *sales@pingidentity.com*.

The PingFederate OAuth AS can be configured independently or in conjunction with STS or browser-based SSO for either an IdP or an SP deployment. In an SP deployment, the inbound SAML assertion can be used to provide authentication information about the user that can be associated with the access token (see *Configuring OAuth Attribute Mapping* on page 287). In an IdP deployment, an IdP adapter can be used to authenticate and provide user information for the access token. See *OAuth Configuration* on page 127 for more information.

For an STS IdP, an OAuth token processor is provided with the PingFederate installation (see *IdP Configuration for STS* on page 327).

Delegated Access Types

Explicit Delegation – This is the most common OAuth use case, which involves a resource owner who explicitly delegates to a client the authority to make API calls to a Resource Server and is asked to approve the transaction. This is the type of delegation inherent in Web Redirect transactions (see *Web Redirect Flow* in the "Supported Standards" chapter of *Getting Started*).

Implicit Delegation – Implicit delegation also generally involves a client who calls an API on behalf of a user; however, the client's authority is implied by the nature of the transaction, and the user is not specifically asked to approve the transaction.

Token Models and Management

Successful OAuth transactions require an OAuth AS to issue access tokens for use in authenticating an API call. These tokens may be characterized by both their security model and data model.

Token Security Model

A token security model refers to the conditions that must be met by a client in order to use a token on an API call. The currently supported model is a *Bearer Token*—a client's presentation of the token to the RS (for example, as a parameter on the API call) is interpreted as providing sufficient proof to the RS that the client received the same token from the OAuth AS.

Token Data Model

A token data model refers to whether the token carries identity and security information or acts as a pointer to the information.

Self-Contained Tokens – Contain identity and security information and attributes in a transport format such as JSON (JavaScript Object Notation), signed by the AS and verified directly by the RS.

Reference Tokens – Serve as a reference to some set of attributes. The RS must de-reference the token for the corresponding identity and security information at the OAuth AS that issued it.

Note: PingFederate supports different token models through a plug-in architecture (see *Access Token Management* on page 133).

Token Management

PingFederate supports multiple access token management instances, providing flexibility for enterprises where deployments may require different token lifetimes, attribute contracts, and/or token validation rules for various clients.

Grant Types

To obtain an *access token*, a client interacts with an OAuth AS, sending a request for an access token that includes an access grant. An access grant is also used when an RS requests validation of an access token from the OAuth AS.

Primary Grant Types

OAuth defines several different access grant types—each reflecting different authorization mechanisms.

Authorization Code – An authorization code is returned to the client through a browser redirect after the resource owner gives consent to the OAuth AS. The client subsequently exchanges the authorization code for an access (and often a refresh) token. Resource owner credentials are never exposed to the client.

Implicit – An access token is returned to the client through a browser redirect in response to the resource owner authorization request (rather than an intermediate authorization code). This grant type is suitable for clients incapable of keeping client credentials confidential (for use in authenticating with the OAuth AS) such as client applications implemented in a browser using a scripting language like Javascript.

Resource Owner Credentials – The client collects the resource owner's password and exchanges it at the OAuth AS for an access token, and often a refresh token (see below). This grant type is suitable in cases where the RO has a trust relationship with the client, such as its computer operation system or a highly privileged application since the client must discard the password after using it to obtain the access token.

Refresh Token – A refresh token is often returned with an access token. Once the original access token expires, the corresponding refresh token can be sent to the OAuth AS to obtain a fresh access token without requiring the resource owner to re-authenticate. This allows short-lived tokens to exist between the client and the Resource Server, and long-lived tokens between the client and the AS.

Client Credentials – The client presents its own credentials to the OAuth AS in order to obtain an access token. This access token is either associated with the client's own resources, and not a particular resource owner, or is associated with a resource owner for whom the client is otherwise authorized to act.

Extension Grant Types

OAuth provides an extension mechanism for defining new extension grant types to support additional clients or to provide a bridge between OAuth and other trust frameworks. An OAuth client uses an extension grant type by specifying an absolute URI as the value of the `grant_type` parameter and by adding any additional parameters necessary (see *Token Endpoint* on page 398).

PingFederate supports the following extension grant types:

SAML 2.0 Bearer – The client obtains a SAML 2.0 Bearer Assertion and uses it to request an access token from the OAuth AS. This grant type allows a client to use an existing trust relationship, expressed through a SAML assertion, without a direct user approval step at the AS.

Note: The SAML assertion used for this grant type generally cannot be a browser-based SSO assertion. To ensure its validity, the assertion must be associated with WS-Trust STS processing (see *STS OAuth Integration* on page 15).

Validation Grant Type – This proprietary PingFederate OAuth extension enables an RS to act as a client in the request/response exchange with the OAuth AS. The grant type allows an RS to check with the OAuth AS on the validity of a bearer access token received from a client making a protected-resources call.

Persistent vs. Transient Grants

Several grant types are usually regarded as persistent, valid until they are explicitly revoked. Persistent grants can result from:

- The Refresh Token grant type when used in conjunction with either the Authorization Code or Resource Owner Password Credentials grants (see *Configuring a Client* on page 141).
- The Implicit grant type when the Reuse Existing Persistent Access Grants for Grant Types checkbox is selected (see *Authorization Server Settings* on page 130).

Transient grants are valid only for the lifetime of the access token itself. Client Credential access grants, for example, are considered transient.

Support for persistent grants requires PingFederate to use a database for long-term storage. The database contains a table defining a `USER_KEY`, which can be populated according to information mapped using attributes obtained during a user's initial authentication verification within PingFederate (see *Mapping OAuth Attributes* on page 18).

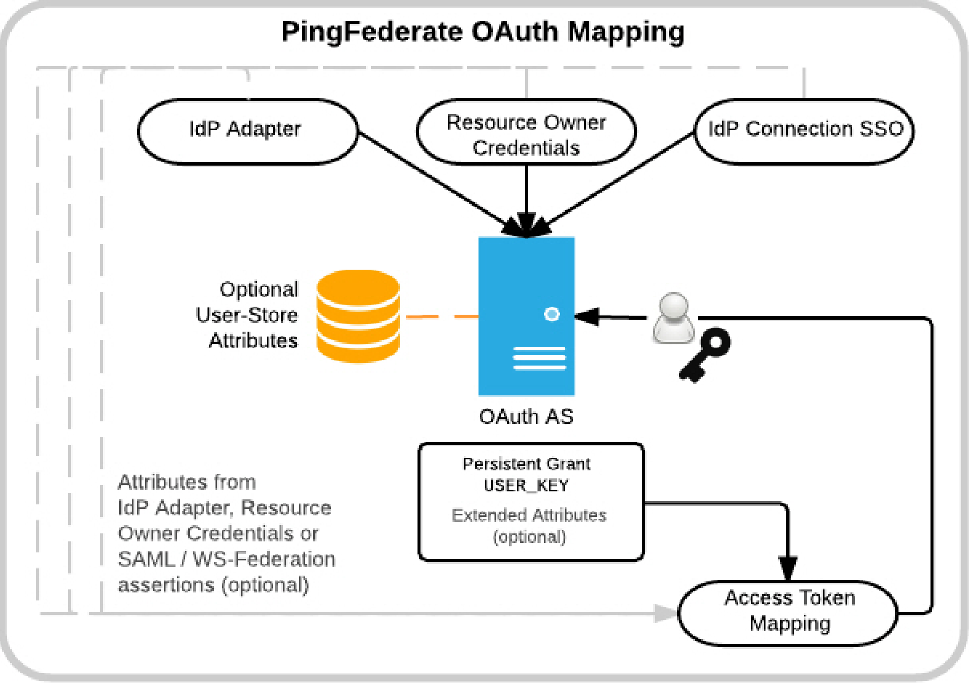
PingFederate automatically removes expired grants once a day. To fine-tune the frequency and the number of expired grants to be removed, see *Managing Expired Persistent Grants* on page 84.

Important: A pre-installed, default HyperSQL database is available for initial setup and testing. However, we strongly recommend that you choose your own, secured database for production deployments. See *Defining an OAuth Grant Data Store* on page 108 for more information.

Persistent grants also support Extended Attributes, where attributes obtained during a user's initial authentication can be used to map values into the access tokens (see *Authorization Server Settings* on page 130 and *Mapping OAuth Attributes* on page 18).

Mapping OAuth Attributes

For OAuth persistent grants, user attributes are mapped in the administrative console for a two-stage processing flow, as shown in the following illustration. (Note that this two-stage mapping work flow is different from other mapping scenarios in PingFederate, which involve just a one-phase configuration—see *About Attributes* on page 23).


PingFederate OAuth Mapping
IdP Adapter
Resource Owner Credentials
IdP Connection SSO
Optional User-Store Attributes
OAuth AS
Persistent Grant
USER_KEY
Extended Attributes (optional)
Attributes from IdP Adapter, Resource Owner Credentials or SAML / WS-Federation assertions (optional)
Access Token Mapping

The First Stage

To accomplish the first stage (top of diagram in solid lines), mapping is required for setting up persistent grants, including a user key and all extended attributes (see the previous section, *Persistent vs. Transient Grants* on page 17).

The mappings may use attributes obtained during initial authentication events within PingFederate—via SAML or WS-Federation assertions (for Service Providers' IdP connections for SSO), IdP adapters, and/or Resource Owner credentials (see *Using OAuth Menu Selections* on page 127). Data-store lookup is provided as needed (for example, to retrieve an LDAP ID for storage as the user key).

Note: The `USER_KEY` values must be unique across all end users because it is the identifier to store and to retrieve persistent grants. For example, if you have two Active Directory domains, the sAMAccountName value of an end user in one domain may collide with that of another end user in the other domain. In this scenario, you can map Subject DN to the `USER_KEY`.

The Second Stage

The second mapping configuration involves mapping from persistent grants (the user keys and/or any extended attributes derived from the first stage) into OAuth access tokens.

If the authentication context matches a specific mapping, then attributes from the IdP adapter, resource owner credentials or IdP connection (the inbound assertions for Service Providers) can also be used to map into OAuth access tokens (see *Access Token Mapping* on page 150).

Data stores may also be used here to retrieve any required user attributes.

Runtime Processing

At runtime, the first time a client requests an OAuth token the two mapping sequences are employed sequentially. The second mapping is invoked every time a new access token is requested based on an existing persistent grant.

Scopes

Where OAuth provides a mechanism to constrain the privileges associated with an access token, *scope*s provide a way to more specifically define the privileges requested and granted.

Generally, a client specifies the scopes desired when asking for authorization. The issued access token is associated with these approved scopes. Scopes are configured globally (see *Authorization Server Settings* on page 130) but may be restricted on a client-by-client basis (see *Client Management* on page 141).

OAuth User-Facing Screens

The PingFederate OAuth AS provides two screens presented to end users (resource owners) during OAuth transactions, one requesting approval of the scope of protected resources requested and one providing a means of revoking persistent access grants.

Tip: These screens can be customized and branded as needed (see *Customizing User-Facing Screens* on page 76).

OpenID Connect

As an extension of OAuth capabilities, PingFederate supports an optional configuration for OpenID Connect, an emerging protocol for secure, lightweight transfer of authentication and user attributes (see *openid.net/connect*).

PingFederate supports both the OpenID Connect Basic and Implicit Profiles defined in the standard. In both of these profiles, the end result is the release of at least two tokens to the requesting client application: an *ID token* and an OAuth access token. (Depending on associated grant types, a refresh token may also be released.)

The ID token is an integrity-secured, self-contained token (in JSON Web Token format) containing claims about the user, namely the subject. A client uses the ID token to securely identify the user authenticated by an OpenID Connect Provider (OP) accessing the client application. A client may subsequently use the OAuth access token to retrieve additional claims about the user, such as a complete profile containing full name, email, phone and other schema elements defined in the OpenID Connect specifications (see *Configuring OpenID Connect Policies* on page 137).

A *UserInfo* endpoint needed for the client to receive additional attributes with the access token is available as a standard OAuth-protected endpoint (see *OpenID Connect Provider Metadata Endpoint* on page 407).

To configure policies, first enable the protocol in **Server Settings** (see *Choosing Roles and Protocols* on page 92). To make use of OpenID Connect defined scopes for accessing various degrees of user-associated claims, you must also configure them as allowed Scope Values in the OAuth AS (see *Authorization Server Settings* on page 130).

Furthermore, PingFederate provides a front-channel endpoint for OAuth Clients using the OpenID Connect protocol to close other associated sessions and a back-channel Web service for clients to revoke end-user sessions. For more information, see *Centralized Session Management* on page 128.

SSO Integration Kits and Adapters

As a stand-alone server, PingFederate must be programmatically integrated with end-user applications and identity management (IdM) systems to complete the “first- and last-mile” implementation of a federated identity network for browser-based SSO.

Note: See the PingFederate *SSO Integration Overview* for more information.

For an IdP (the first mile), this integration process involves providing a mechanism through which PingFederate can look up a user’s current authenticated session data (for example, a cookie) or authenticate a user without such a session. For an SP, the last mile involves enabling PingFederate to supply information needed by the target application to set a valid session cookie or other application-specific security context for the user.

To enable both sides of this integration, PingFederate provides bundled and commercial integration kits, which include *adapters* that plug into the PingFederate server and *agent toolkits* that interface with local IdM systems or applications, as needed.

In addition, for IdP and federation hub deployments PingFederate provides plug-in *authentication selectors*, which enable dynamic selection of authentication sources (IdP adapter instances, or IdP connections for federation hub use cases) based on administrator-specified criteria (see *Bundled Authentication Selectors* on page 20).

PingFederate also includes a robust software development kit (SDK), which software developers can use to write their own adapters for specific systems. Adapters can be written to retrieve attributes from custom data stores, connect to application- or IdM-specific user authentication systems, or provide complex attribute transformations or processing.

Bundled Adapters

PingFederate packages these adapters:

- An OpenToken Adapter, which provides a generic interface for integrating with various applications, including Java- and .NET-based applications (see *OpenToken Adapter Configuration* on page 364).
- An IdP Composite Adapter, which allows multiple configured adapters to execute in sequence for browser SSO. This capability, called *adapter chaining*, may be used either for single-adapter usage, depending on authentication context, or to support multi-factor authentication via a series of adapters.
- HTTP Basic and HTML Form IdP Adapters, which are used in conjunction with Password Credential Validators (see *Validating Password Credentials* on page 170). These adapters provide integration, for example, with LDAP user-data stores such as Active Directory or direct user logon via credentials maintained by PingFederate (see *Configuring the HTTP Basic IdP Adapter* on page 370 and *Configuring the HTML Form IdP Adapter* on page 372).
- A Kerberos Adapter, which provides a seamless desktop SSO experience for Windows environments. This adapter is recommended for new configurations as a simpler alternative to the IWA Integration Kit (see *Kerberos Adapter Configuration* on page 377).

Bundled Authentication Selectors

For IdP and federation hub deployments, PingFederate also includes global (cross-connection) authentication selectors. Along with the Composite Adapter (see the previous section) and *token authorization*, the selectors enable dynamic integration with an organization's authentication or authorization policies (also known as *adaptive federation*).

Tip: The results of authentication-selection criteria evaluation may be used to select subsequent selectors, which allows handling of complex hierarchical access-policy decisions (see *Mapping Selector Results to Authentication Sources* on page 186).

CIDR Authentication Selector – Provides a means of choosing an authentication source at runtime based on whether an end-user's IP address falls within a specified range, or ranges (using Classless Inter-Domain Routing notation). This selector allows administrators to determine, for example, whether an SSO request originates inside or outside the corporate firewall and use different authentication integration accordingly (see *Configuring the CIDR Authentication Selector* on page 183).

Cluster Node Authentication Selector – Provides a means of choosing an authentication source at runtime based on the PingFederate cluster node that is servicing the request. For example, this selector allows you to choose whether or not Integrated Windows Authentication is attempted based on the PingFederate cluster node with which a Key Distribution Center is associated (see *Configuring the Cluster Node Authentication Selector* on page 183).

Connection Set Authentication Selector – Provides a means of selecting an authentication source at runtime based on a match found between the target SP connection used in an SSO request and SP connections configured within PingFederate. For example, administrators with different requirements for SP connections can override connection adapter selection on an individual connection basis (see *Configuring the Connection Set Authentication Selector* on page 184).

Note: Authentication selectors rely on HTTP Request/POST data—ensure that standard security measures are in place when using these selectors.

HTTP Header Authentication Selector – Provides a means of choosing an authentication source at runtime based on a match found (using wildcard expressions) in an HTTP header. This selector allows administrators to determine, for example, authentication behavior based on the type of browser (see *Configuring the HTTP Header Authentication Selector* on page 184).

HTTP Request Parameter Authentication Selector – Provides a means of choosing an authentication source at runtime based on query parameter values in the HTTP request (see *Configuring the HTTP Request Parameter Authentication Selector* on page 185).

OAuth Scope Authentication Selector – Provides a means of choosing an authentication source at runtime based on a match found between the scopes of an OAuth authorization request and scopes configured in the PingFederate OAuth Authorization Server (AS). For example, if a client requires write access to a resource, administrators can configure the selector to choose an adapter that offers a stronger form of authentication such as the X.509 client certificate rather than username and password (see *Configuring the OAuth Scope Authentication Selector* on page 185).

Requested AuthN Context Authentication Selector – Provides a means of picking an authentication source at runtime based on the *authentication context* requested by an SP, for SP-initiated SSO (see *Browser-based SSO* in the “Supported Standards” chapter of *Getting Started*). Configured authetication sources are mapped either to SAML-specified contexts or any ad-hoc context agreed upon between the IdP and SP partners (see *Configuring the HTTP Header Authentication Selector* on page 184).

Commercial Adapters and Selectors

Ping Identity regularly develops and maintains integration kits, including adapters, to work with applications and leading identity management systems. Available kits may be *downloaded* from the Ping Identity Web site (`www.pingidentity.com/en/products/downloads.html`). Additional authentication selectors may also be added to the download site periodically; contact your Ping Identity sales representative if you are looking for specific authentication-selection capabilities.

Software Development Kit

The PingFederate SDK provides a flexible means of creating custom adapters to integrate federated identity management into your system environment. See the PingFederate *SDK Developer's Guide*.

Hierarchical Plug-in Configurations

PingFederate allows you to use a configuration of an adapter (as well as certain other PingFederate plug-ins) as a *parent* instance from which you can create *child* instances. You can then modify the inherited configuration for the child instances as needed. This feature provides easier management of adapter settings in cases where only small changes to an existing adapter (or plug-in) configuration need to be made for a particular use case.

For example, different SP-connection adapter instances might have their own IdP logon URLs (for branding or other application ownership reasons) while the majority of the other adapter configuration settings are the same. In this case, you might want to use a parent/child configuration to override the logon URLs.

Tip: You can also override adapter instances as part of mapping them into either SP or IdP connections, for cases where overridden settings may apply only to one particular connection configuration.

Any changes to a parent configuration are propagated to its child (or connection-based) configurations provided the changes are not already overridden in the derived instance.

In addition to adapters, PingFederate allows you to create parent/child configurations for the following plug-in types:

- Token Translators (see *Token Processors and Generators* on page 13)
- Access Token Management instances (see *Access Token Management* on page 133)

- Password Credential Validators (see *Validating Password Credentials* on page 170)
- Identity Store Provisioners (see *Configuring Identity Store Provisioners* on page 259)

Identity Mapping

Identity mapping is at the core of identity federation. One of the primary goals of SAML is to provide a way for an identity provider (IdP) to send a secure token (the assertion) containing user-identity information that a service provider (SP) can translate, or map, to local user stores. (For more information about SAML, see *Supported Standards* in *Getting Started*.)

For browser-based SSO, PingFederate enables two modes of identity mapping between domains:

- *Account Linking* on page 22
- *Account Mapping* on page 22

For WS-Trust STS, account mapping is used.

Account Linking

Under the standards, *account linking* can be used for browser-based SSO in cases where each domain maintains separate accounts for the same user. Account linking uses the SAML assertion to create a persistent association between these distinct user accounts. The account link, or *name identifier*, may be either a unique attribute, such as an email address, or a *pseudonym* generated by the IdP to uniquely identify individual users. Pseudonyms can be used when privacy is a concern; they cannot easily be traced back to a user's identity at the partner site.

During the user’s first SSO request, the SP prompts for local credentials, which enables the SP to link the name identifier contained within the assertion—either an open attribute or a pseudonym—with the user’s local account. Subsequent SSO events will not prompt the user to authenticate with the SP, since the SP federation server keeps a table associating remote users’ name identifiers with local user accounts. The SP associates the link to the user’s corresponding local account and provides access to the account without separate authentication.

Tip: An SP PingFederate uses a default, HyperSQL database to handle account linking. You can use your own data store instead, as needed. For more information, see *Configuring an LDAP Connection* on page 102.

Optionally, additional attributes may be sent with the name identifier. When a pseudonym is used as the account link, however, care must be taken to send only general attributes (a user’s organizational role or department, for example) that will not compromise privacy.

Linking Permission and “Defederation”

The SAML specification also allows the SP application to build in user verification and approval of account linking and provides a means for the user to permanently cancel the linking, known as *defederation* (see */sp/defederate.ping* on page 391). A user who has defederated may later elect to reassociate with a local user account.

SP Affiliations

Under the SAML 2.0 specifications, an IdP can configure PingFederate to enable a group of SPs—an *SP affiliation*—to share the same persistent name identifier (see *Defining SP Affiliations* on page 249). This capability facilitates the use case in which a number of business partners have an existing relationship and sharing a single name identifier among all parties reduces the federation integration effort.

Account Mapping

Account mapping (also called “*attribute mapping*”) enables an SP to use PingFederate to perform a user lookup and map a user’s identity dynamically based on one or more attributes received in the assertion. The attributes used to look up the user are always “exposed”; that is, they are known to both the IdP and SP. An email address, for example, is a commonly used identifying attribute.

Account mapping can be used to achieve one-to-one mapping (individual user accounts exist on both sides of federated connection) or many-to-few (IdP users without accounts at destination sites may be mapped to guest accounts or to a role-based general account).

For browser-based SSO, *transient identifiers* provide an additional level of privacy—virtual anonymity—by generating a different opaque ID each time the user initiates SSO. Transient IDs are often used in conjunction with federation role mapping, whereby the user is mapped to a guest account or to a role-based account based on the user's association with the IdP organization rather than personal attributes.

As with pseudonyms, additional attributes may be sent with the transient identifier. Again, care should be taken to preserve privacy.

Account mapping is commonly implemented in B-to-B or B-to-E use cases where it might be appropriate for the administrator to create a user lookup on behalf of the user.

About Attributes

Federation transactions require, at a minimum, the transmission of a unique piece of information (such as an email address) that identifies the user for identity mapping between security domains.

In addition to attributes used for identity mapping, the IdP can pass other user attributes in an assertion (including SAML tokens for Web Services). This supplemental information can be used by the SP for several purposes. For example, attributes may be used to map and authorize the user into a specific role, with associated site permissions. In other cases, attributes may be used to customize the end application display for a more robust user experience.

The SP also has the option of incorporating additional attributes prior to creating a session for the target application. This is commonly done where the SP also maintains an account for the user and wants to pass additional information for profiling or access-policy purposes.

Attributes must be carefully managed between IdPs and SPs. PingFederate facilitates the process by providing configuration steps that enable administrators to:

- Define and enforce *attribute contract* on page 442 for each partner connection.
- Define and retrieve attributes from the *adapter* or STS token processor to populate an attribute contract directly or use these attributes to look up additional attributes in IdP data stores.
- Define and enforce a set of required attributes needed by SP adapters or STS token generators to interface local systems or applications (see *Adapter Contracts* on page 24).
- Set up connections to local data stores (see *Data Stores* on page 25).
- Configure specific attribute sources and lookups—based on the data stores—and map attributes into IdP assertions or into SP adapters or token generators used to interface target applications (see *SSO Integration Kits and Adapters* on page 19 or *Token Processors and Generators* on page 13).
- Selectively mask attribute values recorded in transaction logs (see *Attribute Masking* on page 26).

Attribute Contracts

An attribute contract represents an agreement between an SP and an IdP about user attributes sent in a SAML *assertion*, either for browser-based SSO or WS-Trust STS. The contract is a list of case-sensitive attribute names. IdPs and SPs must configure attribute contracts to match.

Tip: When privacy is required for sensitive attributes, you can configure PingFederate to mask their values in log files (see *Attribute Masking* on page 26).

For an IdP, the attribute contract defines which attributes PingFederate sends in an assertion. While this contract is fixed for all users authenticating to the SP partner, the values used to fulfill the contract may differ from one user to the next. The attribute contract may be fulfilled by relying on a combination of different data sources:

- The IdP *adapter* or *STS* token processor
- An IdP attribute source, which identifies the location of individual attributes in a data store
- Static text values for some attributes, or text values combined with variables

- Expressions (see *Using Attribute Mapping Expressions* on page 428)

For an SP, the attribute contract defines the attributes PingFederate expects in a SAML assertion. PingFederate can be configured to pass these attributes to the SP adapter or, for Web Services, to the SP token generator (see *Configuring SP Adapters* on page 254 or *Configuring Token Generators* on page 348). You can also use attributes to look up additional attributes in local data stores, which may be needed to start a user session or create a local security token for Web Services (see *Adapter Contracts* on page 24 below or *STS Token Contracts* on page 25).

The attribute contract must contain the attribute `SAML_SUBJECT`, the primary information used to identify the user, unless you are using *account linking* for browser-based SSO. This attribute is automatically included when creating a new contract.

Note: You create attribute contracts on a per-connection basis. For example, if an SP has deployed two session-creation adapters for two separate applications, a single attribute contract can be created for the IdP connection partner. This single contract would be constructed to supply all the attributes needed by both SP adapters.

Name Formats

By agreement with an SP partner, an IdP may specify a format (email, for example) associated with the `SAML_SUBJECT`. The SP may require this information to facilitate handling of the format.

The partner agreement may also include a requirement for the IdP to provide format specifications associated with other attributes.

For browser-based SSO connections, PingFederate provides a means for an IdP administrator to select from among standard subject and/or attribute formats, depending on the relevant SAML specifications. An administrator can also define a customized selection of additional attribute formats (see *Creating an Attribute Contract* on page 202).

Note: The designation of formats is not applicable to SP administrators. The information is simply available in the incoming assertion to an SP application that might need it for particular processing requirements.

For the WS-Trust IdP configuration, attribute-name formats cannot be specified. If needed, however, an administrator can use a special variable in the attribute contract to set the subject-name format (see *Defining an STS Attribute Contract* on page 333). (The same variable is also available for browser-based SSO attribute contracts, but the feature is deprecated.)

STS Namespaces

By agreement with an SP partner for a WS-Trust STS connection, an IdP may specify an XML namespace to be associated with an attribute (for example, to use claims-based authorization with WIF clients—see *Windows Identity Foundation Clients* on page 14). Namespaces can be specified only for attributes of a WS-Trust IdP configuration using SAML 1.1 as the default token type (see *Defining an STS Attribute Contract* on page 333).

Adapter Contracts

An adapter contract represents an agreement between the PingFederate server and an external application. In concert with the *attribute contract* between partners, adapter contracts specify the transfer of attributes. Adapter contracts consist of a list of case-sensitive attribute names.

On the IdP side of a federation, adapter attributes are supplied to PingFederate by an IdP adapter (see *SSO Integration Kits and Adapters* on page 19 and *Configuring IdP Adapters* on page 178).

On the SP side, adapter contract attributes are those required by an adapter to start a session with an application. At least one *adapter type* is needed for each security domain. Then an *adapter instance* must be configured for each target application. (See *Configuring SP Adapters* on page 254.)

Adapter contracts on the SP side are fulfilled using attributes from the attribute contract, possibly enhanced through other attributes looked up from local data stores. For example, if several target applications are controlled by the same security context and can receive the same set of attributes to start a session for the user, you would deploy an adapter type and configure an adapter instance for each protected application (see *Configuring Target Session Mapping* on page 275).

Extended Adapter Contract

Adapter contracts are created when an adapter type is deployed with PingFederate. When developed, these adapters are “hard-wired” to look up or set a specific set of attributes. After deployment, your attribute requirements may change. To streamline adjustment of adapter contracts, PingFederate allows an administrator to add additional attributes to the adapter instance through the administrative console. These adjustments are called *extended adapter contracts*.

STS Token Contracts

Similar to an adapter contract for browser-based SSO, an STS token-processor or token-generator contract represents an agreement between the PingFederate server and an external application in the context of a Web Services transaction. In concert with the *attribute contract* between partners, token contracts specify the transfer of attributes, consisting of a list of case-sensitive attribute names.

On the IdP side of a federation, token-processor attributes are supplied to PingFederate (see *Token Processors and Generators* on page 13 and *Configuring Token Processors* on page 327).

On the SP side, token-generator contract attributes are those required by a token generator to pass identity information from the token to the Web Service client application. At least one token generator type is needed for each security domain. Then a token generator instance must be configured for each target application (see *Configuring Token Generators* on page 348). If several target applications are controlled by the same security context and can receive the same set of attributes for the user, you would deploy a token generator type and configure a token generator instance for each target application (see *Mapping Token Generators* on page 351).

Extended Token Generator Contract

Token-generator contracts are created when a token-generator type is deployed with PingFederate. When developed, these token generators are “hard-wired” to look up or set a specific set of attributes. After deployment, your attribute requirements may change. To streamline adjustment of token-generator contracts, PingFederate allows an administrator to add additional attributes to the token-generator instance through the administrative console. These adjustments are called *extended token-generator contracts*.

Data Stores

PingFederate can be configured to use local data stores to supply attributes for either the IdP’s *attribute contract*, the SP’s *adapter contract*, or STS token contracts (see sections above). Standard data stores may include any JDBC-accessible database or an LDAP v3-compliant directory server (see *Managing Data Stores* on page 98).

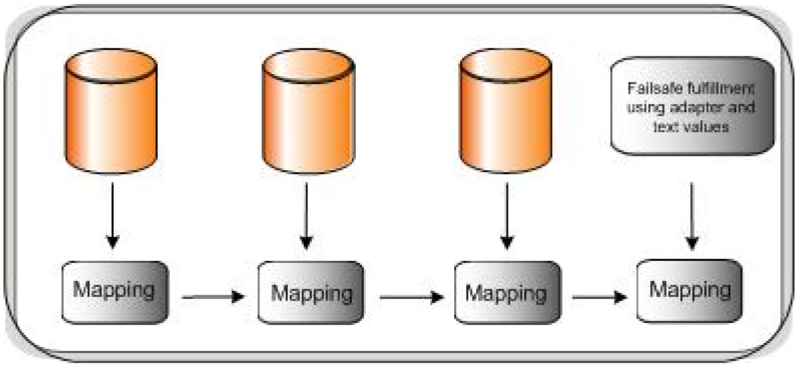
Alternatively, you can use the PingFederate Custom Source SDK to create your own driver for non-JDBC/LDAP data stores—including, for example, flat files or SOAP-connected databases (see the PingFederate *SDK Developer's Guide*).

Data stores can be used across multiple connections.

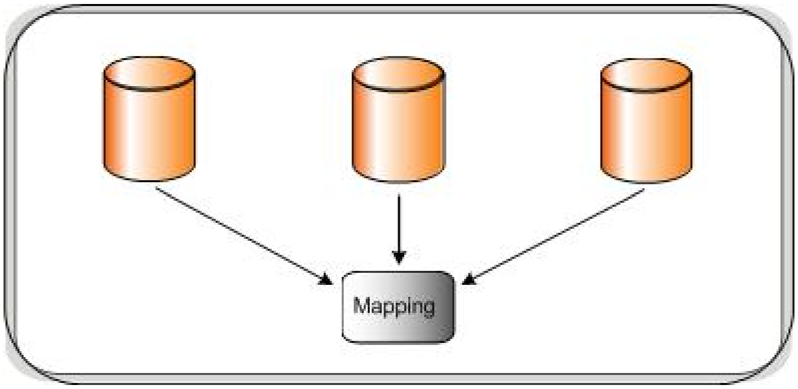
Multiple Data Source Attribute Mapping

When querying data stores for attributes to help fulfill the attribute contract, PingFederate can be configured to use more than one attribute source when mapping values to an assertion. For browser SSO for an IdP, multiple data stores can be used in two ways:

- Set up search parameters separately for each data store and for “fall-through” searches. For example, you can add the same data store more than once, using different search queries for each instance, or you can search different data stores successively. If any search fails to find a user in the specified attribute source, the next search is executed until a match is found. A failsafe attribute source can also be configured, providing a default set of attributes from the IdP adapter and using text values (see *Attribute Source Setup* on page 208).



- Configure separate data stores to look up attributes for a single mapping. For example, you can query multiple data stores for values and map those values in one mapping, or query a data store for a value and use that value as input for subsequent queries of other data stores (see *Attribute Source Setup* on page 208).



Note: SSO fails if the user is not found in any data source.

Attribute Masking

At runtime PingFederate logs user attributes (see *Managing Log Files* on page 45). To preserve user privacy, you may wish to mask the values of logged attributes.

PingFederate provides this masking capability at all points where the server logs attributes. These points include:

- Data-store lookup at either the IdP or SP site (see *Managing Data Stores* on page 98).
- Retrieval of attributes from an IdP adapter or token processor (see *Setting Pseudonym Values and Masking* on page 181 and *Setting Attribute Masking* on page 331).
- SP-server processing of incoming attributes based on the SSO *attribute contract*, (see *Defining an Attribute Contract* on page 274).

  Note that the SAML Subject ID is not masked: the SAML specifications provide for either pseudonymous account linking or transient identification to support privacy for the Subject ID (see *Account Linking* on page 22).
- SP-server processing of incoming attributes in response to an Attribute Request under XASP (see *Defining Security Policy* on page 298).

  For information about XASP, see *Attribute Query and XASP* in the “Supported Standards” chapter of *Getting Started*.

  Important: Many adapter implementations, as well as other product extensions, may independently write unmasked attribute values to the PingFederate server log. These implementations are beyond the control of PingFederate. If sensitive attribute values are a concern when using such a component, a system administrator can adjust the component’s logging threshold in `log4j2.xml` to prevent the recording of attributes (see *Managing Log Files* on page 45).

About Token Authorization

PingFederate provides an optional configuration to evaluate user attributes, as well as other runtime variables (such as *authentication context*), for authorization purposes. This feature, known as *token authorization*, provides a way for administrators to extend access policy directly to browser SSO, STS, and OAuth events by conditionally allowing or disallowing the issuance of relevant security tokens (for example, SAML assertions, STS tokens, OAuth access tokens, or session cookies). The option is also available for extending authorization policy to attribute-query responses (see *Attribute Query and XASP* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide).

Administrators can configure token authorization using Issuance Criteria screens immediately following the configuration of attribute mapping at all applicable points in the administrative console (see *Specifying Issuance Criteria (Optional)* on page 217, as an example). The option is available for any IdP, SP, or OAuth (including OpenID Connect) configuration, as well as for direct browser SSO adapter-to-adapter mappings and STS token exchange mappings.

Issuance Criteria

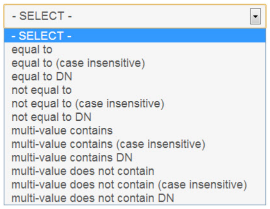
The token-authorization configuration consists of one or more rules that evaluate attribute values against selected conditions (see *Single and Multi-Value Conditions* on page 27 below). You can choose from among several sources for the attributes, depending on the type of configuration that contains the token-authorization setup. The sources always consist of all of those available for attribute mapping, including data stores (when configured) and runtime information related to the context of an event. In addition, values of mapped attributes are available to provide access to any plain-text mappings or the runtime results of any expression mappings (see *Using Attribute Mapping Expressions* on page 428).

Tip: When more than one condition is configured, all are evaluated and all the conditions must be met at runtime (evaluated as “true”) for authorization to succeed and processing to continue. In cases where you might need “or” conditions or layered evaluations, you can create one or more OGNL expressions using an Advanced Criteria feature. For more information, see *Using Attribute Mapping Expressions* on page 428 and *Expression Examples* on page 430.

Note: When authorization fails and a transaction is halted, a configurable Error Result code is passed back up through the system, potentially to an application layer or as a variable on a PingFederate user-facing template. How this code is interpreted depends on the use case and application integration. For more information, see Error Result descriptions in sections of this document covering specific token-authorization configurations.

Single and Multi-Value Conditions

Each token-authorization configuration provides a choice of conditions for evaluating attribute values:


- SELECT -
- SELECT -
equal to
equal to (case insensitive)
equal to DN
not equal to
not equal to (case insensitive)
not equal to DN
multi-value contains
multi-value contains (case insensitive)
multi-value contains DN
multi-value does not contain
multi-value does not contain (case insensitive)
multi-value does not contain DN

Use one of the first six choices only for attributes consisting of a single value.

Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

Security Infrastructure

This section describes the PingFederate security infrastructure that supports encrypted messaging, certificates, and digital signing. These functions are integrated into PingFederate’s configuration screens to provide complete control over certificate generation and authentication verification (see *Security Management* on page 161).

Digital Signatures

A digital signature is a way to verify the identity of a person or entity who originates an electronic document and ensure that the message has not been altered. Digital signatures are used in both SAML (including STS tokens) and WS-Federation electronic documents.

Handling a digital signature involves message signing, signature and certificate validation, and signing-policy coordination between connection partners.

Message Signing

Certificates contain information about the owner of the certificate along with a public key. Applying a digital signature creates and encrypts a hash from the message you are signing, using your private key. PingFederate provides a choice of signature encryption algorithms when a stronger algorithm is required.

To ensure the integrity of SAML messages or STS tokens, we recommend digital signing practices using public/private keypairs in conjunction with X.509 certificates.

Note: Digital signatures do not encrypt the contents of a message; SSL/TLS and/or XML encryption is used for this purpose.

The certificate should be signed by a Certificate Authority (recommended), but it can be self-signed or signed by an untrusted third party. After generating a keypair and a self-signed certificate, you can use PingFederate to create a Certificate Signing Request (CSR) and send it to a CA for signing. After the CA has generated a Certificate Signing Response, you can import it into PingFederate’s certificate management system. (The CA’s certificate must be in PingFederate’s trusted store or in the Java runtime `cacerts` store.)

PingFederate enables signing and validation of responses, requests, and/or the assertion message. In addition, PingFederate provides for certificate generation, import and export functionality, CSR generation, and application of digital signatures. You can create reusable global signing certificates across your federated connection base and import signature verification certificates for each partner (see *Digital Signing and Decryption Keys and Certificates* on page 166).

Note: Ping Identity recommends generating unique certificates for each connection, which limits exposure if the private key becomes compromised.

Signature Validation

After receiving a signed message, PingFederate verifies the signature using the public key that corresponds with the private key used to sign the message or token. Verification involves creating a hash of the received message, using the signing partner’s public key to decrypt the hash sent with the original message, and verifying that both hash values are equal.

Certificate Validation

PingFederate always checks certificates to see if they have expired, both when they are initially imported and at runtime when they are used to encrypt, decrypt, and digitally sign or verify assertions.

PingFederate can also check to see whether a certificate has been revoked, using either Certificate Revocation Lists (CRLs) or the Online Certificate Status Protocol (OSCP). Depending on the content of the certificate in question and your requirements, the server will perform either of these checks during SSO or SLO processing for the following cases:

- Signature verification
- Validation of a client certificate used for authentication to PingFederate when the server is handling direct client requests
- Validation of the server SSL certificate when PingFederate is acting as the client making an HTTPS request to a separate server

If a certificate is expired or revoked, the associated SSO or SLO transaction fails at runtime and an error is written to the transaction log. In the administrative console, an expired or revoked certificate is identified as such in the Status column of its respective Certificate Management list.

CRL Revocation Checking

This process involves querying a CRL distribution-point URL and ensuring that a certificate is not on the returned revocation list maintained at the site. The URL is specified in the certificate.

No setup is needed in the administrative console to enable CRL checking. PingFederate automatically checks CRLs if all of the following conditions are met:

- The certificate contains the URL where the CA maintains its CRL.
- The URL is accessible.
- The returned CRL is signed and the signature verified.
- CRL validation is not explicitly disabled as a failover option in the OCSP setup (see *Certificate Revocation Checking* on page 167).

OCSP Revocation Checking

OCSP was developed as an alternative to CRL validation and provides a more centralized and potentially more reliable means of checking certificate status. In this scenario, an OCSP Responder URL is normally embedded in the incoming certificate (a configured default URL may be used, alternatively). The URL, maintained by the issuing CA, is used to query the certificate status.

The primary difference between OCSP and CRL checking is how the verification occurs. CRL checking requires the requesting client to determine if the certificate has been revoked (or if any of the certificates in the chain of issuer certificates has been revoked), based on the returned CRL. With OCSP, the client sends the certificate itself, and revocation checking is handled by the Responder server, which returns the certificate status.

A PingFederate administrator can enable and configure OCSP processing in the administrative console (see *Certificate Revocation Checking* on page 167). The protocol may be used exclusively or in conjunction with CRL checking as a backup.

For more information about OCSP, see *www.ietf.org/rfc/rfc2560.txt*.

Digital Signing Policy Coordination

To coordinate digital signature policy, partners must first agree about whether they will sign SAML messages or tokens. In some cases, the protocol specifications require signatures—for example, all SAML STS tokens and all SSO assertions sent across the POST binding must be signed. (These requirements are enforced by the PingFederate administrative console and the runtime protocol engine.) Other uses of the digital signatures are optional between partners and enforced if specified for a partner connection.

If a digital-signing certificate is not issued by a trusted CA (that is, “self-signed”), then the signing partner must send the public-key certificate out-of-band (for example, via email) to the partner. The partner must import the certificate into PingFederate when configuring a connection to the signing partner for SSO/SLO or STS.

If the certificate is signed by a trusted CA and the signing partner chooses to embed the certificate in all signed messages, then the verifying partner can elect to use the embedded certificate for signature verification, after validating it against the Subject DN of the original certificate. The public-key certificate may or may not be sent out-of-band (just the Subject DN is required).

Tip: PingFederate can extract the Subject DN from the certificate, when available, during the signature-verification configuration.

The next section provides more information about the two alternative signature-verification trust models described above, from the standpoint of the verifying partner.

Trust Models

For validating digital signatures, PingFederate provides a selection of trust models in the administrative console for each partner connection, based on the certificate categories listed below. Note that for each trust model, PingFederate always verifies that the certificate is current and that the signature in the message can be verified using the certificate specified. Additional checks depend upon the trust model selected.

- Anchored Certificate

In this case, certificates used for signature verification must be issued by a trusted CA, and the certificate chain must be verifiable recursively back to the root issuer. PingFederate validates the certificate (including recursive revocation checking, when enabled, back to the issuer) for all signed messages from the partner. By default, PingFederate also prompts for the Issuer DN of the certificates to mitigate potential man-in-the-middle attacks as well as to provide a means to isolate certificates used by different connections.

In addition, when the anchored trust model is chosen, the incoming message must include the verification certificate for the signature. PingFederate uses that certificate to verify signatures from the partner if its Subject DN matches the partner's public certificate, (as specified in the administrative console), the Issuer DN (if specified) matches one of the issuers in the chain, and the issuer CA certificate is part of the trusted store. This feature provides a dynamic trust model that overcomes the problem of interrupting service to change out expired certificates.

- Unanchored Certificate

  When this option is chosen, incoming signatures are verified exclusively using a specific certificate imported for a connection into PingFederate (or a secondary, backup certificate when specified). The certificate may be self-signed or issued by a trusted CA. The certificate chain, if any, is not verified. However, revocation checking, when enabled, is performed up any existing chain as far as available.

Secure Sockets Layer

SSL certificates signed by a CA can be used to identify one or both ends of the federation. SSL/TLS provides an encrypted connection between the two parties in which the content of a message is not exposed, thus ensuring confidentiality and message integrity.

SAML SSL and TLS Scenarios

SSL/TLS should be used in association with the *SOAP* responder URL and *Single Sign-on Service* located at an IdP site. On the SP side, the *Artifact Resolution Service* should also use SSL/TLS. Optionally, SSL/TLS may also be used to secure communication between internal data stores and PingFederate and between the PingFederate STS and Web Service client or provider applications.

Authentication

Three methods of authentication, described below, are available for use with PingFederate for browser-based SSO to authenticate connection partners making SOAP requests. For SOAP authentication by STS clients, a separate option using either or both of the first two methods, may be configured (the third method, digital signing, is automatically required). The selection of one or more method(s) must be agreed upon between partners and synchronized within IdP and SP federation implementations:

- HTTP Basic Authentication: partners identify themselves by passing username and password credentials.
- SSL Client Certificate Authentication: partners use SSL Client Certificates presented during SOAP request transactions. Each partner needs to import the other's certificate out-of-band (see *SSL Client Keys and Certificates* on page 164).

  Important: The SSL/TLS server-client handshake involves negotiating cipher suites to be used for encryption/decryption on each side of a secured transaction. PingFederate supports only stronger cipher suites; to enhance security, weaker cipher suites are commented out of two configuration files located in `<pf_install>/server/default/data/config-store:`

  `com.pingidentity.crypto.SunJCEManager.xml`

  `com.pingidentity.crypto.NcipherJCEManager.xml`

  To ensure the most secure transactions, we recommend that administrators retain this cipher-suite configuration.

  Due to import control restrictions, the standard Java Runtime Environment (JRE) distribution supports strong but not unlimited encryption. For this reason, the strongest cipher suites in the same configuration files are also commented out. To use the strongest encryption, when permissible, remove the comments from the AES 256 cipher suites and download and install the appropriate version of "Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy Files" from the *Oracle download Web site* (www.oracle.com/technetwork/java/archive-139210.html).

- Digital Signatures: partners sign the XML message transmitted via the SSL/TLS connection. Signatures are verified by the receiver based upon the certificate(s) configured for that connection. Each partner should import the other's certificate(s) out-of-band (see *Digital Signing and Decryption Keys and Certificates* on page 166).

Verifying Trusted Certificates

PingFederate validates the trust of all certificates. A certificate is trusted if the certificate of its issuer is in PingFederate's trusted certificate store. The root certificate of the CA, by which a certificate is issued, must be imported into PingFederate's trusted certificate store or contained in the Java runtime `cacerts` store.

XML Encryption

PingFederate supports the optional SAML 2.0 specification allowing for encryption of assertions (including STS SAML tokens), which further enhances confidentiality when required.

For SAML 2.0 SSO connections you can choose to encrypt entire assertions, the user's name identifier, and/or other user attributes. You can use signature verification and signing keys to encrypt and decrypt messages, respectively.

Using Auto-Connect

PingFederate allows organizations to provide secure SSO on the fly—that is, without the need for configuring partner-specific, browser-based SSO connection parameters. This feature—*Auto-Connect*™—extends SAML 2.0 SP-initiated SSO or SLO and *metadata* specifications to enable deployments to retrieve partner connection information securely on an as-needed basis. (For information about SAML 2.0, see *Supported Standards* in *Getting Started*.)

The feature is especially useful to an SP who wants to provide SSO capability to more than one partner. A SaaS provider, for example, can provide SSO to innumerable clients without specifying redundant connection information for each one. Auto-Connect can also help an enterprise, acting as an IdP, to provide easily scalable SSO for multiple outsourced services.

For either an IdP or SP PingFederate server, you can implement Auto-Connect for any number of partners by configuring a common initial setup and a list of domain names. For an IdP, the domain-name list contains SP partners from whom your site will accept Auto-Connect authentication requests. For an SP, the list contains IdP-partner domains to which your site can send authentication requests and receive SSO assertions.

For information about configuring Auto-Connect for your federation partners, see *Configuring SP Auto-Connect* on page 251 or *Configuring IdP Auto-Connect* on page 321.

Providing Metadata

You enable Auto-Connect as part of Server Settings from the Main Menu (see *Choosing Roles and Protocols* on page 92. Once Auto-Connect is enabled and the initial setup is fully configured and activated, partners can retrieve your connection *metadata* via HTTP. At runtime, Auto-Connect deployments at partner sites use the endpoints provided in the metadata to interact with your server and complete SSO or SLO processing.

The metadata, which follows SAML 2.0 specifications, must be signed, and the validity of the data is time-limited (see *Auto-Connect Security Model* on page 32 and *Configuring Auto-Connect Metadata Lifetime* on page 97).

Runtime Processing

Auto-Connect runtime processing starts when a user tries to reach a protected SP resource. The process depends on SP Web-application functionality that determines the user's IdP domain (for example, from a submitted email address) and passes it to the SP PingFederate server in the SSO request.

This illustration and the accompanying "Processing Steps" describe the complete SSO processing flow:

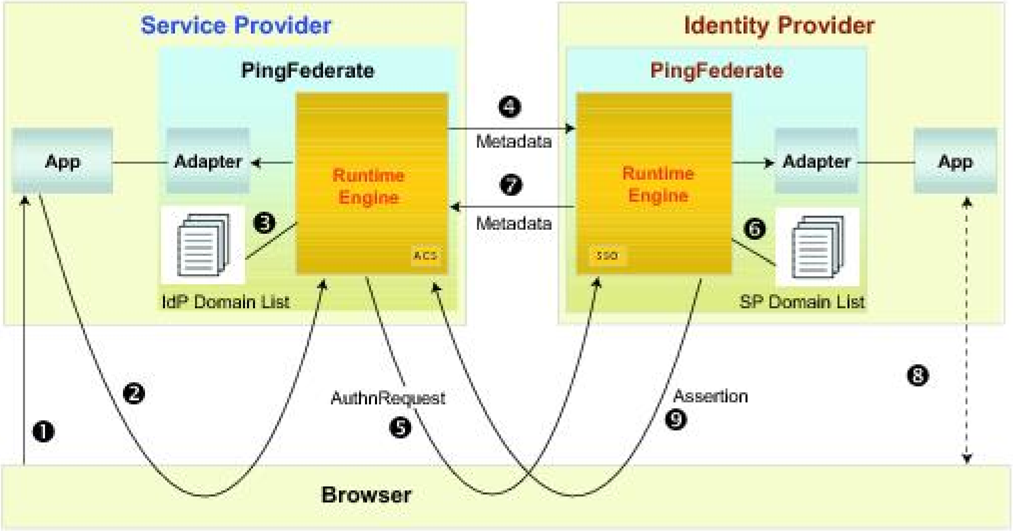


Figure 1: Auto-Connect Processing Flow

Processing Steps

1. User sends a logon request with an email address to an SP application. For example:

   `john@mycompany.com`
2. The application parses the email address and sends a request to PingFederate. For example:

   `https://hostname.com:9031/sp/startSSO.ping/?Domain=mycompany.com`
3. The SP PingFederate server looks up the domain in a list of domain names allowed to use Auto-Connect.
4. If the domain is in the list, the SP retrieves connection metadata from the IdP's public endpoint.

   By default, PingFederate looks for the metadata by prepending `http://saml` to the domain. For example:

   `http://saml.mycompany.com`

   This default location can be changed, if necessary, in the Allowed Domains lists configured in the PingFederate administrative console.
5. After validating the metadata (see *Auto-Connect Security Model* on page 32), the SP sends an authentication request to the IdP's SSO service.
6. If the request `<Issuer>` is not among the IdP's static-connection partners, the IdP PingFederate server looks for the issuer's domain name in the list of domains allowed to use Auto-Connect.
7. The IdP retrieves the SP's metadata via its public endpoint and verifies the metadata signature.

   The process is the same as that used by the SP in *Step 4*.
8. The IdP requests user authentication via the configured adapter instance.
9. Once the user is authenticated, the IdP returns a signed SAML assertion to the SP's Assertion Consumer Service (ACS) endpoint.
10. (Not shown) The SP logs the user on to the requested resource via the configured SP adapter.

Auto-Connect Security Model

Auto-Connect processing requires digital signatures to ensure the authenticity of the published *metadata* as well as all subsequent SSO or SLO requests and responses. The certificate used to sign the metadata is included in the metadata, and all certificates must be signed by a trusted Certificate Authority; thus, partners need not exchange certificates out of band.

In addition to validating certificates, the PingFederate runtime server compares the partner certificate with the entity ID (the "Issuer") found in the SAML message. Then the server matches the entity ID against the configured list of allowed Auto-Connect domains.

This diagram illustrates the security validation process:

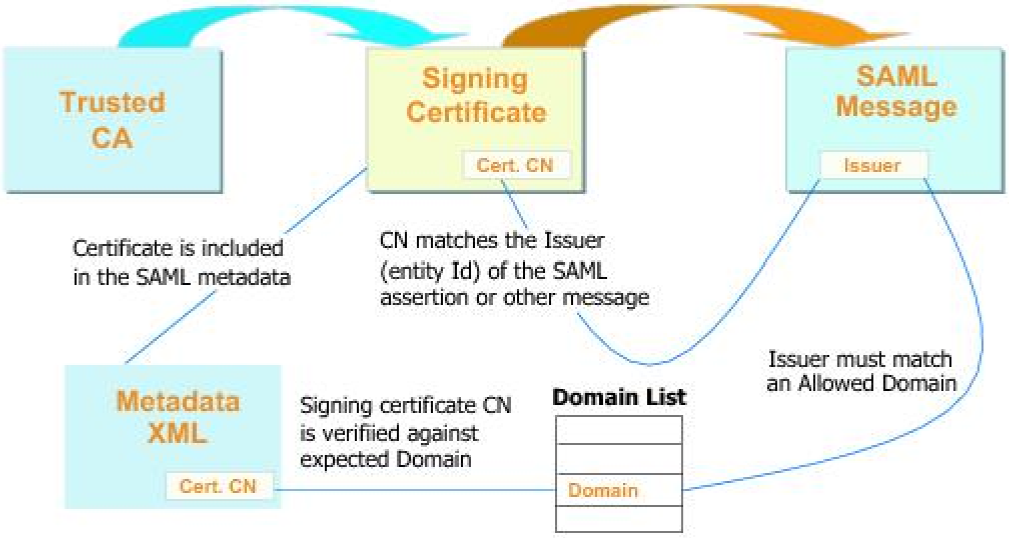

Trusted CA
Signing Certificate
Cert. CN
SAML Message
Issuer
Certificate is included in the SAML metadata
CN matches the Issuer (entity Id) of the SAML assertion or other message
Issuer must match an Allowed Domain
Metadata XML
Cert. CN
Signing certificate CN is verifiied against expected Domain
Domain List
Domain

Figure 2: Auto-Connect Security Model

Note that the diagram assumes that the same certificate is used for signing both the metadata and the runtime SAML messages. This is convenient, but not required.

User Provisioning

PingFederate provides cross-domain user provisioning and account management. User provisioning is an important aspect of identity federation. Often when organizations enable SSO for their users, they must ensure that some form of account synchronization is in place. Automated user provisioning features within PingFederate free administrators from having to devise a manual strategy for this.

Provisioning support takes different forms, depending on what role PingFederate plays in an identity federation, and may be configured either in conjunction with partner SSO connections or separately:

- At an IdP site, you can automatically provision and maintain user accounts at service-provider sites that have implemented the System for Cross-domain Identity Management (SCIM), or at selected SaaS providers (see the next section, *Outbound Provisioning for IdPs* on page 33).

  For information about SCIM, see the Web site *www.simplecloud.info*.
- When PingFederate is configured as an SP, you can provision and manage user accounts and groups for your own organization automatically, by using the standard SCIM protocol or by using identity information received during SSO events from SAML assertions (see *Provisioning for SPs* on page 34).

Outbound Provisioning for IdPs

For IdP sites, PingFederate provides built-in automated provisioning and user-account management to *SCIM*-enabled services providers and to selected SaaS providers, via their proprietary provisioning APIs.

Tip: Support for provisioning for SaaS applications, including quick-connection templates for partner SSO —SaaS Connectors—is available separately from Ping Identity. Contact *sales@pingidentity.com* for more information.

Outbound Provisioning also provides an automated means of account disabling or deprovisioning, which may be of key importance to system auditors.

When Outbound Provisioning is enabled, the PingFederate runtime engine polls the IdP organization's user store periodically (see *Choosing a Connection Type* on page 194). The server uses a separate database internally to monitor the state of the user store and keep user data synchronized between the organization and the target service provider (see illustration).

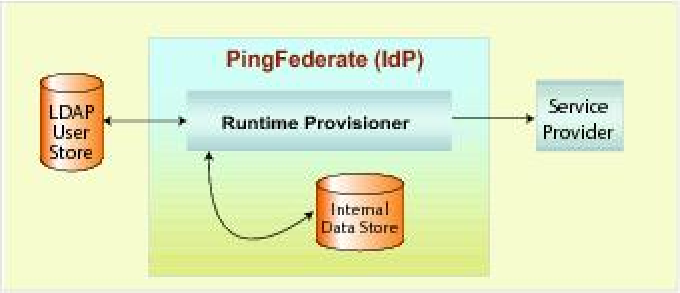


Figure 3: Outbound Provisioning Processing

As user-data sources, PingFederate provides built-in support for Microsoft's Active Directory (AD) and Oracle Directory Server (formerly Sun Directory Server); templates are used to preconfigure many provisioning settings. Although these are the only data stores formally tested and supported, other LDAP data stores will likely work as well (see *Identifying the Source Data Store* on page 243). For convenience, PingFederate provides a sample template that can be used for other types of LDAP servers to simplify the provisioning configuration (see *Configuring an LDAP Connection* on page 102).

Tested internal data stores used for synchronization include HyperSQL, MySQL, MS SQL Server, and Oracle databases (a demonstration-only, embedded HyperSQL database is installed by default). Again, any relational database may be used—scripts are provided to aid setup (see *Configuring Outbound Provisioning Settings* on page 96).

For more information, see *Configuring Outbound Provisioning* on page 239.

Provisioning for SPs

When PingFederate is enabled as an SP, two provisioning choices are available:

- *Inbound Provisioning* on page 34 for *SCIM* requests coming either from inside or outside an organization
- *Just-in-Time Provisioning* on page 34 for creating and updating user accounts based on information contained in SAML assertions

Inbound Provisioning

Inbound Provisioning provides support for incoming SCIM messages containing requests to create, read, update, or delete/deactivate user and group records in Microsoft AD data stores or custom user stores via the Identity Store Provisioners. PingFederate supports SCIM attributes in the core schema as well as custom attributes through a schema extension. An administrator can configure this provisioning feature by itself or in conjunction with an SSO or other connection type (see *Connection Types* on page 12).

In effect, Inbound Provisioning provides an organization with a dedicated SCIM service provider, which can route user-management requests to an organization's centralized user store. The requests may originate from trusted applications within an organization—for example, a human-resources onboarding SaaS product—or from trusted partner IdPs.

For setup information, see *Configuring Inbound Provisioning* on page 303. To integrate Inbound Provisioning with custom user stores, see *Configuring Identity Store Provisioners* on page 259. For application-development information about using PingFederate endpoints for SCIM provisioning, see *SCIM Inbound Provisioning Endpoints* on page 392.

Just-in-Time Provisioning

At an SP site, PingFederate can also create and update local user accounts in an external LDAP directory or Microsoft SQL Server as part of SSO processing—*Just-in-Time (JIT) Provisioning*. This feature (formerly called Express Provisioning) allows SPs to maintain accounts for users who authenticate via IdP partners without having to provision accounts manually, when local accounts are required.

When configured, the PingFederate SP server writes user information to the local user store using attributes from the incoming SAML *assertion*. For SAML 2.0 partner connections, assertion attributes can be supplemented with user attributes returned from an Attribute Query (see *Attribute Query and XASP* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide).

PingFederate can also update existing user accounts based on assertions. When this option is enabled, PingFederate can add or overwrite attributes for a local user account each time SSO for a user is processed.

Note: Note that once user attributes are provisioned, they cannot be removed using JIT Provisioning. Where deprovisioning is required, we recommend using SCIM Inbound Provisioning.

For information about enabling JIT Provisioning, see *Choosing IdP Connection Options* on page 268. For configuration information, see *Using Just-in-Time Provisioning* on page 298.

Federation Planning Checklist

An essential first step in establishing an identity federation involves discussions and agreements between you and your connection partners. The sections below comprise a partial checklist of items that should be coordinated before you deploy PingFederate.

Tip: Extensive coordination and configuration may be avoided by using Auto-Connect (see *Using Auto-Connect* on page 31).

Standards and Specifications

Choose which federation protocol(s) your deployment will support. For SAML SSO configurations, decide which profiles and bindings will be used. (See *Supported Standards* chapter in *Getting Started*.)

Signing and Validation

Decide which SAML messages—assertions, responses, requests—will be digitally signed and how the messages will be verified by your federation partner. If messages are signed, decide how certificates will be exchanged (for example, secure email). (See *Security Infrastructure* on page 27.)

Also, if a stronger signature algorithm is required, determine what RSA algorithm will be used for signing. (The optional algorithm selection is available throughout the administrative console, where signing certificates are specified for various uses.)

Back-Channel Security

Determine what type of *SOAP* channel authentication will be used: Basic or SSL/TLS. If SSL/TLS is used, determine whether server-only or both server and client certificates will be needed and how they will be managed. Also decide what level of security will be required for connections to back-end data stores or identity management systems.

Trusted Certificate Management

Determine whether both partners are using SSL/TLS and/or signing certificates that have been signed by a major CA. (If self-signed certificates or nonstandard CAs are used, the signed certificates must be exchanged and imported into Trusted Certificate stores.) Also, determine whether you want to adopt a trust model that uses embedded certificates (see *Trust Models* on page 29).

Deployment

Decide how PingFederate fits into your existing network. Also, determine whether high-availability and/or failover options are required (see the PingFederate *Server Clustering Guide*).

Federation Server Identification

Determine how you and your partner(s) will identify your respective federation deployments. Under federation standards, both the sender (IdP) and the receiver (SP) of an *assertion* must be uniquely identified within the identity federation (see *Configuration Data Exchange* on page 38).

With PingFederate, you define a unique ID for each supported protocol (see *Specifying Federation Information* on page 94). Optionally, you can also use a list of multiple *Virtual Server IDs* on a connection-by-connection basis (see *Multiple Virtual Server IDs* on page 36).

Tip: PingFederate also provides for *virtual host names*, which differ from virtual server IDs (but are not mutually exclusive); they are intended to be used when your network configuration is such that you receive federation messages under more than one domain name (see *Using Virtual Host Names* on page 68).

Server Clock Synchronization

Ensure that both the SP and IdP server clocks are synchronized. SAML messages and STS tokens provide a time window that allows for small synchronization differentials. However, wide disparities will result in assertion or request time-outs.

User Data Stores

Identify the type of data store that contains user data when needed: LDAP, JDBC, or Custom (see *Data Stores* on page 25).

Web Application and Session Integration

Decide how PingFederate as an IdP receives subject identity information, either from an STS token or a user session.

For an SP, decide how PingFederate will forward user identity information to the destination Web application or system to start a session.

(See *SSO Integration Kits and Adapters* on page 19 and *Token Processors and Generators* on page 13.)

Transaction Logging

PingFederate provides basic transaction logging and monitoring. Decide whether transaction logging should be integrated with a systems management application and whether you have regulatory compliance requirements that affect your logging processes. (For more information, see *Managing Log Files* on page 45.)

Identity Mapping

For browser-based SSO, decide whether you will use PingFederate to link accounts on your respective systems using a persistent name identifier, or whether you will use account mapping (see *Identity Mapping* on page 22).

Attribute Contract Agreement

If your federation partnership will not use account linking, or will not use it exclusively, then you and your partner must agree on a set of attributes that the IdP will send in an assertion for either SSO or Web Service access. (For more information, see *Attribute Contracts* on page 23.)

Metadata Exchange

If you are using SAML, decide whether you will use the *metadata* standard to exchange XML files containing configuration information. PingFederate makes it easy to use this protocol, which provides a significant shortcut to setting up your partner connections. (If your partner is also using PingFederate or supports standards permitting runtime metadata exchange, the process can be even simpler—see *Using Auto-Connect* on page 31.

Multiple Virtual Server IDs

Virtual server IDs provide more configuration flexibility in cases where you need to identify your server differently when connecting to a partner in one connection for multiple environments or in multiple connections where the partner also supports multiple federation IDs.

Connecting to a Partner in One Connection

This is a use case where you need to connect to multiple environments serviced by the same partner using one federation ID—multiplexing one SP connection to access multiple subdomain accounts in Microsoft Office 365.

Suppose both the marketing and the engineering departments of contoso.com (the IdP) have their own departmental subdomains, marketing.contoso.com and engineering.contoso.com. They are both registered in Office 365 (the SP) under the parent domain, contoso.com.

In this scenario, the PingFederate IdP server can be configured to include both marketing.contoso.com and engineering.contoso.com as the virtual server IDs in the Office 365 SP connection. Each virtual server ID has its own set of protocol endpoints, which can be obtained in the connection metadata (see *Exporting Metadata* on page 57 and *System-Services Endpoints* on page 395 for more information).

After providing the protocol endpoints information to Office 365, when Office 365 sends login requests to PingFederate, PingFederate picks the correct IdP adapter to authenticate the end users based on the virtual server ID in the requests.

For each successful login, PingFederate builds an assertion with issuer being set to the corresponding virtual server ID. When Office 365 receives the assertion, it creates the end user session with the right subdomain settings based on the issuer value in the assertion.

Connecting to a Partner in Multiple Connections

In this use case, you connect to your partner in multiple connections. In each connection, you identify yourself and your partner differently.

For example, you as the SP provide separate environments for the end users based on their regions. Your IdP operates in two regions, Europe (EU) and North America (NA); their federation IDs are eu.idp.local and na.idp.local, respectively.

In the PingFederate SP server, you can create two IdP connections to federate identities for end users from both regions as follows:

	Partner’s federation ID	Your virtual server ID
IdP connection #1	`eu.idp.local`	`idp-eu.sp.tld`
IdP connection #2	`na.idp.local`	`idp-na.sp.tld`

Based on the issuer (the partner’s federation ID) and the audience values (your virtual server ID), PingFederate determines at runtime which IdP connection the assertion is intended for, validates as per the connection settings, and passes attribute values to the SP adapter to create the end-user session.

Working with Multiple Virtual Server IDs

You can assign virtual server IDs either as an IdP during configuration of an SP connection (see *General Information* on page 195) or as an SP configuring an IdP connection (see *General Connection Information* on page 269) for both Browser SSO Profiles and WS-Trust STS (for access to identity-enabled Web Services).

If a connection has only one virtual server ID, it becomes the default virtual server ID for the connection. If the list contains several entries, you must specify one of them as the default virtual server ID for that connection. The default virtual server ID is used when no virtual server ID information is included in a request (see *IdP Endpoints* on page 385 as an IdP or *SP Endpoints* on page 387 as an SP).

In a connection with multiple virtual server IDs, you can optionally restrict each adapter added to the connection to certain virtual server IDs to enhance the end-user experience (see *Restricting an Authentication Source to Certain Virtual Server IDs* on page 206, *Restricting a Target Session to Certain Virtual Server IDs* on page 278 and *Restricting a Target Session to Certain Virtual Server IDs* on page 278).

Tip: You can also restrict each token processor or token generator added to a WS-Trust STS SP connection or IdP connection, (see *Restricting a Token Processor to certain Virtual Server IDs* on page 336 or *Restricting a Token Generator to certain Virtual Server IDs* on page 353).

Important: To protect against unauthorized access, configure *Issuance Criteria* to verify virtual server ID in conjunction with other conditions, such as group membership information. For more information, see *Specifying Issuance Criteria (Optional)* on page 217 as an IdP or *Identifying Issuance Criteria (Optional)* on page 286 as an SP.

Configuration Data Exchange

If your partner's deployment does not produce or consume a *metadata* file that conforms to SAML metadata specifications, you may need to exchange connection information manually. The following sections list some common configuration details that must be exchanged if metadata files are not used. (These lists are not exhaustive.)

IdP to SP

If you are the IdP, your SP partner will need some or all of the following connection information (depending upon which profiles and bindings you are configuring):

- **Unique ID**—Identifies the IdP that issues an assertion or other SAML message. For SAML 2.0, the ID is the IdP *Entity ID*; for SAML 1.x, it is the IdP *Issuer*; for WS-Federation, it is the IdP *Realm*.

  PingFederate also supports the optional use of virtual IDs (see *Federation Server Identification*).
- **SOAP Artifact Resolution URL**—The endpoint your site uses to receive an SP's SOAP requests when the *artifact* binding is used.
- **Single Logout Service URL**—The destination of SLO request messages.
- **Single Sign-On Service URL**—The endpoint where you receive and process assertions.

SP to IdP

If you are the SP, your IdP partner will need some or all of the following connection information (depending upon which profiles and bindings you are configuring):

- **Unique ID**—Identifies the SP. For SAML 2.0, the ID is the *Entity ID*; for SAML 1.x, it is the SP's *Audience*; for WS-Federation, it is the SP's *Realm*.

  PingFederate also supports the optional use of virtual IDs (see *Federation Server Identification*).
- **SOAP Artifact Resolution Service URL**—The endpoint to use for SOAP requests when the *artifact* binding is used.
- **Single Logout Service URL (SAML 2.0)**—The destination of SLO request messages.
- **Assertion Consumer Service URL**—The location where the SP receives assertions.
- **Target URLs**—The URLs for the protected resources that a user is trying to access.

Mutual Settings Between Parties

Many settings must be mutually set by the parties. This information might include such items as:

- **Attributes**—User information that will be sent in an assertion, if any (see *About Attributes* on page 23).
- **Signing certificates**—The SAML and WS-Federation protocols specify a number of conditions under which digital signatures are either required or optional (these conditions are built into the PingFederate connection-setup screens).
- **SOAP connection type** and **authentication style**—For SAML connections using the back channel (using the *artifact* binding, for example), HTTP Basic authentication, SSL client certificate authentication, digital signatures, or some combination of the three is required. You and your partner must exchange the necessary credentials, certificates, and/or signing keys.

Federation Hub

PingFederate can be configured as a federation hub to:

- Bridge partners using different federation protocols to circumvent partner or application limitations.
- Multiplex a connection for multiple partners to reduce costs and expand use cases.

As a federation hub, PingFederate can bridge browser-based SSO between identity providers and service providers. It stands in the middle of the SSO flow, acting as the SP for the identity providers and as the IdP for the service providers. The four use cases are:

- *Bridging an IdP to an SP* on page 39

- *Bridging an IdP to multiple SPs* on page 39
- *Bridging multiple IdPs to an SP* on page 40
- *Bridging multiple IdPs to multiple SPs* on page 41

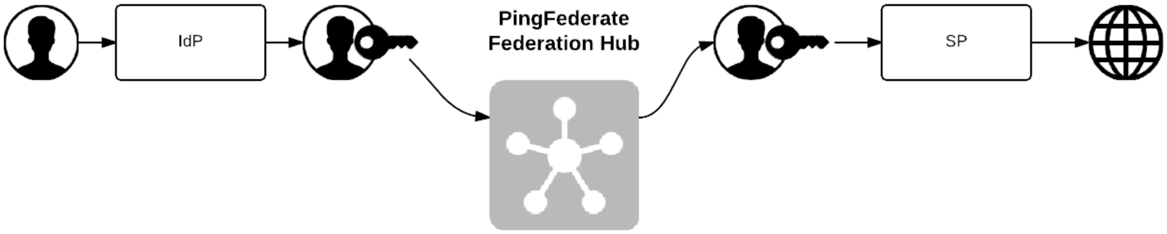
PingFederate also supports protocol translation among SAML 1.0, 1.1, 2.0 and WS-Federation. For SAML based connections, this also means it is possible to bridge between various bindings between identity providers and service providers.

Tip: The federation hub capability can be deployed alongside with other OAuth, IdP and/or SP connections to your partners. This flexibility helps in streamlining your federation infrastructure and reducing operating costs.

Note: Single Logout (SLO) is not supported for federation hub use cases.

Bridging an IdP to an SP

In this use case, PingFederate is bridging SSO transactions between an identity provider and a service provider. For example, you may have a legacy IdP system that is only capable of sending SAML 1.1 assertions via POST. Your service provider however requires SAML 2.0 assertions via the artifact binding. With federation hub, you can configure PingFederate to consume inbound SAML 1.1 assertions (by POST), translate them to SAML 2.0 assertions, and send them via the artifact binding to the service provider.

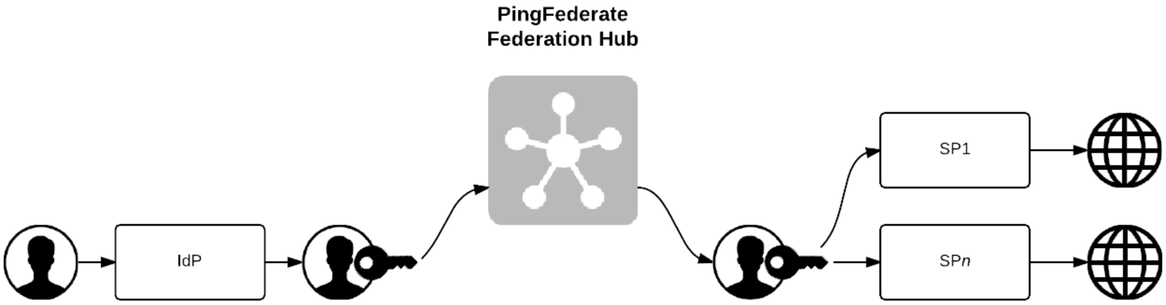


To address this use case:

1. Enable both the IdP and the SP roles with the applicable protocols (see *Choosing Roles and Protocols* on page 92).
2. Create a contract to bridge the attributes between the identity provider and the service provider (see *Connection Mapping Contracts* on page 124).
3. Create an IdP connection between the identity provider and PingFederate (the federation hub as the SP). In the Target Session Mapping screen, add the connection mapping contract into the connection (see *Configuring Target Session Mapping* on page 275).
4. Create an SP connection between PingFederate (the federation hub as the IdP) and the service provider. In the Authentication Source Mapping screen, add the connection mapping contract into the connection (see *Authentication Source Mapping* on page 203).
5. Work with the identity provider to connect to PingFederate (the federation hub) as the SP.
6. Work with the service provider to connect to PingFederate (the federation hub) as the IdP.

Bridging an IdP to multiple SPs

In this use case, PingFederate is bridging SSO transactions between an identity provider and multiple service providers. For example, your company wants to route federation requests from a recently acquired subsidiary through its federation infrastructure. With PingFederate, you can multiplex one IdP connection to multiple SP connections to the desired service providers. The federation hub consumes assertions from the subsidiary and creates new assertions to the respective service providers.

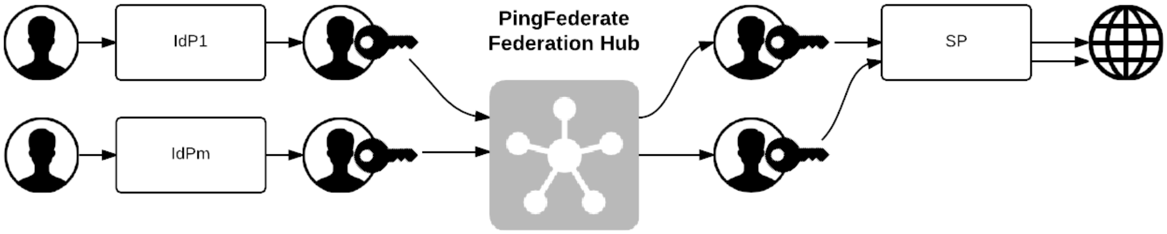


To address this use case:

1. Enable both the IdP and the SP roles with the applicable protocols (see *Choosing Roles and Protocols* on page 92).
2. For each service provider, create a contract to the identity provider (see *Connection Mapping Contracts* on page 124). Multiple contracts are likely required, because each service provider may require a unique set of attributes.
3. Create an IdP connection between the identity provider and PingFederate (the federation hub as the SP). In the Target Session Mapping screen, add the connection mapping contracts into the connection (see *Configuring Target Session Mapping* on page 275).
4. For each service provider, create an SP connection between PingFederate (the federation hub as the IdP) and the service provider. In the Authentication Source Mapping screen, add the corresponding connection mapping contract into the connection (see *Authentication Source Mapping* on page 203).
5. For each service provider supporting the SAML IdP-initiated SSO profile, map the expected Target Resource URLs to the corresponding SP connection (see *Configuring Target URL Mapping* on page 257).
6. Work with the identity provider to connect to PingFederate (the federation hub as the SP).
7. Work with each service provider to connect to PingFederate (the federation hub as the IdP).

Bridging multiple IdPs to an SP

In this use case, PingFederate is bridging SSO transactions between multiple identity providers and a service provider. For example, you are tasked to provide federated access to resources on Microsoft® SharePoint® for various business partners. With PingFederate, you can multiplex one SP connection (to SharePoint) to multiple IdP connections for all your business partners. The federation hub can also, as needed, translates SAML assertions from the business partners to WS-Federation security tokens and send them over to SharePoint.



To address this use case:

1. Enable both the IdP and the SP roles with the applicable protocols (see *Choosing Roles and Protocols* on page 92).

2. Create a contract to bridge the attributes between the identity providers and the service provider (see *Connection Mapping Contracts* on page 124). You likely need only one contract unless the service provider requires a different set of attributes from each identity provider.
3. For each identity provider, create an IdP connection between the identity provider and PingFederate (the federation hub as the SP). In the Target Session Mapping screen, add the corresponding connection mapping contract into the connection (see *Configuring Target Session Mapping* on page 275).
4. Configure an authentication selector to map each identity provider to the corresponding IdP connection (see *Configuring Authentication Selectors* on page 182).
5. Create an SP connection between PingFederate (the federation hub as the IdP) and the service provider. In the Authentication Source Mapping screen, add the connection mapping contract into the connection (see *Authentication Source Mapping* on page 203).

   Important: PingFederate includes the Entity ID of the original identity provider (`Authenticating Authority`) in SAML 2.0 assertions so that the service provider can determine the original issuer of the assertions. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

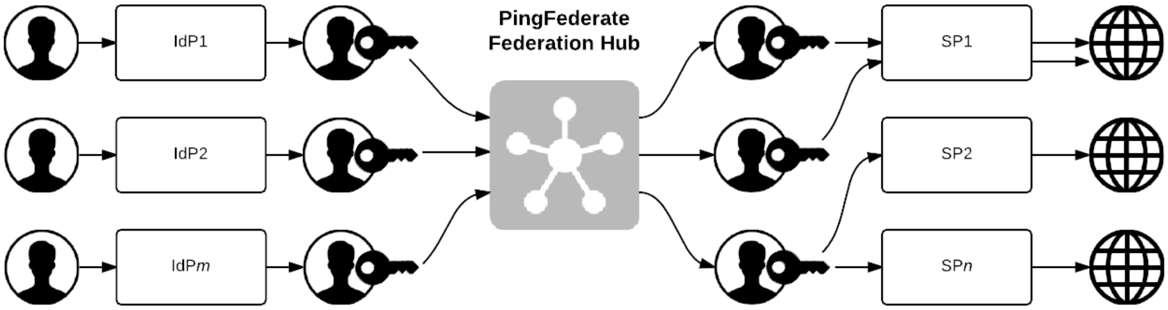
   For SAML 1.x assertions and WS-Federation security tokens, you can add an attribute to the Attribute Contract (see *Creating an Attribute Contract* on page 202) and map `Authenticating Authority` into its value (see *Attribute Contract Fulfillment* on page 215).

   For information about `Authenticating Authority`, see section 2.7.2.2 Element <AuthnContext> in SAML 2.0 specification (*docs.oasis-open.org/security/saml/v2.0/saml-core-2.0-os.pdf*).

   Note: If the service provider does not take action based on `Authenticating Authority`, depending on the attributes from the identity providers, you may use Issuance Criteria in the IdP connection to protect against user impersonation between IdPs.
6. Work with each identity provider to connect to PingFederate (the federation hub as the SP).
7. Work with the service provider to connect to PingFederate (the federation hub as the IdP).

Bridging multiple IdPs to multiple SPs

This use case is a combination of *Bridging an IdP to multiple SPs* on page 39 and *Bridging multiple IdPs to an SP* on page 40.



To address this use case:

1. Enable both the IdP and the SP roles with the applicable protocols (see *Choosing Roles and Protocols* on page 92).
2. Create multiple contracts to bridge the attributes between the identity providers and the service providers (see *Connection Mapping Contracts* on page 124).

3. For each identity provider, create an IdP connection between the identity provider and PingFederate (the federation hub as the SP). In the Target Session Mapping screen, add the applicable connection mapping contract(s) into the connection (see *Configuring Target Session Mapping* on page 275).
4. Configure an authentication selector to map each identity provider to the corresponding IdP connection (see *Configuring Authentication Selectors* on page 182).
5. For each service provider, create an SP connection between PingFederate (the federation hub as the IdP) and the service provider. In the Authentication Source Mapping screen, add the corresponding connection mapping contract into the connection (see *Authentication Source Mapping* on page 203).

   Important: PingFederate includes the Entity ID of the original identity provider (`Authenticating Authority`) in SAML 2.0 assertions so that the service provider can determine the original issuer of the assertions. This is especially important when bridging multiple identity providers to one service provider —the service provider should take the information about the original issuer into consideration before granting access to protected resources.

   For SAML 1.x assertions and WS-Federation security tokens, you can add an attribute to the Attribute Contract (see *Creating an Attribute Contract* on page 202) and map `Authenticating Authority` into its value (see *Attribute Contract Fulfillment* on page 215).

   For information about `Authenticating Authority`, see section 2.7.2.2 Element <AuthnContext> in SAML 2.0 specification (*docs.oasis-open.org/security/saml/v2.0/saml-core-2.0-os.pdf*).

   Note: If the service provider does not take action based on `Authenticating Authority`, depending on the attributes from the identity providers, you may use Issuance Criteria in the IdP connection to protect against user impersonation between IdPs.
6. For each service provider supporting the SAML IdP-initiated SSO profile, map the expected Target Resource URLs to the corresponding SP connection (see *Configuring Target URL Mapping* on page 257).
7. Work with each identity provider to connect to the federation hub (as the SP).
8. Work with each service provider to connect to the federation hub (as the IdP).

Federation Hub and Virtual Server IDs

PingFederate uses two connections to bridge an identity provider to a service provider:

- An IdP connection where end users authenticate and PingFederate (the federation hub) is the SP
- An SP connection to the target application where PingFederate (the federation hub) is the IdP

Generally speaking, PingFederate consumes assertions from the identity provider through the IdP connection and generates new assertions to the service provider via the SP connection.

If the SP connection does not use a virtual server ID (see *General Information* on page 195), the issuer of the assertions (to the service provider) is the ID defined for the protocol between PingFederate (the federation hub as the IdP) and the service provider (see *Specifying Federation Information* on page 94).

If the SP connection uses multiple virtual server IDs (see *Connecting to a Partner in One Connection* on page 36), for SP-initiated SSO, if the service provider sends AuthnRequest messages to the virtual server ID specific endpoint (see step 3 under "**To export connection metadata**" in *Exporting Metadata* on page 57), PingFederate retains this information automatically. When the identity provider returns the corresponding assertions to PingFederate (the federation hub as the SP), PingFederate retrieves the preserved information and uses that specific virtual server ID as the issuer in the assertions it sends to the service provider. For IdP-initiated SSO, the issuer of the assertions (to the service provider) is the default Virtual Server ID.

Chapter 2

System Administration

This chapter describes general administrative functions for PingFederate, including:.

Note: The information in this chapter is presented from the viewpoint of an administrative user with "Admin" permissions (see *Account Management* on page 62).

Starting and Stopping PingFederate

(Windows)

To start PingFederate:

- From Start > Run dialog or a command prompt, run the batch file: `<pf_install>\pingfederate\bin\run.bat`

  Or:

  Open the `\bin` folder in Windows and double-click the `run.bat` file.

  Wait a moment for the script to execute. The server is started when you see the message "PingFederate started in [xx]s:[yy]ms" in the command window, near the end of the start-up sequence.

To shut down PingFederate®:

1. Enter `Ctrl+C` in the command-prompt window.
2. Enter `y` to terminate the batch script when prompted.

(Unix and Linux)

To start PingFederate®:

1. From a command prompt, change directories to `<pf_install>/pingfederate/bin`.
2. Execute the `run.sh` file.
   Wait a moment for the script to execute. The server is started when you see the message "PingFederate started in [xx]s:[yy]ms" in the command window, near the end of the start-up sequence.

To shut down PingFederate®:

- Enter Ctrl+C in the terminal window.

(All Platforms)

To access the PingFederate administrative console:

- Launch a Web browser and go this location:

  `https://<DNS_NAME>:<port>/pingfederate/app`

  where `<DNS_NAME>` is the fully qualified name of the machine running the PingFederate server and `<port>` is the port where the administrative console listens. The default port is `9999`.

Installing a New License Key

If your license key is going to expire or has expired recently, you can install a new one without interrupting services by using the PingFederate administrative console.

Tip: You can configure the server to send administrators email warnings regarding the license status (see *Configuring Runtime Notifications* on page 86).

You also need to install a new license key for a new PingFederate installation as well as software upgrades (other than patch releases).

To request a new license key:

- Go to the Ping Identity *website licensing page* (www.pingidentity.com/support/licensing).

  After you receive the new license key, install it using the administrative console, regardless of whether a previous license is installed or not.

  Tip: When you use the administrative console and a previous license exists, PingFederate compares the new license with the existing one and warns of any potential problems (or aborts the import if the license is invalid for any reason). After the license key is imported, the previous license file is saved with a timestamp in the filename.

To install a license key using the administrative console (when no previous license is configured):

1. Start PingFederate and access the administrative console (see *Starting and Stopping PingFederate* on page 43).
2. On the Import License screen, click **Browse** to select the file, then click **Import**.

   The license file is verified for use with the current instance of PingFederate and copied as `pingfederate.lic` to:

   `<pf_install>/pingfederate/server/default/conf`

This is referred as the primary license file.

For a clustered-server environment, the running engine nodes consume the new license and save the information to `<pf_install>/pingfederate/server/default/data/.pingfederate.lic`. This is referred to as the secondary license file.

Note: The secondary license file is used only when the primary license file cannot be found.

For any engine node that is stopped when a new license is imported through the administrative console, the new license is utilized when PingFederate restarts, and the new license information is saved to the secondary license file.

(For more information about clustering, see the *Server Clustering Guide*.)

To install a replacement license key using the administrative console:

1. Start PingFederate and access the administrative console.
2. Click **License Management** under Administrative Functions.
3. On the License Management screen, click **Choose File** to select the file and then click **Import**.

   No filename restrictions are imposed for importing the file. It can be renamed before installation if necessary.

   Once you import the new license file, the previous `pingfederate.lic` license file is renamed with a timestamp in the `/conf` folder:

   If the new license does not include support for features covered by your existing license, or if there is some other potential problem with the license, you are advised and prompted on whether to continue.

   Note: If the license is for the wrong version of PingFederate or is found to be invalid for some other reason, PingFederate displays the error(s) and reverts to the previous license.

   For a clustered-server environment, the running engine nodes consume the new license and save the information to `<pf_install>/pingfederate/server/default/data/.pingfederate.lic`. This is referred to as the secondary license file.

   Note: The secondary license file is used only when the primary license file cannot be found.

   For any engine node that is stopped when a new license is imported through the administrative console, the new license is utilized when PingFederate restarts, and the new license information is saved to the secondary license file.

(For information about clustering, see the *Server Clustering Guide*.)

Managing Log Files

PingFederate generates these logs that document server events:

- `admin.log` — Records actions performed by administrative-console users (see *Administrator Audit Logging* on page 47).
- `admin-event-detail.log` — Records detailed information about each applicable administrative-console event performed by administrative-console users if detailed event logging is enabled (see *Detailed Event Logging* on page 47).
- `admin-api.log` — Records actions performed by administrative-api users (see *Administrative API Audit Log* on page 48).
- `transaction.log` — Records individual identity-federation runtime transactions at specified levels of detail.

  The level of detail can be set globally or on a connection-by-connection basis (see *Runtime Transaction Logging* on page 49).
- `audit.log` — Records a selected, configurable subset of transaction log information plus additional details, intended for security-audit and regulatory compliance purposes (see *Security Audit Logging* on page 50).

- `provisioner-audit.log` — Records Outbound Provisioning events, intended for security-audit purpose (see *Outbound Provisioning Audit Logging* on page 51).
- `server.log` — Records all PingFederate runtime and administrative server operational activity (see *Server Logging* on page 51). PingFederate provides a utility for filtering server log entries (see *Using the Server Log Filter* on page 52).
- `provisioner.log` — Records only provisioning activity.

  (For more information, see *Outbound Provisioning for IdPs* on page 33).
- `init.log` — Records only Jetty messages generated prior to PingFederate start up.

Tip: PingFederate logs user attributes, when they are present, in the server log, the transaction log, and the audit log (if configured). When privacy is required for sensitive user attributes, you can configure PingFederate to obfuscate (mask) their values in these logs (see *Attribute Masking* on page 26).

The logs are stored by default in the `<pf_install>/pingfederate/log` folder. You can change the location to any network directory by using the runtime parameter `pf.log.dir` (see *Modifying PingFederate Properties* on page 68).

The audit log, server log, provisioner log, and provisioner audit log may be output to alternate formats, including database tables (see *Writing Logs to Other Formats* on page 53).

The PingFederate-generated logs are controlled through the `log4j2.xml` file located in `<pf_install>/pingfederate/server/default/conf` folder. See comments in the file for more information. Changes made are activated within half a minute. No restart is required.

Note: By default, initial server requests are always recorded in the server log with a tracking ID number, which is then used to identify subsequent, related transactions. This ID can be useful for debugging and support purposes to aggregate and analyze log entries tied to the same original request. The ID may also be added to the configuration for `transaction.log` or `audit.log`, or it may be removed from the `server.log <layout>` element in the `log4j2.xml` file, as needed for performance considerations.

Refer to the *log4j2 open-source project* for more information about logging levels and other configuration parameters (`logging.apache.org/log4j/2.x/manual/index.html`).

By default, PingFederate installs with a highly verbose level of logging. However, verbose logging may have a performance impact and clutter the log files. You may choose to lower the level, but we recommend that you not set it below `WARN`. For the transaction log and the audit log, note that any setting below `INFO` turns logging off.

Important: Most PingFederate-generated log files roll over at midnight each day. The system keeps all of the resulting historical log files. Some log files, such as `transaction.log`, `audit.log`, `audit-event-detail.log` (if enabled), and `provisioner-audit.log`, can become quite large, depending on your production load and settings; you may want to back up or remove older files on a routine basis.

`server.log` is rolled over when it reaches 10 MB. The system keeps five old log files before overwriting the oldest. (The file size and the number of files to be kept can be changed in the `log4j2.xml` file.)

Note: `log4j2.xml` is individually managed per PingFederate server. This flexibility allows multiple PingFederate nodes in a clustered environment to write different level of messages and/or to write messages to different destinations.

The following sections provide more information about the primary logs:

- *Administrator Audit Logging* on page 47
- *Administrative API Audit Log* on page 48
- *Runtime Transaction Logging* on page 49
- *Security Audit Logging* on page 50
- *Outbound Provisioning Audit Logging* on page 51
- *Server Logging* on page 51
- *Writing Logs to Other Formats* on page 53

HTTP requests to the runtime engine and administrative console are logged to `pf.log.dir/<date>.request.log` and `pf.log.dir/<date>.request2.log`, respectively, by the Pingfederate Web container. Properties controlling request logging are contained in the Web-container configuration files located in the `<pf_install>/pingfederate/etc` folder, namely `jetty-runtime.xml` (for `<date>.request.log`) and `jetty-admin.xml` (for `<date>.request2.log`).

Administrator Audit Logging

PingFederate records actions performed by server administrators. This information is recorded in the `admin.log` file. While the events themselves are not configurable, `log4j2.xml` configuration settings may be adjusted to deliver the desired level of detail surrounding each event.

Events logged by PingFederate includes (but not limited to):

- Login attempt
- Explicit user logout (no time-outs)
- Account activation or deactivation
- Password change or reset
- Role change
- System settings management
- Certificate management
- OAuth settings management
- Metadata export
- XML file signatures applied
- Configuration archive export and import
- IdP/SP adapter, IdP token processor, or SP token generator created, modified, or deleted
- IdP/SP default URLs modified
- IdP/SP connection created, modified, or deleted
- Adapter-to-Adapter mapping, token exchange mapping, or connection mapping contract created, modified, or deleted
- IdP Discovery management
- SP Affiliation created, modified, or deleted

Each entry in the `admin.log` file is on a separate line and represents a single administrator action. The general format of each entry is the same, though specific events are recorded with information relevant to each type. Events are recorded when the corresponding **Save** button in the administrative console is clicked. Each log entry contains information relating to the event, including:

- The time the event occurred on the PingFederate server.
- The username of the administrator performing the action.
- The role(s) assigned to the administrator at the time the event occurred.
- The type of event that occurred.
- Basic information about the event.

Each of the above fields is separated by a vertical pipe (`|`) for easier parsing.

Detailed Event Logging

PingFederate can also be configured to log additional event information to a separate log file. When detailed event logging is enabled, besides writing basic information to `admin.log`, PingFederate logs detailed information about each event to `admin-event-detail.log`. Events between `admin.log` and `admin-event-detail.log` are linked by a unique event ID. Each entry in `admin-event-detail.log` file contains:

- The ID of the event.
- The name of the file involved.
- The type of event that occurred.
- The line number where the change occurred.
- The changes made.

Note: Not all events have detailed information—for example, login attempts are only logged to `admin.log`.

To enable detail event logging, set `pf.log.eventdetail` to `true` in `<pf_install>/pingfederate/bin/run.properties` (see *Modifying PingFederate Properties* on page 68.)

API Audit Logging

PingFederate provides API endpoints and management services on the administrative port (9999) and the runtime port (9031). Actions performed through these endpoints are logged for auditing purposes, as described below:

API	Port	Log File
Administrative API	Administrative Port	`admin-api.log`
OAuth Client Management Service	Runtime Port	`runtime-api.log`
OAuth Access Grant Management Service	Runtime Port	`runtime-api.log`
Session Revocation API	Runtime Port	`runtime-api.log`

Administrative API Audit Log

PingFederate records actions performed via the administrative API (see *PingFederate Administrative API* on page 423). This information is recorded in the `admin-api.log` file. While the events themselves are not configurable, you may adjust the `log4j2.xml` configuration settings to alter the format and desired level of detail surrounding each event.

Each log entry contains information relating to the event, including:

- Time the event occurred on the PingFederate server
- Administrator username performing the action
- Authentication method
- Client IP
- HTTP method
- REST endpoint
- HTTP status code

Each of the above fields is separated by a vertical pipe (|) for ease of parsing.

Runtime APIs Audit Log

PingFederate records actions performed through the OAuth client management service, the OAuth access grant management service, and the session revocation API in the `runtime-api.log` file. While the events themselves are not configurable, you may adjust the `log4j2.xml` configuration settings to alter the format and desired level of detail surrounding each event.

Each log entry contains information relating to the event, including:

- Time the event occurred on the PingFederate server
- Administrator username performing the action
- Authentication method
- Client IP
- HTTP method
- REST endpoint
- HTTP status code

Each of the above fields is separated by a vertical pipe (|) for ease of parsing.

For information about each service, see:

- *OAuth Client Management Service* on page 414

- *OAuth Access Grant Management Service* on page 420
- *Session Revocation API* on page 421

Runtime Transaction Logging

PingFederate provides for flexible, scalable logging of all federated-identity transactions (inbound and outbound XML messaging). Transaction logging can be configured to any of four modes on a connection-by-connection basis (see “General Information” in either the IdP or SP “SSO Configuration” chapters).

You also have the option of overriding transaction logging for all connections (see *Via the Manage Connections Screen* on page 190 for SP connections or *From the Manage Connections Screen* on page 265 for IdP connections). You may want to use this override for troubleshooting or as a one-step means of raising or lowering all connection logging modes to the same level.

Transaction Logging Modes

The table below describes the four transaction logging modes:

Table 2: Transaction Logging Modes

Mode	Description
None	No transaction logging.
Standard	(Default) Logs summary information for each transaction message, including: • Timestamp • Hostname:Port • Log Mode • Connection ID • SAML Status Code (for SAML responses only) • Context • Message Type • SAML ID (for SAML messages only) • Endpoint (for outbound messages only) • Target URL (if SSO transaction)
Enhanced	Includes everything logged at the Standard level plus: • SAML_SUBJECT* • Binding • Relay State (if available) • Signature Policy • Signature Status • HTTP Request Parameters (outbound messages only) * Only when available in a SAML assertion, a single-logout request, a Request Security Token Response (RSTR), or an authentication request (AuthnRequest)
Full	Includes everything logged at the Enhanced level plus the complete XML message for every transaction.

Each of the above fields is separated by a vertical pipe (|) for easier parsing.

Security Audit Logging

The PingFederate `audit.log` records a selected subset of transaction log information at runtime plus additional details, intended to facilitate security auditing and regulatory compliance. Elements of this log are described in the following table and configurable in the `log4j2.xml` file located in `pingfederate/server/default/conf`.

Note: The audit log records SSO, SLO, OAuth AS, WS-Trust STS, and Inbound *SCIM* transactions. Outbound Provisioning transactions are not included; they are logged to the provisioner audit log (see *Outbound Provisioning Audit Logging* on page 51).

Audit-log elements may be output to different formats, including databases. For information, see *Writing Logs to Other Formats* on page 53.

Table 3: Audit Log Configuration

Item*	Description
%d	Transaction time.
adapterid	The ID of an adapter instance.
app	The target SP application (when available).
assertionid	The unique ID for the SAML assertion.
attributes	User attributes received (for an SP log) or sent (for an IdP log).
attrackingid	The tracking ID for OAuth Access Token. It could be used to analyze the flow of OAuth access tokens in the audit log and between PingFederate and PingAccess.
connectionid	The connection identifier associated with the transaction.
description	Description of an authentication failure (when information is available from an IdP adapter).
event	The type of transaction (e.g. SSO).
granttype	OAuth grant type.
host	PingFederate host name or IP address.
initiator	(SAML 2.0 only) The federation role that initiated the SSO or SLO: SP or IDP.
inmessagetype	Incoming message type. Possible values are Request or Response.
inresponseto	The value of the InResponseTo attribute of an SSO or SLO Response.
inxmlmsg	The incoming XML message.
ip	Incoming IP address.
localuserid	The local ID used for the transaction (when account linking is enabled at the SP).
outxmlmsg	The outgoing XML message.
pfversion	The PingFederate version.
protocol	The associated identity protocol (e.g., SAML 2.0).
requestid	The ID of a request.
responseid	The ID of a response.
responsetime	Time elapsed (in milliseconds) from when a final request for a transaction is received to when the audit message is written. This value serves as an approximation of total transaction processing time and may be useful for monitoring trends.
role	The partner's role in the transaction.
status	Transaction success or failure.

Item*	Description
stspluginid	For STS transactions, the ID for the token-processor or token-generator instance.
subject	The subject of the transaction.
trackingid	The tracking ID used for debugging purposes in the server log (see the last *Note* in the section *Managing Log Files* on page 45).
validatorid	The ID of the Password Credential Validator used for OAuth Resource Owner Grant transactions (see *Resource-Owner Credentials Mapping* on page 144).

* *Italicized items* are *not* configured by default for this log but may be added. Refer to `log4j2.xml` for syntax requirements.

Outbound Provisioning Audit Logging

The PingFederate `provisioner-audit.log` records Outbound Provisioning transactions, intended to facilitate security auditing. Elements of this log are described in the following table and configurable in the `log4j2.xml` file located in `pingfederate/server/default/conf`.

Important: Monitoring Outbound Provisioning transactions using JMX has been deprecated. By default, PingFederate logs outbound provisioning events to `provisioner-audit.log` (see *Runtime Monitoring Using JMX* on page 87).

Elements from the provisioner audit log may be output to different formats, including databases. For information, see *Writing Logs to Other Formats* on page 53.

Table 4: Provisioner Audit Log Configuration

Item	Description
%d	Transaction time.
cycle_id	The unique ID for each provisioning cycle.
channel_id	The unique ID for Provisioning Channel between source and target.
event_type	The type of provisioning events, such as CREATE and UPDATE.
source_id	The provisioning Source ID.
target_id	The provisioning Target ID.
is_success	A flag to show whether the event was successful or not. If the attempt succeeded, the value is `true`; otherwise, the value is `false`.
non_success_ cause	Description of failure cause.

Server Logging

The server log records all PingFederate runtime and administrative events, including status and error messages that can be used for troubleshooting. By default, the information is also sent to the terminal or command window running the PingFederate server.

Note: Alternatively, you can output the server log to a database (see *Writing Logs to Other Formats* on page 53).

To facilitate troubleshooting, administrators can use a filter utility to aggregate related events (see *Using the Server Log Filter* on page 52).

Elements of this log are described in the following table.

Table 5: Server Log Components

Item	Description
%d	Event date and time.
%X{trackingid}	The tracking ID for runtime events, used for debugging purposes (see the last *Note* in the section *Managing Log Files* on page 45).
%p	Logging level.
%c	The Java class issuing the status or error message, when applicable.
%X{connectionid}	The partner ID associated with a runtime event.
%X{subject}	The SAML subject of the transaction, when applicable.
%m	Status or error message.

Using the Server Log Filter

PingFederate provides a utility that administrators can use to filter server logs. The tool, `logfilter.bat|sh`, is located in the `<pf_install>/pingfederate/bin` folder.

By default the utility sorts through all the server logs in the log folder, or you can move or copy one or more files to a different folder that can be specified as an input parameter.

The log filter returns lists of log entries based on either:

- Entity ID and Subject
- Tracking ID
- Session Cross-reference ID

The following table describes the utility's command options. The table afterward describes optional parameters available for all of the commands.

Table 6: Server Log Filter Command Options

Command Option	Description
- entityid <entity-id> - subject <subject>	These two commands must be used together and return a list of transactions for the specified federation partner's entity ID and transaction subject.
- trackingid <tracking_id>	This command returns a list of transactions with the same tracking ID.
- sessionxrefid <session_xref_id>	This command returns a list of transactions for an ID assigned by PingFederate to associate different transactions according to the user session under which they occurred. The value of <session_xref_id> may be the value of any of the following transaction tags in the target server log(s): • Artifact • Session Index • Assertion ID

Table 7: Server Log Filter Parameters*

Parameter*	Description
-logsdir <log-files-directory>	Full or relative path to source folder for the log(s). Default: all `server.log` files in `pf.log.dir`, i.e., `<pf_install>/pingfederate/log` (see *Modifying PingFederate Properties* on page 68).

Parameter*	Description
-outputfile <output-file>	Output path and file for the returned list. Default: `pf.log.dir/logfilter_output.log`.
-outputtoconsole	Returns list to the command console rather than to a file.
*Optional for all commands	

The log filter creates its own log file, `logfilter.log`, located in the log folder. You can control settings for this log, as needed, in the file `logfilter.log4j2.xml`, located in the `<pf_install>/pingfederate/bin` folder.

Writing Logs to Other Formats

PingFederate provides the option of writing the audit, server, provisioner, and provisioner audit logs to commonly used databases (with failover to file logging).

For the audit log and the provisioner audit log, you may choose instead to write the information to the Common Event Format (see *Writing Audit or Provisioner Audit Logs to CEF* on page 55).

Finally, you may also configure PingFederate to write the audit log to a differently formatted log file that can be used by Splunk (see *Writing Audit Logs for Splunk* on page 55).

Writing Logs to Databases

You can enable database logging for the audit log, the server log, the provisioner log, and the provisioner audit log in the `log4j2.xml` file inthe `<pf_install>/pingfederate/server/default/conf` folder. Scripts for selected database types are provided to create the necessary table(s).

Database logging replaces file logging. For the server log, database logging also replaces logging to the terminal or command window running PingFederate.

Failover file logging is provided in the event that database logging fails for any reason. By default, PingFederate retries database logging every minute. Messages written to log files during failover periods are not copied over to the database server.

Important: Ensure that your JDBC 4.1 (or higher) database-driver JAR file is installed in the `<pf_install>/pingfederate/server/default/lib` folder. You must restart the server after installing the driver.

To configure database logging:

1. In `log4j2.xml`, uncomment one of the preset `JDBC` log-appender configurations listed below (or one from each list to configure all logs):

   For the server log:

   - `ServerLogToOracleDB` (for Oracle)
   - `ServerLogToSQLServerDB` (for Microsoft SQL Server)
   - `ServerLogToMySQLDB` (for MySQL)

   For the provisioner log:

   - `ProvisionerLogToOracleDB` (for Oracle)
   - `ProvisionerLogToSQLServerDB` (for Microsoft SQL Server)
   - `ProvisionerLogToMySQLDB` (for MySQL)

   For the audit log:

   - `SecurityAuditToOracleDB` (for Oracle)
   - `SecurityAuditToSQLServerDB` (for Microsoft SQL Server)
   - `SecurityAuditToMySQLDB` (for MySQL)

For the provisioner audit log:

- `OutboundProvisionerEventToOracleDB` (for Oracle)
- `OutboundProvisionerEventToSQLServerDB` (for Microsoft SQL Server)
- `OutboundProvisionerEventToMySQLDB` (for MySQL)

Note: Each appender is followed by a related appender (`RollingFile`) that creates a running `*failover.log` file in the log directory. The failover appender (`PingFailover`) must also be enabled (uncommented).

2. Replace placeholder parameter values in `log4j2.db.properties` in the same folder for the appender(s).

   The parameter values provide access to the database. We recommend that they be tested and validated prior to production deployment. Like `log4j2.xml`, `log4j2.db.properties` is also individually managed per PingFederate server. This flexibility allows multiple PingFederate nodes in a clustered environment to write messages to different destinations.

   Note: See the NOTES in `log4j2.xml` above the appender for more details.

   Tip: You can obfuscate the password used to access the database by running either `obfuscate.sh` or `obfuscate.bat`, located in `<pf_install>/pingfederate/bin`. Use the actual password as an argument and copy the entire result into the value for the password parameter in `log4j2.xml`.

3. Uncomment the appender reference in the associated logger element(s), as described in the appender `NOTES`:

   For the server log:

   Uncomment the appender reference located under `Set up the Root Logger` near the end of the `log4j2.xml` configuration file.

   For the provisioner log:

   Uncomment the appender reference located under `Limit categories` near the end of the `log4j2.xml` configuration file.

   For the audit log:

   Uncomment the appender in one or more of the following loggers located under `Limit categories` in the `log4j2.xml` configuration file:

   - `org.sourceid.websso.profiles.idp.SpAuditLogger` (Browser SSO IdP and Adapter-to-Adapter)
   - `org.sourceid.websso.profiles.sp.IdpAuditLogger` (Browser SSO SP and Adapter-to-Adapter)
   - `org.sourceid.websso.profiles.idp.AsAuditLogger` (OAuth Authorization Server)
   - `org.sourceid.wstrust.log.STSAuditLogger` (WS-Trust STS, IdP and/or SP)

   For the provisioner audit log:

   Uncomment the appender reference located under `Limit categories` near the end of the `log4j2.xml` configuration file.

   Note: As indicated in the IMPORTANT comment for the loggers, you must remove the existing appender reference(s).

4. Optional: For the audit log and the provisioner audit log, you can configure elements for database logging in the `ConversionPattern` appender parameter, as needed. For more information, see *Security Audit Logging* on page 50 and *Outbound Provisioning Audit Logging* on page 51, respectively.

To create database tables:

- Scripts to create database tables for each of the four databases are provided for the audit log, server log, provisioner log, and provisioner audit log. The scripts are located in the directory:

  `<pf_install>/pingfederate/server/default/conf/log4j/sql-scripts`

Note: The scripts are written to handle the default list of elements for the relevant database log-appender in `log4j2.xml`. Any changes to the list requires corresponding changes to the SQL table-creation script (or to the table itself if it is already created).

Writing Audit or Provisioner Audit Logs to CEF

The Common Event Format (CEF) is an open logging standard. PingFederate provides an option of writing elements from audit log or provisioner audit log (or both) at runtime to a syslog receiver for parsing and analysis via HP ArcSight tools. Alternatively, you can write CEF to a flat file; however, using syslog, when available, is recommended.

You can enable this capability in the `log4j2.xml` file (in `pingfederate/server/default/conf`).

Note: PingFederate is certified with HP ArcSight for interoperability using the default elements defined in `log4j2.xml`. Any additions to these elements may render your CEF logging incompatible with HP ArcSight.

To configure CEF logging for the audit log:

1. In `log4j2.xml`, uncomment one of the preset log-appender configurations:
    - `SecurityAuditToCEFSyslog`
    - `SecurityAuditToCEFFile`
2. Replace the placeholder parameter value for the syslog host (if you are configuring the syslog appender).
3. Uncomment the chosen appender in one or more of the following loggers located under `Limit categories` in the `log4j2.xml` configuration file:
    - `org.sourceid.websso.profiles.idp.SpAuditLogger` (Browser SSO IdP and Adapter-to-Adapter)
    - `org.sourceid.websso.profiles.sp.IdpAuditLogger` (Browser SSO SP and Adapter-to-Adapter)
    - `org.sourceid.websso.profiles.idp.AsAuditLogger` (OAuth Authorization Server)
    - `org.sourceid.wstrust.log.STSAuditLogger` (WS-Trust STS, IdP and/or SP)

To configure CEF logging for the provisioner audit log:

1. In `log4j2.xml`, uncomment one of the preset log-appender configurations:
    - `OutboundProvisionerEventToCEFSyslog`
    - `OutboundProvisionerEventToCEFFile`
2. Replace the placeholder parameter value for the syslog host (if you are configuring the syslog appender).
3. Uncomment the chosen appender for the `ProvisionerAuditLogger` logger located under `Limit categories` in the `log4j2.xml` configuration file.

    Note: As indicated in the IMPORTANT comment for the loggers, you must remove the existing appender reference(s) for syslog implementations.

Writing Audit Logs for Splunk

Splunk is enterprise software that allows for monitoring, reporting, and analyzing consolidated log files. Splunk captures and indexes real-time data into a single searchable repository from which reports, graphs, and other data visualization can be generated.

Ping Identity provides a custom Splunk App for PingFederate to process audit logs generated by a PingFederate deployment. The application provides rich system monitoring and reporting, including:

- Current transaction and system reports
- Service reports such as a daily usage report and IdP and SP reports per connection

Note: OAuth AS and WS-Trust STS transactions are not currently supported for Splunk.

- Trend reports such as weekly and monthly usage reports, and trend analysis

The application uses a specially formatted version of the audit log (`splunk-audit.log`), which is written to the PingFederate log directory when the setup steps described below are followed.

Note: The Splunk App for PingFederate is available separately. It requires enterprise-licensed (or trial) installation of the *Splunk* software and the Splunk Universal Forwarder, which is needed to collect data from the PingFederate audit log for Splunk. The application includes additional documentation on installation and available features. Download the free application from the Splunk Apps Web site "*splunkbase*" (`splunkbase.splunk.com`)—search for `PingFederate`.

To use the Splunk App for PingFederate:

1. Download and install the application in your Splunk environment from (see the **Note** above).
2. In your PingFederate installation, open the file `log4j2.xml` in the directory:

   `<pf_install>/pingfederate/server/default/conf`
3. In the `log4j2.xml` file, depending on role of your PingFederate server, search for:
   - `Logger name="org.sourceid.websso.profiles.idp.SpAuditLogger` (Browser SSO IdP and Adapter-to-Adapter)
   - `Logger name="org.sourceid.websso.profiles.sp.IdpAuditLogger` (Browser SSO SP and Adapter-to-Adapter)
   - `Logger name="org.sourceid.websso.profiles.idp.AsAuditLogger` (OAuth Authorization Server)
   - `Logger name="org.sourceid.wstrust.log.STSAuditLogger` (WS-Trust STS, IdP and/or SP)
4. Replace the `ref` attribute value in the `<appender-ref>` element for the applicable logger(s) with the value for Splunk indicated in the associated comment.

   For example, the default logger for an IdP audit log reads:

   ```
   <Logger name="org.sourceid.websso.profiles.idp.IdpAuditLogger"
       level="INFO" additivity="false" includeLocation="false">
       <appender-ref ref="SecurityAudit2File" />
       <!--
           <appender-ref ref="SecurityAuditToCEFSyslog-FAILOVER"/>
           <appender-ref ref="SecurityAuditToCEFFile"/>
           <appender-ref ref="SecurityAuditToMySQLDB-FAILOVER"/>
           <appender-ref ref="SecurityAuditToSQLServerDB-FAILOVER"/>
           <appender-ref ref="SecurityAuditToOracleDB-FAILOVER"/>
           <appender-ref ref="SecurityAudit2Splunk"/>
       -->
   </Logger>
   ```

   To log IdP audit log messages to `splunk-audit.log`, update the attribute value of `ref` from `SecurityAudit2File` to `SecurityAudit2Splunk`:

   ```
   <Logger name="org.sourceid.websso.profiles.idp.IdpAuditLogger"
       level="INFO" additivity="false" includeLocation="false">
       <appender-ref ref="SecurityAudit2Splunk" />
       <!--
           ...
       -->
   </Logger>
   ```

   Note: For auditing of adapter-to-adapter events, you must enable both the IdP and SP loggers.
5. Save the `log4j2.xml` file.
6. Download and install the Splunk Universal Forwarder on the machine running PingFederate.

Configure the Splunk Universal Forwarder to monitor the `splunk-audit.log` in the PingFederate directory `<pf_install>/pingfederate/log`.

For detailed installation and configuration instructions, consult the Splunk documentation: *Set up forwarding and receiving* (`docs.splunk.com/Documentation/Splunk/latest/Forwarding/Setupforwardingandreceiving`).

Note: For a clustered PingFederate environment, repeat step 2 through step 6 on each engine node.

Exporting Metadata

For SAML deployments PingFederate supports the export and import of *metadata* files, which federation partners can use to expedite their configuration. You can export metadata for any connection (or select certain non connection-specific metadata for export) via the Main Menu. You can import your partner’s metadata file, when available, at the beginning of the connection-configuration process or update an existing connection using your partner's metadata file (see *Managing IdP Connections* on page 264 or *Managing SP Connections* on page 189).

Tip: Connection-metadata export is also available from the Manage Connections screens (see *Via the Manage Connections Screen* on page 190 for SP connections or *From the Manage Connections Screen* on page 265 for IdP connections).

To reach the Metadata Export task:

1. Click **Server Configuration** on the Main Menu.
2. Click **Metadata Export** under Administrative Functions.

To export connection metadata:

1. If your PingFederate server is configured to act as both an IdP and an SP, indicate which type of configuration you will export and click **Next**.
2. On the Metadata Mode screen, choose the option to “**Use a connection for metadata generation**” and click **Next**.

   For more information, see *Choosing the Metadata Export Mode* on page 58.
3. On the Connection Metadata screen, select the connection from the drop-down menu. If the selected connection contains two or more virtual server IDs, choose the virtual server ID that you want to use during the export. Click **Next**.

   Note: The protocol endpoints in the connection metadata are specific to the selected virtual server ID. Re-export the connection metadata for your partners after updating your virtual server IDs (see *Multiple Virtual Server IDs* on page 36).
4. Optional: On the Metadata Signing screen, select a certificate to use for signing the metadata XML file and click **Next**.

   Note: If you want to include the public-key information in the signed XML file, select the Key Info option.

   For more information, see *Signing Metadata* on page 59.
5. On the Export & Summary screen click the **Export** button, save the file, and then click **Done**.

To export selected metadata:

1. If your PingFederate server is configured to act as both an IdP and an SP, indicate which type of configuration you will export and click **Next**.
2. On the Metadata Mode screen, select the option to “**Select information . . .**” and click **Next**.

   For more information, see *Choosing the Metadata Export Mode* on page 58.

3. If you support more than one federation protocol, select the desired protocol on the Protocol screen and click **Next**.
4. Configure any or all of the remaining steps in the task (click **Next** to skip steps). For information see:
    - *Defining a Metadata Attribute Contract* on page 58
    - *Including a Signing Key* on page 59
    - *Signing Metadata* on page 59
    - *XML Encryption Certificates* on page 59
5. Optional: On the Metadata Signing screen, select a certificate to use for signing the metadata XML file and click **Next**.

    Note: If you want to include the public-key information in the signed XML file, select the Key Info option.

    For more information, see *Signing Metadata* on page 59.
6. On the Export & Summary screen click the **Export** button, save the file, and then click **Done**.

Choosing the Metadata Export Mode

If you want to export metadata for a specific connection, keep that default selection on the Metadata Mode screen. Or you may choose instead to export metadata that is not bound to specific connection endpoints at your site.

Note: If the PingFederate secondary SSL port is configured and you want to use it for the *SOAP* channel, select the checkbox on the screen. If client-certificate authentication is configured for the SOAP channel, the secondary port is required and you *must* check this box. (For more information, see the description of the runtime property `pf.secondary.https.port` in the table under *Modifying PingFederate Properties* on page 68.)

Choosing the SAML Protocol

The Protocol screen appears if your PingFederate deployment supports only multiple SAML protocol. Choose the applicable standard from the drop-down menu (if not already selected) and click **Next**.

Defining a Metadata Attribute Contract

The Attribute Contract screen allows you to define the attribute contract you want to export in the metadata. For more information, see *Attribute Contracts* on page 23.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Metadata Export** under Administrative Functions.
3. On the Metadata Mode screen, click the button for selecting the information manually and click **Next**.

To add an attribute:

1. Enter an attribute on the Attribute Contract screen and click **Add**.
2. Continue to add attributes as needed and click **Next**.

To edit an attribute name:

1. Click **Edit** and make your change.
2. Click **Update**.

To delete an attribute:

- Click **Delete**.

Including a Signing Key

In a metadata file you can manually include the public key for partners to use to verify the digital signature you will use to sign SAML messages. For more information, see *Digital Signing and Decryption Keys and Certificates* on page 166.

To export your public signature verification key:

- Select the certificate from the drop-down list and click **Next**.

Signing Metadata

Choose your organizational signing certificate on the Metadata Signing screen. The metadata XML file must be signed using a certificate trusted by your federation partner.

To specify a certificate:

1. Select the certificate from the drop-down list.

   If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).
2. Optional: If you have agreed to send your public key with the SAML message, select the checkbox to include the certificate. To include the raw key in the signature as well, select the "**Include the raw key …**" checkbox.
3. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.
4. Click **Next**.

XML Encryption Certificates

In your SAML 2.0 metadata, you can manually include the XML encryption key and certificate your partners can use to encrypt SAML 2.0 messages.

To export an XML encryption key:

- Select the key from the drop-down list and click **Next**.

  Note: If the key is not shown, click **Manage Certificates** to create a new key pair or import a key pair from a PKCS12 file.

Completing the Export

On the Export & Summary screen, you can complete the XML-file download or change any information by clicking any of the headings in the summary.

Important: To finish the download, be sure to click the **Export** button at the bottom left of the screen.

Signing XML Files

PingFederate supports digital signing of SAML *metadata* files or any other XML files that you and your partner might want to exchange. A signature applied to an XML file ensures that the file is from the original source and that its contents have not been modified by a third party.

When you configure a partner connection, you can also verify and import signed metadata files. For information:

- As an SP configuring an IdP connection, see *Importing IdP Metadata* on page 269.

- As an IdP configuring an SP connection, see *Importing SP Metadata* on page 195.
- XML file signing is available from the Main Menu under Administrative Functions.

To sign an XML file:

1. On the Select XML File screen, locate and open the file.
2. On the Digital Signature Settings screen, choose the certificate containing your signing key from the drop-down list.

   Note: By default, certificate and public-key information is included in the signed XML file. If you do not wish to include this information, clear the "**... <KeyInfo> ...** " and the "**... <KeyValue> ...**" checkboxes.
3. Select a signing algorithm corresponding to the selected certificate. Choices include RSA-SHA1, SHA256, SHA384, and SHA512; ECDSA-SHA256, SHA384 and SHA512; as well as DSA SHA1.
4. On the Export & Summary screen, click the **Export** button to save the signed file.

   Important: To finish the download, be sure to click the **Export** button at the bottom left of the screen.

Replicating Configuration

From the Cluster Management screen, which is available only when the administrative console is running in cluster mode, you can replicate the current console configuration to all server nodes in the cluster.

This screen is also useful for verifying that nodes have joined the cluster.

For more information, refer to *Console Configuration Push* in the PingFederate *Server Clustering Guide*.

Using the Configuration Archive Utility

PingFederate's archive utility allows you to export the current administrative-console configuration to a ZIP file and to import an existing archive for immediate deployment into a running PingFederate server.

Tip: A time-stamped configuration archive is created as a backup automatically every time you log on to the administrative console and before an existing archive is imported. The archives are stored in the `<pf_install>/pingfederate/server/default/data/archive` folder. Configuration archives can be used as backups.

Caution: As the backup file contains your complete PingFederate configuration, ensure the file is protected with appropriate security controls in place.

Tip: PingFederate includes a separate command-line utility that provides a finer level of control over configuration migration, as well as providing for scripting of routine configuration-management tasks (see *Automating Configuration Migration* on page 70).

Important: Draft connections in archives are not imported. Complete any unfinished partner connections if you wish to include them in a full backup archive or in an archive to be used for configuration migration.

Note: The archive utility is intended for administrative-console configuration data only. It does not include error-page or other end-user HTML templates (see *Customizing User-Facing Screens* on page 76), nor any files under the `<pf_install>/pingfederate/server/default/conf` folder. If any changes have been made to the default templates or configuration files, you must copy them over to new installations or other instances of PingFederate (assuming the changes are applicable).

The archive also does not capture license files, adapter JAR files, database drivers, or any other plug-ins; these also must be copied into any new instance of PingFederate. The import utility checks for and reports on any missing components (see *Using the Archive Import Screen* on page 61).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Configuration Archive** under Administrative Functions.

To create an archive:

1. On the Select Import/Export screen, ensure Export is selected and click **Next**.
2. On the Export screen, click **Export**, save the download to your file system, and click **Done**.

To import and deploy an archive:

- On the Select Import/Export screen, click **Import** and then **Next**.

  See *Using the Archive Import Screen* on page 61 for more information.

  Note: Alternatively, you can deploy an archive manually, using the procedure below.

  Caution: Deploying a configuration archive, either manually or by using the administrative console, always overwrites all existing configuration data.

To deploy an archive manually:

1. Copy a previously stored archive into this folder:

   ```
   <pf_install>/pingfederate/server/default/data/drop-in-deployer
   ```
2. Rename the copied file to `data.zip`.

   When the PingFederate server is running, the file is again renamed with a timestamp after a moment and the data automatically deploys, replacing the current UI configuration. Restarting the server is not required.
3. Consult the PingFederate server start-up window, or the server log file, for any messages concerning missing plug-in components or other errors.

   Note: A data archive imported via the `drop-in-deployer` folder is deployed by default regardless of errors, unlike the default behavior using the Select Import/Export screen.

Using the Archive Export Screen

To export an archive:

1. Click **Export** and save the archive on your file system.
2. Click **Done**.

Caution: As the backup file contains your complete PingFederate configuration, ensure the file is protected with appropriate security controls in place.

Using the Archive Import Screen

When you initiate deployment of a configuration archive using the Import screen, PingFederate displays error messages if there are any missing plug-in components (such as adapters, database drivers, or token translators) on which the archive depends, or any mismatches of PingFederate licensing authorization.

If there are missing components or license inconsistencies, the import is halted by default to allow you to install the necessary components or license. However, you can choose to force the deployment and then install the necessary files later.

Note: Installation of any missing database drivers or other third-party libraries will require a PingFederate server restart.

Caution: Deploying a configuration archive, either manually or by using the administrative console, always overwrites all existing configuration data.

To deploy a configuration archive:

1. On the Import screen, click **Browse** to locate the required ZIP file.
2. Optional: Select Force Import to deploy the archive regardless of whether dependencies are detected.

   Important: If you make this selection, consult the server start-up window or the server log for any errors.
3. Click **Import**.
4. Read the on-screen caution statement and indicate whether you want to continue.

   When you click **Yes**, a message is displayed indicating the deployment result.
5. Click **Done**.

Account Management

PingFederate provides a choice of single- or multi-user system administration (see *Setting Administration Options* on page 86).

Note: This choice is not presented in the administrative console if you are using your network's LDAP user store, a *RADIUS* server, or client certificates for authentication to the PingFederate administrative console (see *Alternative Console Authentication* on page 65).

If you choose native multi-user administration or if you are using alternative authentication, PingFederate provides role-based access control, as shown in the following table. For native multi-user administration, you can choose to use email for password setting and resetting notifications.

Table 8: PingFederate User Access Control

Role Assignment	Access Privileges
User Admin	Create users, deactivate users, change or reset passwords, and install replacement license keys. (This role is not provided if you are using LDAP or RADIUS authentication for administrative logon, since user management is handled outside of PingFederate.)
Admin	Configure partner connections and most system settings (except user management and local key/ certificate handling).
Crypto Admin	Manage local keys and certificates.
Auditor	View-only permissions for all administrative functions.

When Auditor is assigned, no other roles may be set. Admin users may have multiple roles set.

Tip: The same user may log on from more than one browser or location. Also, by default, more than one user can log on to PingFederate at a time. You can change this default to restrict the administrative console to one administrative user at a time (see *Modifying PingFederate Properties* on page 68).

Any number of auditors may log on at any time, regardless of the property setting.

Note: For security, after three failed logon attempts from the same location within a short time period, the administrative console will temporarily lock out further attempts by the same user. The user must wait one minute to try again.

To reach the Account Management screen:

1. Click **Server Configuration** on the Main Menu.

2. Click **Account Management** under Administrative Functions.

   Note: If you are using alternative PingFederate authentication, the **Account Management** configuration is not available. Set PingFederate-specific permissions for users in configuration files located in `<pf_install>/pingfederate/bin` (see *Alternative Console Authentication* on page 65).

   Users with User Admin permissions can add other users, assign them any role, or reset their passwords, as well as change their own passwords. Other types of users can change only their own passwords from this screen (see *Changing Passwords* on page 64).

To add a user:

1. Click **Create User**.
2. On the User Information screen, enter the required fields (indicated by asterisks).

   Note: Only Username is required, unless you elected on the Account Management screen to have PingFederate send passwords via email, in which case you must supply an email address.
3. Optional: Enter additional information.
4. Click **Next** to set up a password (see *Setting or Resetting Passwords* on page 64).

   Important: After you set the password and return to the Account Management screen, you must select permissions for the new user and click **Save** to complete the process.

To define a user's permissions:

- Select or clear the checkboxes under the permission categories you want to assign or remove (see the table above).

  Clicking the Auditor button deactivates other permission selections.

  Note: For traceability and accountability purposes, users cannot be deleted; their records are retained and they can be reactivated if needed.

To enable password notification:

1. Select the password-notification checkbox.
2. If you have not yet configured PingFederate to use your email server, click **Email Server Settings** and complete the configuration (see *Managing Email Configuration* on page 67).
3. Click **Save** (or **Next** if you are installing PingFederate).

   Note: If you are setting up email notifications for the first time, you must click **Email Server Settings** and configure the settings. If you are not sure of the correct settings, enter placeholders on the Email Notification screen; you can return later and update the information.

Entering User Information

1. On the User Information screen, enter the required fields (indicated by asterisks).

   Note: Only Username is required, unless you have elected to have PingFederate send passwords via email, in which case you must supply an email address (see *Account Management* on page 62).
2. Optionally, enter additional information.
3. Click **Next** to set up a password (see *Setting or Resetting Passwords* on page 64).

   Note: After you set the password and return to the Account Management screen, you must select permissions for the new user and click **Save** to complete the process.

Setting or Resetting Passwords

A user administrator can generate or assign temporary passwords for other users, either during user setup or at a later time (for example, if a user forgets his or her password).

Note: If you are using non-native authentication for PingFederate, password management is handled at the network level (see *Alternative Console Authentication* on page 65).

Initial or reset passwords may be used only once; the administrative console requires the user to change the password immediately after logging on.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Account Management** under Administrative Functions.
3. Click **Reset Password** under Action for a user.

To set or reset a user's password:

1. Either:
   - Click **Generate one-time password**.

     Or:
   - Enter a temporary password in the text box. Password policy applies. For more information, see *Configuring Password Policy* on page 82.
2. Click **Done**.

   Important: The password and any other changes, including new user records, are not stored until you click **Save** on the Account Management screen.

   After you click **Save** on the Account Management screen, the new password is emailed to the user automatically, if you have enabled email notifications (see *Account Management* on page 62).

Changing Passwords

Any user can change his or her own password. For information about resetting another user's password (if you are a user administrator), see the previous section.

Note: If you logged on to PingFederate using your network ID and password, you can change your password only at the network level. The new password will apply to PingFederate automatically the next time you log on.

To change your password:

1. Click **Account Management** on the Main Menu.
2. On the Account Management screen, click **Change Password** under the Action column.
3. Enter your Current Password and New Password (plus confirmation) and click **Save**.

   Password policy applies. For more information, see *Configuring Password Policy* on page 82.

   Important: If you are the sole user administrator, take steps to ensure that you do not forget your new password.

Using the Summary Screen

- On the User Information summary screen, click **Done** or click a heading if you need to make changes.

  Note: Clicking **Done** returns you to the Account Management screen, where you must assign permissions if you are setting up a new user. When are you are finished adding a new user or making any changes to existing user records, click **Save** to store the records.

Alternative Console Authentication

As an alternative to using PingFederate's own internal data store for authentication to the administrative console, you can configure PingFederate to use either your network's LDAP user-data store, the *RADIUS* protocol, or client certificates. You can configure any of these alternatives at any time.

Note that most user-management functions are handled outside the scope of the PingFederate administrative console when alternative authentication is enabled. Authorization levels, however, as described in *Account Management* on page 62, must be assigned in PingFederate configuration files.

Tip: You can use the LDAP configuration file in conjunction with *RADIUS* authentication to determine permissions dynamically via LDAP group assignments.

Using LDAP Authentication

The LDAP authentication setup is available via configuration files in the `<pf_install>/pingfederate/bin` folder.

Note: When LDAP authentication is configured, PingFederate does not lock out administrative users based upon the number of failed logon attempts. Responsibility for preventing access is instead delegated to the LDAP server and enforced according to its password lockout settings.

To configure PingFederate to use network LDAP authentication:

1. In the `<pf_insall>/pingfederate/bin/run.properties` file, change the value of `pf.console.authentication` as shown below:

   `pf.console.authentication=LDAP`

   Note: You can restore internal user-management control at any time by returning the value to `native` and restarting the PingFederate server.
2. In the `<pf_install>/pingfederate/bin/ldap.properties` file, change property values as needed for your network configuration.

   See the comments in the file for instructions and additional information.

   Important: Be sure to assign LDAP users or designated LDAP groups (or both) to at least one of the PingFederate administrative roles as indicated in the properties file. For information about permissions attached to the PingFederate roles, see *Account Management* on page 62.

   Tip: You can also use this configuration file in conjunction with *RADIUS* authentication to determine permissions dynamically via an LDAP connection.
3. Start or restart PingFederate.

Using RADIUS Authentication

The *RADIUS* authentication setup is available via configuration files in the `<pf_install>/pingfederate/bin` folder. The RADIUS protocol provides a common approach for implementing strong authentication in a client-server configuration. PingFederate supports the protocol scenarios for one- and two-step (for example, challenge-response) authentication.

Note: When RADIUS authentication is configured, PingFederate does not lock out administrative users based upon the number of failed logon attempts. Responsibility for preventing access is instead delegated to the RADIUS server and enforced according to its password lockout settings.

Note: The NAS-IP-Address attribute is added to all Access-Request packets sent to the RADIUS server. The value is copied from the `pf.engine.bind.address` property in `run.properties`. Only IPv4 addresses are supported.

To configure PingFederate to use network RADIUS authentication:

1. In the `<pf_install>/pingfederate/bin/run.properties` file, change the value of `pf.console.authentication` as shown below:

   ```
   pf.console.authentication=RADIUS
   ```

   Note: You can restore internal user-management control at any time by returning the value to native and restarting the PingFederate server.
2. In the `<pf_install>/pingfederate/bin/radius.properties` file, change property values as needed for your network configuration.

   See the comments in the file for instructions and additional information.

   Important: Be sure to assign RADIUS users or designated RADIUS groups (or both) to at least one of the PingFederate administrative roles as indicated in the properties file. Alternatively, you can set the `use.ldap.roles` property to `true` and use the LDAP properties file (also in the `bin` folder) to map LDAP group-based permissions to PingFederate roles. (For information about permissions attached to the PingFederate roles, see *Account Management* on page 62.)
3. Start or restart PingFederate.

Using Certificate-Based Authentication

To enable client-certificate authentication, PingFederate administrative users must have imported into their Web browsers an X.509 key and certificate suitable for user authentication. In addition, the corresponding root CA certificate(s) must be contained in the Java runtime or the PingFederate trusted store (see *Trusted Certificate Authorities* on page 161).

Other setup steps, including designating user permissions, are required via configuration files in the `<pf_install>/pingfederate/bin` folder.

To enable certificate-based PingFederate console authentication:

1. If not already done, import the necessary client key and certificate into the Web browser used to access PingFederate.

   Refer to the browser's documentation, as needed, for instructions.
2. Log on normally (using username and password) to the PingFederate console as a user with permissions that include the role Crypto Admin.

   The default administrator includes this role. (For more information, see *Account Management* on page 62).
3. Ensure the client-certificate's root CA and any intermediate CA certificates are contained in the trusted store (either for the Java runtime or PingFederate, or both).

   To import a certificate, click **Trusted CAs** in the Certificate Management section under Server Configuration.

   Tip: You may wish to click the Serial number and copy the Issuer DN to use in a couple steps later.
4. In the `pingfederate/bin/run.properties` file, change the value of `pf.console.authentication` as shown below:

   ```
   pf.console.authentication=cert
   ```
5. In the `<pf_install>/pingfederate/bin/cert_auth.properties` file, enter the Issuer DN for the client certificate as a value for the property: `rootca.issuer.`*`x`*

   where *x* is a sequential number starting at 1 (see the properties file for more information).

   Important: The configuration values are case-sensitive.

   If you copied the Issuer DN a couple steps earlier, paste this value.
6. Repeat the previous step for any additional CAs as needed.

7. Enter the certificate user's Subject DN for the applicable PingFederate permission role(s), as described in the properties file.

   Important: The configuration values are case-sensitive.

   See *Account Management* on page 62 for more information about PingFederate permissions.
8. Repeat the previous step for all users as needed.

   Note: Other settings in the properties file are used to display the user's ID (the Subject DN) in abbreviated form in the administrative console.
9. Restart the PingFederate server (see *Starting and Stopping PingFederate* on page 43).

Managing Email Configuration

If you are using email notification for password resets, licensing events, or certificate-expiration warnings, you must set up and maintain a connection to the email server that PingFederate will use to send messages (see *Account Management* on page 62 and *Configuring Runtime Notifications* on page 86).

Field Descriptions

Field	Description
"From" Address	The email address that appears in the "From" header line in email messages generated by PingFederate. The address must be in valid format but need not be set up on your system.
Email Server	The IP address or hostname of your email server.
SMTP Port	The SMTP port on your email server (default: 25).
SSL SMTP Port	The secure SMTP port on your email server (default: 465). This field is not active unless Use SSL is enabled below.
Connection Timeout	The amount of time in seconds that PingFederate will wait before it times out connecting to the SMTP server.
Use SSL	(Optional) Requires the use of the SMTP secure channel.
Use TLS	(Optional) Requires the use of the secure transport layer.
Enable SMTP Debugging Messages	(Optional) Turns on detailed error messages for the PingFederate server log to help troubleshoot any problems.
Username	(Optional) Authorized email username.
Password	(Optional) User password.
Confirm Password	Re-entered password, when a Password is used.
Test Address	(Optional) An email address to use in conjunction with testing the connection.

To reach this screen

1. Click **Server Configuration** on the Main Menu.
2. Click **Email Configuration** under Administrative Functions.

   If this link is not displayed, then no email notifications are configured (see *Configuring Runtime Notifications* on page 86 or *Account Management* on page 62).

To configure access to your email server:

1. Enter information into required fields, at minimum (Username and Password are not required.)
2. (Recommended) Enter an email address (or addresses) in the Test Address field and click **Test Email Connectivity**.

   A message next to the button indicates a successful test. Verify that the test email address received a message from the server.

   Test reports are also written to the `server.log` file in the `/log` folder.

Using Virtual Host Names

In certain contexts, the SAML specifications require that XML messages include a URL identifying the host name to which the sender directed the message. (The name of the XML element containing the URL varies among protocols.) In addition, the recipient must verify that the value matches the location where the message is received.

Depending on your networking requirements, this specification can present problems—for example, in the case of proxy forwarding, where the final destination host name might be unknown to your federation partner. To provide more flexibility in such cases, you can set up a list of alternative host names for PingFederate to use as part of its message-security validation.

Note that virtual host names are used for a different purpose than virtual server IDs, which provide separate unique identifiers for a federation deployment, normally in the *same* domain (see *Federation Server Identification*). Depending on your needs, however, you can configure virtual server IDs and virtual hosts in the same installation of PingFederate.

Modifying PingFederate Properties

PingFederate's default administrative-console and runtime behavior is controlled in part by configuration properties contained in the file `run.properties`, located in: `<pf_install>/pingfederate/bin`. The table below describes the properties.

Tip: Refer to the file itself for default settings not specified here, including various cookie-encoding options.

Note: Properties related to server clustering and provisioning failover are described in the PingFederate *Server Clustering Guide*.

You can change these settings as needed. Restart the PingFederate server for changes to take effect.

Important: If PingFederate is deployed in a cluster, changes to default settings for runtime-server properties must be applied to other server nodes manually. The settings in `run.properties` are not replicated to other server nodes in the cluster.

Table 9: PingFederate Configuration Properties

Property	Description
pf.admin.https.port	Defines the port on which the PingFederate administrative console runs. Default is `9999`.
pf.console.bind.address	Defines the IP address over which the PingFederate administrative console communicates. Use for deployments where multiple network interfaces are installed on the machine running PingFederate.
pf.console.title	Defines the browser window or tab title for the administrative console, used to make separate instances identifiable.

Property	Description
pf.console.session.timeout	Defines the length of time in minutes until an inactive administrative console times out. The minimum setting is 1 minute; maximum is 8 hours (480 minutes). Default is 30 minutes.
pf.log.eventdetail	Enables or disables (the default) detailed event logging for actions performed by administrative-console users (see *Detailed Event Logging* on page 47).
pf.console.login.mode	Indicates whether more than one Admin user may access the administrative console at one time (see *Setting Administration Options* on page 86). Values: `Single | Multiple`. Default is `Multiple`.
pf.console.authentication	Indicates whether administrators log on to PingFederate using credentials managed internally, by PingFederate, or externally (see *Alternative Console Authentication* on page 65).
pf.admin.api.authentication	Defines the authentication method of the PingFederate administrative API (see *Configuring Access to the Administrative API* on page 424).
ldap.properties.file	When LDAP administrative-console authentication is enabled, indicates the name of the file containing configuration properties.
cert.properties.file	When certificate-based console authentication is enabled, indicates the name of the file containing configuration properties.
radius.properties.file	When RADIUS-based console authentication is enabled, indicates the name of the file containing configuration properties.
pf.http.port	Defines the port on which PingFederate listens for unencrypted HTTP traffic at runtime. For security reasons, this port is turned off by default. **Caution:** This port should remain disabled in production if your deployment configuration directly exposes the PingFederate server to the Internet.
pf.https.port	Defines the port on which PingFederate listens for encrypted HTTPS (SSL/TLS) traffic. Default is `9031`.
pf.secondary.https.port	Defines a secondary HTTPS port that can be used, for example, with *SOAP* or *artifact* SAML bindings or for WS-Trust STS calls. To use this port, change the placeholder value to the port number you want to use. **Important:** If you are using mutual SSL/TLS for either WS-Trust STS authentication or for SAML back-channel authentication, you *must use* this port for security reasons (or use a similarly configured new listener, with either `WantClientAuth` or `NeedClientAuth` set to `true`—see "**Note**" at the end of this table).
pf.engine.bind.address	Defines the IP address over which the PingFederate server communicates with partner federation gateways. Use for deployments where multiple network interfaces are installed on the machine running PingFederate.
pf.monitor.bind.address	Defines the IP address over which an SNMP agent and JMX communicate with PingFederate (see *Configuring Runtime Reporting* on page 87). Use for deployments where multiple network interfaces are installed on the machine running PingFederate.
pf.engine.prefer_ipv4	Defines the protocol to be used by PingFederate. `True` (the default) enables use of `ipv_4` only. `False` enables use of both `ipv_4` and `ipv_6`.
pf.runtime.context.path	Allows customization of the server path for PingFederate endpoints (see *Application Endpoints* on page 385).

Property	Description
	Note: If this property is changed, the path must also be added to the Base URL for your server (see *Specifying Federation Information* on page 94).
pf.log.dir	Network path to the output location of log files. The default is: `<pf_install>/pingfederate/log`
pf.hsm.mode	Enables or disables (the default) a FIPS-compliance Hardware Security Module (see *Using the Thales nShield Connect HSM* in *Getting Started*).
pf.provisioner.mode	Enables or disables (the default) Outbound Provisioning (see *Outbound Provisioning for IdPs* on page 33). Also used to enable provisioning failover (see the PingFederate *Server Clustering Guide*).

Note: Additional configuration of the listener ports (including adding new listeners) is available via the `<pf_install>/pingfederate/etc/jetty-runtime.xml` file. For example, options include `WantClientAuth` and `NeedClientAuth` flags, which indicate that a client certificate is either requested or required, respectively, for mutual SSL/TLS. (For the preconfigured SSL secondary port, `WantClientAuth` is set to `true` by default; `NeedClientAuth` is set to `false`.)

Automating Configuration Migration

PingFederate provides a configuration-migration tool that can be used for scripting the transfer of administrative-console configurations and configuration property files from one PingFederate server to another—for example, from a test environment to production. The tool may also be used to manage certificates for the target server.

The command-line utility, `configcopy` in `<pf_install>/pingfederate/bin`, uses PingFederate's built-in Connection Management Web Service in conjunction with an internal Web Service to export and import connections and other configurations, and to obtain lists (see *Connection Management Service* on page 408).

Important: The Connection Management Service must be activated for both the source and target servers before the configcopy tool can be used (see *Authentication* on page 169).

Caution: For security reasons, the Management Service should be disabled whenever it is not in use.

Copying the Key from the Source to the Target Server

You must copy the key from the source server to the target server before you migrate data using the configcopy tool. To do this, you copy the key (or keys, if you have more than one) from the `pf.jwk` file on the source server and append it to the last key in the `pf.jwk` file on the target server, and then restart that target server. This step only needs to be done before the first migration.

To copy the key from the source to the target servers:

1. In your PingFederate installation on the source server, open the `pf.jwk` file in the directory:

   ```
   <pf_install>/pingfederate/server/default/data
   ```

2. Copy the key in the file. Ensure you copy the entire key JSON message. For example, you would copy all the bolded text as shown below:

   ```
   {"keys":[{"kty":"oct","kid":"j0PUEdAb95","k":"AGi8Lg_ewdl-
   _30Cx83kDMQE9oNlhgJSa_Pc4I8JTU8"}]}
   ```

3. In your PingFederate installation on the target sever, open the `pf.jwk` file in the directory:

   ```
   <pf_install>/pingfederate/server/default/data
   ```

4. Insert a comma at the end of the last key in the file and append the source key as shown below:

```
{"keys":[{"kty":"oct","kid":"wER9zEpaPe","k":"i0HQr9JmsqjAX4o_BQU1qGJzoLQI-
nmwp8u3GyHzTB8"},{"kty":"oct","kid":"j0PUEdAb95","k":"AGi8Lg_ewdl-
_30Cx83kDMQE9oNlhgJSa_Pc4I8JTU8"}]}
```

5. Save the `pf.jwk` file and start or restart the target server.
6. If applicable, repeat the steps above for each target server running PingFederate.

Administrative Console Migration

For migrating data configured with the source server's administrative console, this tool performs these overall processing steps:

1. Retrieves specified connection and/or other configuration data (XML) from a source PingFederate server.
2. Modifies the configuration with any changes required for the target environment, according to settings in one or more properties files and/or command-line arguments.
3. Imports the updated configuration into the PingFederate target server.

The configcopy tool can perform these functions in real time, from server to server, or by using an intermediate file. The latter option is useful when both the source and target PingFederate servers are either not running at the same time or not accessible from the same operating-system command window.

Important: For one-time configuration transfers from one version of PingFederate to a newer version, we recommend using a complete configuration archive, either with configcopy archive export/import commands or manually (see *Using the Configuration Archive Utility* on page 60). Other configcopy commands are not supported for this purpose.

Operational capabilities include:

- Listing of source partner connections, *adapter* or *STS* token-translator instances, outbound-provisioning channels, or data-store connections.

  List commands include optional filter settings, when applicable.
- Copying one or more partner connections, outbound-provisioning channels, or instances of adapters or token translators.
- Copying one or more data-store connections.
- Copying server settings.
- Exporting and importing full configuration archives.

Configuration File Copying

The configcopy tool supports copying configuration files containing runtime properties (including those needed for server clustering) that may have been manually customized for the source configuration and need to be migrated. The file-copy command may also be used to copy the PingFederate internal, HyperSQL database when needed.

Certificate Management

Administrators may use the configcopy tool to perform the following certificate-management tasks on the target PingFederate server:

- List source trusted CAs and target key aliases
- Copy one or all trusted CAs from the source server
- Create certificates
- Create Certificate Signing Requests (CSRs)
- Import CA-signed and PKCS-12 certificates

Using the Migration Tool

The configcopy tool may be used in conjunction with one or more property files to define the operational command and other parameters, including the source and/or target PingFederate servers, and to modify configuration settings as needed for the target environment.

Property-file templates are available for each command option in `<pf_install>/pingfederate/bin/configcopy_templates`.

Note: Refer to the `README.txt` file in the `configcopy_templates` folder for a list of all commands and summary information. See the template files themselves for parameters associated with each command (or with use cases), as well as lists of Override Properties (configuration settings that can be modified in transit), where applicable.

Copies of the templates can be configured as needed and then used together (or combined into one file). Use the applicable filenames as an argument when running `configcopy.bat` or `configcopy.sh` (depending on your operating system) for particular configurations, using the following command syntax:

(On Windows)

```
configcopy.bat -Dconfigcopy.conf.file=<properties_file1>;
<properties_file2>;...
```

When paths are included with the filenames, you cannot use backslashes (\). Use forward slashes (/) or escape the backslash (\\).

(On Unix/Linux)

```
configcopy.sh -Dconfigcopy.conf.file=<properties_file1>:
<properties_file2>:...
```

Note that the file separators are platform specific, corresponding to the syntax used for system-level path separators.

Alternatively (or in addition), you can specify any property values via command-execution arguments, using the following syntax:

```
configcopy[.sh] -D<property>=<value> ...
```

where `<property>` is any property named in the properties file and `<value>` is the value.

Command-line property designations take precedence over any values set in the properties file.

Note: Access to the Connection Management Web Services are password-protected (see *Authentication* on page 169). The usernames and passwords may be set in the properties file for both the source and target Web Services (passwords can be obfuscated). If passwords are set in the properties file, they cannot be overridden using the command line. If a password is not set, the `configcopy` tool prompts for it. Usernames always must be supplied where applicable, either in the command line or in the properties file.

The configcopy utility generates its own log file, `configcopy.log`, which is located in the `<pf_install>/pingfederate/log` folder. You can control settings for this log, as needed, in the file `configcopy.log4j2.xml`, located in the `bin` folder.

Caution: Importing connections or other discrete configurations at the target server is not subject to the same rigorous data validation performed by the administrative console during manual configuration. Although some checks are made, it is possible to create invalid connections using the connection-migration process. Therefore, you should not use the configcopy tool to attempt to create settings at the target that do not exist at the source; for connections and other configurations copied separately, the tool is designed only for modifying the values of existing source settings to make them applicable to the target environment.

In addition, to avoid errors and prevent unstable target configurations due to missing components or faulty cross-component references (for example, invalid ID references from connection configurations to data-store configurations), be sure to adhere closely to the instructions provided in the following procedure.

To use configcopy:

1. Ensure access to the Connection Management Web Service is enabled for both the source and target PingFederate servers (see *Authentication* on page 169).
2. Determine which component configurations need to be copied, including plug-ins.

For example, connection configurations always reference either adapter or token-translator configurations (or both) and may reference data-store configurations. These are all separate configurations, and must be copied separately (unless they already exist at the target) in conjunction with copying connection configurations.

Server Settings, unless preconfigured at the target, also need to be copied over separately.

Provisioning settings may be copied separately as needed to update target connections.

3. Determine whether any configuration property files or other supporting files need to be copied.
4. Ensure necessary plug-in JAR files are installed on the target server.

   The configcopy tool does not copy over these files, which include libraries for adapters, token translators, and JDBC or any custom database drivers.

   The JAR files are located in either:

   `<pf_install>/pingfederate/server/default/deploy`

   or:

   `<pf_install>/pingfederate/server/default/lib`
5. On the target server, ensure that signing certificates (or certificates used for XML decryption) are already in place (see *Security Management* on page 161).

   Private keys are not copied from server to server (public certificates may be copied); however, you may use configcopy to upload keys/certificates to the target server.

   Make note of identifying information about the target keys so you can reference the certificates in connection-copy properties.
6. If you have not yet installed your organization's (CA-issued) SSL server certificate on both the target and source servers, either do so—you can use a configcopy command for this—or use one of the following work-arounds to ensure that configcopy can contact both servers:

   Either:

   - (Recommended) Install the Issuer certificate for the PingFederate SSL certificate in a separately managed trust store. Then the location of the file can be specified when running configcopy using the property `configcopy.connection.trust.keystore`.

     Or:
   - Install the Issuer certificate for the PingFederate SSL certificate into the trust store for the Server JRE under which configcopy runs.

     Note: If different SSL certificates are installed on the two servers, the configcopy tool must be able to trust both. In this case, both certificates must be installed in the trust store used by configcopy, or in the trust store for the Server JRE under which configcopy runs.
7. Create properties files for the necessary commands and associated command-parameter values needed to copy the required configurations and any additional files.

   Refer to the REAME.txt file and to the properties-file templates in the directory:

   `<pf_install>/pingfederate/bin/configcopy_templates`

   Note: This step and those following assume the use of properties files based on the templates provided; you may also use command-line parameters (see information earlier in this section).
8. If you are copying connections, override ID properties referencing adapter, data stores or other plug-in configurations, as needed (see *Step 2*).

   Important: Ensure that the plug-in configurations are either previously defined at the target or are part of the same configcopy process used to copy the connections that depend on them.
9. Create a script or run a command (or command series) that executes configcopy for each of the prepared properties files.

   See the discussion above for syntax requirements, or the README file.

Outbound Provisioning CLI

PingFederate provides as command-line interface (CLI) to help manage automated outbound provisioning at IdP sites (see *Outbound Provisioning for IdPs* on page 33). Administrators can use this tool to view the status of user provisioning, either globally or one provisioning channel at a time, and to rectify unusual situations where provisioning at the service provider may get out of sync with the enterprise user store (see *Configuring Outbound Provisioning* on page 239).

The CLI tool, `provmgr.bat` or `provmgr.sh`, is located in the directory `<pf_install>/pingfederate/bin`. The tool interacts with the internal data store PingFederate uses to maintain provisioning synchronization between the LDAP user store and the target service (see *Configuring Outbound Provisioning Settings* on page 96).

Note that the tool creates its own log file, `provmgr.log`, located in the directory `<pf_install>/pingfederate/log`. You can control settings for this log, as needed, in the file `provmgr.log4j2.xml`, located in the `bin` folder.

The following tables describes the available global and channel-specific command arguments:

Table 10: Outbound Provisioning CLI Global Options

Command Argument	Description
--help	Describes the available options. The help is also displayed if the command is run with no arguments.
--show-channels	Lists all channels in a table format, showing for each: • ID - A numeric channel ID (channel-specific commands need this ID) • Name - The channel name • Connection ID • Status (active/inactive) - Both the connection and the channel status are shown (see *Channel Activation and Summary* on page 248) • User count/dirty-user-record count (e.g.: 5000/12 means 5000 users and 12 dirty records) • Source (as LDAP URL) • Target code
--show-nodes	Shows all the provisioning-server nodes with their status and the last timestamp (applies only to a failover configuration—see the PingFederate *Server Clustering Guide*).
--force-node-backup Use with node number: -n <node ID>	Sets the provisioner mode to FAILOVER for the associated PingFederate server node (see the *Server Clustering Guide*).

The following table describes the available channel-specific command arguments:

Note: With each command, specify the channel with the argument:

```
-c <channel-id-number>
```

Example:

```
provmgr -c 1 --show-source
```

You can determine channel ID numbers by using the global command:

```
provmgr --show-channels
```

Table 11: Outbound Provisioning CLI Channel-Specific Options

Command Argument	Description
--reset-group-timestamp	Deletes the user-group timestamp, which forces the provisioner to process the provisioning group on the next cycle, even if the timestamp on that group did not actually change. Depending on your LDAP server and administrative practices, you may want to schedule this command to run periodically to catch up with any users that may have been deleted (rather than deactivated) in the directory server: some directory servers do not update the group timestamp for deleted users. **Important:** This option should seldom be needed if users are deactivated rather than deleted. If it is needed, you may wish to schedule it when other network activity is low.
-reset-attribute-sync	Sets the attribute sync timestamp to 1, which forces the provisioner to look at all users for changes, not only those that have a newer timestamp on their LDAP entry. **Important:** This option should be needed rarely and may consume considerable network resources, depending on the number of users. If it is needed, you may wish to schedule it when other network activity is low.
--reset-values-hash	Removes the values hash for all users. (The database stores a hash of attribute values for users to determine whether any values have been changed.) This argument forces users that have a newer timestamp on their LDAP entry to be updated at the service provider, regardless of the actual field values. Note, however, that users whose recorded timestamp is unchanged are *not* updated.
--reset-all	Equivalent to using all three of the arguments above. **Important:** This option should be needed rarely if ever and may consume considerable network resources, depending on the number of users. If it is needed, you may wish to schedule it when other network activity is low.
--show-dirty-records	Lists all users or groups that have not been provisioned or updated at the service-provider site.
--show-dirty-group-records	List groups that have not been provisioned or updated at the service-provider site.
--show-dirty-user-records	List all users that have not been provisioned or updated at the service-provider site.

-show-group
--show-user
Use with:
-u <provider name>
Or:
-g <LDAP GUID>
	Shows all internal database fields related to the specified user or group, including transitory mapping fields (fields waiting to be pushed to the service provider); for a user, shows all LDAP attributes retrieved from the directory server.
	Note: You can obtain user or group names and GUIDs for dirty records, as needed, using any of the `--show-dirty-*` options (described above).
	The LDAP GUID, if used and if it is binary, should be entered in hexadecimal format (as shown in log files).
	Examples:
	`provmgr.sh --show-user -u`
	`john@example.com`
	`provmgr.sh --show-user -g`
	`ffd448643f812b43a0bee2504173f0`

--clear-dirty-records	Clears the dirty flag on all records.
--clear-dirty-group-records	Clears the dirty flag on all group records.

Command Argument	Description
--clear-dirty-user-records	Clears the dirty flag on all user records.
-delete-dirty-records	Removes all dirty records from the internal store.
--delete-dirty-group-records	Removes all dirty group records from the internal store.
--delete-dirty-user-records	Removes all dirty user records from the internal store.
–delete-all --delete-all-users	The delete-all parameter removes all users and groups from the internal store and deletes the provisioning group timestamp and the last attribute-sync timestamp. The delete-all-users parameter deletes users and timestamps but retains groups. The effect of either command is to reset the channel to its initial state for user provisioning. All user metadata is lost and provisioning for the channel will start from the beginning, picking up all users (and groups if deleted) and pushing them to the service provider when the synchronization frequency interval is expired (see *Configuring Outbound Provisioning Settings* on page 96). **Important:** These options should be needed rarely if ever. If needed, you may wish to schedule the operation when other network activity is low.
--show-target	Displays the target configuration.
--show-source	Displays all source LDAP configuration parameters, including settings and location.

Customizing User-Facing Screens

PingFederate supplies HTML templates to provide information to the end user or to request user input during SSO/ SLO processing. These template pages utilize the Velocity template engine, an open-source Apache project, and are located in the `<pf_install>/pingfederate/server/default/conf/template` folder.

You can modify most of these pages in a text editor to suit the particular branding and informational needs of your PingFederate installation. (Cascading style sheets and images for these pages are included in the `template/assets` subdirectory.) Each page contains both Velocity constructs and standard HTML. The Velocity engine interprets the commands embedded in the template page before the HTML is rendered in the user's browser. At runtime, the PingFederate server supplies values for the Velocity variables used in the template.

Each sample template provided contains specific variables that can be used for rendering the associated Web-browser page. You can see the variables and usage examples in the comments of each template. The following table describes variables that are available across *all* templates.

Variable	Description
`$escape`	A utility class that can be used to escape String variables inserted into the template, for example, `$escape.escape($client.name)` where `$client.name` is a second variable available for the page.
`$HttpServletRequest`	A Java object instance of `javax.servlet.http.HttpServletRequest`. Used to add additional knowledge about the request that is otherwise unavailable in the template (for example, HTTP User-Agent header).
`$HttpServletResponse`	A Java object instance of `javax.servlet.http.HttpServletResponse`. Used to modify the response in the template (for example, setting additional browser cookies).
`$locale`	A Java object instance of `java.util.Locale` that represents a user's country and language. Used to customize the end-user experience. For example, the locale is used to display content in the user's preferred language.
`$PingFedBaseURL`	The PingFederate base URL (see *Specifying Federation Information* on page 94).

Variable	Description
`$templateMessages`	Used to localize messages in the template (based on user's Locale), an instance of `com.pingidentity.sdk.locale.LanguagePackMessages`. For more information, see the Javadoc for the `LanguagePackMessages` class in the directory `<pf_install>/pingfederate/sdk/doc`. For more information about localization, see *Localization* on page 81.
`$TrackingId`	The user's session tracking ID (see the last *Note* in the section *Managing Log Files* on page 45).

For information about Velocity, please refer to the Velocity project documentation on the Apache Web site:

http://velocity.apache.org/engine/releases/velocity-1.4

Changing Velocity or Javascript code is not recommended.

At runtime, the user's browser is directed to the appropriate page, depending on the operation being performed and where the related condition occurs (see tables below). For example, if an SSO error occurs during IdP-initiated SSO, the user's browser is directed to the IdP's SSO error-handling page.

Applications can override the PingFederate server-hosted pages provided specifically for SSO and SLO errors by specifying a URL value in the relevant endpoint's `InErrorResource` parameter (see *Application Endpoints* on page 385). Administrators can override SSO/SLO success pages by specifying default URLs in the administrative console (for the IdP configuration, see *Configuring a Default URL and Error Message* on page 187; for the SP, see *Configuring Default URLs* on page 261).

The following tables describe each of the templates. To help identify the templates from the end user's point of view, the tables are organized by the titles that appear at the top of the user's browser window.

Note: The titles listed in the tables are the defaults shipped with PingFederate and may be modified. The templates retrieve titles and other text from a language localization file (see *Localization* on page 81).

IdP User-Facing Pages

Page Title *and template file name*	Purpose	Type	Action
Change Password *html.form.change.password.template.html*	Allows a user to change his or her password via the HTML Form Adapter (see *Configuring the HTML Form IdP Adapter* on page 372).	Normal	User input required
Change Password Message *html.form.message.template.html*	Displayed when a user has successfully changed his or her password (see *Configuring the HTML Form IdP Adapter* on page 372).	Normal	User input required
Error - Single Logout *idp.slo.error.page.template.html*	Displayed when an SLO request fails and no other SLO error landing page is specified.	Error	User should close browser
Error - Single Sign-On *idp.sso.error.page.template.html*	Displayed when IdP-initiated SSO fails on the IdP side and no other SSO error landing page is specified. Displays system errors and information for the user.	Error	Consult log and Web developer
IdP Logout *idp.logout.success.page.template.html*	Default page may be displayed when user is logged out of the IdP by the HTTP Basic and HTML Form adapters (see *Configuring the HTTP Basic IdP Adapter* on page 370 and	Normal	None

Page Title ***and template file name***	**Purpose**	**Type**	**Action**
	Configuring the HTML Form IdP Adapter on page 372).		
IdP Logout Confirmation *idp.slo.confirm.page.template.html*	Displayed to prompt the user to confirm Single Logout (SLO). For more information, see *Configuring a Default URL and Error Message* on page 187).	Normal	User input required
Password Management System Message *html.form.message.template.html*	Displayed when a user is being redirected to a password management system to change his or her password (see *Configuring the HTML Form IdP Adapter* on page 372).	Normal	User input required
Please Select Authentication System *sourceid-choose-idp-adapter-form-template.html*	Displayed when the user must choose from several IdP security domains. Based on the user's selection, the server redirects the browser to the appropriate adapter instance for authentication.	Normal	User must make selection
Login Challenge *html.form.login.challenge.template.html*	Displays a configurable challenge form for two-step authentication. This template can be used, for example, to create a *RADIUS* challenge form when using the RADIUS Username/Password Credential Validator (see *Configuring the HTML Form IdP Adapter* on page 372).	Normal	User input required
Sign On *html.form.login.template.html*	Displays a configurable user logon form when the HTML Form Adapter is in use for a connection (see *Configuring the HTML Form IdP Adapter* on page 372).	Normal	User input required
Signed Out *sourceid-wsfed-idp-signout-cleanup-template.html*	Indicates user signed out of the IdP under the WS-Federation protocol and lists each successful SP logout, when applicable. Also displays when an OpenID Connect Client sends a logout request to the `/idp/startSLO.ping` endpoint (see *Asynchronous Front-Channel Logout* on page 128).	Normal	None
Signing Out *sourceid-wsfed-idp-signout-cleanup-invisible-template.html*	WS-Federation and OpenID Connect Client IdP sign-out processing page. **Note:** No HTML is rendered in the browser.	Normal	None
Success - Single Logout *idp.slo.success.page.template.html*	Displayed when an SLO request succeeds but no other SLO landing page is specified.	Normal	None
User Consent *consent-form-template.html*	Displayed when a request requires a user's consent for an SSO to an SP.	Normal	User input required
Working . . . *sourceid-wsfed-http-post-template.html*	Used to auto-submit a WS-Federation assertion to the SP. If Javascript is disabled, the user is prompted to click a button to POST the assertion directly.	Normal	None

Page Title *and template file name*	Purpose	Type	Action
	Note: Normally not displayed if Javascript executes properly.		

SP User-Facing Pages

Page Title *and template file name*	Purpose	Type	Action
Account Link Removed *TerminateAccountLinks.page.template.html*	Communicates a user's successful "defederation" operation.	Normal	None
Account Linking *LocalIdPasswordLookup.form.template.html*	Used to authenticate a user at the SP when an account link needs to be established.	Normal	None
Authentication Failed *sourceid-wsfed-idp-exception-template.html*	Displayed when an authentication challenge fails during WS-Federation processing.	Error	Consult log and Web developer
Error - Single Logout *sp.slo.error.page.template.html*	Displayed when an SLO request fails and no other SLO error landing page is specified.	Error	User should close the browser
Error - Single Sign-On *sp.sso.error.page.template.html*	Displayed when SP-initiated SSO fails (or IdP-initiated SSO fails on the SP side) and no other SSO error landing page is specified.	Error	Consult log and Web developer
Select Identity Provider *sourceid-saml2-idp-selection-template.html*	The user requested SP-initiated SSO, but the IdP partner was not specified in the appropriate query parameter or cookie. This page allows the user to select the IdP manually. Based on the user's selection, the server redirects the browser to the appropriate IdP partner's SSO service.	Normal	User must make selection
Signed Out - Service Provider *sourceid-wsfed-sp-signout-cleanup-template.html*	Displays the user's sign-out status.	Normal	None
Success - Single Logout *sp.slo.success.page.template.html*	Displayed when an SLO request succeeds and no other SLO success landing page is specified.	Normal	None
Single Sign-On Target Unspecified *sp.sso.success.page.template.html*	Displayed when an SSO request succeeds but no target-resource parameter is specified by the incoming URL, and no default URL is set (see *Configuring Default URLs* on page 261).	Error	Consult Web developer, or specify default URL

Either IdP or SP User-Facing Pages

Page Title *and template file name*	Purpose	Type	Action
Error - Single Sign-On *generic.error.msg.page.template.html*	For an Auto-Connect SSO transaction, indicates a range of possible error conditions (see *Using Auto-Connect* on page 31): • The requesting Auto-Connect partner is not found in the PingFederate server's list of allowed domains. • The partner's *metadata* is not accessible. • The server is not configured for Auto-Connect. • General error, with error code.	Error	Consult log, check configuration, or contact partner. If unresolved, contact Ping Identity *support*.
HTTP Error *http.error.page.template.html*	Indicates that an HTTP error has occurred and provides the HTTP status code.	Error	Consult log, contact PingIdentity *support*
Error *general.error.page.template.html*	Indicates that an unknown error has occurred and provides a error reference number and (optionally) an error message.	Error	Consult log, contact Ping Identity *support*
Multiple SSO in Progress *speed.bump.template.html*	Displayed to a user when response is slow due to simultaneous SSO requests coming from multiple browser tabs.	Normal	None
Page Expired *state.not.found.error.page.template.html*	Displayed when simultaneous SSO requests from multiple tabs using the same key value cause a user session to be overwritten or deleted and remaining requests attempt to retrieve the state fail.	Error	None
Sign On *AbstractPasswordIdpAuthnAdapter.form.template.html*	Challenges user for credentials when authentication can take place via HTTP Basic Authentication or an HTML form, depending on the operational mode.	Normal	User must sign on
Submit Form *form.autopost.template.html*	Whenever the server posts a form, this template is used to auto-submit the form. If Javascript is disabled, the user is prompted to click a button to post the form manually. **Note:** Normally not displayed if Javascript executes properly.	Normal	None

OAuth User-Facing Pages

Page Title *and template file name*	Purpose	Type	Action
Access Revocation *oauth.access.grants.page.template.html*	Provides a means for end-users (resource owners) to revoke persistent access grants.	Normal	None
Information Access Approval *oauth.approval.page.*	Advises resource owners that their information is being requested by the identified OAuth client and provides for approval/disapproval.	Normal	None

Page Title *and template file name*	Purpose	Type	Action
template.html	This page appears for Implicit or Authorization Code grant types, either one time only or repeatedly depending on OAuth AS settings (see *Authorization Server Settings* on page 130). **Tip:** The OAuth client configuration provides an option to bypass this approval page entirely, as needed for trusted clients (see *Configuring a Client* on page 141).		

Localization

The English display text in each of the user-facing templates is retrieved from a default localization file, `pingfederate-messages.properties`, in the directory:

```
<pf_install>/pingfederate/server/default/conf/language-packs
```

An administrator can localize the text by copying the default file, providing translated text in place of English, and then adding the standard language tag to the base filename (as indicated in browser settings).

For example, for text in French rename the translated copy of the localization file in the language-packs directory to:

```
pingfederate-messages_fr.properties
```

To include a region, append the capitalized abbreviation using an *underscore*.

Note: The capitalization and underscore usage may not correspond to the way regions are listed in browser settings. However, the usage is required by the Java-based localization implementation (see *Retrieving Localized Messages* on page 82).

For example, for Canadian French:

```
pingfederate-messages_fr_CA.properties
```

Note: If the system language of the PingFederate server is not English, copy pingfederate-messages.properties as `pingfederate-messages_en.properties` for the English users (if any), translate `pingfederate-messages.properties` for the local users, and provide additional translations as needed.

Developers can also customize the look and feel of the templates by using localization variables in logic statements to control fonts, color, and other style elements. Refer to the templates for examples.

Tip: To maximize performance, PingFederate caches localized UI strings on start-up. For testing new localization implementations, an administrator can temporarily turn off caching by changing the value of `cache-language-pack-messages` to false in:

```
.../pingfederate/server/default/data/config-store/locale-options.xml
```

Be sure to return the value to `true` when testing is complete. Note that restarting the server is required for changes to configuration files.

Overriding Locales with Cookies

For convenience, an administrator or Web developer might want to provide end-users a means of overriding browser language preferences temporarily by setting cookies—for example, by creating a company Web portal link for users to click instead of manually changing their browser options.

By default, PingFederate supports overriding the locale via a cookie named `pf-accept-language`. The cookie value must conform to guidelines defined under *IETF BCP 47*. For more information, see documentation for the Java core method PingFederate uses to parse the cookie: *Locale.forLanguageTag(String languageTag)* (docs.oracle.com/javase/7/docs/api/java/util/Locale.html#forLanguageTag(java.lang.String)). (This locale-override behavior is the default implementation of the Java interface LocaleOverrideService defined in the PingFederate SDK. For more information, see the Javadoc for that interface in the directory <pf_install>/pingfederate/sdk/doc.)

PingFederate displays the language indicated in the cookie if the language is supported in the language-packs directory. If the matching localization file is not found, PingFederate defaults to the browser settings.

Retrieving Localized Messages

Retrieval of localized messages is supported via the LanguagePackMessages class available in the PingFederate SDK. An instance of this class is passed into every template file and available for use there. For information, refer to the Javadoc for the class in the directory <pf_install>/pingfederate/sdk/doc.

Configuring Password Policy

PingFederate applies a configurable policy to passwords, pass phrases, and shared secrets defined by the administrators in the administrative console. These fields include, but are not limited to:

- Passwords used by HTTP Basic authentication for:
  - Inbound SOAP messages from partners via back-channel calls
  - WS-Trust STS
- Shared secrets used by the credentials defined for:
  - Attribute Query
  - JMX
  - Connection Management
  - SSO Directory Service
- Passwords used by instances of the Simple Username Password Credential Validator
- Passwords used for encrypting certificates exported with their private keys
- Pass phrases used by IdP Discovery
- Passwords used by administrative console credentials when native authentication is used

Note: Passwords external to PingFederate—passwords used by instances of the Data Stores, for example—are not subject to this password policy.

To configure the complexity of the password policy:

1. Edit <pf_install>/pingfederate/server/default/data/config-store/password-rules.xml.
2. Save the changes.
3. Restart PingFederate.

   For a clustered PingFederate environment, perform these steps on the console node. No changes or restart of PingFederate is required on the engine nodes.

Extending the Lifetime of the PF Cookie

PingFederate identifies sessions by their respective PF cookie. By default, the PF cookie is a session cookie. You can extend the lifetime of the PF cookie by making it a persistent cookie. Unlike session cookies, persistent cookies are saved to disk, enabling your web browser to reuse them when restarted.

To extend the lifetime of the PF cookie in a standalone environment:

1. Edit `<pf_install>/pingfederate/server/default/data/config-store/session-cookie-config.xml`.
2. Modify the `cookie-max-age` value. The default value (-1) makes the cookie a session cookie; a positive integer defines the age of the persistent cookie in seconds.
3. Save the change.
4. Restart PingFederate.

To extend the lifetime of the PF cookie in a clustered PingFederate environment:

1. On the console node, edit `<pf_install>/pingfederate/server/default/data/config-store/session-cookie-config.xml`.
2. Modify the cookie-max-age value. The default value ('`-1`') makes the cookie a session cookie; a positive integer defines the age of the persistent cookie in seconds.
3. Save the change.
4. Log on to the administrative console.
5. Click **Server Configuration** on the Main Menu.
6. Click **Cluster Management** under Administrative Functions.
7. On the Cluster Management screen, click **Replicate Configuration**.

Note: It is not necessary to restart PingFederate on any running engine node.

The HTML Form IdP Adapter utilizes the PF cookie to manage its sessions. For more information, see *Configuring the HTML Form IdP Adapter* on page 372.

Adding Custom HTTP Response Headers

The PingFederate administrative console and runtime server are capable of returning custom HTTP response headers, such as Strict-Transport-Security to enforce HTTPS based access and P3P for Microsoft Internet Explorer interoperability.

To add custom HTTP response headers:

1. Edit `<pf_install>/pingfederate/server/default/data/config-store/response-header-admin-config.xml` or `response-header-runtime-config.xml`.
2. Save the changes.
3. Restart PingFederate.

In a clustered PingFederate environment:

1. On the console node, edit `response-header-admin-config.xml` or `response-header-runtime-config.xml` on the console node.
2. Restart PingFederate.
3. Log on to the administrative console.
4. Click **Server Configuration** on the Main Menu.
5. Click **Cluster Management** under Administrative Functions.
6. On the Cluster Management screen, click **Replicate Configuration**.
7. For each engine node, restart PingFederate as `response-header-admin-config.xml` and `response-header-runtime-config.xml` are not reloaded after Replicate Configuration.

Customizing the Favicon for Application and Protocol Endpoints

PingFederate provides a favorite icon (favicon) for its Application and Protocol Endpoints (see *Application Endpoints* on page 385, *Viewing Protocol Endpoints* on page 188 for IdP and *Viewing SP Protocol Endpoints* on page 262).

To change the favorite icon:

1. Replace the `favicon.ico` file in the `<pf_install>/pingfederate/server/default/conf/template/assets/images` folder.
2. Restart PingFederate.
3. Repeat these steps on each engine node if you have a clustered PingFederate environment.

Managing Expired Persistent Grants

PingFederate automatically removes 500 expired persistent grants once a day. If expired grants are growing rapidly, you may increase the frequency of the cleanup process as well as the number of expired persistent grants to be removed during each run.

Note: Increasing the frequency or the number of grants to be removed adds more workload to your database server. We recommend making changes gradually to observe the impact, if any.

To adjust the frequency of the cleanup process:

1. Edit `<pf_install>/pingfederate/server/default/data/config-store/timer-intervals.xml`.

   Note: If you have a clustered PingFederate environment, edit this file on the console node.
2. Update the `AccessGrantCleanerInterval` value.
3. Save your change.
4. Restart PingFederate.

   Note: For a clustered PingFederate environment, you do not need to modify anything on the engine nodes. The cleanup process only runs on the console node.

To adjust the number of expired persistent grants to be removed:

1. Edit `<pf_install>/pingfederate/server/default/data/config-store/org.sourceid.oauth20.token.AccessGrantManagerJdbcImpl.xml`.

   Note: If you have a clustered PingFederate environment, edit this file on the console node.
2. Update the `ExpiredGrantBatchSize` value.
3. Save your change.
4. Restart PingFederate.

   Note: For a clustered PingFederate environment, you do not need to modify anything on the engine nodes. The cleanup process only runs on the console node.

Chapter

3

System Settings

The System Settings links on the Server Configuration sub menu provide access to global settings that may apply to either an IdP or an SP configuration.

This chapter covers:

- *Managing Server Settings* on page 85
- *Managing Data Stores* on page 98
- *Configuring IdP Discovery* on page 110
- *Configuring Redirect Validation* on page 112

Note: The information in this chapter is presented from the viewpoint of an administrative user with "Admin" permissions (see *Account Management* on page 62).

Managing Server Settings

Server settings include unique federation server identifiers, the designation of your site's federation role (SP, IdP, or both), and your enabled federation protocols (see *Supported Standards* chapter in *Getting Started*).

Server settings also include system-administration configuration (one-user or multi-user), email notification options and setup, and a shortcut link to account management (when multi-user administration is enabled).

If you have enabled Auto-Connect and/or Outbound Provisioning, then you must configure several parameters specific to those features in the System Settings task flow.

You configure many of these settings initially during the installation setup (see *Starting PingFederate for the First Time* in the "Installation" chapter of *Getting Started*), but you can change or add to them as needed from the Main Menu.

Note: For information about WS-Trust STS Settings, see *Configuring STS Authentication* on page 325.

Information in this section covers:

- *Setting Administration Options* on page 86
- *Entering System Information* on page 86
- *Configuring Runtime Notifications* on page 86
- *Configuring Runtime Reporting* on page 87
- *Managing PingOne Settings* on page 90
- *Managing Accounts* on page 92
- *Choosing Roles and Protocols* on page 92
- *Specifying Federation Information* on page 94
- *Setting System Options* on page 94
- *Configuring Outbound Provisioning Settings* on page 96
- *Configuring Auto-Connect Metadata Signing* on page 97
- *Configuring Auto-Connect Metadata Lifetime* on page 97

- *Saving and Editing Server Settings* on page 98

Setting Administration Options

On the System Administration screen, PingFederate provides a choice of single- or multi-user access to the administrative console.

Note: If you are using your network's LDAP user-data store or client certificates for administrative-console authentication, this screen is not presented (see *Alternative Console Authentication* on page 65).

If you choose Single-user Administration, the console is accessible only by using the default `Administrator` ID, for which full privileges are provided. Multi-user Administration (the default) provides role-based access control (see *Account Management* on page 62).

Tip: To return to single-user administration after having previously enabled multi-user, only one user can be marked as active under Account Management.

Entering System Information

On the System Info screen, you provide general information about your company.

To reach this screen

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **System Info** on the Summary screen.

Configuring Runtime Notifications

Depending on your licensing agreement, your PingFederate license may have an expiration date. Under Runtime Notifications you can set up the server to send an email warning when your license is about to expire.

Note: The license-notification option does not appear if you have a perpetual license.

You can also configure the server to send an email notification to a specific administrator (or a group) when a certificate used by PingFederate is about to expire, or has expired.

Note: When a certificate expires, PingFederate always writes an error in the server log, regardless of whether runtime notification is configured (see *Managing Log Files* on page 45).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Runtime Notifications** on the Summary screen.

To configure notifications:

1. Select the checkbox next to the type of notification you want, and enter an email address.
2. If you are configuring certificate-expiration notification, enter an advance-warning time period in the Initial Warning field (optional) and in the Final Warning field.

   Note: When advance certificate-expiration notification is configured, the server also sends notification if a license expires.
3. If you have not previously configured PingFederate to access your email server, click **Email Server Settings** (see *Managing Email Configuration* on page 67).

Configuring Runtime Reporting

PingFederate supports runtime monitoring and reporting through the Simple Network Management Protocol (SNMP), a standard used by network-management consoles to monitor network and server activity across an enterprise.

PingFederate also supports runtime monitoring and reporting through Java Management Extensions (JMX) (see *Runtime Monitoring Using JMX* on page 87).

Using SNMP Monitoring

The SNMP Management Information Base (MIB) defines network data available for SNMP monitoring. The MIB file is located in: `<pf_install>/pingfederate/SNMP`

The MIB describes the object identifiers that PingFederate uses to communicate information through SNMP. These identifiers are globally unique and managed by the Internet Assigned Numbers Authority (IANA).

Configure access to SNMP monitoring on the Runtime Reporting screen.

SNMP supports *Gets* and *Traps*. A `Get` is a request for status information sent by a network-management console to an SNMP agent. Embedded within each PingFederate server is an SNMP agent that brokers the communication between the management console and the PingFederate runtime engine (for each engine separately when PingFederate is deployed in a cluster—see the PingFederate *Server Clustering Guide*).

Gets

PingFederate responds to two SSO/SLO types of `Get` requests:

- The total number of transactions that the server instance has processed since installation
- The total number of failed transactions that the server instance has encountered since installation

In addition, because PingFederate is built within an existing Jetty framework, Gets include a variety of server information available via Jetty-standard Managed Beans (MBeans). A detailed list of this information is provided in the MIB file in the `pingfederate/SNMP` folder. (For more information about MBeans, see the next section, *Runtime Monitoring Using JMX* on page 87).

Note: Some operating systems (Solaris 10, for example) may not allow the SNMP agent to bind to privileged ports: those below 1024. Consult your operating system's documentation on how to get around this limitation, or change the default port 161 to a port above 1023.

Traps

A `Trap` is a spontaneous communication from an agent to a network-management console. PingFederate generates a `Trap` at regular intervals—the server "heartbeat." Each `Trap` contains the amount of time the server instance has been running since its most recent start-up.

- If you configure Traps, change settings as needed and then click **Test SNMP Configuration** to send a single Trap to your network-management console.

  You can also use an HTTP call at any time to verify that the PingFederate server is running (see *System-Services Endpoints* on page 395).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Runtime Reporting** on the Summary screen.

Runtime Monitoring Using JMX

Similar to SNMP, JMX technology represents a Java-centric approach to application management and monitoring. JMX exposes instrumented code in the form of MBeans. Application management systems that support JMX technology—for example, the standard Server JRE client JConsole— may request runtime information from the PingFederate JMX server.

PingFederate's JMX server reports monitoring data for SSO and SLO transactions. In addition, as with SNMP monitoring, numerous Jetty-standard MBeans are available to the PingFederate server's JMX clients (see *Example Jetty Metrics* on page 89).

Important: Authentication is required for JMX-client access to PingFederate runtime data (see *Authentication* on page 169).

Tip: Administrators can supplement JMX monitoring information by applying third-party analysis and reporting tools to the security audit log (see *Security Audit Logging* on page 50). That log records fine-grain details (including, for example, response times and event types) for all server transactions.

SSO-SLO Monitoring

For SSO/SLO transaction processing, PingFederate provides these MBeans:

- `pingfederate:type=TOTAL_FAILED_TRANSACTIONS`
- `pingfederate:type=TOTAL_TRANSACTIONS`

Each type contains a single attribute, `Count`, which reports the same information as an SNMP `Get` (see the previous section, *Configuring Runtime Reporting* on page 87).

Provisioning Monitoring

Important: Monitoring Outbound Provisioning transactions using JMX has been deprecated. By default, PingFederate logs outbound provisioning events to `provisioner-audit.log` (see *Outbound Provisioning Audit Logging* on page 51).

To re-enable JMX monitoring:

1. Edit `<pf_install>/pingfederate/bin/run.properties`.
2. Change the value of `provisioner.events.monitor` from `LOG` to `JMX`.
3. Edit `<pf_install>/pingfederate/server/default/conf/jmx.remote.access`.
4. Change the value of `default-jmx-principal` from `readonly` to `readwrite`.
5. Save all changes.
6. Restart PingFederate.

Note: Repeat these steps on each PingFederate server configured to process Outbound Provisioning (see *Outbound Provisioning for IdPs* on page 33).

When JMX monitoring for Outbound Provisioning is enabled, PingFederate provides an MBean called `pf.provisioning:type=saas.provisioning.events`. The MBean exposes five JMX Operations, each corresponding to the Java methods described in the following table. Each method returns a `CompositeData` object, which allows for the retrieval of complex data without requiring application-specific code to reside with the JMX client.

Table 12: Outbound Provisioning JMX Monitoring Options

Method	Description	Parameter
`viewEvents(Boolean wasSuccessful, String eventTypeStr, String fromDate, String toDate)`	Gets an array of specific events based on the given criteria. The parameters filter the data collectively; that is, they are joined logically by "and".	wasSuccessful – If `true`, returns information only on successful transactions; `false` returns information only on failed transactions; `null` returns all transactions. `eventTypeStr` – The type of event. Valid values are: `CREATE`, `UPDATE`, `DISABLE`, `ENABLE`; `null` or an empty string returns all types.

Method	Description	Parameter
		fromDate – See Note below. toDate – See Note below.
eventSummaryReport(String fromDate, String toDate)	Gets a summary of transactions counts for the given time period. Counts are provided for success, failure, and total. Each count includes a drill-down capability, providing counts by event type.	See Note below.
provisioningCycleSummary(String fromDate, String toDate)	Gets a total count of provisioning cycles for the given time period. The drill-down provides information for each cycle, including success totals for users and groups added, modified, or removed in the internal tracking database; for the target data store, success and failure totals are listed for each type of transaction.	See Note below.
eventSummaryReportAllData()	Gets a summary of transaction counts with no time constraints (equivalent to eventSummaryReport with null or empty strings used as parameters).	None.
eventSummaryRollup()	Gets a report representing an aggregate of multiple Summary Reports covering the last 0, 1, 2, 7, 30, 60, 90, 180, and 360 days.	None.

Note: Date parameters may be formatted as either yyyy, yyyy-MM-dd, or yyyy-MM-dd HH:mm:ss. A null value or empty string for a date parameter indicates no constraint for that end of the range.

Example Jetty Metrics

The following table describes examples of Jetty MBean metrics, available via JMX, that administrators may find useful to supplement information provided via the PingFederate-specific MBeans described in previous sections.

Table 13: Selected Jetty Metrics

MBean	Attributes
com.pingidentity.appserver.jetty.server.connector.ssl.nio:runtimesslselectchannelconnector	connections – The total number of TCP connections accepted by the server. connectionsDuration* – How long connections are kept open. Maximum, mean, standard deviation, and total accumulated time are available.

MBean	Attributes
(For Jetty connectors including the primary and secondary PingFederate runtime server ports)	`connectionsOpen` – The current number of open connections. Maximum is also available (`connectionsOpenMax`). `connectionsRequests*` – Number of requests processed per connection. Maximum, mean, and standard deviation are available.
`org.eclipse.jetty.server.handler.statisticshandler`	`requests` – Total number of requests received. `requestsActive` – Number of requests currently being processed. Max is also available. `requestTime` – Request duration. Maximum, mean, standard deviation, and total accumulated time are available. `responses1xx, responses2xx, responses3xx`, … – Total number of requests that returned HTTP status codes of 1xx, 2xx, 3xx, etc.
`org.eclipse.jetty.util.thread.queuedthreadpool` (Two pools: one for the runtime server, with 200 maximum threads; one for the administrative console, with 20 maximum threads)	`idleThreads` – Number of idle threads currently available. `threads` – Number of threads currently running (including both idle and active). `minThreads` – Minimum number of threads in the pool. `maxThreads` – Maximum number of threads in the pool. `lowOnThreads` – A boolean flag indicating whether the pool is running low on threads.

`java.lang: Memory`
`java.lang: MemoryPool`
`java.lang: GarbageCollection`
`java.lang: OperatingSystem`
	Various attributes measuring CPU usage and memory.

Advanced JMX Configuration

By default, PingFederate uses port 1099 for its JMX server. To change the port or other JMS configuration items, if needed, modify the configuration file `jmx-remote-config.xml` in the directory `<pf_install>/server/default/conf`.

Note: When connecting to the JMX service using SSL (the default), ensure that the client trusts the PingFederate SSL server certificate presented (see *SSL Server Certificates* on page 162). (This should be a consideration only during testing, when using the certificate installed with PingFederate or another self-signed certificate.)

Managing PingOne Settings

After connecting PingFederate to PingOne through a managed SP connection, use the PingOne Settings screen to manage:

- *SSO from PingOne to the PingFederate administrative console*
- *Monitoring of PingFederate from PingOne*

Note: Automatic certificate rotation is managed within the SP connection, see *Configuring Automatic Certificate Rotation* on page 235.

To reach to this screen:

1. Click **Server Configuration** on the Main Menu.

2. Click **Server Settings** under Server Configuration.
3. Click **PingOne Settings** on the Summary screen.

SSO from PingOne to the PingFederate administrative console

In PingFederate 8.0 (or higher), if you have selected to connect PingFederate to PingOne during the initial setup process, the option to SSO from PingOne to the PingFederate administrative console is enabled for you.

Tip: In this scenario, the initial setup wizard does not create any local administrative login. If you subsequently decide to disable the SSO from PingOne option, the administrative console will bring you to the **Account Management** screen and prompt you to create at least one user with the User Admin role for later use.

If you setup PingFederate without PingOne at the beginning but have subsequently created a managed SP connection to PingOne using the Connect to PingOne wizard, use the PingOne Settings screen to enable this option.

Additionally, you can continue to sign on to the administrative console via native or alternative console authentication using the direct login page. (For information about native authentication and alternative console authentication, see *Account Management* on page 62 and *Alternative Console Authentication* on page 65, respectively.) You can also disable the direct login page to enforce the policy that administrators must SSO to the administrative console using their PingOne credentials.

To SSO to the administrative console:

1. Verify the feature is enabled in the PingOne Settings screen.
2. Launch your browser.
3. Go to:

   ```
   https://<DNS_NAME>:9999/pingfederate/app
   ```

   where `<DNS_NAME>` is the fully qualified name of the machine running the PingFederate server.

   Note: The port number 9999 is set by default. For information on changing this setting, see *Modifying PingFederate Properties* on page 68 in the “System Administration” chapter of the PingFederate *Administrator’s Manual*.

If you have already logged on to the PingOne admin portal, the Main Menu opens. If you are not logged on to the PingOne admin portal, you will be prompted by PingOne to enter your admin portal credentials. Upon verification, the Main Menu opens.

To sign on via native or alternative console authentication:

When the SSO from PingOne feature is enabled, you can use the direct login page to sign on via native authentication or alternative console authentication.

1. Launch your browser.
2. Go to:

   ```
   https://<DNS_NAME>:9999/pingfederate/app?service=page/directLogin
   ```

   where `<DNS_NAME>` is the fully qualified name of the machine running the PingFederate server.

   Note: The port number 9999 is set by default. For information on changing this setting, see *Modifying PingFederate Properties* on page 68 in the “System Administration” chapter of the PingFederate *Administrator’s Manual*.

To disable native and alternative console authentication:

1. Edit `<pf_install>/pingfederate/bin/run.properties`.
2. Change the `pf.console.authentication` value to `none`.
3. Save the change.
4. Restart PingFederate.

Note: In a clustered PingFederate environment, you only need to modify `run.properties` on the console node.

After restart, the direct login page is disabled. Administrators can only SSO to the PingFederate administrative console from PingOne at `https://<DNS_NAME>:9999/pingfederate/app`.

If you wish to re-enable native or alternative console authentication, update the `pf.console.authentication` setting accordingly and restart PingFederate.

Monitoring of PingFederate from PingOne

After establishing a managed SP connection to PingOne, you can monitor PingFederate from the PingOne admin portal.

The PingOne admin portal displays your PingFederate server (or servers if you have a clustered PingFederate environment) with basic information such as the node index number, the IP address, and the connected/disconnected status with the date last seen. For each server, you can also drill down for additional information such as CPU load, JVM memory information, and system memory information.

If you do not wish to monitor PingFederate from the PingOne admin portal, clear the option checkbox and click **Save** in the PingOne Settings screen.

Managing Accounts

When you choose multi-user system administration, you can create users during installation or while configuring Server Settings (see *Setting Administration Options* on page 86).

Note: If you are using your network's LDAP user-data store or client certificates for PingFederate authentication, the Account Management screen is not presented (see *Alternative Console Authentication* on page 65).

Alternatively, you can set up and maintain user accounts later as a separate task (assuming you have user administration permissions—see *Account Management* on page 62). By default for installation, the user "Administrator" has full system permissions.

- To continue, click **Next** or **Save**.
- For information about adding or managing users, see *Account Management* on page 62.

Choosing Roles and Protocols

On the Roles and Protocols screen, select which role(s) your organization plays and which sets of standards you will use with your PingFederate server (see *Supported Standards* chapter in *Getting Started*).

Note: If you are using the PingFederate WS-Trust STS for either an IdP, an SP, or both, notice that a new configuration step, WS-Trust STS Settings, appears under the Server Settings tab. For information about this configuration, see *WS-Trust STS Configuration* on page 324.

Also on this screen, you can choose any of several options:

- Enable the PingFederate OAuth AS (see *About OAuth* on page 15).

  You can also extend OAuth processing to OpenID Connect policy configurations (see *OpenID Connect* on page 19).
- As an SP, if you are using SAML 2.0 XASP for multiple IdP connections, you may choose to have PingFederate determine dynamically which connection to use (see *Attribute Query and XASP* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide)
- For either role you can enable Auto-Connect for SAML 2.0 connections (see *Using Auto-Connect* on page 31).
- Also for either role, you can enable the Outbound/Inbound Provisioning option (see *User Provisioning* on page 33).

- If you are installing PingFederate and are not sure of your selections, just click **Next**.

Note: If you do not choose a role during installation, you must return to this screen to do so before you can configure connections to partners.

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Roles and Protocols** on the Summary screen.

To choose roles and protocols:

1. Select your federation role(s) and then select at least one protocol.

   Note: Outbound Provisioning for SaaS applications requires the use of the SAML 2.0. (For more information, refer to the *Quick Connection Guide* contained in the PingFederate SaaS Connector package for your service provider.)

2. Optional: If you are using SAML 2.0 and want to configure Auto-Connect, select that feature for your role(s) (see *Using Auto-Connect* on page 31).

   Note: Clearing this checkbox does *not* deactivate an existing Auto-Connect configuration in production. If you have already deployed Auto-Connect and wish to suspend the deployment for any reason, use the **Initial Setup** Summary screens (accessible from the Main Menu) for your respective role.

   When you make this selection, two additional steps are added to the System Settings task:

   - Metadata Signing (see *Configuring Auto-Connect Metadata Signing* on page 97)
   - Metadata Lifetime (see *Configuring Auto-Connect Metadata Lifetime* on page 97)

3. Optional: If you are using PingFederate as an IdP for provisioning or have installed a SaaS Connector package, select the Outbound Provisioning checkbox.

   (For more information, see *Outbound Provisioning for IdPs* on page 33.)

   Note: After provisioning is configured for a connection, you cannot clear this checkbox—you must delete all provisioning configurations first. To suspend provisioning for an SP partner, you can deactivate the specific configuration (see *Channel Activation and Summary* on page 248). Alternatively, you can deactivate the associated SP connection; note, however, that this will also disable SSO/SLO transactions (see *Editing and Activating a Connection* on page 248).

4. Optional: If you are using PingFederate as an SP for provisioning, select Inbound Provisioning.

   (For more information, see *Just-in-Time Provisioning* on page 34.)

5. Optional: If you are using SAML 2.0 XASP as an SP for multiple IdP connections, you may select the option to determine dynamically which connection to use, based on the X.509 certificate presented (see *Attribute Requester Mapping* on page 262).

   Tip: After you make this selection and create XASP IdP connections (see *Configuring the Attribute Query Profile* on page 228), configure dynamic IdP discovery via the **Attribute Requester Mapping** link on the SP Configuration sub menu. Once the mapping is configured, you cannot clear the checkbox on the Roles and Protocols screen unless you first delete the mapping.

   For general information about XASP, see *Attribute Query and XASP* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide.

6. Click **Next** (or **Save**, if you are modifying existing selections).

For information about configuring settings associated with your selections, see these relevant portions of this manual:

- *OAuth Configuration* on page 127
- *Identity Provider SSO Configuration* on page 178
- *Service Provider SSO Configuration* on page 254
- *WS-Trust STS Configuration* on page 324
- *Configuring IdP Discovery* on page 110

Specifying Federation Information

This information identifies your federation deployment to your partners, according to the protocol(s) you support.

Note: You must provide an ID that uniquely identifies your federation gateway for each protocol you support. For WS-Trust STS, IDs are required for both SAML 2.0 and SAML 1.x, regardless of browser-based SSO protocol support or the type of token expected to be issued, to ensure that the STS will perform correctly under all conditions.

Each ID normally applies across all connection partners for a given protocol; however, if your implementation requires different IDs for the same protocol, you can use virtual server IDs (see *Federation Server Identification*).

You can also use a different ID for Auto-Connect transactions (see *Using Auto-Connect* on page 31).

Field Descriptions

Field	Description
Base URL	The fully qualified host name, port, and path (if applicable) on which the PingFederate server runs. This field is used to populate configuration settings in metadata files (see *Exporting Metadata* on page 57).
SAML 2.0 Entity ID	This ID defines your organization as the entity operating the server for SAML 2.0 transactions. It is usually defined as an organization's URL or a DNS address; for example: `pingidentity.com`. The SAML SourceID used for *artifact* resolution is derived from this ID using SHA1.
Auto-Connect Entity ID	(Optional) If you are using Auto-Connect, you can specify a unique ID here for Auto-Connect processing. The value must be a fully qualified URL and should match the CN of your Auto-Connect certificates (see *Auto-Connect Security Model* on page 32). When a value is supplied, this ID is used instead of the SAML 2.0 Entity ID in your server's Auto-Connect metadata, as well as in associated SSO/SLO requests and responses. Use this field if you have configured regular, static SAML 2.0 connections to other partners and your SAML 2.0 Entity ID is not a fully qualified URL (see *Using Auto-Connect* on page 31).
SAML 1.x Issuer/Audience	This ID identifies your federation server for SAML 1.x transactions. As with SAML 2.0, it is usually defined as an organization's URL or a DNS address. The SourceID used for artifact resolution is derived from this ID using SHA1.
SAML 1.x Source ID	(Optional) If supplied, the Source ID value entered here is used for SAML 1.x, instead of being derived from the SAML 1.x Issuer/Audience.
WS-Federation Realm	The URI of the realm associated with the PingFederate server. A realm represents a single unit of security administration or trust.

Note: The fields available on this screen depend on the federation protocols enabled on your server (see *Choosing Roles and Protocols* on page 92).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Federation Info** on the Summary screen.

Setting System Options

The System Options screen provides global settings that allow you to:

- Turn off automatic multi-connection error checking

- Define a caching interval for data-store validation
- Configure incoming proxy settings

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **System Options** on the Summary screen.

Disabling Automatic Connection Validation

Automatic multi-connection error checking occurs by default for all configured connections whenever you access connection lists (via the Manage Connections screen for SP or IdP connections). The same multi-connection checking also occurs when you access the Manage IdP/SP Adapter Instances screens.

Because validation time increases with the number of connections and adapter instances, this option is provided in case you experience any noticeable delays in loading either of the Manage Connection screens or the adapter management screens. Disabling the feature results in immediate display of the screens, deferring error checking to manual controls on Manage Connection screens.

Note: This option does not affect the validation of connections as they are being configured or modified. Also, individual connections are always validated automatically when accessed for editing, regardless of the setting on this screen.

The multi-connection error checking is intended to verify that completed connections have not been affected by any subsequent changes in *adapter* configurations or other dependencies such as data-store access (see *Data Stores* on page 25).

For more information about connection validation, see:

- *Managing SP Connection Validation* on page 193(for SP connections)
- *Managing IdP Connection Validation* on page 267 (for IdP connections)

Defining Data-Store Validation Intervals

Automatic data-store validation tests occur by default for any adapter-to-adapter mappings or partner connections. This validation test occurs at various points within the administrative console.

The Data Store Validation Interval (secs) field defines the length of time for which a successful data-store validation is cached. (Only successful test results are cached.) The data-store connection is validated using the cached result without performing the test, speeding up the validation process. The default interval is five minutes (300 seconds). A value of 0 turns off the caching and validation tests are executed with each access.

Defining Proxy Options

When PingFederate is deployed behind a proxy server or load-balancer, the options described in the following four sections enable PingFederate to use information in HTTP headers added by the proxy server to construct correct responses. These options apply globally to all incoming requests.

Note: These settings override Jetty proxy options.

HTTP Header for Client IP Addresses

The HTTP Header for Client IP Addresses field allows you to globally specify the header name (for example, `X-Forwarded-For`) where PingFederate should attempt to retrieve the client IP address in all HTTP requests sent to PingFederate. Defining this field helps PingFederate identify the correct client IP address when PingFederate is operating behind a reverse proxy or load balancer.

It is common for proxies to append the IP address from an incoming request to the `X-Forwarded-For` (or similar) header. If you enter `X-Forwarded-For` as the HTTP Header for Client IP Addresses, PingFederate combines multiple comma-separated header values into the same order that they are received. Define which IP address you want to use in the list box:

- Leave the default of **Use Last Value** to use the last value in the combined list.
- Select **Use First Value** to use the first value in the combined list.

HTTP Header for Hostname

The HTTP Header for Hostname field allows you to globally specify the header name (for example, `X-Forwarded-Host`) where PingFederate should attempt to retrieve the hostname and port in all HTTP requests sent to PingFederate. It is common for proxies to append the hostname and port from an incoming request to the `X-Forwarded-Host` (or similar) header. If you enter `X-Forwarded-Host` as the HTTP Header for Hostname, PingFederate combines multiple comma-separated header values into the same order that they are received. Define which hostname you want to use in the list box:

- Leave the default of **Use Last Value** to use the last value in the combined list.
- Select **Use First Value** to use the first value in the combined list.

Client Certificate Header Name and Chain Header Name

If you are using mutual client certificate authentication for either WS-Trust STS authentication or SAML back-channel authentication and would like to use the Apache HTTP Server with `mod_ssl` as the incoming proxy, configure the Apache HTTP Server to pass client certificates as HTTP request headers and enter the header names in the System Options screen.

For example, suppose you have configured the Apache HTTP Server to pass the client leaf certificate and up to four intermediate certificates as headers:

```
...
SSLOptions +ExportCertData
RequestHeader set LEAF_CERT "%{SSL_CLIENT_CERT}s"
RequestHeader set CHAIN0    "%{SSL_CLIENT_CERT_CHAIN_0}s"
RequestHeader set CHAIN1    "%{SSL_CLIENT_CERT_CHAIN_1}s"
RequestHeader set CHAIN2    "%{SSL_CLIENT_CERT_CHAIN_2}s"
RequestHeader set CHAIN3    "%{SSL_CLIENT_CERT_CHAIN_3}s"
...
```

Note: This configuration snippet is for demonstration purposes only.

To configure PingFederate to consume these HTTP request headers for the purpose of mutual client certificate authentication:

- Enter `LEAF_CERT` as the **Client Certificate Header Name**.
- Enter `CHAIN` as the **Client Certificate Chain Header Name**.

  Note: Do not enter the trailing number from the chain header names.

Caution: Since HTTP request headers could potentially be forged, you should only specify a **Client Certificate Header Name** and a **Client Certificate Chain Header Name** if the Apache HTTP Server is immediately in front of your PingFederate environment. In addition, the specified values must match the header names used in the Apache HTTP Server configuration (with the exception of omitting the trailing number from the chain header names).

Incoming proxy terminates HTTPS connections

The Incoming proxy terminates HTTPS connections field allows you to globally specify that connections to the proxy server are made over HTTPS, even if HTTP is used between the proxy server and PingFederate.

Configuring Outbound Provisioning Settings

On the Outbound Provisioning screen, you can select the database that PingFederate uses internally to facilitate provisioning for service providers when PingFederate is configured as an IdP (see *Outbound Provisioning for IdPs* on page 33).

This screen is presented only if Outbound Provisioning is enabled for the IdP federation role (see *Choosing Roles and Protocols* on page 92).

Caution: A pre-installed, default HyperSQL database is selected for initial setup and testing. However, we strongly recommend that you choose your own, secured database for production deployments.

On this screen, you can also change the provisioning synchronization frequency—that is, how often PingFederate checks the local user store for changes.

The database stores the state of synchronization between the source data store and the target data store, enabling periodic checking to determine whether updates are required at the target site. (For information on configuring provisioning as an IdP, see *Configuring Outbound Provisioning* on page 239).

Note: PingFederate has been tested using HyperSQL, Oracle, MySQL, and MS SQL Server databases as internal provisioning data stores. However, any relational database should work as well; adaptable setup scripts used for HyperSQL, Oracle, MySQL, and MS SQL Server are provided in the directory: `<pf_install>/pingfederate/server/default/conf/provisioner/sql-scripts`

To configure the internal data store:

1. Select the data store from the drop-down list.

   If the data store you want is not shown in the list, then PingFederate is not yet configured to access the store; click **Manage Data Stores** to create a connection to the data store (see *Managing Data Stores* on page 98).
2. Optional: Change the Synchronization Frequency value.

Configuring Auto-Connect Metadata Signing

When Auto-Connect is enabled, PingFederate generates publicly available, signed metadata for partners to use. The metadata contains information about your server configuration (see *Providing Metadata* on page 31).

On the Metadata Signing screen, choose a certificate to use for signing the metadata.

Important: The certificate CN must match the domain name associated with the Entity ID (see *Specifying Federation Information* on page 94).

This screen appears only if Auto-Connect is enabled for either an IdP or SP (see *Choosing Roles and Protocols* on page 92).

To specify a certificate:

1. Select the certificate from the drop-down list.

   If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).
2. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.

   Note: The public certificate is included as part of the metadata and must be trusted by your partner (see *Auto-Connect Security Model* on page 32).

Configuring Auto-Connect Metadata Lifetime

Partners using Auto-Connect metadata will cache it to use for the future requests during the “lifetime” in which the metadata is valid, as configured on the Metadata Lifetime screen. After the metadata lifetime is expired, the metadata is retrieved again.

This metadata expiration ensures that partners always have reasonably up-to-date information about your server. You may elect to use the default time period or change it on the Metadata Lifetime screen.

This screen appears only if Auto-Connect is enabled for either an IdP or SP (see *Choosing Roles and Protocols* on page 92).

Saving and Editing Server Settings

On the Server Settings Summary screen you can view, edit, and save your configuration.

- Click **Save** if you are finished with this configuration, or click any heading to make changes.

Connecting to PingOne

PingOne is Ping Identity's multi-tenant, identity-as-a-service (IDaaS) solution. PingOne enables browser-based SSO and user provisioning for Identity Providers, and provides application providers with a rapid-deployment SSO capability. PingOne can be used together with PingFederate to provide a powerful solution combining the benefits of an on-premise deployment with the flexibility of a cloud solution.

To leverage this unique capability, you need a PingOne account and a *managed* SP connection from PingFederate to PingOne. If you do not have a PingOne account, sign up at *Ping Identity's Web site*.

Note: A managed SP connection to PingOne is a connection created by the initial setup wizard or the Connect to PingOne wizard in PingFederate 8.0 (or higher).

If you have created an SP connection to PingOne in PingFederate 7.3 (or older), delete that connection and let the Connect to PingOne wizard create a new managed SP connection to PingOne for you. The benefits of a managed connection include the capability to SSO from PingOne to the PingFederate administrative console, monitoring of PingFederate from PingOne, automatic metadata exchange between PingFederate and PingOne, and automatic certificate rotations.

To create a managed SP connection to PingOne:

1. Click **Server Configuration** on the Main Menu.
2. Click **Connect to PingOne** under System Settings.

The *Connect to PingOne* wizard will guide you through the steps required. When finished, the menu item **Connect to PingOne** is removed from the Server Configuration sub menu.

Note: Automatic certificate rotation is managed within the SP connection, see *Configuring Automatic Certificate Rotation* on page 235.

Tip: To manage console authentication and monitoring of PingFederate from PingOne, see *Managing PingOne Settings* on page 90.

Managing Data Stores

PingFederate can connect to local data stores to retrieve user attributes on either the IdP or SP side of an SSO transaction (or both).

Tip: Whenever attributes are retrieved from a data store at runtime, PingFederate logs the activity (see *Managing Log Files* on page 45). When you set up access to a data store, you can choose to mask the values of all retrieved attributes in the log files to enhance security and privacy of personal information (see *Attribute Masking* on page 26).

As an IdP, you use this feature whenever you need to fulfill an *attribute contract* that requires information beyond that which can be derived from the user's session (see *Configuring Attribute Sources and User Lookup* on page 208). For example, this information may include such attributes as an email address, a job title, or any data that can be used to customize a user's experience at the SP site.

As an SP, you can use data stores to retrieve additional attributes to package with the IdP's assertion data to meet SP adapter requirements (see *SSO Integration Kits and Adapters* on page 19). Such attributes may be needed, for example, to establish authorization levels or to manage the local account.

Either IdP or SP organizations configuring PingFederate for user provisioning must set up connections to data stores (see *User Provisioning* on page 33).

You can add data stores at any time. Standard data stores include JDBC-enabled databases and LDAP v3-compliant directories. Alternatively, you can develop a driver using the PingFederate Custom Source SDK to connect to non-JDBC databases (see the PingFederate *SDK Developer's Guide*).

Note: You cannot delete or modify a data-store connection if it is associated with an attribute source as part of a partner-connection configuration. You must remove the association first.

Important: You must have current connectivity from PingFederate to a data store in order to create or modify the configuration. If you find that the configuration is not editable, then your connection has been lost due to a system problem not related to the PingFederate server. The problem must be identified and corrected before you can continue.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.

To add a data store:

1. Click **Add New Data Store**.
2. Select Database, LDAP, or Custom and click **Next**.
3. Continue the configuration:
   - For Database configuration information see *Configuring a JDBC Database Connection* on page 99.
   - For LDAP configuration information see *Configuring an LDAP Connection* on page 102.
   - For Custom configuration information see *Configuring a Custom Data Store* on page 105.
4. Click **Save** when you return to this screen.

To modify a data store:

- Click the data store Description.

To delete a data store:

1. Click **delete** under Action for the data store you want to delete.

   Note: This option does not appear if the data store is being used in a configuration for provisioning or attribute lookup. To enable deletion, click **Check Usage** to locate the configuration(s) and change the associated data-store dependencies as needed.
2. Click **Save**.

Selecting a Data Store Type

Qualified data stores must be either JDBC-enabled databases, LDAP V3-enabled directory stores, or Custom. You can add data stores at any time.

For more information see *Managing Data Stores* on page 98.

Configuring a JDBC Database Connection

You configure access to a database by providing basic JDBC information.

Note: Ensure that your JDBC 4.1 (or higher) database-driver JAR file is installed in the `pingfederate/server/default/lib` folder and that the driver is compatible with the Server JRE version in use and with the target database. You must restart the server after installing the driver.

Field Descriptions

Field	Description

JDBC URL	(Required) The location of the JDBC database, in the format:
	`jdbc:mysql://databaseservername/databasename`
	`jdbc:sqlserver://databaseservername/databasename`
	`jdbc:oracle:thin://databaseservername/databasename`
	where *`databaseservername`* is the DNS host name (or IP) of the server hosting the database, and *`databasename`* is the name of a database on that server.
	Note: For MySQL, to enable automatic reconnection attempts if the connection is not available at runtime, enter a SQL statement in the Validate Connection SQL field below and add the following query string to the JDBC URL:
	`?autoReconnect=true`
	For more information, see the field description for Validate Connection SQL below.

Driver Class	(Required) The name of the driver class used to communicate with the source database. For example, `com.mysql.jdbc.Driver`, `com.microsoft.sqlserver.jdbc.SQLServerDriver`, or `oracle.jdbc.OracleDriver`. This class should be supplied by the database software vendor in a JAR file, which must be present in the `pingfederate/server/default/lib` folder.
Username	(Required) The name that identifies the user when connecting to the database.
Password	The password needed to access the database.
Validate Connection SQL	(Optional, but recommended) A simple SQL statement used by PingFederate at runtime to verify that the database connection is still active and to reconnect if needed. If a SQL statement is not provided here, PingFederate may not be able to reconnect to the database if the connection is broken. **Note:** To use this feature for MySQL, you must also add a query parameter to the JDBC URL (see information in field description above). **Important:** Ensure that the SQL statement is valid for your database. Examples: (For Oracle or MySQL) `SELECT 1 from dual` (For SQL Server) `SELECT getdate()`
Mask Values in Log (Checkbox)	Determines whether all attribute values returned from this data store will be masked in PingFederate log files (see *Attribute Masking* on page 26).
Allow Multi-Value Attributes (Checkbox)	When selected (the default), indicates that this JDBC data store can select more than one record from a column and return the results as a multi-value attribute. Otherwise, a query returns only the first value in the column.

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.

2. Click **Data Stores** under System Settings.
3. Click the data-store Description link on the Manage Data Stores screen.

To configure a new data store:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.
3. Click **Add New Data Store**.
4. Select Database and click **Next**.

To establish access to a database:

1. Enter the applicable JDBC URL.

   This URL is used to identify the data store in lists. Example: `jdbc:mysql://10.0.1.81:3306/idp`
2. Enter the Driver Class.

   Example: `com.mysql.jdbc.Driver`

   Note: The driver JAR file must be loaded into the directory: `pingfederate/server/default/lib`.
3. Enter a valid Username and Password.
4. Optional: Enter a valid SQL statement in the Validate Connection SQL field.

   For information, see the Description of this field in the “Field Descriptions” table above.
5. Optional: Select Mask Values in Log.

   For information, see *Attribute Masking* on page 26.
6. Optional: Click **Advanced**.

   Use this option to change default sizes or look-up time-outs, or to validate the connection using a specific SQL call (see *Setting Advanced Options* on page 101).
7. Click **Next**.

   Note: PingFederate tries to connect to the database at this point. If it cannot, there may be a problem with your settings.
8. On the Summary screen, click **Done**.
9. Click **Save** on the Manage Data Stores screen.

Setting Advanced Options

Use the Advanced Database Options screen to change default pool sizes or look-up time-outs, or to validate the connection using a specific SQL call.

Field Descriptions

Field	**Description**
Minimum Pool Size	The smallest number of database connections in the connection pool for the given data store.
Maximum Pool Size	The largest number of database connections in the connection pool for the given data store.
Blocking Timeout (ms)	The amount of time a request waits to get a connection from the connection pool before it fails.
Idle Timeout (min)	The length of time the connection can be idle in the pool before it is closed.

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.

2. Click **Data Stores** under System Settings.
3. Click the Data Store Description link on the Manage Data Stores screen.
4. Click **Advanced** on the Database Config screen.

To configure a new data store:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.
3. Click **Add New Data Store**.
4. Select Database and click **Next**.
5. Enter information on the Database Config screen and click the **Advanced** button.

   Internally, PingFederate is preconfigured to use published Jetty server default values. To view or restore these values, click **Apply Defaults**.

Configuring an LDAP Connection

This screen establishes a connection between the PingFederate server and an LDAP data store.

Field Descriptions

Field	Description
Hostname(s)	The DNS name or IP address of the data store, which may include a port number; example: `181.20.42.130:389`. For failover, you can enter one or more backup LDAP servers, each separated by a space. **Note:** If more than one Hostname is entered, each server must be accessible using the same User DN and Password (or via Bind Anonymously).
LDAP Type	If you are using this data store for Outbound Provisioning and your LDAP store is either Active Directory (AD) or Oracle Directory Server, select the applicable Type (see *Outbound Provisioning for IdPs* on page 33). Identifying the LDAP type permits PingFederate to configure many provisioning settings automatically (see *Modifying Source Settings* on page 243). The LDAP type is also used to enable password-change messaging between AD and PingFederate (see *HTML Form Adapter Configuration* on page 372). **Tip:** If you are using Outbound Provisioning and your LDAP server is *not* AD or Oracle, you may wish to define a custom LDAP Type to streamline the provisioning configuration (see *Defining an LDAP Type* on page 103).
Bind Anonymously (Checkbox)	(Optional) Username and password are not required (see procedure below).
User DN	The username credential required to access the data store. **Important:** The user must have permission to search the directory for user-account information. For security, this user should have read-only access. When connecting to an AD LDAP server running on Microsoft Windows Server 2008 R2 (or higher), enter a User account; do not use a Computer account.
Password	The password credential required to access the data store.
Use LDAPS (Checkbox)	(Optional) Connects to the LDAP data store using LDAPS. This selection applies equally to any secondary servers specified in Hostname(s).

Field	Description
	Important: We recommend that all LDAP connections be secured using LDAPS.
Mask Values in Log (Checkbox)	(Optional) Determines whether all attribute values returned from this data store will be masked in PingFederate log files (see *Attribute Masking* on page 26).

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.
3. Click the data-store Description link on the Manage Data Stores screen.
4. Click **LDAP Configuration** on the Summary Info screen.

To establish a connection to an LDAP data store:

Note: The fields referenced in the following steps are detailed in the Field Descriptions table above.

1. Enter the applicable Hostname(s).

   Hostnames identify this LDAP configuration in selection lists elsewhere in the administrative console.
2. Optional: Select an LDAP Type from the drop-down list.
3. Either:

   - Select Bind Anonymously if your LDAP interface supports anonymous binding and if no credentials are needed to access the data store.

   Or:

   - Enter a valid User DN and Password.

     Note: If you choose an anonymous binding, ensure that this access level provides permission to search the directory for user-account information.
4. Optional: Select Use LDAPS.

   Important: We recommend that all LDAP connections be secured using LDAPS.
5. Optional: Select Mask Values in Log.
6. Optional: Click **Advanced**.

   Use this option to configure LDAP pooling properties (see *Setting Advanced LDAP Options* on page 104).
7. Click **Next**.

   Note: PingFederate attempts to connect to the data store at this point. If it cannot, there may be a problem with your settings.
8. On the Summary screen, click **Done**.
9. Click **Save** on the Manage Data Stores screen.

Defining an LDAP Type

If you are using Outbound Provisioning and your user-management LDAP server is not Active Directory or the Oracle Directory Server, you can define a custom LDAP Type for PingFederate to use to streamline the provisioning configuration (see *Outbound Provisioning for IdPs* on page 33).

When the LDAP server is defined, its type appears in the LDAP Type drop-down list on the LDAP Configuration screen (see previous section). When the data store is selected as the source for provisioning, a number of other settings can be automatically configured (see *Modifying Source Settings* on page 243).

To define an LDAP Type:

1. If you are using the LDAP Configuration screen, click **Previous** or **Cancel**.

2. Copy and rename the file `sample.template.txt: <pf_install>/pingfederate/server/default/conf/template/ldap-templates`
3. Change the `template.name` in the new template file.

   The `template.name` you specify appears in the LDAP Type list on the LDAP Configuration screen when you save the template.
4. Modify other property values in the file to match the corresponding configuration of your LDAP server.

   The properties are used in the Outbound Provisioning setup (see *Modifying Source Settings* on page 243).
5. Save the new template file.

Setting Advanced LDAP Options

PingFederate maintains a search pool and a bind pool for each LDAP data store instance for optimal performance. The search pool is meant for LDAP directory searches. The bind pool is meant for LDAP bind authentication purposes.

Use the Advanced LDAP Options screen to change default pool settings for the related data store. These settings are applicable to both the search pool and the bind pool.

Field Descriptions

Tip: The defaults on this screen are conservative based on the default thread-pooling limits allowed by the installed PingFederate Web container. (These limits are under “Server Thread Pool” in `jetty-runtime.xml` located in `<pf_install>/pingfederate/etc`.)

If any changes are made to thread pooling, we recommend updating settings as outlined in the following table.

Field	Description
Test Connection on Borrow (Checkbox)	Indicates whether objects are validated before being borrowed from the pool.
Test Connection on Return (Checkbox)	Indicates whether objects are validated before being returned to the pool.
Create New Connection If Necessary (Checkbox)	Indicates whether temporary connections can be created when the Maximum Connections threshold is reached. Temporary connections are managed automatically. **Note:** If disabled, when the Maximum Connections threshold is reached, subsequent requests relying on this LDAP data store instance may fail.
Verify LDAPS Hostname	Indicates whether to verify the hostname of the LDAP server matches the Subject (CN) or one of the Subject Alternative Names from the certificate. **Important:** We recommend to verify LDAPS hostname in all LDAP connections.
Minimum Connections	The smallest number of connections that can remain in each pool, without creating extra ones. A minimum value of `1` creates one connection in the search pool and one connection in the bind pool. **Note:** For optimal performance, the value for this setting should be equal to 50% of the `maxThreads` value in the Jetty server configuration (see the **Tip** above this table).
Maximum Connections	The largest number of active connections that can remain in each pool without releasing extra ones. The value must be greater than or equal to the Minimum Connections value. **Note:** For optimal performance, the value for this setting should be equal to 75% to 100% of `maxThreads` value in the Jetty server configuration (see the **Tip** above this table).

Field	Description
Maximum Wait (Milli)	The maximum number of milliseconds the pool waits for a connection to become available when trying to obtain a connection from the pool. A value of `-1` causes the pool not to wait at all and to either create a new connection or produce an error (when no connections are available).
Time Between Eviction (Milli)	The frequency, in milliseconds, that the evictor cleans up the connections in the pool. A value of `-1` disables the evictor.
Read Timeout (Milli)	The maximum number of milliseconds a connection waits for a response to be returned before producing an error. A value of `-1` causes the connection to wait indefinitely.
Connection Timeout (Milli)	The maximum number of milliseconds that a connection attempt should be allowed to continue before returning an error. A value of `-1` causes the pool to wait indefinitely.

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.
3. Click the data-store Description link on the Manage Data Stores screen.
4. Click **LDAP Configuration** on the Summary Info screen.
5. Click **Advanced**.

Specifying LDAP Binary Attributes

The LDAP Binary Attributes screen allows you to specify which attributes must be handled as binary data for use in attribute contract fulfillment. Binary data cannot be used in an assertion. Encoding must be applied and is handled on a connection basis when binary attributes are selected for attribute mapping.

To reach this screen for editing:

1. Click **Server Configuration** on the Main Menu.
2. Click **Data Stores** under System Settings.
3. Click the data-store Description link on the Manage Data Stores screen.
4. Click **LDAP Configuration** on the Summary Info screen.
5. Click **Advanced**.
6. Click **LDAP Binary Attributes**.

To configure LDAP Binary Attributes:

1. Enter the attribute name in the text box.
2. Click **Add**.
3. Repeat steps 1 and 2 for other attributes as needed.
4. Click **Done**.

To edit LDAP Binary Attributes:

1. Click **Edit** under Action for the binary attribute.
2. Make your change and click Update.

To delete an LDAP Binary Attribute

Click **Delete** under Action for the binary attribute.

Configuring a Custom Data Store

Developers can use the PingFederate Custom Source SDK to create specific drivers for non-JDBC/LDAP data stores (or more sophisticated JDBC/LDAP lookups) including, for example, flat files or SOAP-connected databases (see the PingFederate *SDK Developer's Guide*).

Once the data-store driver is installed, you can select it on the Custom Data Store Type page.

To start configuring a Custom Data Store:

1. Enter a unique Instance Name.

   You can create more than one instance of the same Data Store Type for use with different connection partners, as needed.
2. Select the Data Store Type.
3. Optional: Select Mask Values in Log.

   For information see *Attribute Masking* on page 26.
4. Click **Next**.

Configuring a Custom Data Store Instance

This screen will vary depending on the implementation. Below is a sample for a SOAP-enabled database driver. The screen shown below is only an example of a custom data store and is not available in the PingFederate distribution.

To configure the driver instance for use with a partner connection:

- Enter or select required information and click **Next**.

Adapter Actions

Custom data store adapters may be written to interface PingFederate to perform configuration assistance or validation *actions* (for example, testing a connection to a database). Actions may also include generation of parameters that might need to be set manually in a configuration file.

- To invoke an adapter action (when applicable), click its link on the Adapter Actions screen.

Editing and Saving a Data Store

On the Data Store Summary page, you can view or edit your configuration.

To modify the configuration:

- Click the heading above the information you want to change.

To save a new configuration:

- Click **Done** on the Summary screen and then **Save** on the Manage Data Stores screen.

Defining an Account-Linking Data Store

When an SP is configured to use *account linking* for an IdP connection, PingFederate uses an embedded HyperSQL database as the account-link repository (see *Account Linking* on page 22). This default implementation does not require any changes to PingFederate to support account linking. However, you can manually customize PingFederate to store account links in a different data store—either a different database or an LDAP directory. You might want to do this for any of several reasons, including:

- You are running a cluster of PingFederate runtime engines (see the PingFederate *Server Clustering Guide*). This scenario requires that you use an external database or directory for account links to ensure proper local user lookup.
- You have performance or scalability requirements that exceed the HyperSQL database's capabilities.
- You and your federation partner previously established a different system for creating and mapping opaque *pseudonym*s, and PingFederate needs access to the system.

Changing the Account-linking Database

Changing the default database involves creating a table in your JDBC database to support account linking, and modifying PingFederate configuration XML files to use the database.

To create a database table for account linking:

- Run one of the table-setup scripts provided in the directory:
  `<pf_install>/pingfederate/server/default/conf/account-linking/sql-scripts`

If a script is not provided for your database, you can derive the setup from information available in any of the other scripts.

To change the account-linking database:

1. If you have not already done so, create a connection to the database you want to use (see *Configuring a JDBC Database Connection* on page 99).

   Be sure to save the configuration on the Manage Data Stores screen.
2. Any time after saving the database connection, return to the Manage Data Stores screen from the Main Menu.

   (To reach the screen, click **Data Stores** under System Settings.)
3. Copy the System ID for the database you want.
4. In the directory `<pf_install>/pingfederate/server/default/data/config-store`, open the file:

   `org.sourceid.saml20.service.impl.AccountLinkingServiceDBImpl.xml`

   Between the XML tags for the `item` named `PingFederateDSJNDIName`, insert the System ID you copied at *Step 3* and save the file.
5. Start or restart PingFederate.

   Note: If you are running PingFederate in a cluster, push the new configuration to other server nodes. For more information, see the PingFederate *Server Clustering Guide*.

Changing the Default Data Store to use LDAP

Changing the default data store to use LDAP involves modifying PingFederate configuration XML files to use the LDAP directory.

To use an LDAP directory:

1. If you have not already done so, create a connection to the LDAP data store you want to use (see *Configuring an LDAP Connection* on page 102).

   Be sure to save the configuration on the Manage Data Stores screen.
2. Any time after saving the LDAP data store connection, return to the Manage Data Stores screen from the Main Menu.

   (To reach the screen, click **Data Stores** under System Settings.)
3. Copy the System ID for the data store you want.
4. In the directory `<pf_install>/pingfederate/server/default/conf/META-INF`, open the file: `hivemodule.xml`

   Locate the Service-Point ID for AccountLinkingService and change the value of the `create-instance class` to:

   `org.sourceid.saml20.service.impl.AccountLinkingServiceLDAPImpl`
5. In the directory `<pf_install>/pingfederate/server/default/data/config-store`, open the file: `org.sourceid.saml20.service.impl.AccountLinkingServiceLDAPImpl.xml`

   Insert the following values between the XML tags for the these items:

   - `PingFederateDSJNDIName`: System ID you copied at *Step 3*
   - `UserSearchBase`: LDAP location where searches begin—for example, `CN=Users,DC=LDAPDir,DC=com`
   - `UsernameAttribute`: LDAP attribute that represents the user identifier—for example, Active Directory is `sAMAccountName`

- `AccountLinkDataAttribute`: LDAP attribute used to store account linking data

  Note: The `AccountLinkDataAttribute` can be any multi-valued string attribute on a user object class. We recommend that you extend the LDAP schema with a custom attribute for use here. See this *MSDN article* for further information on extending the Active Directory schema (`msdn.microsoft.com/library/ms676900(v=VS.85).aspx`).

6. Start or restart PingFederate.
7. If you are running PingFederate in a cluster, push the new configuration to other server nodes (see the PingFederate *Server Clustering Guide*)

   Important: You must manually apply the changes made in *Step 4* to the hivemodule.xml file on each server node in a cluster and then start or restart PingFederate.

   Note: User accounts to be linked must exist in the LDAP directory prior to establishing the account link. The Account Linking service does not add users to the LDAP data store but simply updates `AccountLinkDataAttribute` for a given user.

Defining an OAuth Grant Data Store

As is the case for Account Linking (see *Defining an Account-Linking Data Store* on page 106), PingFederate uses its internal HyperSQL database by default to maintain persistent grants (if any) for the OAuth AS—Persistent grants can result from some OAuth use cases (see *Persistent vs. Transient Grants* on page 17 for more information).

Important: When persistent grants are expected, administrators should consider changing this configuration to use an external secured database for production standalone deployments. For server clustering, an external database is required, since the HyperSQL database cannot be shared across other PingFederate engine nodes.

Changing the default data store for OAuth persistent grant storage involves modifying a PingFederate configuration XML file to point to the appropriate database.

To create the database tables for grant storage:

- Run the table-setup scripts for your database server provided in the directory:

  `<pf_install>/pingfederate/server/default/conf/access-grant/sql-scripts`

If scripts are not provided for your database server, you can derive the setup from information available in any of the other scripts.

To change the database:

1. If you have not already done so, create a connection to the database you want to use (see *Configuring a JDBC Database Connection* on page 99).

   Be sure to save the configuration on the Manage Data Stores screen.
2. Any time after saving the database connection, return to the Manage Data Stores screen from the Main Menu.

   (To reach the screen, click **Data Stores** under System Settings.)
3. Copy the System ID for the database you want.
4. In the directory `<pf_install>/pingfederate/server/default/data/config-store`, open the file: `org.sourceid.oauth20.token.AccessGrantManagerJdbcImpl.xml`

   Change the value of the item named `PingFederateDSJNDIName` to the System ID you copied in the previous step and save the file.
5. Start or restart PingFederate.

   Note: If you are running PingFederate in a cluster, push the new configuration to other server nodes. For more information see the PingFederate *Server Clustering Guide* and restart PingFederate.

PingFederate automatically removes expired grants once a day. To fine-tune the frequency and the number of expired grants to be removed, see *Managing Expired Persistent Grants* on page 84.

Defining an OAuth Client Data Store

By default, PingFederate stores OAuth clients entered into the system through the administrative console (see *Client Management* on page 141) or the REST-based application programming interface (see *PingFederate Administrative API* on page 423) in XML files. Alternatively, it can be configured to use a centralized database for OAuth client records, allowing the records to be managed via the administrative console, the REST-based application programming interface, or an OAuth Client Web Service (see *OAuth Client Management Service* on page 414).

Tip: Database management is recommended for scalability in deployments where large numbers of clients are anticipated.

As with the OAuth grant database (see previous section), when database usage is enabled, PingFederate uses its internal HyperSQL database by default. Administrators should consider changing this configuration to use an external secured database for production standalone deployments.

Important: For server clustering, an external database is required, since the HyperSQL database cannot be shared across other PingFederate engine nodes.

Enabling database usage and changing the default database involve modifying two PingFederate configuration files and restarting the server. For production databases, an administrator must also create a database table for OAuth clients using an SQL script.

To enable usage of an OAuth-client database:

1. In the directory `<pf_install>/pingfederate/server/default/conf/META-INF`, open the file: `hivemodule.xml`
2. Search the file for:

   `ClientManagerXmlFileImpl`

   Replace with:

   `ClientManagerJdbcImpl`

   You can reverse the setting if you ever want to revert to the default XML file storage implementation.

   Caution: If clients are already defined using the default XML implementation, the records are not moved to a database: they must be recreated. Likewise, if the configuration is changed back to the default, database records are not ported to XML files.
3. Restart PingFederate.
4. If you are running PingFederate in a server cluster, repeat the previous steps for each server node.
5. If you are ready to define an external enterprise database, follow the steps below.

To change the database:

1. For the database you want to use, run one of the table-setup scripts provided in the directory: `<pf_install>/pingfederate/server/default/conf/oauth-client-management/sql-scripts`

   If a script is not provided for your database, you can derive the setup from information available in any of the other scripts.
2. If you have not already done so, create a connection to the database (see *Configuring a JDBC Database Connection* on page 99).

   Be sure to save the configuration on the Manage Data Stores screen.
3. Any time after saving the database connection, return to the Manage Data Stores screen from the Main Menu.

   (To reach the screen, click **Data Stores** under System Settings.)
4. Copy the System ID for the database you want.
5. In the directory `<pf_install>/pingfederate/server/default/data/config-store`, open the file: `org.sourceid.oauth20.domain.ClientManagerJdbcImpl.xml`

   Change the value of the `item` named `PingFederateDSJNDIName` to the System ID you copied in the previous step and save the file.

Note: If you are running PingFederate in a cluster, be sure to make this modification on the administrative server.

6. Start or restart PingFederate.

   Note: If you are running PingFederate in a cluster, push the new configuration to other server nodes (see the PingFederate *Server Clustering Guide*).

Configuring IdP Discovery

PingFederate provides two kinds of IdP discovery:

- SAML 2.0 standard IdP Discovery (see *IdP Discovery* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide)
- Proprietary IdP discovery using a persistent cookie written by an SP PingFederate server

Standard IdP Discovery is configured in the administrative console (see the next section).

Discovery based on a PingFederate proprietary cookie is configured in an XML file (see *IdP Discovery Using a Persistent Cookie* on page 112). Note that this method can be used in conjunction with any of the federation standards.

Standard IdP Discovery

SAML IdP Discovery provides a cookie-based look-up mechanism used to identify a user's IdP dynamically during an SP-initiated SSO event, when the IdP is not otherwise specified. To enable this feature, IdP Discovery must be selected on the Roles and Protocols screen in the System Settings configuration (see *Choosing Roles and Protocols* on page 92). Then click **IdP Discovery** under System Settings on the Server Configuration sub menu to reach this screen.

For an overview of this SAML 2.0 profile, see *IdP Discovery* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide.

- To continue, click **Configure IdP Discovery**.

Choosing Domain Cookie Settings

On the Domain Cookie Settings screen, you choose the discovery role or roles that PingFederate will play.

The choices that appear on this screen depend on whether PingFederate is acting as an SP, an IdP, or both; or as an IdP Discovery server only (see *Choosing Roles and Protocols* on page 92).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **IdP Discovery** under System Settings.

   If this link is not available, then IdP Discovery is not yet enabled (see *Choosing Roles and Protocols* on page 92).
3. On the IdP Discovery screen, click **Configure IdP Discovery**.

For a detailed discussion of selections on this screen, see *IdP Discovery* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide.

Configuring a Common Domain Service

A Common Domain Service is where PingFederate reads and/or writes authentication information contained in shared cookies, as determined by whether your site is an SP or IdP, respectively. (The service is shared if your PingFederate server is acting in both roles.).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **IdP Discovery** under System Settings.

   If this link is not available, then IdP Discovery is not yet enabled (see *Choosing Roles and Protocols* on page 92).
3. On the IdP Discovery screen, click **Configure IdP Discovery**.
4. Click **Common Domain Service** under the Configure IdP Discovery tab.

   This step is not available if your server is configured for IdP Discovery only (see *Choosing Roles and Protocols* on page 92).

To configure the Common Domain Service:

1. Enter the Base URL.

   You must use SSL/TLS (`HTTPS`) for a common domain.
2. Enter and confirm a Pass phrase that a Web application must use to access the domain.

Configuring a Local Common Domain Server

A Local Common Domain Server is where PingFederate reads (as an SP) or writes (as an IdP) a common domain cookie (CDC) for IdP Discovery.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **IdP Discovery** under System Settings.

   If this link is not available, then IdP Discovery is not yet enabled (see *Choosing Roles and Protocols* on page 92).
3. On the IdP Discovery screen, click **Configure IdP Discovery**.
4. Click **Local Common Domain Server** under the Configure IdP Discovery tab.

   This step is available only if the common-server option is selected under Domain Cookie Settings (see *Configuring IdP Discovery* on page 110).

To configure the Local Common Domain Server:

1. Enter the Common Domain.

   Your entry must include an initial period (.); for example:

   ```
   .pingidentity.com
   ```
2. Enter the Cookie Lifetime.

   The range is `1` to `1,825` days; or to indicate a nonpersistent, session cookie, enter `-1`.
3. Enter and confirm a Pass phrase that a Web application must use to access the domain.

   Important: This configuration does *not* automatically enable the setting of the cookie itself at runtime. Follow one of the two options described below.

To enable setting the common cookie at runtime:

- *Either:*

  Ensure that, prior to launching any SSO events, the Web application that implements IdP Discovery sets the cookie using the PingFederate endpoint intended for that purpose (see */idp/writecdc.ping* on page 387).
- *Or:*

  Enable setting the cookie at runtime during SSO events by enabling IdP Discovery for the desired SP connection on the Connection Options page (see *Choosing Connection Options* on page 195).

Editing and Saving the Configuration

After configuring or modifying IdP Discovery settings, you can review the configuration on the Summary screen.

- If you are finished with the configuration, click **Save**; otherwise, click any heading to make changes.

IdP Discovery Using a Persistent Cookie

PingFederate's proprietary IdP-discovery method makes use of an IdP Persistent Reference Cookie (IPRC) to track the identity provider with whom a user last authenticated. There are three significant differences between standard IdP Discovery and the IPRC method:

- Standard IdP Discovery may be used only with SAML 2.0; the IPRC may be used with any federation protocol.
- The Common Domain Cookie (CDC) may be configured as a temporary, session-based cookie; the IPRC always persists for a configurable period of time.
- The CDC is set by the IdP and readable by both federation partners; the IPRC is set by the SP, using information in the SAML *assertion*, and cannot be accessed by the IdP.

Configuration

Enable the IPRC feature for your SP site using the configuration file `org.sourceid.websso.profiles.sp.IdpIdCookieSupport.xml` located in the directory `<pf_install>/pingfederate/server/default/data/config-store`.

Note that the deployed connection configuration between SP and IdP partners must include SP-initiated SSO (see *Configuring SAML Protocol Settings* on page 290).

To enable IPRC:

1. In the XML configuration file cited above, set the value of `EnableIdpIdCookie` to `true`.
2. Optional: Change the default value(s) of any of the remaining elements in the configuration, as described in the following table:

IdpIdCookieName	The name of the IPRC set by the SP installation (default: `IdPId`). Note that the cookie name cannot contain any of the following characters: &, >, <, comma, semicolon, space.
IdpIdCookieLifeTimeInDays	The lifetime for the cookie (default: `365` days, maximum: `24,855` days). The browser will delete the cookie when the period is expired.
ShowIdpSelectionList	If set to `true` (the default), the SP displays a list of IdPs that can be used to initiate the SSO event if the cookie is not set. If set to `false`, the SP installation generates an error page.

3. Start or restart PingFederate.

Note: Once an IPRC cookie is set, the only way to change the IdP to whom the SP will send Authentication Requests for the user is to do one of the following: wait for the cookie to expire, delete the cookie, or perform IdP-initiated SSO using the new IdP.

Configuring Redirect Validation

Several SP adapters can be configured to pass security tokens or other user credentials from the PingFederate SP server to the target resource via HTTP query parameters, cookies, or POST transmittal. In all cases, these transport methods open the possibility that a third party (with specific knowledge of aspects of the IdP and/or SP network, as well as PingFederate endpoints and configuration) might be able to obtain and use valid security tokens to gain improper access to the target resource.

This potential security threat would involve using well-formed SSO or SLO links to start an SSO or SLO request for a resource at the SP site. However, the target resource designated in the link would be intended to intercept the security token by redirection to a malicious Web site.

To prevent such an attack, PingFederate provides a means of validating SSO and SLO transactions to ensure that the designated target resource exists in a domain controlled by the SP through a list of configurable URLs.

Note: Validating target resource for SSO is applicable for IdP connections, adapter-to-adapter mappings and SAML 2.0 IdP Discovery.

The following default target URLs are always allowed:

- The default target URL for any IdP connections (see *Configuring Default Target URLs (Optional)* on page 295)
- The default target URL for any adapter-to-adapter mappings (see *Configuring a Default Target URL (Optional)* on page 118)
- The SP default URL for successful SSO (see *Configuring Default URLs* on page 261)
- The IdP default URL for successful SLO (see *Configuring a Default URL and Error Message* on page 187)

They do not need to be entered into the list manually.

Tip: PingFederate is also capable of validating the error resource (`InErrorResource`) parameter for the same reason. For more information, see *IdP Endpoints* on page 385, *SP Endpoints* on page 387 and *System-Services Endpoints* on page 395.

Important: PingFederate enables target resource validation for SSO and SLO, as well as error resource URLs, and requires HTTPS in new installations by default.

For backward compatibility, PingFederate Upgrade Utility does not enable these options if they were not selected in the previous PingFederate installation. Although optional, it is strongly recommended to enable target and error resource validation (including the HTTPS option) and to enter all expected resources to prevent unauthorized access.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Redirect Validation** under System Settings.

To enable target resource validation for SSO and/or SLO:

- Select the SSO and/or SLO checkbox(es).

To enable error resource validation:

- Select the Enable InErrorResource validation checkbox.

To enter expected resources:

1. Indicate whether to require HTTPS.

   Important: This selection is recommended to ensure that target validation will always prevent message interception for this type of potential attack, under all conceivable permutations.
2. Enter the domain or IP address containing the expected target resource under Valid Domain Name.

   Use the domain only, without qualifiers. For example:

   `mycompany.com`

   Using an initial wildcard and period for a domain name will cover multiple subdomains. For example:

   `*.mycompany.com`

   covers `hr.mycompany.com` or `email.mycompany.com`.

   (Optional) Enter the exact path of the resource (case-sensitive) under Valid Path. Starts with a forward slash, without any wildcard characters in the path. If left blank, any path (under the specified domain or IP address) is allowed. For example:

   `/inbound/Consumer.jsp`

   allows `/inbound/Consumer.jsp` but rejects `/inbound/consumer.jsp`

Tip: You can also enter multiple query parameters with or without a fragment.

For example: `/inbound/Consumer.jsp?area=West&team=IT#ref1001`

matches `/inbound/Consumer.jsp?area=West&team=IT#ref1001` but not `/inbound/Consumer.jsp?area=East&team=IT#ref1001` (Optional) Select the Allow Any Query / Fragment checkbox if you want to allow any query parameters or fragment in the resource.

Note: When selected, no query parameter and/or fragment is allowed in the path.

Select the TargetResource for SSO, TargetResource for SLO and/or InError Resource checkbox(es) to indicate the resource type(s).

Click **Add**.

3. Repeat the previous step to add additional entries as needed.
4. Click **Save**.

Managing Partner Redirect Validation

Some of the parameters used to perform redirection represent locations at a partner site—for example, the wreply parameter in WS-Federation. To protect against session token hijacking via open redirections, PingFederate provides an option to validate wreply for SLO. Once enabled, the whitelist for the parameter is managed within the connection settings on a per-partner basis. PingFederate amalgamates the entries from all active WS-Federation connections and validates wreply against the consolidated list.

Important: PingFederate enables wreply validation for SLO in new installations by default.

For backward compatibility, PingFederate Upgrade Utility does not enable this option if it was not selected in the previous PingFederate installation. Although optional, it is strongly recommended to enable wreply validation for SLO and to specify the allowed domains and paths for each WS-Federation IdP connection to prevent unauthorized access (see *Specifying a Service URL (WS-Federation)* on page 292).

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Redirect Validation** under System Settings.
3. Click **Partner Redirect Validation**.

To enable wreply validation for SLO:

1. Select the Enable wreply validation for SLO checkbox.
2. Click **Save**.

To disable wreply validation for SLO:

1. Clear the Enable wreply validation for SLO checkbox.
2. Click **Save**.

Chapter 4

IdP-to-SP Bridging

The IdP-to-SP Bridging links on the Server Configuration sub menu provide access to advanced federation settings.

This chapter covers:

- *Adapter-to-Adapter Mapping* on page 115
- *Token Exchange Mapping* on page 120
- *Connection Mapping Contracts* on page 124

Note: The information in this chapter is presented from the viewpoint of an administrative user with "Admin" permissions (see *Account Management* on page 62).

Adapter-to-Adapter Mapping

This configuration is provided for special use cases in which PingFederate is acting as both an IdP and an SP, and user attributes from an IdP adapter are used to create an authenticated session via an SP adapter on the same PingFederate server. Generally, these cases involve SaaS providers who may not support standards-based SSO but do provide proprietary SSO with "delegated authentication" (for example, Salesforce and Workday).

The mapping may also be used to enable the Google Apps Password Manager (available separately with the Google Apps Connector—see *Outbound Provisioning for IdPs* on page 33).

In effect, this configuration provides an alternative to setting up complete connections to send SAML assertions and other messages back and forth between an IdP and an SP running on the same PingFederate server (a loopback configuration) to enable nonstandard use cases. Instead, attributes that would normally be sent in an assertion are mapped directly from the IdP authentication adapter to an SP adapter, resulting in a secure SP user session.

To use this configuration, ensure that you have already configured the required IdP and SP adapter instances. Note that you may reuse instances that are also in use for connection configurations. For more information, see:

- *Configuring IdP Adapters* on page 178
- *Configuring SP Adapters* on page 254

Managing Mappings

On the Manage Mappings screen you can add, modify, or delete Adapter-to Adapter Mappings.

To add a mapping:

- Select the adapter Source Instance (IdP) and Target Instance (SP) and click **Add Mapping**.

  Note: You can create only one mapping of a source to the same target. However, you can map different sources to the same target, and vice versa.

To edit a mapping:

- Click the mapping name.

To delete a mapping:

- Click **Delete** under Actions for the mapping and then click **Save**.

Assigning a License Group

Adapter-to-adapter mapping is considered a connection for licensing purposes. If your PingFederate license manages connections by groups, select a license group for this mapping configuration.

Note: This screen is not displayed for unrestricted or other types of licenses.

To assign a License Group:

- Select the License Group from the drop-down list and click **Next**.

Configuring Attribute Lookup for Adapter-to-Adapter Mapping

Attribute sources are specific data store or directory locations containing information that may be required to fulfill the SP adapter contract.

This portion of the adapter-to-adapter configuration allows you to configure one or more data stores to look up attributes and to set up search parameters.

- If data-store lookup is *not* required, click **Next**.
- If data-store lookup is required, click **Add Attribute Source** and complete the setup steps (see *Choosing a Data Store (Optional)* on page 116 next).

To modify an attribute source configuration:

1. Click the attribute source Description link.
2. Click **Save** on the screen you change.

   Note: Depending on what you change, you may need to modify dependent data in subsequent steps, as indicated. Click **Save** or **Done** when either of those options appears.

Choosing a Data Store (Optional)

Under some circumstances, to fulfill the SP *adapter contract*, you may need to look up user attributes in data stores to supplement those available from the user's session via the IdP adapter. This screen provides that option.

To define an attribute source:

1. Enter an Attribute Source Id to uniquely identify the data source for the mapping.
2. Use Attribute Source Description to specify an attribute source name that distinguishes this user lookup for the selected data store.

   Note: PingFederate appends this description to the data store type in the Source list on the Adapter Contract Fulfillment screen (see *Adapter Contract Fulfillment* on page 117).
3. Choose an Active Data Store and click **Next**.

   A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Data Store Configuration for Adapter-to-Adapter Mappings

Note: Data-store lookup screens for this configuration are functionally identical to those used for an IdP connection. Refer to the table below to find applicable sections in this manual containing configuration information and procedures. Then continue to the next section, *Adapter Contract Fulfillment* on page 117.

- For information about data-store lookup configuration screens, depending on the type of data store, use this table:

Data Store Type	Manual Section
JDBC	• *Selecting a JDBC Database Table and Columns* on page 210 • *Configuring a Database Filter (WHERE Clause)* on page 211
LDAP	• *Configuring an LDAP Directory Search* on page 212 • *Configuring an LDAP Filter* on page 214
Custom	• *Configuring Custom Source Filters* on page 215 • *Selecting Custom Source Fields* on page 215

Identifying Target Application (Optional)

Use this screen to enter the name of the target application and the URL of the application icon, accessible through the IdP Adapter interface (`IdpAuthenticationAdapterV2`) in the PingFederate Java SDK. (For more information about the SDK, see *SDK Developer's Guide*.) Both fields are optional.

To complete the configuration:

- Enter an Application Name and an Application Icon URL.

Adapter Contract Fulfillment

The next step in this configuration is to map values from the IdP adapter into the attributes required by the SP adapter (the Adapter Contract).

Map each attribute to fulfill the Adapter Contract from one of these Sources:

- Adapter

  When you make this selection, the associated Value drop-down list is populated by the IdP adapter.
- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- LDAP/JDBC/Custom (if a data store is configured)

  Values are returned from a data source. When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes you identified.

  Note: PingFederate appends a description in parentheses for configured data store lookups (see *Configuring Attribute Lookup for Adapter-to-Adapter Mapping* on page 116).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the IdP Adapter, using the `${attribute}` syntax.

You can also enter values from your data store, when applicable, using this syntax:

`${ds.attr-source-id.attribute}`

where `attr-source-id` is the Attribute Source Id value (see *Choosing a Data Store (Optional)* on page 116) and attribute is any of the data store attributes you select.

To map attributes:

1. Choose a Source for each SP Adapter Contract attribute.

   See the list under *Map each attribute to fulfill the Adapter Contract from one of these Sources* above.
2. Choose (or enter) a Value for each attribute.

   All values must be mapped.
3. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

Configuring a Default Target URL (Optional)

Use this screen to assign a default target URL for this adapter-to-adapter mapping. Entering a URL in the Default Target URL field overrides any SP Default URL SSO setting (see *Configuring Default URLs* on page 261).

Note: If specified, the adapter-to-adapter endpoint parameter `TargetResource` overrides any default target URL for an adapter-to-adapter mapping (see *System-Services Endpoints* on page 395).

Configuring Issuance Criteria (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether to issue an SP adapter token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can SSO to protected resources.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Adapter – Select to access attributes from the IdP Adapter.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

     Note: PingFederate appends a description in parentheses for configured data store lookups (see *Configuring Attribute Lookup for Adapter-to-Adapter Mapping* on page 116)
   - Mapped Attributes – Select to access the required attributes.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).

5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Error results are handled in one of two ways:

   - **Redirect** – When an `InErrorResource` URL is provided., the value of the Error Result field is used by an `ErrorDetail` query parameter in the redirect URL.
   - **Template** – When an `InErrorResource` URL is not provided, the value of the Error Result field is used by the variable `$errorDetail` in the `idp.sso.error.page.template.html` template (for more information on this and other user-facing templates, see *Customizing User-Facing Screens* on page 76).

     Note: Using an error code in the Error Result field allows the error template or a Web application to process the error result in a variety of ways—for example, a redirect to another page or e-mail to an administrator.

     If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Summary Screen

When you have finished configuring Adapter-to-Adapter Mapping, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Mappings screen.

Token Exchange Mapping

This configuration is provided for use cases in which the PingFederate WS-Trust STS exchanges one type of security token for another without requiring a SAML token to be generated in between (see *About WS-Trust STS* on page 13). Use this configuration, for example, to convert a user's Kerberos token to a third-party proprietary WAM session token.

In effect, this configuration provides an alternative to setting up complete STS connections to make such an exchange using the same instance of PingFederate. Instead, incoming user attributes from an IdP token processor are mapped directly to an SP token generator.

To use this configuration, ensure that you have enabled both the IdP and SP roles for PingFederate, including the WS-Trust protocol (see *Enabling the WS-Trust STS* on page 324). Also, be sure to configure the required token-translator instances. Note that you may reuse instances that are also in use for STS connection configurations. For more information, see:

- *Configuring Token Processors* on page 327
- *Configuring Token Generators* on page 348

Managing Token Mappings

On the Manage Mappings screen you can add, modify, or delete token-to-token mappings.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **STS Token Exchange Mapping** under IdP-to-SP Bridging.

To add a mapping:

- Select the token-processor Source Instance and the token-generator Target Instance and click **Add Mapping**.

  Note: You can create only one mapping of a source to the same target. However, you can map different sources to the same target, and vice versa. When multiple IdP token processors and/or SP token generators are configured, you must provide the `TokenProcessorId` and/or the `TokenGeneratorId` query parameter(s) in the request (see *System-Services Endpoints* on page 395).

To edit a mapping:

- Click the mapping name.

To delete a mapping:

- Click **Delete** under Actions for the mapping and then click **Save**.

Configuring Attribute Lookup for Token Exchange Mapping

Attribute sources are specific data store or directory locations containing information that may be required to fulfill a token-generator contract.

This optional portion of the configuration allows you to configure one or more data stores to look up attributes and to set up search parameters.

- If data-store lookup is *not* required, click **Next**.
- If data-store lookup is required, click **Add Attribute Source** and complete the setup steps (see *Choosing a Data Store for Token Mapping* on page 121 next).

To modify an attribute source configuration:

1. Click the attribute source Description link.
2. Click **Save** on the screen you change.

   Note: Depending on what you change, you may need to modify dependent data in subsequent steps, as indicated. Click **Save** or **Done** when either of those options appears.

Choosing a Data Store for Token Mapping

On this screen choose a data store to use for supplemental user attributes.

To define an attribute source:

1. Enter an Attribute Source Id to uniquely identify the data source for the mapping.
2. Use Attribute Source Description to specify an attribute source name that distinguishes this user lookup for the selected data store.

   Note: PingFederate appends this description to the data store type in the Source list on the Token Contract Fulfillment screen.
3. Choose an Active Data Store and click **Next**.

   A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click Manage Data Stores to add it (see *Managing Data Stores* on page 98).

Data Store Configuration for Token Mapping

Note: Data-store lookup screens for this configuration are functionally identical to those used for an IdP connection. Refer to the table below to find applicable sections in this manualhelp topics containing configuration information and procedures. Then continue to the next section, *Token Contract Fulfillment* on page 121.

- For information about data-store lookup configuration screens, depending on the type of data store, use this table:

Data Store Type	Manual Section
JDBC	• *Selecting a JDBC Database Table and Columns* on page 210 • *Configuring a Database Filter (WHERE Clause)* on page 211
LDAP	• *Configuring an LDAP Directory Search* on page 212 • *Configuring an LDAP Filter* on page 214
Custom	• *Configuring Custom Source Filters* on page 215 • *Selecting Custom Source Fields* on page 215

Token Contract Fulfillment

The next step in this configuration is to map values from the token processor into the attributes required by the token generator (the Token Generator Contract).

Map each attribute to fulfill the Token Generator Contract from one of these Sources:

- Token

  When you make this selection, the associated Value drop-down list is populated by the token processor.
- Context

  Values are returned from the context of the transaction at runtime.

Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- LDAP/JDBC/Custom (if a data store is configured)

  Values are returned from a data source. When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes you identified.

  Note: PingFederate appends a description in parentheses for configured data store lookups (see *Choosing a Data Store for Token Mapping* on page 121).

- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the token processor, using the `${attribute}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.attr-source-id.attribute}`

  where `attr-source-id` is the Attribute Source Id value (see *Data Store Configuration for Token Mapping* on page 121) and `attribute` is any of the data store attributes you select.

To map attributes:

1. Choose a Source for each Token Generator Contract attribute.

   See the list under *Map each attribute to fulfill the Token Generator Contract from one of these Sources:* above.

2. Choose (or enter) a Value for each attribute.

   All values must be mapped.

3. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

Selecting Token Issuance Criteria

Use this optional configuration to define criteria PingFederate can evaluate to determine whether to issue a security token (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access protected Web services.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request and STS SSL Client Certificate Chain selections are retrieved as Java objects rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

     Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428.

For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

  Note: PingFederate appends a description in parentheses for configured data store lookups (see *Choosing a Data Store for Token Mapping* on page 121).
- Mapped Attributes – Select to access the required attributes from the token contract.
- Token – Select to access attributes from the IdP token processor.

2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

   Important: When using the STS SSL Client Certificate's Subject DN attribute, you must select one of the following conditions: equal to DN, not equal to DN, multi-value contains DN, or multi-value does not contain DN. These operators take into account minor differences that might be present in the DN syntax (for example, whether spaces are present after commas).
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in a `SOAP` message returned. The Error Result field is used by the `faultstring` element for SOAP 1.1 and the `Reason/Text` element for SOAP 1.2.

   For more information on SOAP, see the World Wide Web Consortium's *Simple Object Access Protocol* (`www.w3.org/TR/2000/NOTE-SOAP-20000508/#_Toc478383507`).

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Token Mapping Summary Screen

When you have finished configuring token-to-token mapping, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Mappings screen.

Connection Mapping Contracts

PingFederate uses two connections to bridge an identity provider to a service provider:

- An IdP connection where end users authenticate and PingFederate (the federation hub) is the SP
- An SP connection to the target application where PingFederate (the federation hub) is the IdP

It fuses these two connections together by a connection mapping contract—a connection mapping contract is the medium that carries user attributes from the identity provider to the service provider.

Each connection mapping contract comes with one default attribute (`subject`). You can extend the contract to include additional attributes as needed. In most federation hub use cases, you configure PingFederate to pull attribute values from inbound assertions into the connection mapping contract in an IdP connection and to push those values from the connection mapping contract into the outbound assertions through an SP connection. For advanced use cases, you have the option to configure the IdP and/or SP connections to look up values from multiple data store instances.

When bridging one identity provider to one service provider, you need to create one connection mapping contract and associate the contract with both the IdP connection and the SP connection.

When bridging one identity provider to multiple service providers, you need to create a connection mapping contract per service provider because each service provider likely requires a different set of attributes. Map all the connection mapping contracts into the IdP connection. Add the respective connection mapping contract to each SP connection to the service provider.

When bridging multiple identity providers to one service provider, you likely need only one contract unless the service provider requires a different set of attributes from each identity provider. Add the connection mapping contract to the SP connection as well as the applicable IdP connections.

(See *Federation Hub* on page 38 for more information.)

Managing Contracts

On the Manage Contracts screen, you can add, modify, or delete connection mapping contracts.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Connection Mapping Contracts** under IdP-to-SP Bridging.

To add a contract:

- Click **Create New Contract**.

To edit a contract:

- Click the contract name.

To delete a contract:

1. Click **Delete** under Actions for the mapping that you want to delete.

   Note: This option does not appear if the connection mapping contract is associated with at least one IdP or SP connection. To enable deletion, click **Check Usage** to locate the connection(s) and change the mappings as needed.
2. Click **Save**.

Editing Contract Info

On the Contract Info screen, you can enter or modify the contract name.

To create a new contract:

1. Enter a new contract name.
2. Click **Next**.

To modify an existing contract:

1. Edit the contract name as needed.
2. Click **Next**.

Defining Contract Attributes

On the Contract Attributes screen, you can enter or modify the set of user attributes to map between an SP connection and an IdP connection.

To extend the contract:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your SP and IdP connections.
2. Click **Add**.
3. Click **Next**.

To modify an existing contract:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

   Note: If you change your mind, ensure that you click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made in the configuration steps.
3. Click **Next**.

To delete an attribute:

1. Click **Delete** under Action for the attribute.
2. Click **Next**.

Using the Connection Mapping Contracts Summary Screen

When you have finished configuring Connection Mapping Contracts, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Contracts screen.

Chapter

5

OAuth Configuration

To use the OAuth Authorization Server (AS), start by enabling that role for PingFederate under **Server Settings** on the Roles and Protocols screen. Then configure the OAuth AS using options available under Server Configuration on the Main Menu, as described in this section.

For more information about the OAuth AS, see *About OAuth* on page 15.

Tip: Service providers may also add OAuth capabilities to the Browser SSO configuration for IdP connection partners—see *Configuring OAuth Attribute Mapping* on page 287.

Enabling the OAuth AS

You can enable the OAuth AS when you first install PingFederate (see *Starting PingFederate for the First Time* in the “Installation” chapter of *Getting Started*). If you have already installed PingFederate or are upgrading to a new version, use the following procedure.

Note: OAuth AS capabilities are available under special licensing. If your license does not include the OAuth AS, please contact *sales@pingidentity.com*.

To enable the OAuth Authorization Server:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Roles and Protocols** on the Summary screen.
4. Select the **Enable OAuth 2.0 Authorization Server (AS) role** checkbox.
5. Optional: Select the **OpenID Connect** checkbox to enable that feature (see *OpenID Connect* on page 19).
6. Click **Save**.

Using OAuth Menu Selections

PingFederate provides a choice of ways for administrators and software developers to take advantage of OAuth AS capabilities, depending on configuration and application needs (see *About OAuth* on page 15). The Main Menu provides links to most of the configuration pathways, including global settings for the AS, client management, and required and optional mappings (see *Mapping OAuth Attributes* on page 18). (Additional optional mapping scenarios are provided for SPs as part of the IdP Connection task flow—see *Configuring OAuth Attribute Mapping* on page 287 and *Configuring an OAuth SAML Grant IdP Connection* on page 153.)

At a minimum from the OAuth Settings sub menu, an administrator must:

1. Configure Authorization Server Settings (see *Authorization Server Settings* on page 130).
2. Configure settings for OAuth clients (see *Client Management* on page 141).

3. Configure how *access tokens* are handled, including setting up an Attribute Contract (see *Access Token Management* on page 133).
4. Configure a default attribute mapping from persistent grants to access tokens (see *Access Token Mapping* on page 150).

   Note: This option appears on the OAuth Settings sub menu only after Access Token Management is configured.

   Additionally, optional mappings may be configured, depending on applicable authentication-context mappings (see *Mapping OAuth Attributes* on page 18), as described in the following procedure.

To configure additional, optional mappings

- Configure policies to extend OAuth process to include authorization policies for clients using OpenID Connect, including attribute mappings specific to that standard (see *OpenID Connect* on page 19).

  Note: This option appears only after the OpenID Connect protocol is enabled in Server Settings (see *Choosing Roles and Protocols* on page 92).
- Map persistent grants based on contexts, as described below, and then return to the Access Token Mapping screen to complete the mapping(s) (see *Access Token Mapping* on page 150).
  - *Resource-Owner Credentials Mapping* on page 144

    Use this option to map persistent grants based on authentication handled by PingFederate via Password Credential Validators (see *Validating Password Credentials* on page 170).
  - *IdP Adapter Mapping for OAuth* on page 147

    Use this option to map persistent grants based on user authentication information provided by PingFederate IdP adapters (see *Configuring IdP Adapters* on page 178).
  - *Configuring OAuth Attribute Mapping* on page 287

    This mapping option can be configured for Service Providers as part of an IdP connection, using incoming assertion attributes to populate persistent grants.

Centralized Session Management

When an organization opens Web-based protected resources to their remote employees, business partners and customers, it has limited control over the end-user devices. To minimize security risk, both the IT administrators and end users desire session management with tight controls.

PingFederate provides an asynchronous front-channel logout endpoint and a back-channel revocation Web service to help OAuth Clients using the OpenID Connect protocol, such as PingAccess, to terminate sessions when end users log out and to prevent unauthorized access until the end users log in again.

PingAccess works out-of-the-box with PingFederate, taking full advantages of these two features. For more information, see *documentation* for PingAccess (documentation.pingidentity.com/display/PA/).

Asynchronous Front-Channel Logout

Asynchronous Front-Channel Logout provides OpenID Connect Clients the capability to initiate single logout requests to sign off associated SLO-enabled sessions; the logout request endpoint is /idp/startSLO.ping (see *IdP Endpoints* on page 385). Optionally, clients can add end-user sessions to a revocation list on logout and query the revocation list through the Session Revocation API. For more information on how to query session status, see *Back-Channel Session Revocation* on page 129.

Tip: Information about the Asynchronous Front-Channel Logout endpoint is also available in the OpenID Connect metadata (see *OpenID Connect Provider Metadata Endpoint* on page 407). Look for `ping_end_session_endpoint` in the metadata.

On a per-client basis, PingFederate can be configured to send (via the browser) logout requests to PingAccess and additional requests to other relying parties.

Note: When the PingAccess option is selected, PingFederate sends logout requests (via the browser) to an OpenID Connect logout endpoint (/pa/oidc/logout.png) in PingAccess to sign off other domains previously called by the session. For more information, see *OpenID Connect Endpoints* in the PingAccess *Administrator's Manual*.

In addition, when signing off an SLO-enabled SAML 2.0 or WS-Federation session, as the SLO request reaches the PingFederate IdP server, the same logout process applies as well. Depending on the enterprise architecture, this could further improve single sign-on and logout use cases.

To configure Asynchronous Front-Channel Logout:

1. In the Authorization Server Settings screen, select the **Track User Sessions for Logout** checkbox to enable Asynchronous Front-Channel Logout for OpenID Connect Clients (see *Authorization Server Settings* on page 130).
2. Optional: Select the **Revoke User Session on Logout** checkbox in the Authorization Server Settings screen to add the PingFederate session to the revocation list.
3. Optional: For each applicable client, select the **PingAccess Logout Capable** checkbox for PingAccess clients and enter additional endpoints at the relying parties in **LOGOUT URIS** for other client types as needed (see *Configuring a Client* on page 141).

Back-Channel Session Revocation

Back-Channel Session Revocation allows OpenID Connect Clients, such as PingAccess, to query the revocation status of their sessions by sending HTTP GET requests to a session revocation endpoint in PingFederate. To access the session revocation endpoint, a client must be granted access to the Session Revocation API in the PingFederate administrative console. It must also authenticate with its Client Secret or Client Certificate and include in the request the session identifier, which can be obtained from the ID Token.

Back-Channel Session Revocation also allows the clients to revoke sessions by sending HTTP POST requests to the same session revocation endpoint. This gives application developers the flexibility to revoke sessions based on the logic of their applications.

When a browser comes back to PingFederate with a revoked session, if the HTML Form Adapter is used, PingFederate assigns a new session identifier to the request and redirects the browser to the login form for the end user to sign on again. Other IdP adapters manage their own sessions; the end users may, or may not, need to re-authenticate.

For each session added to the revocation list, PingFederate retains its revocation status for a configurable lifetime. Access control and authentication requirements to revoke sessions are identical to those to query for the revocation status.

For detailed information about querying the revocation status or adding sessions to the revocation list, see *Session Revocation API* on page 421.

To configure Back-Channel Session Revocation:

1. For each applicable client, select the **Grant Access to Session Revocation API** checkbox (see *Configuring a Client* on page 141).
2. Select the **Include Session Identifier in ID Token** checkbox in OpenID Connect policies that are applied to clients supporting session revocation (see *Configuring OpenID Connect Policies* on page 137).
3. In the Authorization Server Settings screen, modify the **Session Revocation Lifetime** value as needed (see *Authorization Server Settings* on page 130).

   Important: The **Session Revocation Lifetime** value should match or exceed the maximum session lifetime of the relying parties, including the **Session Timeout** value in all the applicable instances of the HTML Form Adapter (see *Configuring the HTML Form IdP Adapter* on page 372).

   For example, the default **Session Revocation Lifetime** value of 250 minutes exceeds the default lifetime of the PingAccess (PA) Tokens by 10 minutes to allow for clock skew between servers (see *Web Sessions* in the PingAccess *Administrator's Manual*).

Authorization Server Settings

The Authorization Server Settings screen provides overall controls over the usage and behavior of the PingFederate OAuth AS, including scope descriptions, authorization-code policy, and refresh-token and persistent-grant policy.

Field Descriptions

Field	Description
Default Scope Description	Description of the permissions implied when no scope values are indicated or in addition to any values. This description displays when the user is prompted for authorization. **Tip:** If you want to localize the display text, you can enter a unique alias here, then use the same alias in language resource files (see *Localization* on page 81).
Scope Value	A value that represents access to a resource or API on the Resource Server (RS). Applicable values require coordination with a developer or someone familiar with details of the RS OAuth implementation. **Tip:** For OpenID Connect, you can change the message presented to users for their authorization by entering `openid` as a Scope Value and the message you want under Scope Description. **Important:** Also for OpenID Connect, to use the following key attributes in authorization policies, you *must* add them in this row, along with Scope Descriptions (see *Configuring OpenID Connect Policies* on page 137). • `profile` • `email` • `address` • `phone` **Note:** By default, scopes are available to all OAuth clients unless access is restricted on a per-client basis (see *Configuring a Client* on page 141).
Scope Description	A description of the Scope Value. This description appears when the user is prompted for authorization. **Tip:** If you want to localize the display text, you can enter unique aliases here, then use the same aliases in language resource files (see *Localization* on page 81).
Scope Group Value	A value that represents a group of scopes (a “super scope”) that you can reference in applicable OAuth 2.0 protocol interactions. The scopes within the scope group can be downgraded (upon refresh) into application-specific scopes with fewer permissions.
Scope Group Description	A description of the scope group value. This description appears when the user is prompted for authorization. **Tip:** If you want to localize the display text, you can enter unique aliases here, then use the same aliases in language resource files (see *Localization* on page 81).
Authorization Code Timeout (seconds)	The amount of time (in seconds) that an authorization code is considered valid.
Authorization Code Entropy (bytes)	The length (in bytes) of the authorization code returned to the OAuth Client.

Field	Description
Persistent Grant Lifetime (blank for indefinite)	(Integer) Indicates the number of days or hours the OAuth AS stores persistent grants. Leave blank to maintain grants indefinitely. **Note:** You can also set persistent grant expiration for specific OAuth clients, overriding this global configuration (see *Client Management* on page 141).
Refresh Token Length (characters)	The number of characters the OAuth AS uses to generate the refresh token returned to the client.
Roll Refresh Token Values (default policy) (checkbox)	When selected, the OAuth AS generates a new refresh token value when a new access token is obtained. **Note:** New refresh token values are not issued during the defined interval (see the Minimum Interval to Roll Refresh Tokens box below). Not selecting the checkbox means the refresh token value is used until it becomes invalid (either by manually revoking or by some other security setting that renders it invalid).
Minimum Interval to Roll Refresh Tokens (hours)	The minimum number of hours that must pass before a new refresh token value can be issued. Provides a way to allow for rolling a refresh token value without having to send a new value on every request.
Reuse Existing Persistent Access Grants for Grant Types (checkboxes)	If a client makes multiple requests for the same user and same (or lesser) scope, select the grant types you want the OAuth AS to reuse rather than creating a new grant for each request. Reusing an existing persistent grant imposes a limit of one grant per client. For example, in the case of refresh tokens, only one (the most recently issued) is valid, and the previously issued refresh token is invalidated. If multiple instances of the same client are used regularly by the same user, the associated check box should be cleared. When Implicit is selected, consent from the user is requested only for the first OAuth resource request associated with the grant. When Authorization Code is selected, the same is true *if* the checkbox Bypass Authorization for Previously Approved Persistent Grants is also selected.
Bypass Authorization for Previously Approved Persistent Grants (checkbox)	When selected, consent from the user is requested only once (see *OAuth User-Facing Pages* on page 80). The user is not asked for authorization on subsequent requests until the access grant is revoked. This function applies only when using the Authorization Code grant type *and* when the Reuse Existing Persistent Access Grants for Grant Types checkbox is selected. **Tip:** On a per-client basis, user consent may be bypassed completely, overriding this setting (see *Configuring a Client* on page 141).
Allow Unidentified Clients to Request Resource Owner Password Credentials Grants (checkbox)	When selected, allows Resource Owners to obtain access tokens without defining a client.
Allow Unidentified Clients to Request Extension Grants (checkbox)	When selected, allows user-initiated or client-initiated events (for example, a mobile application or scheduled task) to obtain access tokens without the client presenting a `client_id` or `client_secret` for extension grant types (see *Extension Grant Types* on page 17).
Persistent Grant Extended Attributes	Extend persistent grants to include additional attributes from your authentication systems. **Tip:** This is useful for Default access-token attribute mappings, because you can fulfill the access-token contracts by the extended attributes. For more

Field	Description
	information, see *Access Token Mapping* on page 150 and *Token Attribute Contract Fulfillment* on page 150.
Password Credential Validator	Required for HTTP Basic authentication if the OAuth REST Web Service is used for managing client applications (see *OAuth Client Management Service* on page 414) and/or the OAuth Access Grant Management Service is used for managing access grants (see *OAuth Access Grant Management Service* on page 420). These service cannot be used if a validator is not provided.
Track User Sessions for Logout	When selected, PingFederate links sessions using the OpenID Connect and other federation protocols for end users. When an end user logs out of one session, PingFederate sends (via the browser) logout requests to close other associated sessions (see *Asynchronous Front-Channel Logout* on page 128).
Revoke User Session on Logout	When selected, PingFederate revokes the corresponding sessions on logout (see *Back-Channel Session Revocation* on page 129). **Note:** PingFederate always adds the session to the revocation list, even if a logout error occurs.
Session Revocation Lifetime (minutes)	The amount of time (in minutes) until the revoked sessions are removed from the revocation list for optimal performance. **Important:** The value should match or exceed the maximum session lifetime of the relying parties (see *Back-Channel Session Revocation* on page 129).

To define Authorization Server settings:

- Fill in information or change defaults, as needed, and click **Save**.

Default Scope Description, Authorization Code Timeout, and Authorization Code Entropy are required (see **Field Descriptions** above).

To add a Scope:

1. Enter a value that represents access to a resource or API on the RS.
2. Enter a description of the scope. This description appears when the user is prompted for authorization.
3. Click **Add**.

To modify a Scope:

1. Click **Edit** under Action for the Scope.
2. Edit the Scope Value or Description and click **Update**.

   Caution: Changing a Scope Value in production will cause runtime errors if a client request specifies the scope using the previous value. In addition, errors will result if a requesting OAuth client is restricted to a scope whose Value is no longer listed on this screen, unless the affected client configuration(s) are also updated (see *Client Management* on page 141 next).

   Note: If you change your mind, be sure to click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made.
3. Click **Save**.

To delete a Scope Value:

1. Click **Delete** for the Scope Value.

Caution: Deleting a scope in production will cause runtime errors if a client request specifies the scope. In addition, errors will result if a requesting OAuth client is restricted to a scope whose Value is no longer listed on this screen, unless the affected client configuration(s) are also updated (see *Client Management* on page 141).

2. Click **Save** on the Authorization Server Settings screen.

Access Token Management

PingFederate supports multiple access token management instances. This capability allows you (the administrator) to configure different access token policies and attribute contracts for different OAuth clients. It also provides a means to control validation of access tokens to a certain RS.

Clients can specify an access token management instance by providing the access token manager ID (`access_token_manager_id`) or a resource URI (`aud`) in their requests to the PingFederate AS.

When defining an access token management instance, you can customize various settings, including the token format, lifetime and attribute contract for this instance. You can also limit the access token management instance to a list of resource URIs and/or clients in an access control list (ACL). For example, you can use the ACL to limit which clients can obtain access tokens from a particular access token management instance.

You can also add the desired RS clients to the ACL, such that these are RS clients can ensure that the access token they have received was issued by a specific access token management instance. They do this by specifying which instance will be used in validating the token (via the `access_token_manager_id` or `aud` parameter) they want to use in the token validation request.

At runtime, the PingFederate AS uses the following rules to determine which access token management instances it should use:

1. Limit the eligible access token management instances to those that are available in the context of the request. For most requests, these are instances that have an attribute mapping defined in Access Token Mapping. For OAuth SAML Grant requests, it is the set of instances for which a mapping is defined in the IdP Connection. Furthermore, the client ACL (if configured) can also limits which access token management instances are eligible.
2. If the request comes with an `access_token_manager_id` or `aud`, the PingFederate AS uses the information to determine the applicable access token management instance.
3. If the request does not come with either parameter, for OpenID Connect clients (where the scope value contains `openid` in their requests), the PingFederate AS uses the access token manager specified by the OpenID Connect policy of the client.
4. If the request comes with neither of the two parameters nor the `openid` scope, the PingFederate AS uses the default access token manager of the client (if configured) or the default instance defined for the installation.

If no match can be found in the eligible list, the PingFederate AS aborts the request. For more information about the access token manager ID (`access_token_manager_id`) and resource URI (`aud`) parameters, see the “Access Token Management parameters” sections under *Token Endpoint* on page 398 and *Authorization Endpoint* on page 403.

Managing Access Token Management Instances

Use this screen flow to specify how the PingFederate AS manages OAuth access tokens.

To configure a new instance:

- Click **Create New Instance**.

To edit an existing access token management instance:

- Click the Instance Name and click the step you need to change.

To delete an access token management instance:

1. Click **Delete** next to the Instance Name. (To undo the deletion, click **Undelete**.)

Note: This option is inactive if the instance is referenced elsewhere, or if it is a parent to other instances. To enable deletion, click **Check Usage** to locate the configuration(s) that depend on the instance and go to each listed configuration to remove the dependencies. If the instance you want to delete is a parent, delete child instances first.

2. Click **Save** to confirm the deletion.

Defining an Access Token Management Instance

Use this screen to create a new or to edit an existing access token management instance.

To create a new instance:

1. Enter an Instance Name and Instance Id. The Instance Id may not contain spaces or underscores.
2. Choose the plug-in type of the access token management instance.

   Type varies depending on the plug-ins deployed on your server. For information about adding a customized plug-in, please contact a support representative via the *Support Center* (pingidentity.com/support)
3. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
4. Click **Next**.

To edit an existing access token management instance:

1. Edit the Instance Name as needed.
2. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
3. Click **Next**.

Configuring a Token-Management Instance

This configuration varies depending on the Type of the access token manager. The following sections provide information for token plug-ins bundled with PingFederate:

- *Configuring Reference-Token Management* on page 134
- *Configuring JSON-Token Management* on page 135

Configuring Reference-Token Management

On this screen, you can make changes to preset default settings for Reference Tokens (see *Token Models and Management* on page 16) as well as set an optional maximum token lifetime.

- Make changes as needed (see **Field Descriptions** below), or click **Next** to continue.

  Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

Field Descriptions

Field	Description
Token Length	The number of characters the AS uses to define the token reference. Increasing the length will enhance token security, if desired. (Maximum: 256)
Token Lifetime	The amount of time (in minutes) that an access token is considered valid.
Lifetime Extension Policy	Indicates whether the OAuth AS should reset token lifetimes each time a token is validated. The token plug-in checks the policy before updating the lifetime of an

Field	Description
	access token. Options are: no extension policy, reset token lifetimes only for transient tokens (not backed by a persistent policy), or reset lifetimes for all tokens.
Maximum Token Lifetime	(Optional) Defines an absolute maximum token lifetime (in minutes) for use with the Lifetime Extension Policy. An access token's lifetime can be extended but not beyond this setting. You must specify a value that is greater than or equal to the value specified in the Token Lifetime.
Lifetime Extension Threshold Percentage	When PingFederate is deployed in a cluster and token-lifetime extension is enabled, there must be a cluster-group remote procedure call (RPC) to extend the life of a token. This setting limits RPC overhead by suspending the calls until the set threshold is crossed. For example, if the token lifetime is one hour and the threshold is 50%, the lifetime will not be extended until the remaining time is less than 30 minutes. This option could potentially reduce RPC traffic between nodes by orders of magnitude while still supporting the LifeTime Extension Policy.
Advanced Fields	
Mode for Synchronous RPC	Some RPC events require that the caller get some data from the remote nodes, so the call is synchronous and blocks waiting on the responses. This configuration setting indicates whether the caller should wait for a response from all nodes in the cluster or just a majority of nodes. This is designed to eliminate the need for a complete state synchronization at startup. Synchronous RPC calls occur when a node receives a verification request for a token it does not recognize and for token issuance.
RPC Timeout	Timeout between cluster nodes during synchronous communication. Recommended setting is from 100 milliseconds to 1000 (1 second).

Configuring JSON-Token Management

On this screen, you can configure settings for bearer JSON Web Tokens (JWTs)— secure, self-contained tokens that can be validated locally by the target RS (see *Token Models and Management* on page 16).

The configuration provides for token security using either symmetric keys or asymmetric signing-certificate keys (see *Digital Signing and Decryption Keys and Certificates* on page 166). Multiple entries are allowed for either signing mechanism to facilitate rollover of keys when they expire.

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

To configure a JWT token instance:

1. Add one or more Symmetric Keys and/or signing Certificates:

   Use the **Add a new row . . .** links, enter information, and then click **Update** under Action.

   If you are using signing certificates not yet contained in the PingFederate key store, click **Manage Signing Certificates**.

   Note: Signing certificate key length must be at least 2,048 bits.

2. Change or select entries for required fields and make other changes as needed (see **Field Descriptions** below).
3. Click **Next**.

Field Descriptions

Field	Description
Token Lifetime (Required)	The amount of time, in minutes, that an access token is considered valid.

Field	Description
JWS Algorithm (Required)	The hash-based message authentication code (HMAC) or RSA signing algorithm used to protect the integrity of the token.
Active Symmetric Key ID	The Key ID of the key to use when producing JWTs using an HMAC-based algorithm. (Required if an HMAC JWS Algorithm is selected above.)
Include Key ID Header Parameter	When selected (the default), the Key ID is used in the `kid` header parameter for the token.
Active Signing Certificate Key ID	The Key ID of the key pair and certificate to use when producing JWTs using an RSA-based algorithm. (Required if an RSA JWS Algorithm is selected above.)
Include X.509 Thumbprint Header Parameter	When selected, the X.509 Certificate Thumbprint is used in the `x5t` header parameter for the token.
Client ID Claim Name	The name of a JWT claim used to represent the OAuth Client ID.
Scope Claim Name	The name of a JWT claim used to represent the scope of the grant.
Advanced Fields	
Space Delimit Scope Values	When selected, indicates scope strings will be delimited by spaces rather than represented as a JSON array (the default).
Issuer Claim Value	The value of the Issuer (`iss`) claim in the JWT.
Audience Claim Value	The value of the Audience (`aud`) claim in the JWT.
JWT ID Claim Length	Indicates the number of characters of the JWT ID (`jti`) claim in the JWT. (If `0`, no claim is included.)
Access Grant GUID Claim Name	The name of the JWT claim used to carry the persistent access grant GUID. If the claim is present during validation, the grant database is consulted to ensure the grant is still in force.
Publish Key ID X.509 URL	Indicates whether certificates will be made accessible by Key ID at `https://<pf_host>:<port>/ext/oauth/x509/kid?v=<id>`
Publish Thumbprint X.509 URL	Indicates whether certificates will be made accessible by thumbprint at `https://<pf_host>:<port>/ext/oauth/x509/x5t?v=<base64url encoded SHA-1 thumbprint>`

Defining the Access Token Attribute Contract

On this screen, create a list of attributes to be referenced in an OAuth access token. You must enter at least one attribute.

Note: If this is a child instance, select the override checkbox to modify the configuration.

To add an attribute:

1. Enter the attribute name in the text box.
2. Click **Add**.

   Add additional attributes as needed. Attribute names are case-sensitive and must correspond to the attribute names expected by the Resource Server.

To modify an attribute name:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Click **Next** when finished editing attributes.

Configuring Resource URIs

Specify a list of resource URIs which can be used to select this Access Token Management instance.

Note: If this is a child instance, select the override checkbox to modify the configuration.

To add a resource URI:

1. Enter the value in the text box.
2. Click **Add**.

   Enter additional resource URIs as needed. The resource URIs must correspond to the resource expected by the Resource Server.

To modify a resource URI:

1. Click **Edit** under Action for the resource URI.
2. Make the change and click **Update**.

To delete a resource URI:

- Click **Delete** under Action for the resource URI.

Click **Next** when finished editing resource URIs. (To undo the deletion, click **Undelete**.)

Defining Access Control

Use this screen to enable access control by OAuth clients.

Note: If this is a child instance, select the override checkbox to modify the configuration.

To enable access control:

1. Select the Restrict Allowed Clients checkbox.
2. Select a client under Allowed Clients and click **Add**.
3. Select additional clients as needed.

To remove a previously allowed client:

- Click **Delete** next to the applicable client. (To undo the deletion, click **Undelete**.)

To disable access control:

- Clear the Restrict Allowed Clients checkbox.

Click **Next** when finished configuring access control.

Using the Access Token Management Summary Screen

When you have finished the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Save**.

Configuring OpenID Connect Policies

This configuration allows you to define OpenID Connect policies for client access to attributes mapped according to OpenID specifications (see *OpenID Connect* on page 19). It also provides an option to include a session identifier in the ID Tokens, which could be useful for the relying parties, such as PingAccess (see *Back-Channel Session Revocation* on page 129).

Note: The **OpenID Connect Policy Management** link on the OAuth Settings sub menu appears only after the protocol is enabled in Server Settings (see *Choosing Roles and Protocols* on page 92).

To begin creating a new policy:

1. Click **Add Policy**.
2. On the next screen, Manage Policy, enter a Policy ID and Name.

   The Policy ID is used internally and may not contain any spaces or underscores. The Name is any you choose for display in other UI screens.
3. Select an Access Token Manager.
4. Optional: Change the default ID Token Lifetime.

   Values can be between 0 and 65,535.
5. Optional: Select the Include Session Identifier in ID Token checkbox to add a session identifier in the ID Tokens.
6. Optional: Select the Include User Info in ID Token checkbox to include additional attributes in the ID Tokens.

   Tip: Alternatively, OAuth clients can obtain additional attributes from the UserInfo endpoint (see *OpenID Connect Provider Metadata Endpoint* on page 407).

To edit an existing policy:

- Click its link and then on the Summary screen click the heading over the information that needs updating.

Configuring the Policy Attribute Contract

On this screen, specify attributes you want returned from the PingFederate UserInfo endpoint for OpenID Connect.

Note: The `sub` value of this configuration is also used to fulfill an internally managed ID Token attribute contract. The contract usage is dynamic, depending on how and when the user authenticated.

To add an attribute:

- Enter the attribute name in the text box and click **Add**.

To modify an attribute name:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Policy Attribute Sources and User Lookup

Attribute sources are specific data store or directory locations containing information that may be needed to fulfill the attribute contract for a policy. This configuration is optional.

- If you are not using a data store, click **Next** and see the next section, *Policy Contract Fulfillment* on page 139.

To configure an attribute source:

1. Click **Add Attribute Source**.
2. On the Data Store screen, enter an Attribute Source Id and an Attribute Source Description. Then, select an Active Data Store and click **Next** to continue the configuration.

Note: This setup is identical for all OAuth mapping configurations—for information, see *OAuth Attribute Mapping Using a Data Store* on page 157. When complete, click **Next**. on this screen and see the next section.

Policy Contract Fulfillment

On this screen map attributes from the access token or other sources to fulfill the attribute contract.

Map the subject attribute and all extended attributes from one of these Sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- LDAP/JDBC/Custom (when a data store is used)

  Values are returned from your data store (if used). When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes identified for this data store (see *Searching LDAP for OAuth Mapping* on page 159, *Defining a JDBC Location for OAuth* on page 158, or *Configuring OAuth Custom Source Filters* on page 160).

- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

- Text

  The value is what you enter. This can be text only, or you can mix text with references to the unique user ID returned from the credentials validator, using the syntax `${attribute}`.

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.`*`attribute`*`}`

  where *`attribute`* is any of the data store attributes you have selected.

- Access Token

  The value is provided from the access token (*Access Token Management* on page 133).

To map attributes:

1. Choose a Source for the attribute.
2. Choose (or enter) a Value.
3. Click **Next**.

Identifying Issuance Criteria for Policy Mapping

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue the ID token and access token. If a criterion fails, no tokens are issued and access is denied (see *About Token Authorization* on page 27).

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.
   - Mapped Attributes – Select to access the output data returned from UserInfo endpoint.
   - Access Token – Select to use attributes from the access token.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in the value of this field being used by the `error_description` protocol field.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations (for example, OR conditions) using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error message or an error code for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.

   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Policies screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Policy Summary Screen

When you have finished the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Policies screen.

Note: If this is the first policy you are creating, you must designate it as the default before saving. You can change the default as needed when you create additional policies.

Client Management

An OAuth client application interacts with the PingFederate OAuth AS to obtain access tokens needed to call OAuth-protected services at the Resource Server. Use this screen flow to specify how the OAuth AS manages these applications.

Important: OAuth client records, like other PingFederate configuration data, are maintained in XML files. Alternatively, you can set up a centralized database to store client records (see *Defining an OAuth Client Data Store* on page 109).

Note: When a database is defined, PingFederate provides a REST Web Service for managing OAuth clients, allowing administrators to add and maintain clients in a database programmatically (see *OAuth Client Management Service* on page 414).

Tip: For detailed developer information for client applications, see *OAuth 2.0 Endpoints* on page 398.

To add a new Client:

- Click **Add Client**.

To edit an existing Client:

1. Click the Client ID and make the necessary changes on the Manage Clients screen.

   Tip: Use the **Search** features to locate clients that may be out of view or on subsequent pages, or use the page-navigation controls, when present. Click **Clear** to redisplay the list after a search. (Select Advanced Search for search options.)

2. Click **Done** and then **Save**.

To delete a Client:

1. Click **Delete** next to the Client name. (To undo the deletion, click **Undelete**.)
2. Click **Save** to confirm the deletion.

Configuring a Client

The Manage Client screen provides controls over the usage and behavior of the applications requesting access to protected resources through the PingFederate AS.

Field Descriptions

Field	Description
Client ID	(Required) A unique identifier the client provides to the Resource Server to identify itself. This identifier is included with every request the client makes.
Client Authentication	A selection other than **None** is required only for the Client Credentials grant type (see *Grant Types* on page 16). When required, select *either*: • **Client Secret** for Basic authentication. Click **Generate Secret** to create a strong random alphanumeric string or manually enter a secret. If this button is disabled, select the **Change Secret** checkbox. *Or*: • **Client Certificate** for mutual SSL/TLS authentication—recommended for application configurations where security policies prohibit storing passwords. **Note:** Mutual SSL/TLS authentication requires the use of a secondary PingFederate SSL port (see *Modifying PingFederate Properties* on page 68). Enter information into the following required fields: **Client TLS Certificate Issuer** – Select a Trusted CA from the list (see *Trusted Certificate Authorities* on page 161). Alternatively, you may choose to Trust Any of the issuers listed (CA certificates imported into PingFederate). **Client TLS Certificate Subject DN** – Enter the client-certificate subject DN, or click **Browse** to locate the certificate and then **Extract** to retrieve the DN.
Name	(Required) A descriptive name for the client instance. This name appears when the user is prompted for authorization. **Tip:** If you want to localize the displayed name, you can enter a unique alias here, then use the same alias in language resource files (see *Localization* on page 81).
Description	A description of what the client application does. This description appears when the user is prompted for authorization. **Tip:** If you want to localize the displayed description, you can enter a unique alias here, then use the same alias in language resource files (see *Localization* on page 81).
Redirection URIs	URIs to which the OAuth AS may redirect the resource owner's user agent after authorization is obtained. A redirection URI is used with the Authorization Code and Implicit grant types (see *Grant Types* on page 16). Enter a fully qualified URL and click **Add** for each entry required. Wildcards are allowed. However, for security reasons, make the URL as restrictive as possible. For example: `https://www.company.com/OAuthClientApp/callback.jsp` **Important:** If more than one URI is added or if a single URI uses wildcards, then Authorization Code grant and token requests must contain a specific matching `redirect_uri` parameter (see *OAuth 2.0 Endpoints* on page 398).

Field	Description
Logo URL	The location of the logo used on user-facing OAuth grant authorization and revocation pages (see *Customizing User-Facing Screens* on page 76). (For best results with the installed HTML templates, the recommended size is 72 x 72 pixels.)
Bypass Authorization Approval	When selected, resource-owner approval for client access is assumed—the authorization consent page is not presented to the user for this client. Use this setting, for example, when you want to deploy a trusted application and authenticate end users via an IdP adapter or IdP connection.
Restrict Scopes	Restricts this client's access to specific scopes or scope groups. When selected, a list appears of all scopes defined within the PingFederate AS. Select the scopes or scope groups available for this client. **Note:** Selecting this box and not selecting any specific scopes restricts this client's access to only the default scope (see *Authorization Server Settings* on page 130). If a client requests a specific scope (not selected in the list), an error is returned.
Allowed Grant Types	Available grant types that this client is allowed to use.
Default Access Token Manager (optional)	Select a default Access Token Manager for this client (see *Access Token Management* on page 133).
Persistent Grants Expiration	Allows an administrator to override the Persistent Grant Lifetime set globally for the OAuth AS (see *Authorization Server Settings* on page 130).
Refresh Token Rolling Policy	Select **Don't Roll** or **Roll** to override the Roll Refresh Token Values setting on the Authorization Server Settings screen (see *Authorization Server Settings* on page 130). Leave **Use Global Setting** selected to default to the Roll Refresh Token Values setting on the Authorization Server Setting screen.
OpenID Connect	**Note:** These options are displayed only when OpenID Connect is enabled in Server Settings (see *Choosing Roles and Protocols* on page 92). **ID Token Signing Algorithm** (Optional): Select the signing algorithm for the ID Token. The default algorithm is `RSA using SHA-256`. **Policy** (Optional): Choose a specific OpenID Connect policy (see *Configuring OpenID Connect Policies* on page 137). **Grant Access to Session Revocation API**: When selected, this client application is allowed to add sessions to or query the revocation status. Authentication is required (see *Session Revocation API* on page 421). **Note:** If the Track User Sessions for Logout checkbox is selected in the Authorization Server Settings screen, there are two additional settings: **PingAccess Logout Capable**: (Optional) When selected, PingFederate sends (via the browser) logout requests to an OpenID Connect endpoint in PingAccess as part of the logout process (see *Asynchronous Front-Channel Logout* on page 128). **Logout URIs** (Optional): Enter additional endpoints at the relying parties as needed. PingFederate sends (via the browser) requests to these URIs as part of the logout process (see *Asynchronous Front-Channel Logout* on page 128). For more information about the logout endpoint in PingAccess, see *OpenID Connect Endpoints* in the PingAccess *Administrator's Manual*.

Resource-Owner Credentials Mapping

This configuration allows you to map attributes based on validated user credentials into the USER_KEY and extended attributes for a persistent grant (see *Authorization Server Settings* on page 130 and *Mapping OAuth Attributes* on page 18). You may supplement credential-validation mapping sources with attribute look-ups from your user data source.

Note: At least one credential validator instance must be configured in order to map attributes (see *Validating Password Credentials* on page 170).

To create a mapping:

- Select a Source Instance from the drop-down list and click **Add Mapping**.

If the list does not contain any instances or the instance you want, return to the Main Menu and click **Password Credential Validators** under Authentication (see *Validating Password Credentials* on page 170)

To edit an existing mapping:

- Click its link and then on the Summary screen click the heading over the information that needs updating.

Resource-Owner Attribute Sources and User Lookup

Attribute sources are specific data store or directory locations containing information that may be needed to fulfill the USER_KEY and/or the extended attribute values of persistent grants. This configuration is optional.

- If you are not using a data store, click **Next** and see the next section, *Resource-Owner Contract Fulfillment* on page 144.

To configure an attribute source:

1. Click **Add Attribute Source**.
2. On the Data Store screen, enter an Attribute Source Id and an Attribute Source Description. Then, select an Active Data Store and click **Next** to continue the configuration.

   Note: This setup is identical for all OAuth mapping configurations—for information, see *OAuth Attribute Mapping Using a Data Store* on page 157. When complete, click **Next** on this screen and see the next section.

Resource-Owner Contract Fulfillment

On this screen, you map values into the USER_KEY and extended attributes for a persistent grant. Use this mapping for the Resource Credential grant type (see *Grant Types* on page 16).

Note: The USER_KEY values must be unique across all end users because it is the identifier to store and to retrieve persistent grants. For example, if you have two Active Directory domains, the sAMAccountName value of an end user in one domain may collide with that of another end user in the other domain. In this scenario, you can map Subject DN to the USER_KEY.

Map each attribute from one of these Sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting Context as the **Source** and Authenticating Authority as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

> **Note:** The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.
>
> Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- Password Credential Validator

  When you make this selection, the associated Value drop-down list consists of the attributes (for example, username) associated with the credential-validation instance.

- LDAP/JDBC/Custom (when a data store is used)

  Values are returned from your data store (if used). When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes identified for this data store (see *Searching LDAP for OAuth Mapping* on page 159, *Defining a JDBC Location for OAuth* on page 158, or *Configuring OAuth Custom Source Filters* on page 160).

- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

- Text

  The value is what you enter. This can be text only, or you can mix text with references to the unique user ID returned from the credentials validator, using the syntax:

  ```
  ${attribute}
  ```

  You can also enter values from your data store, when applicable, using this syntax:

  ```
  ${ds.attribute}
  ```

  where `attribute` is any of the data store attributes you have selected.

To map attributes:

1. Choose a Source for the attribute.
2. Choose (or enter) a Value.
3. Click **Next**.

Identifying Issuance Criteria for Credentials Mapping

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue an access token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access an OAuth-protected resource.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     > **Note:** The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

- Mapped Attributes – Select to access the output of the mapping into the persistent grant—for example, the USER_KEY or an extended attribute.
- Password Credential Validator – Select to access attributes returned from the credential-validation instance.

2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in the value of this field being used by the `error_description` protocol field.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations (for example, OR conditions) using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error message or an error code for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Credentials-Mapping Summary Screen

When you have finished the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Mappings screen.

IdP Adapter Mapping for OAuth

This configuration allows you to map attributes based on an IdP adapter configuration into the `USER_KEY` and extended attributes for a persistent grant, as well as the `USER_NAME` (presented to the user for authorization permission). You may supplement values returned from the adapter with attribute look-ups from your user data source. (For more information about adapters, see *Configuring IdP Adapters* on page 178.)

Use this mapping for Authorization Code and Implicit grant types (see *Grant Types* on page 16).

To create a mapping:

- Select a Source Instance from the drop-down list and click **Add Mapping**.

To edit an existing mapping:

- Click its link and then on the Summary screen click the heading over the information that needs updating.

IdP Adapter Attribute Sources and User Lookup

Attribute sources are specific data store or directory locations containing information that may be needed to fulfill the `USER_KEY` and/or extended attribute values of persistent grants, as well as the `USER_NAME` presented to the end user for authorization permission. This configuration is optional.

- If you are not using a data store, click **Next** and see the next section, *Grant Contract Fulfillment* on page 147.

To configure an attribute source:

1. Click **Add Attribute Source**.
2. On the Data Store screen, enter an Attribute Source Id and an Attribute Source Description. Then, select an Active Data Store and click **Next** to continue the configuration.

   Note: This setup is identical for all OAuth mapping configurations—for information, see *OAuth Attribute Mapping Using a Data Store* on page 157. When complete, click **Next** on this screen and see the next section.

Grant Contract Fulfillment

On this screen, you map values into the `USER_KEY` and extended attributes for a persistent grant, as well as the `USER_NAME` for the user's display name on the authorization page.

Note: The `USER_KEY` values must be unique across all end users because it is the identifier to store and to retrieve persistent grants. For example, if you have two Active Directory domains, the sAMAccountName value of an end user in one domain may collide with that of another end user in the other domain. In this scenario, you can map Subject DN to the `USER_KEY`.

Map each attribute from one of these Sources:

- Adapter

  When you make this selection, the associated Value drop-down list contains attributes configured in the IdP adapter instance.
- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- LDAP/JDBC/Custom (when a data store is used)

  Values are returned from your data store (if used). When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes identified for this data store (see *Searching LDAP for OAuth Mapping* on page 159, *Defining a JDBC Location for OAuth* on page 158, or *Configuring OAuth Custom Source Filters* on page 160).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to the attributes returned from the adapter instance, using the syntax:

  `${attribute}`

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.attribute}`

  where `attribute` is any of the data store attributes you have selected.

To map attributes:

1. Choose a Source for the attribute.

   Choose (or enter) a Value.
2. Click **Next**.

Defining Issuance Criteria for OAuth Adapter Mapping

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue an access token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access an OAuth-protected resource.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Adapter – Select to access attributes from the IdP Adapter.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

- Mapped Attributes – Select to access the output of the mapping into the persistent grant—for example, the USER_KEY or an extended attribute.

2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in the value of this field being used by the `error_description` protocol field.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error message or an error code for use if authorization fails (see step 5 for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Adapter-Mapping Summary Screen

When you have finished the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Mappings screen.

Access Token Mapping

In this required configuration, an administrator maps attributes to be requested from the OAuth resource server with the access token—the token attribute contract (see *Defining the Access Token Attribute Contract* on page 136).

When mapping a Default context, you define how the OAuth AS maps values into the attributes based on the persistent-grant USER_KEY and any extended attributes (see *Authorization Server Settings* on page 130).

When a specific context is selected, you can also map attributes from the selected context, namely the chosen IdP adapter, credential validator, or IdP connection (configured with OAuth Attribute Mapping), into the access tokens.

The mapping used at runtime depends on the authentication context of the original grant. If the authentication context results a match, the OAuth AS uses that specific mapping; otherwise, it uses the default mapping for the applicable access token manager.

Note: This option appears on the OAuth Settings sub menu only after Access Token Management is configured (see *Access Token Management* on page 133).

To create a token mapping:

1. Select a Context from the drop-down list.

   Contexts for mappings include:

   - (Required) The default mapping when no other contexts are configured
   - The user key for a grant request as determined by instances of a credentials validator (see *Validating Password Credentials* on page 170)
   - User key from the OAuth IdP adapter-mapping configurations (see *IdP Adapter Mapping for OAuth* on page 147)
   - IdP-connection OAuth mappings (see *Configuring OAuth Attribute Mapping* on page 287)
2. Select an Access Token Manager.
3. Click **Add Mapping**.

To edit an existing mapping:

- Click its link and then on the Summary screen click the heading over the information that needs updating.

Access Token Attribute Sources and User Lookup

Attribute sources are specific data store or directory locations containing information that may be needed to fulfill the token attribute contract. This configuration is optional.

If you are not using a data store, click Next and see the next section, *Token Attribute Contract Fulfillment* on page 150.

To configure an attribute source:

1. Click **Add Attribute Source**.
2. On the Data Store screen, enter an Attribute Source Id and an Attribute Source Description. Then, select an Active Data Store and click **Next** to continue the configuration.

   Note: This setup is identical for all OAuth mapping configurations—for information, see *OAuth Attribute Mapping Using a Data Store* on page 157. When complete, click **Next** on this screen and see the next section.

Token Attribute Contract Fulfillment

On this screen, you map values into the token attribute contract (see *Defining the Access Token Attribute Contract* on page 136). These are the attributes that will be included or referenced in the access token.

Map each attribute to fulfill the Token Attribute Contract from one of these Sources:

- Adapter/Password Credential Validator/IdP Connection

  If you selected a specific IdP adapter, password credential validator or IdP connection under Context in the previous screen, you have the option to map attributes from that specific authentication system. Select the corresponding Context in this screen and choose the desired attribute under Value.
- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Persistent Grant

  When you make this selection, the associated Value drop-down list is populated by the `USER_KEY` and extended attributes from the persistent access-token grant.
- LDAP/JDBC/Custom (when a data store is used)

  Values are returned from your user-data store. When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes identified for this data store (see *Searching LDAP for OAuth Mapping* on page 159, *Defining a JDBC Location for OAuth* on page 158, or *Configuring OAuth Custom Source Filters* on page 160).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to the `USER_KEY` using the syntax:

  ```
  ${USER_KEY}
  ```

  You can also enter values from your data store, when applicable, using this syntax:

  ```
  ${ds.attribute}
  ```

  where `attribute` is any of the data store attributes you have selected.

To map attributes:

1. Choose a Source for each attribute.
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Next**.

Configuring Issuance Criteria for Access Token Mapping

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue an access token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access an OAuth-protected resource. For example, before reissuing a token in a refresh-token scenario, the server can verify that the user is still current in your organization's user-data store and has retained the necessary permissions.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.
   - Mapped Attributes –Select to use access token attributes returned from token attribute contract mapping.
   - Persistent Grant – When you select this option, the associated Attribute Name drop-down list is populated by the `USER_KEY` and extended attributes from the persistent access-token grant.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in the value of this field being used by the `error_description` protocol field.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error message or an error code for use if authorization fails (see step 5 for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.

   - Click **Add**. Continue to add expressions, as needed.

- Click the **Test** link to input values and test the resulting output for the expression.

  Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Token-Mapping Summary Screen

When you have finished the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** and then **Save** on the Manage Mappings screen.

Configuring an OAuth SAML Grant IdP Connection

An OAuth SAML Grant connection exchanges a SAML assertion for an OAuth access token with the PingFederate Authorization Server. You can configure an OAuth SAML Grant connection with an IdP partner either in conjunction with browser-based SSO, WS-Trust, or independently.

To enable OAuth SAML Grant for a new connection, or to add the capability to an existing connection:

- On the Connection Type screen, select OAuth SAML Grant (see *Choosing an IdP Connection Type* on page 268).

  Note: Before you can select this option, you must enable the OAuth 2.0 protocol in Server Settings (see *Choosing Roles and Protocols* on page 92) and configure an access token plug-in (see *Access Token Management* on page 133).

  When the option is enabled, the configuration starts on the OAuth SAML Grant Attribute Mapping screen.
- To continue, click **Configure OAuth SAML Grant Attribute Mapping**.

Specifying an Attribute Contract for the OAuth SAML Grant

An attribute contract is a set of user attributes the IdP sends in the SAML assertion for this connection. You identity these attributes on this screen.

SAML_SUBJECT is always sent in a SAML assertion and contains the name identifier of the user for whom the access token is being requested.

Optionally, you can mask the values of attributes (other than SAML_SUBJECT) in the log files that PingFederate writes when it receives security tokens (see *Attribute Masking* on page 26).

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your partner.
2. Optional: Select the checkbox under Mask Values in Log.
3. Click **Add**.

To modify an attribute name or masking selection:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

   Note: If you change your mind, ensure that you click the Cancel link in the Actions column, not the Cancel button, which discards any other changes you might have made in the configuration steps.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Configuring Access Token Manager Mappings

Use this screen to associate one or more Access Token Managers with this connection to define how access tokens are created.

To create a new access token manager mapping:

- Click **Create New Access Token Manager Mapping**.

To edit an existing access token manager mapping:

- Click on the Access Token Manager and click the step you need to change.

To delete an access token manager mapping:

1. Click **Delete** next to the Access Token Manager. (To undo the deletion, click **Undelete**.)
2. Click **Save** to confirm the deletion.

Selecting an Access Token Manager Instance

Use this screen to select an Access Token Manager instance to associate with this connection. Attributes are mapped from the connection's contract into the Access Token Manager's contract to define the resulting content of created access token.

To select an Access Token Manager Instance:

- Select an Access Token Manager from the drop-down menu.

  Tip: If the Access Token Manager you need is not available, click **Manage Access Token Management Instances** to define one or more instances you need for this connection.

Choosing a Data Store for OAuth SAML Grant Attribute Mapping

This optional configuration is the same for all OAuth attribute-mapping task flows. For detailed instructions, see *OAuth Attribute Mapping Using a Data Store* on page 157.

- If you do not need additional attributes from a data store, just click **Next** on the Data Store screen.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **OAuth SAML Grant Attribute Mapping** under the IdP Connection tab.
4. Click **Configure OAuth SAML Grant Attribute Mapping**.
5. Click **Data Store** on the Summary screen.

OAuth SAML Grant Contract Fulfillment

The last step in configuring OAuth SAML Grant attribute mapping is to map SAML grant attributes to the attribute values of the access token (see *Access Token Mapping* on page 150).

Map attributes from one of the following Sources:

- Assertion

  Values are contained in the assertions from this IdP. When you make this selection, the associated Value drop-down list is populated by the attribute contract.
- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- JDBC/LDAP/Custom

  Values are returned from your user-data store. When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes identified for this data store (see *Defining a JDBC Location for OAuth* on page 158 or *Configuring an OAuth Database Filter (WHERE Clause)* on page 159).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the assertion, using the `${attribute}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  ```
  ${ds.attribute}
  ```

  where attribute is any of the data store attributes you have selected.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **OAuth SAML Grant Attribute Mapping Configuration** under the IdP Connection tab.
4. Click **Configure OAuth SAML Grant Attribute Mapping Configuration**.
5. Click **Contract Fulfillment**.

To map attributes:

1. Choose a Source for each attribute.

   (For descriptions, see *Map attributes from one of the following Sources* above.)

2. Choose (or enter) a Value for each attribute.

   All values must be mapped.

3. Click **Next**.

Selecting Issuance Criteria for OAuth SAML Grant

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue an access token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access an OAuth-protected resource.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Assertion – Select to access attributes from the assertion.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.
   - Mapped Attributes – Select to access the output of the mapping into the access token.

2. Select an attribute name.

3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).

5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in the value of this field being used by the `error_description` protocol field.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.

6. Click **Add**.

7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.

8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.

- Use the Error Result box to enter an error message or an error code for use if authorization fails (see step 5 above for more information).

  Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.

- Click **Add**. Continue to add expressions, as needed.
- Click the **Test** link to input values and test the resulting output for the expression.

  Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432.

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

OAuth SAML Grant Attribute Mapping Configuration Summary

When you finish the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you finish, click **Done**.

OAuth SAML Grant Configuration Summary

When you finish the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you finish, click **Done**.

OAuth Attribute Mapping Using a Data Store

This optional configuration is the same for all of the OAuth attribute-mapping task flows described under *Using OAuth Menu Selections* on page 127, including:

- *Configuring OpenID Connect Policies* on page 137
- *Resource-Owner Credentials Mapping* on page 144
- *IdP Adapter Mapping for OAuth* on page 147
- *Access Token Mapping* on page 150

A similar configuration is also used for attribute mapping in an IdP connection (see *Configuring OAuth Attribute Mapping* on page 287) and when configuring an OAuth SAML Grant connection (see *Configuring an OAuth SAML Grant IdP Connection* on page 153).

- If you do not need additional attributes from a data store for the respective mapping configuration, just click **Next** when you reach the Data Store screen.

To look up user attributes for an OAuth mapping configuration:

1. Choose an Active Data Store and click **Next**.

A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

2. See the following sections, depending on the type of data store:

Data Store Type	Related Section
JDBC	• *Defining a JDBC Location for OAuth* on page 158 • *Configuring an OAuth Database Filter (WHERE Clause)* on page 159
LDAP	• *Searching LDAP for OAuth Mapping* on page 159 • *Configuring an LDAP Filter for OAuth Mapping* on page 160
Custom	• *Configuring OAuth Custom Source Filters* on page 160 • *Selecting OAuth Custom Source Fields* on page 160

Defining a JDBC Location for OAuth

When you choose to use a database source for attributes, you follow this path through the configuration steps.

On the Database Tables and Columns screen you begin to specify exactly where additional data can be found to complete the attribute contract. Only one table may be used as a source of data for a JDBC lookup.

Important: (For MySQL users) To allow for table and column names that may contain spaces, PingFederate inserts double quotes around the names at runtime. To avoid SQL syntax errors resulting from the quotes, add the property `ANSI_QUOTES` to `sql-mode` in the configuration file `my.cnf` (on Unix/ Linux) or `my.ini` (on Windows). For example:

```
sql-mode=”...,ANSI_QUOTES”
```

For more information, see:

dev.mysql.com/doc/refman/5.0/en/identifiers.html

and

dev.mysql.com/doc/refman/5.1/en/option-files.html

Field Descriptions

Field	Description
Schema	Lists the table structure that stores information within a database. Some databases, such as Oracle, require selection of a specific schema for a JDBC query. Other databases, such as MySQL, do not require selection of a schema.
Table	The name of the table contained in the database. Use the drop-down to change the table.
Columns to return from SELECT	Displays selected table columns. Select the columns associated with the desired attributes you would like to return from the JDBC query.

To select a database table and columns for queries:

1. Choose a Schema file (when applicable) from the drop-down list.
2. Choose a Table from the drop-down list.
3. Choose a name under Columns to Return from Select and click **Add Attribute**.

   Tip: Click **Refresh** if you are updating an existing configuration and changes may have been made to the database.

   Repeat this step for other columns as needed.

   Note: You do not need to add a column here for it to be used as part of a search filter (see *Configuring an OAuth Database Filter (WHERE Clause)* on page 159 next).

Tip: To determine what attributes to look up during a query, click the **View Attribute Contract** link to see what information must be collected (see *Defining the Access Token Attribute Contract* on page 136). Then determine if sufficient information is available from the mapping context.

Configuring an OAuth Database Filter (WHERE Clause)

The JDBC `WHERE` clause in PingFederate queries the data table you selected to retrieve a record associated with a particular value (or values) from the assertion. The clause is in the form: `WHERE column1=value1 [AD column2=value2] [O...]`

The left side of the first variable pair uses a column name in the database table you selected (see *Defining a JDBC Location for OAuth* on page 158).

You can also apply additional search criteria from your own database, using any other columns from the targeted table.

Tip: Click "**View List of Columns . . .**" to see a list from which to copy and paste.

For more information about `WHERE` clauses, consult your DBMS documentation.

To construct the `WHERE` clause:

1. Enter the statement in the space provided, following the guidelines and example above.

   The initial `WHERE` is optional.
2. Ensure the syntax and variable names are correct.

Searching LDAP for OAuth Mapping

When you choose to use an LDAP source for attributes, you follow this path through the configuration steps.

On this screen you specify the branch of the LDAP hierarchy where you want PingFederate to look up user data.

Field Descriptions

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. This field is optional if records are located at the LDAP root.
Search Scope	Determines the node depth of the query. Select Subtree, One level or Object.
Root Object Class	The class containing the attributes you want.
Attributes to return from search	A list of attributes added from the drop-down list below. Subject DN is a default attribute, which may be used as the primary user identifier.

To select LDAP attributes:

1. Optional: Enter a Base DN.
2. Select a Search Scope.
3. Select a Root Object Class.
4. Under Attributes to return from search, choose an attribute and click **Add Attribute**.

   Note that the attribute Subject DN is always returned by default.

   Note: When connecting to Microsoft Active Directory, if you choose the memberOf attribute, an optional checkbox, Nested Groups, appears on the right. Select this checkbox if you want PingFederate to query for groups the end users belong to directly as well as indirectly through nested group membership (if any) under the Base DN.

For example, suppose you have three groups under the Base DN, namely Canada, Washington and Seattle. Seattle is a member of Washington. Ana Smith is an end user and a member of Seattle. If the Nested Groups checkbox is selected, when PingFederate queries for Ana's memberOf attribute values, the expected results are Seattle and Washington. (When the Nested Groups checkbox is not selected (the default), the expected result is Seattle.)

For Oracle Directory Server, choose isMemberOf under Attribute for nested group membership. For more information, see *documentation about isMemberOf from Oracle* (docs.oracle.com/cd/E29127_01/doc.111170/e28967/ismemberof-5dsat.htm).

5. Repeat the last step for other attributes as needed.
6. Optional: Change the Search Scope or the Root Object Class if you want attributes from other locations.

Note: You do not need to add an attribute here for it to be used in a search filter (see *Configuring an LDAP Filter for OAuth Mapping* on page 160). Add only attributes from which you need actual values.

Configuring an LDAP Filter for OAuth Mapping

The LDAP filter queries the data you selected to retrieve a record associated with a particular value (or values) from the user's session. The filter is in the form:

(`attribute=${`*`value`*`}`)

The left-side variable is an attribute you selected earlier (see *Searching LDAP for OAuth Mapping* on page 159).

The right side generally uses values passed in from the mapping context (variables, including the correct syntax, are listed under "Values available...".

You can also apply additional search criteria from your data store, using any other attributes from the targeted object classes.

Tip: Click "**View List of Available LDAP Attributes**" for a list from which you can copy and paste.

For general information about search filters, consult your LDAP documentation.

Configuring OAuth Custom Source Filters

When you choose to use a custom source for attributes, you follow this path through the configuration steps.

On this screen you specify a filter, or lookup query, for your custom data source. This screen display and the syntax of the filter depends on your developer's implementation of the custom source SDK.

Selecting OAuth Custom Source Fields

On the Configure Custom Source Fields screen, you can choose from among the fields shown to map to the adapter contract. These choices are supplied by the driver implementation. Select only those needed to fulfill the token contract for this partner connection.

OAuth Setup Data Store Summary Screen

Use this screen to view and edit the configuration as needed. Click any heading to change the settings.

Chapter 6

Security Management

PingFederate provides built-in certificate management to handle SSL/TLS server security, as well as certificate signing and verification of SSO and other transactions, when required.

In addition, the server provides authentication capabilities for applications making use of secured system features, or for protocol features requiring management and validation of end-user password credentials.

This section covers:

- *Certificate Management* on page 161
- *Authentication* on page 169

Note: This information is presented from the viewpoint of an administrative user with “Crypto Admin” permissions (see *Account Management* on page 62).

Certificate Management

PingFederate administrators manage certificates via the Certificate Management section on the Server Configuration sub menu.

Trusted Certificate Authorities

You can import your federation partner’s CA certificate or self-signed certificate(s) into PingFederate’s global trust list. If the Certificate Authority is not one of the major authorities, you may also need to import the certificate from the CA that signed the partner certificate.

Note: If a required CA certificate is already available in `cacerts` in the Java runtime, it is not necessary to import the same certificate into the PingFederate store.

To import a certificate:

1. Click **Import**.
2. Click **Browse** to locate the certificate.
3. Highlight the file and click **Open**.
4. Click **Next**.
5. Click **Done**.
6. Click **Save** on the Manage Trusted CAs screen.

To export a certificate:

1. Click **Export** under Action for the certificate you want to export.
2. On the Summary page, click the **Export** button.
3. Save the file on your system.

To delete a certificate:

1. Click **Delete** under Action for the certificate you want to delete.

   To undo the deletion, click **Undelete**.
2. Click **Save**.

To view certificate details:

- Click the certificate Serial number.

SSL Server Certificates

PingFederate provides built-in SSL/TLS certificate management. Use this feature to establish and maintain the certificate(s) presented for access to the PingFederate administrative console and for incoming SSL/TLS connections at runtime (see *Setting Administration Options* on page 86).

To create a new certificate:

1. Click **Create New**.
2. Enter the requested information on the form.
3. Click **Next**.
4. On the Summary screen, click **Done**.
5. Click **Save** on the Manage SSL Server Certificates screen.

To import a certificate and private key:

1. Click **Import**.
2. Click **Browse** to locate the certificate.
3. Highlight the file and click **Open**.
4. Enter the certificate password.
5. Click **Next**.
6. Click **Done**.
7. Click **Save** on the Manage SSL Server Certificates screen.

To view certificate information:

- Click its Serial number.

  Note: If a certificate has been revoked, PingFederate indicates this problem in the certificate information window.

To activate a certificate:

1. Click **Activate for Runtime Server** or **Activate for Admin Console** under Action for the certificate you want to activate.

   These choices are enabled only if you have created or imported more than one certificate. Otherwise, a single certificate is used for both the administrative console and runtime operations.
2. Click **Save** on the Manage SSL Server Certificates screen.

To export a certificate:

1. Click **Export** under Action for the certificate you want to export.
2. Select **Certificate Only** on the Export Certificate screen.

Or:

Select **Certificate and Private Key** and enter an Encryption Password.

3. Click **Next**.
4. On the Certificate Summary screen, click **Export**.
5. Save the file on your system and click **Done**.

To create a certificate-authority signing request:

1. Click **Certificate Signing** under Action for the desired certificate.

   Note: This selection is inactive if you have not yet saved a newly created or imported certificate. Click **Save** and then return to this screen from the Main Menu.

   Tip: The selection is also inactive if a previously signed certificate has been revoked. Because the revocation may indicate that the private key has been compromised, the best practice is to import or create a replacement certificate for CA signing.
2. Select Generate Certificate Signing Request (CSR), if not already selected.
3. Click **Next**.
4. Click **Generate CSR** on the Generate CSR screen.
5. Click **Next**.
6. On the Certificate Summary screen, click **Export**.
7. Save the file on your system and click **Done**.

To import a certificate authority response:

1. Click **Certificate Signing** under Action for the relevant certificate.
2. Select Import CSR Response and click **Next**.
3. Click **Browse** and locate the CSR response to import.
4. Highlight the file and click **Open**.
5. Click **Next**.
6. Click **Done** on the Summary screen.
7. Click **Save** on the Manage SSL Server Certificates screen.

To delete a certificate:

1. Click **Delete** under Action for the certificate you want to delete.

   This option does not appear if the certificate is in use. To enable deletion, add (if needed) and activate a different certificate for the administrative console and/or the runtime server. If the usage is not clear, click **Check Usage**.
2. Click **Save**.

Create Certificate Field Descriptions

Field	Description
Common Name	The common name (CN) identifying the certificate.
Organization	The organization (O) or company name creating the certificate.
Organizational Unit	The specific unit within the organization (OU).
City	The city or other primary location (L) where the company operates.
State	The state (ST) or other political unit encompassing the location.
Country	The country (C) where the company is based.

Field	Description
Validity (days)	The time during which the certificate is valid.
Key Algorithm (drop-down menu)	A mathematical formula used to generate a key. PingFederate uses either of two algorithms, RSA or EC.
Key Size (bits)	The number of bits used in the key. (RSA-1024, 2048 and 4096; as well as EC-256, 384 and 521)
Signature Algorithm (drop-down menu)	The signing algorithm of the certificate. (RSA-SHA256, SHA384 and SHA512; as well as ECDSA-SHA256, SHA384 and SHA512)

SSL Client Keys and Certificates

You can create and manage your authentication private keys and the certificates your server presents as a client in an SSL/TLS transaction.

To create a new certificate:

1. Click **Create New**.
2. Enter the information on the form.
3. Click **Next**.
4. On the Summary screen, click **Done**.
5. Click **Save** on the Manage SSL Auth Private Keys and Certificates screen.

To import a certificate:

1. Click **Import**.
2. Click **Browse** to locate the certificate.
3. Highlight the file and click **Open**.
4. Enter the certificate password.
5. Click **Next**.
6. Click **Done** on the Import Certificate Details screen.
7. Click **Save** on the Manage SSL Auth Private Keys and Certificates screen.

To view certificate information:

- Click the certificate Serial number.

  If a certificate has been revoked, PingFederate indicates this problem in the certificate information window.

To export a certificate:

1. Click **Export** under Action for the certificate you want to export.
2. Select **Certificate Only**.

   Or:

   Select **Certificate and Private Key** and enter an Encryption Password.
3. Click **Next**.
4. On the Certificate Summary screen, click **Export**.
5. Save the file on your system and click **Done**.

To create a certificate-authority signing request:

1. Click **Certificate Signing** under Action for the desired certificate.

Note: This selection is inactive if you have not yet saved a newly created or imported certificate. Click **Save** and then return to this screen from the Main Menu.

Note: The selection is also inactive if a previously signed certificate has been revoked. Because the revocation may indicate that the private key has been compromised, the best practice is to import or create a replacement certificate for CA signing.

2. Select Generate Certificate Signing Request (CSR), if not already selected.
3. Click **Next**.
4. Click **Generate CSR** on the Generate CSR screen.
5. Click **Next**.
6. On the Certificate Summary screen, click **Export**.
7. Save the file on your system and click **Done**.

To import a certificate authority response:

1. Click **Certificate Signing** under Action for the relevant certificate.
2. Select Import CSR Response and click **Next**.
3. Click **Browse** and locate the CSR response to import.
4. Highlight the file and click **Open**.
5. Click **Next**.
6. Click **Done** on the Summary screen.
7. Click **Save** on the Manage SSL Auth Private Keys and Certificates screen.

To delete a certificate:

1. Click **Delete** under Action for the certificate you want to delete.

   Note: This option is inactive if the certificate is used in any connection or other type of configuration. To enable deletion, click **Check Usage** to locate the configuration(s) that depend on the certificate and then modify each to remove the dependency.
2. Click **Save**.

Create Certificate Field Descriptions

Field	Description
Common Name	The common name (CN) identifying the certificate.
Organization	The organization (O) or company name creating the certificate.
Organizational Unit	The specific unit within the organization (OU).
City	The city or other primary location (L) where the company operates.
State	The state (ST) or other political unit encompassing the location.
Country	The country (C) where the company is based.
Validity (days)	The time during which the certificate is valid.
Key Algorithm (drop-down menu)	A mathematical formula used to generate a key. PingFederate uses either of two algorithms, RSA or EC.
Key Size (bits)	The number of bits used in the key. (RSA-1024, 2048 and 4096; as well as EC-256, 384 and 521)
Signature Algorithm (drop-down menu)	The signing algorithm of the certificate. (RSA-SHA256, SHA384 and SHA512; as well as ECDSA-SHA256, SHA384 and SHA512)

Digital Signing and Decryption Keys and Certificates

You can use PingFederate to create and maintain your server's signing certificates, which you may use to sign SAML requests, responses, and assertions. The same type of certificate is also used for XML decryption (see *XML Encryption* on page 31).

⚠ **Caution:** For best security, we recommend using separate certificates for signing and decryption.

To create a new certificate:

1. Click **Create New**.
2. Enter the information on the form.
3. Click **Next**.
4. On the Summary screen, click **Done**.
5. Click **Save**.

Create Certificate Field Descriptions

Field	Description
Common Name	The common name (CN) identifying the certificate.
Organization	The organization (O) or company name creating the certificate.
Organizational Unit	The specific unit within the organization (OU).
City	The city or other primary location (L) where the company operates.
State	The state (ST) or other political unit encompassing the location.
Country	The country (C) where the company is based.
Validity (days)	The time during which the certificate is valid.
Key Algorithm (drop-down menu)	A mathematical formula used to generate a key. PingFederate uses either of two algorithms, RSA or EC.
Key Size (bits)	The number of bits used in the key. (RSA-1024, 2048 and 4096; as well as EC-256, 384 and 521)
Signature Algorithm (drop-down menu)	The signing algorithm of the certificate. (RSA-SHA256, SHA384 and SHA512; as well as ECDSA-SHA256, SHA384 and SHA512)

To import a certificate:

1. Click **Import**.
2. Click **Browse** to locate the certificate.
3. Highlight the file and click **Open**.
4. Enter the certificate password.
5. Click **Next**.
6. Click **Done**.
7. Click **Save**.

To view certificate information:

- Click the certificate Serial number.

Note: If a certificate has been revoked, PingFederate indicates this problem in the certificate information window.

To export a certificate:

1. Click **Export** under Action for the certificate you want to export.
2. Select **Certificate Only**.

   Or:

   Select **Certificate and Private Key** and enter an Encryption Password.
3. Click **Next**.
4. On the Certificate Summary screen, click **Export**.
5. Save the file on your system and click **Done**.

To create a certificate-authority signing request:

1. Click **Certificate Signing** under Action for the desired certificate.

   Note: This selection is inactive if you have not yet saved a newly created or imported certificate. Click **Save** and then return to this screen from the Main Menu.

   Tip: The selection is also inactive if a previously signed certificate has been revoked. Because the revocation may indicate that the private key has been compromised, the best practice is to import or create a replacement certificate for CA signing.
2. Select Generate Certificate Signing Request (CSR), if not already selected.
3. Click **Next**.
4. Click **Generate CSR** on the Generate CSR screen.
5. Click **Next**.
6. On the Certificate Summary screen, click **Export**.
7. Save the file on your system and click **Done**.

To import a certificate authority response:

1. Click **Certificate Signing** under Action for the relevant certificate.
2. Select Import CSR Response and click **Next**.
3. Click **Browse** and locate the CSR response to import.
4. Highlight the file and click **Open**.
5. Click **Next**.
6. Click **Done** on the Summary screen.
7. Click **Save** on the Manage Digital Signing Certificates screen.

To activate a certificate:

- Click **Activate** under Action for the certificate.

  This action is enabled only if more than one certificate is in the list.

Certificate Revocation Checking

By default at runtime, PingFederate attempts to retrieve a *CRL* to verify that a signing certificate has not been revoked, whenever a CRL distribution-point URL is included within the certificate (see *Certificate Validation* on page 28). Optionally, on the Manage Certificate Revocation screen you can enable and configure *OCSP* checking as the preferred verification method, depending on your requirements (see *OCSP Revocation Checking*).

OCSP can be used in place of CRL checking, or CRLs can be retained as a backup method (for failover).

Note: When OCSP is enabled, CRL checking is not done independently—only as a failover option for one or more OCSP failure conditions.

Also on the Manage Certificate Revocation screen, you can change system-default settings for CRL checking, as needed.

Note: No configuration changes are necessary on this screen if OCSP is not required for your federation deployment and the CRL defaults are acceptable.

To reach this screen:

1. Click **Server Configuration** on the Main Menu.
2. Click **Certificate Revocation Checking** under Certificate Management.

Field Descriptions (For OSCP Checking)

Field/Selection	Description
Enable OCSP	Turns on OCSP certificate-revocation checking.
Default OCSP Responder URL	The location of a URL to use for certificate-revocation checking, a backup used only if the OCSP Responder URL is not contained in the certificate.
Default OCSP Responder Signature Verification Certificate	Certificate used to verify that the returned certificate status was sent from the Default OCSP Responder—required if the certificate is not included in the response (click **Manage Certificates** to import the verification certificate, as needed).
Do NOT allow Responder to use cached responses	When unchecked (the default), the OCSP Responder uses cached responses when available for the subject certificate (for an indicated period of time—see the description for “Next Update Grace Period,” below). If checked, PingFederate sends a nonce in the request to the Responder, effectively requiring that the status of the certificate be determined in real time. This option is intended to enhance the prevention of Internet replay attacks (in addition to timestamping), where required. **Important:** Making this selection may slow down OCSP response time for a request and will increase general processing overhead at the Responder site.
This Update Grace Period	For the response to be considered valid, the PingFederate server-clock time must correspond to the `<thisUpdate>` timestamp in the OCSP response, plus or minus the number of minutes set for this field (to compensate for clock variances).
Next Update Grace Period	If the response includes a `<nextUpdate>` timestamp indicating when updated certificate statuses will be available, then PingFederate checks to ensure that the timestamp is not earlier than the current server time, adding this grace period to compensate for clock variances.
Responder Timeout	The allowable response time before the OCSP Responder URL is considered unavailable and processing continues (see “OCSP Responder is Unavailable,” below).
Certificate is Unknown	The certificate does not fall under the purview of the CA associated with the OCSP Responder. The drop-down choices indicate whether an unknown certificate is to be considered valid or not, or whether to try CRL checking.
OCSP Responder is Unavailable	Indicates what action to take if the Responder cannot be reached.
OCSP Responder Returns Error	Indicates what action to take if the Responder returns an error.
Proxy Settings	If OCSP messaging is routed through a proxy server, specify the server's Host (DNS name or IP address) and the Port number. The same proxy information applies to CRL checking, when CRL is enabled for failover.

Field Descriptions (For CRL Checking)

Field/Selection	Description
Enable CRL Checking	Enables CRL revocation checking (the default). **Note:** CRL checking must remain enabled if any selections for OCSP Error Handling include failover. If OCSP is enabled and no CRL failover is specified, then this selection has no effect.
Treat Unretrievable CRLs as Revoked	If checked, PingFederate immediately aborts the processing associated with the certificate. If unchecked, the server treats the certificate as valid but continues trying to retrieve the CRL.
Next Retry on Resolution Failure	Specifies the number of minutes the server waits before trying to retrieve a CRL when the previous attempt failed—applies only when the selection above (Treat Unretrievable CRLs as Revoked) is unchecked.
Next Retry on Next Update Expiration	How long the server waits before requesting a new CRL when the most recently retrieved CRL (in cache) has a next-update time in the past. **Note:** Certain actions in the administrative console, such as saving changes to an IdP adapter instance, reset the CRL cache. When it happens, PingFederate requests new CRLs for subsequent transactions as needed.
Verify CRL Signature	When checked (recommended), PingFederate verifies the CRL signature using the public key of the issuer, which must be in the certificate chain or in the list of Trusted CAs (see *Trusted Certificate Authorities* on page 161).
Proxy Settings	If CRL checking is routed through a proxy server, specify the server's Host (DNS name or IP address) and the Port number. The same proxy information applies to OCSP checking, when enabled.

Authentication

This portion of the Main Menu, under Server Configuration, allows administrators to manage Basic authentication to the PingFederate server, when needed, as well as authentication needs for secured protocol transactions.

Application Authentication

When you use the SAML 2.0 Attribute Query profile as an SP, password security is required between the application requesting attributes and the SP PingFederate server. Basic authentication is also required for applications making calls to PingFederate's Connection Management Service and optional for the SSO Directory Service (see *Web Service Interfaces* on page 408).

If you are using the SAML 2.0 Attribute Query profile as an SP, then the requesting application(s) at your site must authenticate to the PingFederate server (see *Attribute Query and XASP* in the "Supported Standards" chapter of *Getting Started* and */sp/startAttributeQuery.ping* on page 391).

In addition, authentication is required to access PingFederate runtime data via JMX (see *Runtime Monitoring Using JMX* on page 87) or to make *SOAP* calls to the Connection Management Web Service. Authentication is optional for the SSO Directory Service (see *Web Service Interfaces* on page 408).

Note: To help ensure network security, access to all of these services is deactivated when PingFederate is first installed.

Administrators can activate and configure authentication for any or all of the services on the Application Authentication screen.

To enable access to a service:

1. Click **Activate** for the Service under Action.
2. Where required, enter an Id, Shared Secret, and Confirm Shared Secret for the service.

   You and the application developer must agree to these values.

   This step is optional for the SSO Directory Service; the Service can be active without requiring authentication (the default setting).
3. Repeat the steps above for other Services, as needed.
4. Click **Save**.

To change an application ID or password:

- Replace the existing information in the necessary field(s) and click **Save**.

To block access to an active service:

- Click **Deactivate** for the Service under Action and then click **Save**.

  Tip: Although not accessible when deactivated, the Connection Management Service and the SSO Directory Service are still deployed by default as part of PingFederate. If your organization does not plan to use one (or either) of these services, you may wish to remove the corresponding WAR file(s) from the `<pf_install>/pingfederate/server/deploy` or (and) `../deploy2` directories, respectively:

  ```
  pf-ws.war
  pf-mgmt-ws.war
  ```

Validating Password Credentials

PingFederate provides an authentication mechanism using plug-in Password Credential Validators. This feature provides centralized credential validation for other PingFederate configurations. Currently, instances of credential validators are used when configuring an HTTP Basic or HTML Form IdP Adapter (see *Configuring the HTTP Basic IdP Adapter* on page 370 and *Configuring the HTML Form IdP Adapter* on page 372) and for OAuth resource-owner grant configurations (see *Grant Types* on page 16 and *Resource-Owner Credentials Mapping* on page 144).

PingFederate is distributed with the following plug-in Password Credential Validators:

- **LDAP Username/Password** – Validates credentials based on an LDAP look-up in an organization’s user-data store.
- **Simple Username/Password** – Validates credentials maintained by PingFederate.
- **RADIUS Username/Password** – Validates credentials based on the RADIUS protocol on an organization’s RADIUS server.
- **PingOne directory Username/Password** – Validates credentials stored in PingOne directory.

- To configure an instance of a credentials validator, click Create New Instance.
- To edit an existing instance, click its Instance Name.

To delete an existing instance:

1. Click **Delete** next to the Instance Name (To undo the deletion, click **Undelete**.)

   Note: This option is inactive if the instance is referenced elsewhere, or if it is a parent to other instances. To enable deletion, click **Check Usage** to locate the configuration(s) that depend on the instance and go to each listed configuration to remove the dependencies. If the instance you want to delete is a parent, delete child instances first.
2. Click **Save** to confirm the deletion.

Choosing a Type

The first step in this configuration is choosing a credentials-validator type. Available types are determined by plug-in JAR files loaded in the `<pf_install>/pingfederate/server/default/deploy` folder. Several validator plug-ins are bundled with PingFederate. Other plug-ins may be added periodically, available from *Ping Identity* (www.pingidentity.com/en/products/downloads.html).

Field Descriptions

Field	Description
Instance Name	A descriptive name for the credentials-validator instance—for example, an identity management system name.
Instance ID	An internal identifier for the credentials-validator instance. Must be alphanumeric with no spaces.
Type	A list of deployed credentials-validator types available for creating an credentials-validator instance for the server. A developer typically deploys any new credentials-types before an administrator sets up a connection partner.
Parent Instance (Optional)	A list of configured instances for this type of credentials-validator. If applicable, select an instance that can be used as a basis for a parent/child configuration.

To specify a validator instance:

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select the Type from the drop-down menu.

   If the validator type you need is not listed, click **Visit PingIdentity.com for additional types** to see if a suitable validator plug-in is available from the download site.
3. Optional: Select a Parent Instance from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
4. Click **Next** and enter information on the configuration screen for this validator instance.

   This configuration varies depending on the validators deployed on your server. For add-on validators please consult the online documentation referenced in the download package, or look under *Product Documentation* at pingidentity.com.

   For validators bundled with PingFederate, refer to one of the following sections:

   - *Configuring the LDAP Credential Validator* on page 172
   - *Configuring the Simple Credential Validator* on page 173
   - *Configuring the RADIUS Credential Validator* on page 173
   - *Configuring the PingOne Directory Credential Validator*

Configuring a Credentials Validator Instance

This configuration varies depending on the validators deployed on your server. For add-on validators please consult the online documentation referenced in the download package, or look under *Product Documentation* at pingidentity.com.

For validators bundled with PingFederate, refer to one of the following sections:

- *Configuring the LDAP Credential Validator* on page 172
- *Configuring the Simple Credential Validator* on page 173
- *Configuring the RADIUS Credential Validator* on page 173
- *Configuring the PingOne Directory Credential Validator* on page 174

Configuring the LDAP Credential Validator

The LDAP Username/Password Credential Validator verifies credentials using an organization's user-data store.

In addition to lookup configuration, this screen provides a means of defining error-message interpretation for LDAP stores other than Microsoft Active Directory or Oracle Directory Server. (Message parsing for AD and Oracle messages is built into PingFederate; however, an administrator may also override the default message handling for those data stores on this screen.)

Tip: LDAP server messages are used by the HTML Form Adapter to determine LDAP password-change scenarios and then present relevant messages to end users (see *Configuring the HTML Form IdP Adapter* on page 372). The end-user messages are configurable for the associated HTML templates and may be localized (see *Customizing User-Facing Screens* on page 76).

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

Field Description

Field	Description
LDAP Datastore	The LDAP data store configured in PingFederate. If you have not yet configured the server to communicate with the LDAP server you need, click **Manage Data Stores**. **Note:** If you are using Active Directory and want to support password changes (see *Configuring the HTML Form IdP Adapter* on page 372), ensure that the connection to Active Directory is secured using LDAPS. Active Directory requires this level of security to allow password changes (see *Configuring an LDAP Connection* on page 102).
Search Base	The location in the LDAP directory server from which the search begins.
Search Filter	Query used to produce the desired set of matching records.
Scope of Search	The level of search to be performed in the search base. One level indicates a search of objects immediately subordinate to the base object, not including the base object itself. Subtree indicates a search of the base object and the entire subtree within the base object distinguished name.

To complete the LDAP validation:

1. Optional: Click **Add a new row to 'Authentication Error Overrides'**.

   Tip: This option may be required for an LDAP directory other than AD or Oracle to support the HTML Form Adapter's password change function or to alter end-user messages associated with that function (see *Configuring the HTML Form IdP Adapter* on page 372).

   a) Enter an expression, using wildcard asterisks (*), to match against messages returned from the LDAP server.

      For example: `*expired*`

   b) Select a relevant error condition from the **Error** drop-down list.

   c) Click **Update** under Action.

   d) Repeat these steps for additional overrides as needed.

      After overrides are configured, you can use the links under Action to edit or delete an override, or to change their display order. (The ordering does not affect runtime processing.)

2. Select the LDAP Datastore and enter information into the required fields, as described under Field Descriptions above.

To edit an authentication error override:

1. Click **Edit** next to the authentication error override.
2. Change information as needed, then click **Update**.

To delete an authentication error override:

- Click **Delete** next to the authentication error override.

Configuring the Simple Credential Validator

The Simple Username/Password Credential Validator verifies credentials maintained by PingFederate.

Note: This validator is best used for testing purposes or for an organization with few accounts.

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

To add users:

1. Click **Add a new row to 'Users'**.
2. Enter a Username and Password and click **Update**.
3. Repeat the previous steps for additional users as needed.

To edit user credentials:

1. Click **Edit** next to the user's credentials.
2. Change information as needed, then click **Update**.

To delete a user:

- Click **Delete** next to the user's credentials.

Configuring the RADIUS Credential Validator

The *RADIUS* Username/Password Credential Validator verifies credentials using the RADIUS protocol.

RADIUS supports strong authentication with both one-step (a combination of regular password and a one-time password in one field) and two-step (challenge- response) authentication. Two-step authentication is supported in the HTML Form IdP Adapter.

Tip: RADIUS server messages are used by the HTML Form Adapter to determine two-step authentication scenarios and then present a logon screen to end users. The screen is configurable and may be localized (see *Customizing User-Facing Screens* on page 76).

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

Field Descriptions

Field	Description
Hostname	The IP address of the RADIUS server. For failover, you can enter one or more backup RADIUS servers by adding each server in its own row of the table. Each row represents a distinct RADIUS server that can be used for failover. PingFederate attempts to make a connection to each server in the order listed until a successful connection is obtained. If authentication to this Password Credential Validator fails, control is returned to the adapter using it so that other Password Credential Validators can be tried (if defined).
Authentication Port	The UDP (User Datagram Protocol) port used to authenticate to the RADIUS server. The default value is `1812`.
Authentication Protocol	The protocol used to authenticate to the RADIUS server. The available choices are Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP). Select the protocol expected by your RADIUS server. The default value is PAP.

Field	Description
Shared Secret	The password shared between PingFederate and the RADIUS server used to encrypt passwords.

Note: The NAS-IP-Address attribute is added to all Access-Request packets sent to the RADIUS server. The value is copied from the pf.engine.bind.address property in run.properties. Only IPv4 addresses are supported.

To complete the RADIUS validation:

1. Click **Add a new row to 'RADIUS Servers'**.
2. Enter a Hostname, Authentication Port, and Shared Secret and click **Update**.
3. Repeat the previous steps for additional servers as needed.

To edit a RADIUS server:

1. Click **Edit** next to the server's credentials.
2. Change information as needed, then click **Update**.

To delete a RADIUS server:

- Click **Delete** next to the RADIUS server.

Setting Advanced Options

- Optional: Click **Show Advanced Fields** to reconfigure default settings for the *RADIUS* instance, as needed.

  Refer to the on-screen field descriptions and the following table for more information.

Field Descriptions

Field	Description
NAS Identifier	(Required) The attribute identifying the *NAS* (Network Access Server) originating the request for access. The default value is `PingFederate`.
Timeout	(Required) The maximum number of milliseconds before a connection timeout to the RADIUS server.
Retry Count	(Required) Number of times to retry a failed connection before moving to the next host

Configuring the PingOne Directory Credential Validator

The PingOne directory Username/Password Credential Validator verifies credentials stored in the PingOne directory.

Note: The PingOne directory Credential Validator requires a PingOne Enterprise account. For more information, see *Manage PingOne Directory Users* in the PingOne *Enterprise Administration Guide*.

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

Field Descriptions

Field	Description
Client ID	The REST API Client ID of your PingOne account, see *View or Renew Directory API Credentials* in the PingOne *Enterprise Administration Guide*.
Client Secret	The password for the REST API Client ID of your PingOne account, see *View or Renew Directory API Credentials* in the PingOne *Enterprise Administration Guide*.

Note: To review the following settings, click **Show Advanced Fields**.

Field	Description
PingOne URL	The PingOne directory API. The default value is `https://directory-api.pingone.com/api`.
OAuth Token Endpoint	The PingOne directory API OAuth 2.0 token endpoint. The default value is `/oauth/token`.
Reset Password URL	The relative path for password reset. The default value is `/directory/users/password-reset`.
SCIM User URL	The SCIM GET User endpoint. The default value is `/directory/user`.

To complete the configuration:

- Enter a value for each field as described above.

Extending Contracts for the Credential Validator

In some cases, you might want to extend contracts in the LDAP or RADIUS Password Credential Validator. For example, you might use extended attributes to map into a USER_KEY for an OAuth persistent grant configuration (see *About OAuth* on page 15 and *Resource-Owner Credentials Mapping* on page 144) or attributes in the access token (see *Token Attribute Contract Fulfillment* on page 150).

This capability allows the validator to return attribute values pertaining to the authenticated users from the LDAP or RADIUS server.

Tip: If you are configuring the HTML Form IdP Adapter with the LDAP credential validator, extend the contract of the adapter by the same attribute names in order for the credential validator to pass extended attribute values to the HTML Form IdP Adapter (see *Configuring the HTML Form IdP Adapter* on page 372).

Tip: If you are configuring the HTML Form IdP Adapter with the RADIUS credential validator, you only need to extend the contract of the adapter itself (see *Configuring the HTML Form IdP Adapter* on page 372).

Vendor specific RADIUS attributes can be made available by extending the RADIUS attribute dictionary. Copy the vendor-specific attribute dictionaries into the `pingfederate/server/default/conf/radius` folder. The format of the dictionaries must use the *FreeRADIUS* dictionary syntax. Then edit the existing `dictionary` file to include each of them.

To extend the contracts for a credential validator:

- Optional: On the Extended Contract screen, click **Add**. Continue to add attributes, as needed.

Finishing the Validator Configuration

- To complete and save the configuration, click **Done** on the Summary screen and then **Save** on the Manage Credential Validators screen.

Using AD Domains and Kerberos Realms

Active Directory (AD) Domains and Kerberos Realms provide PingFederate with a centralized configuration for verifying authenticated users via adapters or token processors, including:

- **PingFederate integrated Kerberos Adapter** – Using the built-in Kerberos Adapter with a configured AD Domain allows a PingFederate IdP server to perform SSO to SP applications based on Kerberos tickets.
- **PingFederate Integrated Windows Authentication (IWA) Integration Kit** (version 3.0 and later) – Using the IWA Adapter with a configured AD Domain allows a PingFederate IdP server to perform SSO to SP applications based on IWA credentials.

- **PingFederate Kerberos Token Processor** (version 2.0 and later) – This token processor allows the PingFederate WS-Trust *Security Token Service* to accept and validate Kerberos tokens—via a configured Kerberos Realm—from a Web Service Client (see *Token Processors and Generators* on page 13).

  Tip: Find *User Guides* and other documentation for Integration Kits and Token Processors under *Product Documentation* at pingidentity.com (`documentation.pingidentity.com/display/LP/Product+Documentation`).

- To configure an AD Domain or Kerberos Realm, click Add Domain/Realm.
- To edit an existing Domain or Realm, click its name.

Configuring a Domain or Realm

Use this screen to configure AD Domains or Kerberos Realms that PingFederate can use to contact Domain Controller(s) or Key Distribution Center(s) for verifying user authentication.

Field Descriptions

Field	Description
Domain/Realm Name	The fully-qualified domain or realm name. For example: `corporation.companydomain.com`
Domain/Realm Username	The ID for the domain or realm account name.
Domain/Realm Password	The password for the domain or realm account.
Domain Controller/Key Distribution Center Host Names	(Optional) Specify the host name or IP address for the domain controller or KDC and click **Add**. For example: `fn_dc1` If unspecified, PingFederate uses a DNS lookup.
Test Domain/Realm Connectivity (button)	Tests access to the domain controller or KDC from the administrative-console server. When a connection to any of the configured controllers/KDCs is successful, the message `Test Successful` appears. Otherwise, the test returns error messages near the top of the screen. For multiple connections, note that the test stops at the first successful result, so all connections are not necessarily verified. Also, connectivity may be subsequently affected in different deployment scenarios, including for engine server nodes running in a clustered environment. **Tip:** For help resolving connection issues, select the **Debug Log Output** checkbox on the Manage Domain/Realm Settings screen, and run the test again to view the debug output to the PingFederate `server.log` (see *Managing Domain or Realm Settings* on page 176 (the next section). For server clusters, you can also push this setting to PingFederate engine nodes as needed (see the *Server Clustering Guide*).

Managing Domain or Realm Settings

Use this screen to change default security and logging settings for all configured AD Domains and Kerberos Realms.

Field Descriptions

Field	Description
Force TCP	When selected, requires use of the Transmission Control Protocol instead of the default User Datagram Protocol. Use this option when firewall or network configurations require acknowledgement that packets are properly received.

Field	Description
	Note: If you choose this option, ensure that you restart PingFederate after saving the configuration.
Debug Log Output	When selected, sends verbose debugging output to the PingFederate `server.log` for all interactions with Domain Controllers or Key Distribution Centers (KDCs). For more information on the `server.log`, see *Managing Log Files* on page 45.
AD Domain Controller/ Key Distribution Center Timeout (secs)	Specifies the amount of time (in seconds) PingFederate waits for a network response from a domain controller or KDC. The default is **3** seconds. **Note:** This value applies to each attempt PingFederate makes to contact the domain controller or KDC. **Note:** The new timeout takes effect only after PingFederate is restarted, after you save the configuration.
AD Domain Controller/Key Distribution Center Retries	Specifies the number of times PingFederate tries contacting the domain controller or KDC. The default is **3** times.

Chapter 7

Identity Provider SSO Configuration

In an IdP role, you use the PingFederate administrative console to configure local application-integration information and to manage connections to your SP-partner sites. You must configure Server Settings from the Main Menu to establish your site as an IdP before configuring connections to SPs (see *Choosing Roles and Protocols* on page 92).

Note that only one connection is needed per partner, even if you are targeting more than one Web application at the destination SP site. You can configure more than one connection, however, if your partner supports multiple protocols, or supports multiple federation IDs for the same protocol (see *Federation Server Identification*).

Note: This chapter applies to configuration settings needed for browser-based SSO. While there is some cross-over information also applicable to WS-Trust STS, if you are using PingFederate *exclusively* as an STS, start with *WS-Trust STS Configuration* on page 324.

Under some conditions, you can enable SSO for an unlimited number of partners at once by configuring a single, common connection (see *Using Auto-Connect* on page 31).

You can also deploy an SP connection to bridge a service provider to one or more identity providers through one or more connection mapping contracts (see *Federation Hub* on page 38 and *Connection Mapping Contracts* on page 124 for more information).

This chapter covers the following topics:

Application Integration Settings

The integration of local applications with PingFederate is the essential “first-mile” configuration that allows end-users to access protected resources across domains. This process is facilitated through the use of application-integration kits and a robust Software Development Kit (see *SSO Integration Kits and Adapters* on page 19).

Under Application Integration Settings on the IdP Configuration sub menu, you configure the IdP Adapters that PingFederate needs to interact with applications or access-management systems used to authenticate users at your site. You can also set a Default URL to which users may be directed during SLO, and you can look up system endpoints that application developers at your site need to access PingFederate’s SSO/SLO services.

Note: If your PingFederate configuration enables the WS-Trust *STS*, the selections under Application Integration Settings also include links for configuring plug-in **Token Processors** and, optionally, **STS Request Parameters**. Locate configuration information under *IdP Configuration for STS* on page 327.

Configuring IdP Adapters

An IdP adapter is used to look up session information and provide user identification to PingFederate (see *SSO Integration Kits and Adapters* on page 19).

You must configure at least one instance of an IdP adapter in order to set up connections to SP partners.

For information about configuring the adapters packaged with PingFederate, see:

- *Configuring the IdP OpenToken Adapter* on page 365
- *Configuring the HTTP Basic IdP Adapter* on page 370
- *Configuring the HTML Form IdP Adapter* on page 372
- *Configuring the Kerberos Adapter* on page 378
- *Configuring the Composite Adapter* on page 382

- You reach this screen by clicking Adapters under Application Integration Settings in IdP Configuration.

To configure a new instance:

- Click **Create New Instance**.

To edit an existing adapter instance:

- Click the Instance Name and click the step you need to change.

To delete an adapter instance:

1. Click **Delete** next to the Instance Name. (To undo the deletion, click **Undelete**.)

   Note: This option is inactive if the instance is referenced elsewhere, or if it is a parent to other instances. To enable deletion, click **Check Usage** to locate the configuration(s) that depend on the instance and go to each listed configuration to remove the dependencies. If the instance you want to delete is a parent, delete child instances first.
2. Click **Save** to confirm the deletion.

Selecting an IdP Adapter Type

The first step in creating an adapter instance is choosing an adapter type. Available adapter types are determined by JAR files loaded in the `<pf_install>/pingfederate/server/default/deploy` folder. Some adapters are bundled with PingFederate (see *SSO Integration Kits and Adapters* on page 19). Other adapters and integration kits are available from the *Ping Identity Web site* (www.pingidentity.com/en/products/downloads.html).

Field Descriptions

Field	Description
Instance Name	A descriptive name for the adapter instance—for example, an identity management system name.
Instance ID	An internal identifier for the adapter instance. Must be alphanumeric with no spaces.
Type	A list of deployed adapter types available for creating an adapter instance for the server. A developer typically deploys any new adapter types before an administrator sets up a connection partner.
Parent Instance (Optional)	A list of configured instances for this type of adapter. If applicable, select an instance that can be used as a basis for a parent/child configuration.

To define an adapter instance:

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select the Type from the drop-down menu.

   If the adapter you need is not listed, click **Visit PingIdentity.com for additional types** to see if a suitable adapter is available from the PingFederate download site, or create your own adapter (see *SSO Integration Kits and Adapters* on page 19).
3. Optional: Select a **Parent Instance** from the drop-down list.

If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.

4. Click **Next** and enter information on subsequent screens for this adapter setup.

   Tip: The setup steps and information needed at those steps vary with the adapters deployed on your server (see *SSO Integration Kits and Adapters* on page 19). For information about configuring the adapters packaged with PingFederate, see *OpenToken Adapter Configuration* on page 364, *Configuring the HTTP Basic IdP Adapter* on page 370, *Configuring the HTML Form IdP Adapter* on page 372, *Kerberos Adapter Configuration* on page 377, or *Configuring the Composite Adapter* on page 382.
5. Click **Done** on the Adapter Summary screen.
6. Click **Save** on the Manage IdP Adapter Instances screen.

Configuring an IdP Adapter

Depending on the adapter you choose, different configuration parameters are available on the IdP Adapter screen. These options are controlled by the adapter plug-in software (see *SSO Integration Kits and Adapters* on page 19).

- For information about configuring the OpenToken Adapter, see *OpenToken Adapter Configuration* on page 364.
- For information about configuring the HTTP Basic IdP Adapter, see *Configuring the HTTP Basic IdP Adapter* on page 370.
- For information about configuring the HTML Form IdP Adapter, see *Configuring the HTML Form IdP Adapter* on page 372.
- For information about configuring the Kerberos Adapter, see *Kerberos Adapter Configuration* on page 377.
- For information about configuring the Composite Adapter, see *Configuring the Composite Adapter* on page 382.
- For information about configuring an adapter contained in an integration kit, locate the *User Guide* under *Product Documentation* at *pingidentity.com*.

Important: If you change adapters that are used by existing partner connections, you may need to reconfigure those connections. If so, a **Fix Errors** link appears on the Manage IdP Adapter Instances screen. Click the link to navigate to the screens you need to reconfigure. You cannot save the changes to the adapter until the existing connections have been repaired.

Invoking Adapter Actions

Adapters may be written to provide configuration assistance or validation *actions*. Actions may also include generation of parameters that might need to be set manually in a configuration file.

For information about actions available using the OpenToken Adapter, see *Configuring the IdP OpenToken Adapter* on page 365.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Adapters** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Actions** (if available).

To generate a properties list:

- Click **Download** under Action Invocation Link.

Extending an Adapter Contract

Adapters may be written with an option allowing administrators to add to the attributes that the adapter returns from a user's session. The PingFederate OpenToken Adapter, for example, provides such an option (see *OpenToken Adapter Configuration* on page 364).

Note: For the Composite Adapter, attributes for IdP Adapter Instances that comprise the composite configuration must be added on this screen (see *Configuring the Composite Adapter* on page 382).

To reach this screen:

Note: If this is a child instance, select the override checkbox to modify the configuration.

1. Click **IdP Configuration** on the Main Menu.
2. Click **Adapters** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Extended Contract** (if available).

To add an attribute

- Enter the attribute name in the text box and click **Add**.

Setting Pseudonym Values and Masking

On the Adapter Attributes screen you must select attributes to use for generating a *pseudonym* identifier (see *Account Linking* on page 22).

Optionally on this screen, you can also choose to mask the values of any or all attributes that PingFederate logs from this adapter instance at runtime (see *Attribute Masking* on page 26).

Note: If this is a child instance, select the override checkbox to modify the configuration.

Tip: If the IdP Adapter supports the creation of an Extended Adapter Contract (see the previous section, *Extending an Adapter Contract* on page 180), then the Override Attributes checkbox in this screen reflects the status of the override option in the Extended Contract screen.

To configure Pseudonym generation:

- Under Pseudonym select the value(s) to use.

  Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

To mask attributes in log files:

- Under Mask Log Values select the attribute(s) whose value(s) you want to mask.

  If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Adapters** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Adapter Attributes**.

Selecting an Authentication Context

If you have deployed an integration kit that supports authentication context, you can specify the context in the IdP adapter configuration under **Advanced Fields**.

(For a discussion of authentication context, find that term under *Terminology* in the “Supported Standards” chapter of *Getting Started*. For detailed information, see the OASIS SAML document *saml-authn-context-2.0-os.pdf*.)

- To enter an authentication context URI for an adapter that supports this feature, click **Advanced Fields** on the adapter configuration screen.

Editing and Saving Adapter Instances

From the Adapter Instance Summary screen, you can reach adapter settings for editing.

To edit the configuration:

1. Click the heading above the information you want to change.
2. Make your changes.
3. Click **Save** on the configuration page and on the Manage IdP Adapter Instances screen.

To save an adapter instance:

1. Click **Done** on the Summary screen.
2. Click **Save** on the Manage IdP Adapter Instances screen.

Configuring Authentication Selectors

Authentication selectors provide a plug-in capability for PingFederate to choose among configured authentication sources (IdP adapter instances or IdP connections) for any SSO request and some OAuth flows that involve the browser. PingFederate chooses authentication sources based on criteria you define in a configured authentication selector or series of selectors. This optional feature provides for global and flexible authentication-source usage across SP connections.

⚠ **Important:** Before configuring adapter selectors, it is best to configure the authentication sources and to associate them with the applicable SP connections (see *Authentication Source Mapping* on page 203).

The configuration of plug-in selectors packaged in this PingFederate release—see *Bundled Authentication Selectors* on page 20—is described in the following sections. For information on the configuration of other plug-ins, please consult the associated documentation.

To reach this screen:

- Click Authentication Selection under Application Integration Settings in IdP Configuration.

To configure an instance of an authentication selector:

- Click Create New Instance.

To edit an existing instance:

- Click its Instance Name.

To delete an instance:

1. Click **Delete** next to the Instance Name. (To undo the deletion, click **Undelete**.)
2. Click **Save** to confirm the deletion.

Choosing a Selector Type

On this screen an administrator chooses the authentication selector to configure. Many selector plug-ins are bundled with PingFederate (see *Bundled Authentication Selectors* on page 20). Other plug-ins may be added periodically, available from *Ping Identity* (www.pingidentity.com/en/products/downloads.html).

Field Descriptions

Field	Description
Instance Name	A descriptive name for the selector instance.
Instance ID	An internal identifier for the selector instance—must be alphanumeric with no spaces.
Type	A list of deployed selector types available for creating an instance for the server.

To specify a selector instance:

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select the Type from the drop-down list.
3. Click **Next** and enter information on the configuration screen for this authentication-selector instance.

Configuring an Authentication-Selector Instance

This configuration varies depending on the selectors deployed on your server. For selectors bundled with PingFederate, refer to one of the following sections:

- *Configuring the CIDR Authentication Selector* on page 183
- *Configuring the Cluster Node Authentication Selector* on page 183
- *Configuring the Connection Set Authentication Selector* on page 184
- *Configuring the HTTP Header Authentication Selector* on page 184
- *Configuring the HTTP Request Parameter Authentication Selector* on page 185
- *Configuring the OAuth Scope Authentication Selector* on page 185
- *Configuring the Requested AuthN Context Authentication Selector* on page 185

Configuring the CIDR Authentication Selector

This authentication selector determines the authentication source based on the IP address of an incoming SSO request.

To configure the selector:

1. Under Action, click **Add a new row to 'Networks'**.
2. Enter a Network Range (IPv4 addresses only) and click **Update**.

   Note: If you want to include all IP addresses for testing, add two separate ranges: 0.0.0.0/1 and 128.0.0.0/1. The CIDR Adapter Selector interprets a specification of 0.0.0.0/0 as an empty range rather than as a wildcard for all addresses.
3. Repeat the previous step as needed for additional ranges.
4. Optional: Enter a value for Result Attribute Name.

   This field provides a means to indicate in the SAML assertion that a network range was matched during processing (values: `Yes` or `No`). Any authentication sources configured as a result of this authentication selector must have their attribute contract extended with the Result Attribute Name value in order to use its value to fulfill an attribute contract or for issuance criteria.

   Note: Result Attribute Name (if specified) is provided to the chosen authentication source only when the CIDR authentication selector is the last test. For more information, see *Mapping Selector Results to Authentication Sources* on page 186.

Configuring the Cluster Node Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on the PingFederate cluster node that is servicing the request (for more information on clustering, see the PingFederate *Server Clustering Guide*). For example, this selector allows you to choose whether or not Integrated Windows Authentication is attempted based on the PingFederate cluster node with which a Key Distribution Center is associated.

On the Authentication Selector screen for this selector, there are no individual configurable fields. Click **Next** to continue to the Selector Result Values screen to define cluster node index numbers for specific adapter instances (see *Defining Cluster Node Results* on page 183).

Defining Cluster Node Results

On the Selector Result Values screen, list the index numbers for each of the cluster nodes to be associated with specific authentication sources (see *Mapping Selector Results to Authentication Sources* on page 186). These results are used as the criteria for authentication selection.

To add values:

1. Enter a node index number as the Result Value and click **Add**.
2. Add more index numbers to differentiate criteria for adapter selection.

Configuring the Connection Set Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on a match found between the target SP connection used in an SSO request and SP connections configured within PingFederate. This selector allows you to override connection authentication selection on an individual connection basis.

To configure the selector:

1. Under Action, click **Add a new row to 'Connections'**.
2. Select an SP connection from the drop-down list and click **Update**.

   At runtime, the selector compares the target SP connection in the SSO request to SP connections configured here. If a match is found, the selector returns a result value of `Yes`.
3. Repeat the previous step as needed for additional connections.

   There is no priority given to the order in which the connections appear.

Configuring the HTTP Header Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on a match found in a specified HTTP header. Use this selector to choose from authentication sources that share a similar level of assurance, such as among multiple instances of the HTML Form Adapter or between a Kerberos Adapter instance and an x.509 Adapter instance. For example, use an instance of this selector to choose an authentication source based on the end user's browser identified by the User-Agent HTTP header.

Important: We do not recommend using this selector to determine whether, or not, an authentication source with a higher level of assurance should be bypassed because HTTP request headers could potentially be forged.

To configure the selector:

1. Under Action, click **Add a new row to 'Results'**.
2. Enter an expression for use when inspecting the HTTP header value of the target HTTP header and click **Update**.

   This field is case-sensitive and wildcard entries are allowed—for example, *Firefox*

   At runtime, the selector compares the HTTP header to these wildcard expressions. If a match is found, the selector returns a result value of `Yes`.

   The following expressions work to identify these commonly used browsers.

Browser	Expression
Chrome	*Chrome*
Firefox	*Firefox*
iPhone	*iPhone*
iPad	*iPad*
Internet Explorer	*MSIE*
Safari	*Safari*

   For information about Internet Explorer 11 (or higher), see *User-agent string changes* from Microsoft (`msdn.microsoft.com/library/hh869301(v=vs.85).aspx`).
3. Repeat the previous step as needed to add more wildcard expressions.
4. Enter the Header Name for the type of HTTP Header you want the selector to inspect — for example, User-Agent. This field is not case-sensitive.

Configuring the HTTP Request Parameter Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on query parameter values. Use this selector to choose from authentication sources that share a similar level of assurance, such as among multiple instances of the HTML Form Adapter or between a Kerberos Adapter instance and an x.509 Adapter instance. For example, use an instance of this selector to choose an authentication experience based on the reward program information indicated by a query parameter in the SSO request.

Important: We do not recommend using this selector to determine whether, or not, an authentication source with a higher level of assurance should be bypassed because query parameters could potentially be forged.

To configure the selector:

Enter the exact HTTP Request Parameter Name. This field is case-sensitive.

Defining Parameter Values

On the Selector Result Values screen, enter the exact parameter values to be associated with specific authentication sources (see *Mapping Selector Results to Authentication Sources* on page 186). These results are also used as the criteria for authentication selection.

To add values:

1. Enter a Result Value and click **Add**.

   Note: Result Values are case-sensitive.

2. Add more values to differentiate criteria for authentication selection.

Configuring the OAuth Scope Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on a match found between the scopes of an OAuth authorization request and scopes configured in the PingFederate OAuth Authorization Server (AS).

This selector allows you to control the strength of authentication based on client access requirements. For example, if a client requires write access to a resource, you can configure the selector to choose an adapter that offers a stronger form of authentication such as the X.509 client certificate rather than username and password.

Note: To configure an OAuth Scope Selector, you must first configure scopes for the PingFederate OAuth AS (see *Authorization Server Settings* on page 130).

To configure the selector:

- Select the required scopes and click **Next**.

  At runtime, the selector compares the requested OAuth scopes to the scopes selected here. All of the selected scopes must match for the selector to return a result value of `Yes`.

  Note: This selector matches only scopes from OAuth authorization requests to the `/as/authorization.oauth2` endpoint. SAML SSO requests do not match this authentication selector's criteria and result in a returned result value of `No`. Therefore, if you are using this selector as well as selectors specific to SAML connections, place this selector first in the mapping list so that it takes precedence for OAuth without disrupting selector logic on SAML connections (see *Mapping Selector Results to Authentication Sources* on page 186).

Configuring the Requested AuthN Context Authentication Selector

This authentication selector enables PingFederate to choose configured authentication sources based on the *authentication context* requested by an SP partner. The Authentication Selector screen provides an option to use the authentication-context selection result in SAML assertions. (Context results are defined on the next screen—see *Defining AuthN Context Results* on page 186.)

Note: This authentication selector works in conjunction with SP partner connections via SAML 2.0 only, using SP-initiated SSO. Other federation protocols do not support authentication context.

When selected (the default), the checkbox on this screen provides a means of either:

- Adding the value of the authentication context determined by the selector into the SAML assertion; or,
- When applicable, replacing any value returned from the associated adapter instance with the selector-result value.

Authentication sources are mapped to the results of selector instances in a subsequent screen, Map Results to Authentication Sources.

Note: The authentication context is modified only when the Requested AuthnN Context authentication selector is the last test. For more information, see *Mapping Selector Results to Authentication Sources* on page 186.

Defining AuthN Context Results

On the Selector Result Values screen, list the authentication contexts to be associated with specific authentication sources (see *Mapping Selector Results to Authentication Sources* on page 186). These results are also used as the criteria for authentication selection.

To add values:

1. Enter a Result Value and click **Add**.

   Values may include URIs defined in the SAML 2.0 specifications (see the OASIS SAML document *saml-authn-context-2.0-os.pdf*) or any other value agreed upon with an SP partner.
2. Add more values to differentiate criteria for authentication selection.

Finishing the Selector-Instance Configuration

To complete the selector-instance configuration, click **Done** on the Summary screen.

- On the Manage Authentication Selector Instances screen, add more instances or click **Next** to complete the selector configuration (see the next section, *Mapping Selector Results to Authentication Sources* on page 186).

  Caution: If you are yet not ready to map results, be sure to click **Save** on the Manage Authentication Selector Instances screen. Selector-instance configurations are not retained until you click **Save** either on this screen or on the Map Results to Authentication Sources screen.

Mapping Selector Results to Authentication Sources

An administrator can map the results of selector instances either to authentication sources or to other selectors for subsequent evaluation of additional criteria (for example, to determine whether off-site SSO requests are also authenticated in a certain context or originating from certain browser types).

Note: At runtime, the order of authentication-instance selection attempts is determined by the order of selector-instance mappings on this screen. The selection process stops when a match is found, and control is passed to the SP connection runtime configuration.

If the match is not allowed based on restrictions imposed (see *Restricting an Authentication Source to Certain Virtual Server IDs* on page 206), PingFederate falls back on the Default Authentication Sources (if any) or selects among the available authentication sources configured for the applicable SP connection (see *Step 2* and *Step 7*).

Change the order as needed using the arrows in the left column.

To complete this configuration:

1. Ensure the checkbox Enable Authentication Selection is selected.

   Tip: This checkbox allows an administrator to turn authentication selection on and off and is primarily useful during deployment testing. If this checkbox is *not* selected, all authentication-selection mappings are deactivated.
2. Optional: Select the checkbox Fail If No Selection.

   If no authentication sources match either the selector-result mappings or any Default Authentication Sources listed at the bottom of the screen (see *Step 7*), PingFederate selects among the authentication sources configured for the applicable SP connection. This checkbox overrides this behavior, allowing for cases where strict authentication policy might be required. When selected, an SSO request returns a failure message if no authentication sources satisfy requirements specified in this configuration.

3. Click the Selector Instance Name drop-down and choose an instance that needs mapping.
4. Under Instance for Selector Result Values, choose either an authentication source or a subsequent selector for the values from the drop-down lists.

   Note: Mapping all values is not required: for example, you might leave --None-- selected if you want the result to continue down to the next "decision tree."

   The default `Yes/No` values for selector instances indicate whether the pre-authentication circumstances meet the defined condition or not.
5. If you chose a selector in the previous step for any result value, repeat that step for the new Selector Result Values and Instance columns that appear at the right.

   Note: Repeat this step for subsequent selectors shown in the rightmost Instance column.

   Tip: There is no limit to the depth of the decision-tree processing this configuration makes possible; use the browser's horizontal scroll bar, if needed, to view the rightmost columns.
6. Repeat *Step 3* through *Step 5* for each Selector Instance Name that needs mapping.
7. Optional: Under Default Authentication Sources, choose an authentication source from the drop-down list.

   Repeat this step to choose additional default authentication sources, if needed.

   If no authentication sources match any of the selector mappings at runtime, the authentication sources listed in this column are tried in order. The first authentication source that is mapped in the target SP connection configuration is the one used.
8. Click **Save**.

Configuring a Default URL and Error Message

As an IdP, you can specify to prompt end users to confirm their single logout requests and a default URL indicating a successful SLO to the end-user (if no other page is designated). On the IdP Default URL page, you can also customize an error message to be displayed as part of the error page rendered in the end-user's browser if an error occurs during IdP-initiated SSO. For example, you might consider modifying the default text to include useful information regarding whom the user should contact or what their next step should be.

Note: The error message is displayed only when the application calling the start-SSO endpoint does not explicitly provide its own error page URL. The default entry in this field is used to localize the message. For information about how to find and change the default English message and how use the PingFederate localization feature, see *Localization* on page 81. If localization is not needed, you may also specify a message directly in this field to change the default.

Your application or your partner's application may supply the URL at runtime (see *IdP Endpoints* on page 385), but if none is provided, PingFederate will use the default value you enter on this screen.

Tip: If you leave the default URL blank, PingFederate provides built-in landing page for the user. This Web page is among the templates you can modify with your own branding or other information (see *Customizing User-Facing Screens* on page 76).

Viewing Application Endpoints

Click **Application Endpoints** on the IdP Configuration sub menu to see a list of endpoints and descriptions applicable to your federation role (IdP or SP). These endpoints are built into PingFederate and cannot be changed.

Web-application developers at your site need to know the application endpoints to initiate transactions via PingFederate (see *SSO Integration Kits and Adapters* on page 19).

Note: For specific parameters required or allowed for Application Endpoints, see *IdP Endpoints* on page 385.

This screen also shows a Maintenance Endpoint that you can use to verify that the PingFederate server is running (see *System-Services Endpoints* on page 395).

Viewing Protocol Endpoints

Click Protocol Endpoints under Federation Settings in the IdP Configuration section of the Main Menu to see a list of SAML, WS-Federation, and/or WS-Trust STS endpoints—a pop-up window displays only those endpoints related to the federation protocols enabled in Server Settings (see *Choosing Roles and Protocols* on page 92). These endpoints are built into PingFederate and cannot be changed.

PingFederate provides a favorite icon for all Protocol Endpoints. For more information, see *Customizing the Favicon for Application and Protocol Endpoints* on page 84.

Your federation partners or STS clients need to know the applicable IdP Services endpoints to communicate with your PingFederate server. Configured service endpoints for SAML connections are included in metadata export files (see *Exporting Metadata* on page 57).

The table below describes each endpoint:

Table 14: PingFederate IdP Endpoints

Service	URL and Description
Single Logout Service (SAML 2.0)	`/idp/SLO.saml2` The URL that receives and processes logout requests and responses.
Single Sign-on Service (SAML 2.0)	`/idp/SSO.saml2` The SAML 2.0 implementation URL that receives authentication requests for processing.
Artifact Resolution Service (SAML 2.0)	`/idp/ARS.ssaml2` The SOAP endpoint that processes artifacts returned from a federation partner to retrieve the referenced XML message on the back channel. (See "**Important**" footnote in this table.)
Attribute Query Service (SAML 2.0)	`/idp/attrsvc.ssaml2` The SAML implementation that receives and processes attribute requests. (See "**Important**" footnote in this table.)
Metadata Service	`/` The default endpoint (empty path) from which partners can retrieve Auto-Connect metadata (see *Using Auto-Connect* on page 31).
Single Sign-on Service (SAML 1.x)	`/idp/isx.saml1` The SAML 1.x implementation of IdP intersite transfer service (ISX) to which clients are redirected for SSO requests.
Artifact Resolution Service (SAML 1.x)	`/idp/soap.ssaml1` The SOAP endpoint that processes artifacts returned from a federation partner to retrieve the referenced XML message on the back channel. (See "**Important**" footnote in this table.)
Single Sign-on Service (WS-Federation)	`/idp/prp.wsf`

Service	URL and Description
	The WS-Federation implementation URL that receives and processes security-token requests and SLO messages.
WS-Trust STS (two endpoints)	`/idp/sts.wst` The SOAP endpoint that receives and processes security-token requests from STS clients (Web Service Clients at the IdP site) to be exchanged for a SAML token based on the configured SP connection. `/pf/sts.wst` Initiates direct STS token-to-token exchange and token validation from an IdP token processor to an SP token generator, when that feature is configured (see *Token Exchange Mapping* on page 120). **Note:** If multiple token-processor instances of the same type are configured for the same connection or token-to-token mapping, a query parameter, `TokenProcessorId`, must be added to either of these endpoints—see *Configuring Token Processors* on page 327. (See also “**Important**” footnote in this table.)

Important: If mutual SSL/TLS is used for authentication, a secondary PingFederate listening port must be configured and used by partners or STS clients for the relevant endpoints—`*.ssaml*` and `*.wst` (see *Modifying PingFederate Properties* on page 68).

Note: For any connection using multiple virtual server IDs (see *Multiple Virtual Server IDs* on page 36), each virtual server ID has its own set of protocol endpoints. Use Metadata Export on the Server Configuration sub menu to export a connection metadata for your partner. For more information, see *Exporting Metadata* on page 57.

Managing SP Connections

As an IdP, you manage connection settings to support the exchange of federation-protocol messages (SAML, WS-Federation, or WS-Trust) with an IdP or *STS* client application at your site.

Note: If you are configuring a new connection only for WS-Trust STS, follow the sections in this part of the manual up to and including *General Information* on page 195. Then turn to *WS-Trust STS Configuration* on page 324.

These settings include:

- User attributes you expect to send in an SSO assertion (including STS SAML tokens).
- User attributes that may be sent using the Attribute Query profile (if that profile is used).
- The protocol and, for SAML, the profile you will use, including detailed security specifications (the use of digital signatures, signature verification, XML encryption, and SSL). For more information, see *Supported Standards* in *Getting Started*.

To continue with the configuration, you and your connection partner must have decided this information in advance (see *Federation Planning Checklist* on page 35). Your federation partner must supply some connection settings and other information (see *Configuration Data Exchange* on page 38).

Tip: If you are configuring connections to more than one partner under SAML 2.0 specifications, or if you intend to add partners in the future, consider using Auto-Connect (see *Configuring SP Auto-Connect* on page 251).

If your agreement includes sending assertions containing attribute values from a local data store, then you need to define the data store during this configuration if you have not done so already (see *Managing Data Stores* on page 98).

Accessing Connections

You can create, modify or import connections directly under SP Connections. Note that the IdP Configuration menu displays the four most-recently modified connections. To view a list of all SP connections, click the **Manage All** button.

Via the Main Menu

From the Main Menu under IdP Configuration, you can configure a new connection, modify an existing connection, import a connection, or view connections.

Tip: To copy, delete or export connections, as well as to recover connection drafts, click **Manage All** (see *Via the Manage Connections Screen* on page 190).

Note that long connection names are truncated for this display and the list is limited to four connections, chronologically ordered according to most recently edited. The full connection names and a complete list are displayed on the Manage Connections screen (see *Via the Manage Connections Screen* on page 190).

To begin configuring a new connection:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Create New** under SP Connections.

   Tip: The fastest way to create a new connection is to click **Manage All** and copy the connection with similar settings (see *Via the Manage Connections Screen* on page 190).

To modify a connection

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Only the four most recently edited connections are displayed. To see all connections, including drafts, click **Manage All**.
3. On the Activation & Summary screen, click the heading for the information you want to change.
4. Make your change and click **Save**.

   Note: If **Save** is not available, it means your modification requires other changes or you are editing a screen that is part of a series of subtasks. Click **Next** and continue making indicated changes. The **Done** button indicates that further changes in the task are optional. When you have no further changes, click **Done** and then click **Save** on the task summary screen.

To import a connection:

1. Click **Import**.
2. In the Import Connection screen, browse to a connection XML file.
3. Optional: Select the Allow Update checkbox. When selected, if the connection already exists, it will be overwritten.
4. Click **Import** and **Done**.

Via the Manage Connections Screen

From the Manage Connections screen you can:

- Create a new connection.
- Modify or copy an existing connection.
- Continue working on a connection draft.
- Delete a connection—if it is not active or referenced in other parts of the configuration (In Use).
- Export or import individual connection configurations.

  Note: The connection export function results in an XML file that you can modify and import into the same PingFederate server or another PingFederate server acting in the same federation role (IdP or

SP) at your site. You can import connections in this screen. Alternatively, you can use the Connection Management Service to complete the task (see *Importing Connections* on page 409). Finally, you also have the option to automate this process (see *Automating Configuration Migration* on page 70).

- Export metadata about a connection to expedite your partner's corresponding configuration (see *Exporting Metadata* on page 57).
- Update a SAML connection with metadata from your partner.

  Note: The update operation may require additional configuration. Reviewing the connection after the update operation is recommended.

On this screen you can also globally override transaction logging levels set for individual connections or restore connection-based logging (see *Runtime Transaction Logging* on page 49).

Tip: A check-mark icon next to a Connection Name indicates that the connection has been checked for configuration errors. For more information about connection-validation features associated with this screen, see *Managing SP Connection Validation* on page 193.

To access the Manage Connections screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Manage All** under SP Connections.

To begin configuring a new SP connection:

- Click **Create Connection** on the Manage Connections screen.

To copy a connection:

1. Click **Copy** under Action for the connection you want to copy.
2. Update the Connection ID (of the partner) and the Connection Name in the General Info screen (see *General Information* on page 195).
3. Make any further changes needed for the new connection.

   Note: Outbound Provisioning configurations are not copied for a connection (see *Outbound Provisioning for IdPs* on page 33).

To edit a connection or continue working on a draft:

- Click the Connection Name link.

  For a draft, you will return to where you left off.

To export a connection:

1. Click **Export Connection** under Action for the connection.
2. Save the XML file on your file system.

   You can change the name of the file, but keep the XML extension.

To import a connection:

1. Click **Import**.
2. In the Import Connection screen, browse to a connection XML file.
3. Optional: Select the Allow Update checkbox. When selected, if the connection already exists, it will be overwritten.
4. Click **Import** and **Done**.

To export connection metadata:

1. Click **Export Metadata** under Action for the connection.

This action takes you to the Export Metadata screen flow, with the connection selection preset (see *Exporting Metadata* on page 57).

2. Complete the steps remaining in the Export Metadata screen flow (starting at *Step 4* under *To export connection metadata:* on page 57).

To update a connection with your partner's metadata:

1. Click **Update with Metadata** under Action for the connection.
2. In the Import Metadata screen, select the metadata XML file.
3. Click **Load Metadata**.
4. Click **Yes** to proceed.

   Note: Click **No** if you want to select another metadata file or stop the update process.

5. Click **Next**.
6. In the Import Certificate screen, select the verification certificate from your partner.

   Note: Applicable only if your partner provides the verification certificate outside of the metadata.

7. In the Metadata Summary screen, review the signature information to evaluate the authenticity of the metadata. Click **Done** or **Save** to complete the update operation.

   Note: If you change your mind, click **Cancel** to go back to the Manage Connection screen without updating the connection.

8. If the metadata does not contain information required by the previously selected SAML profile(s), follow the Dependency Errors page to complete the configuration.

To delete a connection:

1. Under Action, click **Delete** for the connection.

   (To undo the deletion, click **Undelete**.)

   Note: The **Delete** function is not available if the connection is Active or In Use.

2. To confirm the deletion, click **Save**.

To sort the list of connections:

- Click the arrow next to any column heading to sort the list based on that column.

  Note: The Virtual ID displays the default virtual server ID of the connection, if any (see *General Information* on page 195).

To filter the list by Protocol and/or Status:

- Select a filter criterion from either or both of the drop-down lists.

To override connection-based transaction logging:

1. Select **On** under Logging Mode Override.
2. Choose the logging mode you want to use for all connections.

To restore connection-based transaction logging:

- Select **Off** under Logging Mode Override.

Importing a Connection

Use the Import Connection screen to import a connection.

To import a connection:

1. Click **Import**.
2. In the Import Connection screen, browse to a connection XML file.
3. Optional: Select the Allow Update checkbox. When selected, if the connection already exists, it will be overwritten.
4. Click **Import** and **Done**.

Updating a Connection Using Metadata

Use the Import Metadata wizard to update a connection using a metadata XML file from your partner.

To update a connection with your partner's metadata:

1. In the Import Metadata screen, select the metadata XML file.
2. Click **Load Metadata**.
3. Click **Yes** to proceed.

   Note: Click **No** if you want to select another metadata file or stop the update process.
4. Click **Next**.
5. In the Import Certificate screen, select the verification certificate from your partner.

   Note: Applicable only if your partner provides the verification certificate outside of the metadata.
6. In the Metadata Summary screen, review the signature information to evaluate the authenticity of the metadata. Click **Done** or **Save** to complete the update operation.

   Note: If you change your mind, click **Cancel** to go back to the Manage Connection screen without updating the connection.
7. If the metadata does not contain information required by the previously selected SAML profile(s), follow the Dependency Errors page to complete the configuration.

Managing SP Connection Validation

By default PingFederate automatically validates all existing connections before displaying the Manage Connections screen. This validation ensures that any updates to supporting components—*adapter*s or data-store configurations, for example—have not invalidated any connection settings.

If such errors are found, a warning icon appears next to the Connection Name.

To correct errors:

- Click the Connection Name to reach the top-level task in which reconfiguration is needed, and to see the error message. Then navigate into deeper tasks using **Configure . . .** buttons to find a link to the screen that needs updating.

  (For more information about console navigation, see *About Tasks and Steps* in the “Console Navigation” chapter of *Getting Started*).

Note that the connection validation time increases with the number of connections and when connections are configured to access data stores for attribute mapping. Consequently, there may be noticeable delays in displaying the Manage Connections screen. For this reason, PingFederate provides a way to turn off the automatic validation under Server Settings (see *Setting System Options* on page 94).

When validation is turned off, administrators can check connections manually on the Manage Connections screen. A question-mark icon indicates the connection has not been validated. You may, however, still edit the connection by clicking its name.

In addition, Action links are disabled (except for **Delete**, if the connection is Inactive and/or In Use) until the connection is validated.

When automatic validation is disabled, use one of the following procedures to validate connections:

To validate a single connection:

- Click icon next to the Connection Name.

  Note: Validating a single connection does not check connectivity for any configured data-store lookups (see *Selecting Mapping Method* on page 207). However, this check *is* performed when you access the connection for editing.

To validate all connections (including for data-store connectivity):

1. Click **Check All Connections for Errors**.
2. When prompted, click **Yes**.

Choosing a Connection Template

On the Connection Template screen (shown only for a new connection), you can choose a quick-connection template if your installation includes an optional PingFederate SaaS Connector (see *Outbound Provisioning for IdPs* on page 33).

Tip: When you select a Connection Template, many connection settings are configured for you automatically. For information about using a template, refer to the *Quick Connection Guide* available with your PingFederate SaaS Connector.

- To configure a connection without a template, click **Next**.
- To use a template, select that option, then choose the template and enter additional information as required.

  Note: Once you click **Next**, you cannot return to this screen and make a different selection. If you intended to use a different template or no template, you must create a new connection.

Choosing a Connection Type

If you are not using a connection template (which preconfigures browser-based SSO), indicate on the Connection Type screen whether the connection to this partner is for Browser SSO, WS-Trust STS, and/or Outbound Provisioning (see *Connection Types* on page 12).

Note: You can add STS, OAuth, and Outbound Provisioning support to any existing SSO connection, or vice versa, at any time.

If your federation deployment supports multiple protocols and you are not using a connection template, then for new SSO connections you can also select the applicable protocol on the Connection Type screen (see *Choosing Roles and Protocols* on page 92).

Note: If your partner's deployment also supports multiple protocols and you intend to communicate using more than one, then you must set up a separate connection for each protocol.

- To configure a connection for secure browser-based SSO, select Browser SSO Profiles and the Protocol (if necessary). For a WS-Federation connection, select the desired token type, namely SAML 1.1 or JWT (JSON Web Token).

  Tip: If you are creating a WS-Federation connection to Microsoft Windows Azure Pack, select JWT as the token type.
- To configure a connection for WS-Trust STS, make that selection and then select a Default Token Type.

  The Default Token Type, either SAML 1.1 or 2.0, is used when a Web Service client does not specify in the token request what token type the STS should issue.

  Note: The Default Token Type *does not* need to match the Protocol indicated on the screen for SSO (when applicable).
- To configure a connection for Outbound Provisioning, make that selection and then select the Outbound Provisioning Type (if multiple outbound provisioning drivers are installed, such as SCIM, Google, or Salesforce).

> **Note:** The Outbound Provisioning option is active only after you enable the Outbound Provisioning protocol on the Roles & Protocols screen (see *Choosing Roles and Protocols* on page 92).

- Optional: If your PingFederate license manages connections by groups, then you can select a group for this connection.

  This option is not displayed for unrestricted or other types of licenses.

Choosing Connection Options

On the Connection Options screen, you can enable the Browser SSO and Attribute Query options for the current connection. In addition, for browser-based SSO you can enable IdP Discovery for the current connection.

> **Note:** This screen is presented only for browser-based SSO connections (see *Choosing a Connection Type* on page 194).

- To create a connection for browser-based SSO, select Browser SSO.
- To enable IdP Discovery for this connection, select IdP Discovery.

  > **Note:** The IdP Discovery checkbox is only enabled if IdP Discovery is configured and the Domain Cookie Setting "IdP using a common domain service to advertise the ability to authenticate a principal” is enabled (see *Standard IdP Discovery* on page 110).
- To create a connection for attribute query, select Attribute Query. See *Attribute Query and XASP* in the “Supported Standards” chapter of *Getting Started*.
- Click **Next**.

Importing SP Metadata

If you are using one of the SAML protocols (without a connection template) and have received a *metadata* file from your partner, click **Browse** on the Import Metadata screen, select the file, and click **Next**.

> **Note:** If the endpoints in the metadata file share the same base URL (protocol, hostname, and port), PingFederate 7.3 uses this information to populate the Base URL field (see *General Information* on page 195). Consequently, individual endpoints on other screens do not include this information—only relative paths are shown.

> **Note:** If you are importing a signed metadata file that does not include the certificate and public key, you will be asked to import the certificate needed to verify the XML signature (see the next section).

If you are not using a metadata file, click **Next** on the Import Metadata screen.

Importing a Verification Certificate

The Import Certificate screen appears only if the metadata file you have chosen to import is signed and the certificate needed to verify the signature is not contained in the file.

- Click **Browse** to locate and open the signature verification certificate for this partner.

Viewing the Metadata Summary

The Metadata Summary screen provides security information about an imported metadata file, including whether the file was signed and, if so, the trust status of the certificate used to verify the signature.

General Information

On the General Info screen, you provide a required unique identifier and display name for a connection, as well as optional contact information. In addition, on this screen you can set the level of transaction logging for this connection partner (see *Runtime Transaction Logging* on page 49).

Field Descriptions

Field	Description
Partner's Entity ID/ Audience/ Partner's Realm (Connection ID)	(Required) The published, protocol-dependent, unique identifier of your partner. For a SAML 2.0 connection, this is your partner's SAML Entity ID. For a SAML 1.x connection, this is the Audience your partner advertises. For a WS-Federation connection, this is your partner's Realm. This ID may have been obtained out-of-band or via a metadata file if you are using a SAML protocol (see *Exporting Metadata* on page 57). For STS-only connections, this ID can be any unique identifier
Connection Name	(Required) A plain-language identifier for the connection—for example, a company or department name. This name is displayed in the connection list on the administrative console.
Virtual Server IDs	If you want to identify your server to this connection partner using an ID other than the one you specified under Server Settings (see *Specifying Federation Information* on page 94), enter a virtual server ID in this field and click **Add**. Enter additional virtual server IDs as needed (see *Multiple Virtual Server IDs* on page 36).
Base URL	The fully qualified hostname and port on which your partner's federation deployment runs (e.g., `https://sso.thespcompany.com:9031`). This entry is an optional convenience, allowing you to enter relative paths to specific endpoints, instead of full URLs, during the configuration process.
Company	The name of the partner company to which you are connecting.
Contact Name	The contact person at the partner company.
Contact Number	The phone number of the contact person at the partner company.
Contact Email	The email address for the contact person at the partner company.
Application Name	The name of the application, accessible through the IdP Adapter interface (IdpAuthenticationAdapterV2) in the PingFederate Java SDK. (For more information about the SDK, see *SDK Developer's Guide*.)
Application Icon URL	The URL of the application icon, accessible through the IdP Adapter interface (IdpAuthenticationAdapterV2) in the PingFederate Java SDK. (For more information about the SDK, see *SDK Developer's Guide*.)
Logging Mode	The level of transaction logging applicable for this connection (see *Runtime Transaction Logging* on page 49).

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click**Manage All**, if needed, to see a full list of connections.
3. Click **General Info** under the SP Connection tab.

Configuring Browser-Based SSO

Browser-based SSO (also, Browser SSO) is another term for secure SSO, which relies on a user's Web browser and HTTP to broker XML identity-federation messaging between an IdP and an SP (in contrast to WS-Trust *STS* messaging, which is typically application-driven across the back channel and does not require browser mediation).

- To continue, click **Configure Browser SSO**.

Configuration Steps

Many steps involved in setting up a federation connection are protocol-independent; that is, they are required steps for all connections, regardless of the associated standards (see *Supported Standards* chapter in *Getting Started*). Also, for any given connection, some configuration steps are required under the applicable protocol, while others are optional. Still others are required only based on certain selections. The PingTrust administrative console determines the required and optional steps based on the protocol and dynamically presents additional requirements or options based on selections.

The following sections provide sequential information about every step you might encounter while configuring browser-based SSO, regardless of the protocol you are using for a particular connection.

Note: The configuration screens represented in this chapter show “SAML 2.0” in their left corners, unless they are exclusive to WS-Federation or SAML 1.x setup requirements. When the SAML 2.0 screens are also applicable to SAML 1.x and/or WS-Federation connections, the SAML 2.0 representations and discussions also apply to the other protocols, unless otherwise indicated.

After configuring SSO settings, you will normally need to configure authentication credentials, the range of which depends on your SSO selections (see *Configuring Credentials* on page 232). Also, other configuration tasks may remain to be configured for new or modified connections, depending on selected connection options (see *Choosing Connection Options* on page 195).

Important: For new connections you must completely configure these SSO settings and subsequent tasks before you can save the connection on the Activation & Summary screen. Until then, the *configuration is temporary and can be lost*; the console times out after several minutes of inactivity. At any time, however, you can click **Save Draft**, which is available on most screens after you enter General Information (see *Console Buttons* in the “Console Navigation” chapter of *Getting Started*).

Use the lists and links (or page references) below to find specific information about steps that may apply to your SSO connection requirements:

SAML 2.0 SSO Steps

- *Choosing Profiles (SAML 2.0)* on page 198
- *Setting an Assertion Lifetime* on page 200
- *Assertion Creation* on page 200
  - *Choosing an Identity Mapping Method* on page 200
  - *Creating an Attribute Contract* on page 202
  - *Authentication Source Mapping* on page 203
- *Configuring Protocol Settings* on page 221
  - *Setting Assertion Consumer Service URLs (SAML)* on page 222
  - *Specifying SLO Service URLs (SAML 2.0)* on page 224
  - *Choosing Allowable SAML Bindings (SAML 2.0)* on page 225
  - *Setting an Artifact Lifetime (SAML)* on page 225
  - *Specifying Artifact Resolver Locations (SAML 2.0)* on page 226
  - *Defining Signature Policy* on page 226
  - *Configuring XML Encryption Policy (for SAML 2.0)* on page 296

WS-Federation SSO Configuration Steps

- *Setting an Assertion Lifetime* on page 200
- *Assertion Creation* on page 200
- *Defining Signature Policy* on page 226
  - *Choosing an Identity Mapping Method* on page 200

    - *Creating an Attribute Contract* on page 202
    - *Authentication Source Mapping* on page 203
- *Configuring Protocol Settings* on page 221
    - *Defining a Service URL (WS-Federation)* on page 223

SAML 1.x SSO Configuration Steps

- *Setting an Assertion Lifetime* on page 200
- *Assertion Creation* on page 200
    - *Choosing an Identity Mapping Method* on page 200
    - *Creating an Attribute Contract* on page 202
    - *Authentication Source Mapping* on page 203
- *Configuring Protocol Settings* on page 221
    - *Setting Assertion Consumer Service URLs (SAML)* on page 222
    - *Setting a Default Target URL (SAML 1.x)* on page 223
    - *Setting an Artifact Lifetime (SAML)* on page 225
    - *Defining Signature Policy* on page 226

Choosing Profiles (SAML 2.0)

A SAML profile is the message-interchange scenario that you and your federation partner have agreed to use (see *Federation Planning Checklist* on page 35). For SAML 2.0, PingFederate supports all IdP- and SP-initiated SSO and SLO profiles.

For information on typical SSO/SLO profile configurations, including illustrations, see the “Profiles” sections in *Supported Standards* chapter in *Getting Started*.

Note: This screen is not presented for SAML 1.x connections because IdP SSO is assumed, the SLO profiles are not supported, and the server supports SP-initiated SSO automatically (see *SAML 1.x Profiles* chapter of *Getting Started*).

The screen is also not presented for WS-Federation connections because profile selection is not required (see *WS-Federation* in *Getting Started*).

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **SAML Profiles** on the Summary screen.

To configure profiles:

1. Select the profile(s) applicable to this connection and click **Next**.

   You must select an SSO profile before you can enable SLO.
2. Continue through the remaining connection-configuration tasks.

The following topics provide more information on requirements for each SAML profile:

- *Configuring IdP-Initiated SSO* on page 199
- *Configuring SP-Initiated SSO* on page 199
- *Configuring IdP-Initiated SLO* on page 199

- *Configuring SP-Initiated SLO* on page 199

Configuring IdP-Initiated SSO

When PingFederate is operating as an IdP, the IdP-initiated SSO profile configuration defines the message-transport mechanisms (*bindings*) your enterprise has agreed to use for this partner, plus optional digital signature requirements for outbound assertions (see *Security Infrastructure* on page 27).

For illustrations of typical profile and binding scenarios, see the “Profiles” sections in the *Supported Standards* chapter in *Getting Started*.

For this configuration you need to know:

- The transport binding(s) to which you and your partner have agreed
- The certificate to be used for signing assertions (not always required for the artifact binding)
- The URL(s) of your partner’s *Assertion Consumer Service*(s)

Configuring SP-Initiated SSO

The SP-initiated profile configuration for SSO defines the message-transport mechanisms (bindings) and security requirements for receiving authentication requests and sending assertions when your SP partner initiates SSO transactions (see *Single Sign-on* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide).

For SAML 1.x, the SP-initiated SSO profile is also known as the “destination-first” profile, which was added as a supported “non-normative” use case after the release of the SAML 2.0 specifications. As an IdP, you do not need to configure this profile; when the SP sends an authentication request to your SSO Service endpoint, PingFederate will handle the response automatically.

For illustrations of typical profile and binding scenarios, see the Profiles in *Supported Standards* in *Getting Started*.

For this configuration you will need to know:

- The endpoint URL(s) for your SP’s *Assertion Consumer Service*(s)
- The transport bindings that you and your partner have agreed upon *inbound* and *outbound*
- The certificates you will use to sign outbound assertions and to verify incoming digital signatures from your SP, when either is required

When Artifact is an allowable inbound SAML binding, you also need to know the endpoint(s) to your partner’s *Artifact Resolution Service*(s) and the SOAP client authentication mechanism to use: either HTTP Basic, SSL client certificates, a digital signature, or a combination of these mechanisms.

Configuring IdP-Initiated SLO

The SAML 2.0 IdP-initiated SLO profile configuration defines the message-transport mechanisms (*bindings*) and security requirements for exchanging SLO requests and responses.

For more information about SLO, see *Single Logout* in the “Supported Standards” chapter of *Getting Started*.

For this configuration you need to know:

- The transport bindings to which you and your partner have agreed to send SLO requests and receive responses
- The certificates to be used for signing outgoing messages and for verifying incoming digital signatures from your SP (not always required for the artifact binding)
- The URL(s) of your SP’s *Single Logout Service*(s)

Configuring SP-Initiated SLO

The SAML 2.0 SP-initiated SLO profile configuration defines the message-transport mechanisms (*bindings*) and security requirements that you and your partner have agreed upon for exchanging SAML requests and responses.

For more information about SLO, see *Single Logout* in the “Supported Standards” chapter of *Getting Started*.

For this configuration you need to know:

- The transport bindings that you and your partner have agreed upon to send SLO requests and receive responses

- The certificates to be used for signing outgoing messages and for verifying incoming digital signatures from your SP (not always required for the artifact binding)
- The URL(s) of your SP's *Single Logout Service*(s)
- The URL of your SP's *Artifact Resolution Service*(s)—if this binding and endpoint are different from your SSO configuration—and SOAP client authentication requirements

Setting an Assertion Lifetime

Identity-federation standards require a window of time during which an *assertion* is considered valid. Each assertion has a time-stamp XML element as well as elements indicating the allowable lifetime of the assertion (in minutes) before and after the assertion time stamp.

Field Descriptions

Field	Description
Minutes Before	The amount of time before the assertion was issued during which it is to be considered valid.
Minutes After	The amount of time after the assertion was issued during which it is to be considered valid.

To change the default times:

- Edit the desired setting(s) and click **Next** or **Save**.

  Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), specify values for Minutes Before and Minutes After in the JWT Lifetime screen.

Assertion Creation

As an IdP, you must specify how PingFederate obtains user-authentication information and use it to create *assertion*s appropriate for your SP partner, including additional user attributes as needed.

If you are a federation hub, bridging a service provider to one or more identity providers, you must associate one or more connection mapping contracts to the SP connection (see *Federation Hub* on page 38 and *Connection Mapping Contracts* on page 124 for more information).

For both scenarios, the configuration includes:

- Choosing an identity-mapping method (see *Choosing an Identity Mapping Method* on page 200).
- Defining the *attribute contract* you will use with this partner, if any (see *Creating an Attribute Contract* on page 202).
- Configuring instances of one or more authentication sources (see *Authentication Source Mapping* on page 203) and specifying how they are used to fulfill the *attribute contract*.

- Click **Configure Assertion Creation** to continue.

Note: The same steps apply to WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194) as well. Click **Configure JWT Creation** to continue.

Choosing an Identity Mapping Method

PingFederate allows your SP partner to use either *account linking* or *account mapping* to associate remote users with local accounts for SSO between business partners (see *Identity Mapping* on page 22). At the Identity Mapping step, you choose the type of name identifier your partner needs to facilitate one of these options. You and your partner may want to decide in advance which option to use (see *Federation Planning Checklist* on page 35).

The choices of name-identifier types depend on which protocol you are using:

- For information about SAML selections, see *SAML Name ID Selections* on page 201.
- For information about WS-Federation selections, see *WS-Federation Name ID Selections* on page 201.

SAML Name ID Selections

The allowable types of name identifiers for SAML connections are described below. These choices affect how SPs make use of *account mapping* or *account linking*.

If your SP is using account linking, then establishing an *attribute contract* is not required. Depending on your partner agreement, however, you may choose to supplement the account link with an attribute contract. In this configuration the account link is used to determine the user's identity, while the additional attributes might be used for authorization decisions, customized Web pages, and so on, at the SP site (see *About Attributes* on page 23).

⚠ **Important:** If you have previously set up a configuration to use an attribute contract and want to change the configuration to use account linking without additional attributes, then the existing attribute contract will be discarded.

Account linking can be used with either a clear, standard name identifier or an opaque pseudonym.

- If you want to send a known attribute to identify a user—for example, a username or email address—then select **Standard**.
- If you and your partner have agreed to use an opaque persistent name identifier (often used for account linking), then select **Pseudonym** on the Identity Mapping screen.

  The pseudonym is based on values pulled from the IdP adapter instance used to authenticate the user. You select these values when you configure IdP adapter instances (see *Setting Pseudonym Values and Masking* on page 181).

  To set up an attribute contract to use in conjunction with an opaque identifier, select the checkbox next to "Include attributes . . ." after selecting **Pseudonym**.

- Select **Transient** to enhance the privacy of a user's identity. Unlike a pseudonym, a transient identifier is different each time a user initiates SSO (see *Account Linking* on page 22).

  A typical application for this selection might be, for example, when an SP provides generalized group accounts based on organizational rather than individual identity.

  To set up an attribute contract to use in conjunction with an opaque identifier, select the checkbox next to "Include attributes . . ." after selecting **Transient**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Identity Mapping** on the Summary screen.

WS-Federation Name ID Selections

For WS-Federation purposes a name identifier is a uniquely identifying user attribute.

- Make one of the selections described below:
  - **Email Address**: This attribute is commonly used as a unique identifier for SSO and SLO. Make this selection, for example, if a user logs in using an email address or if the information is available for lookup in a local data store.
  - **User Principal Name**: The username or other unique ID of the subject initiating the transaction. Make this selection, for example, if a username will be available from the current user session as part of a cookie or can be derived from a local data store.

- **Common Name**: This selection provides for anonymous SSO to your SP, generally using a hard-coded generalized logon. Make this selection if your partner agreement involves a many-to-one use case— for example, if the SP has a group account set up for all users in a particular domain.

Later, you will map your choice to the `SAML_SUBJECT` attribute in the SAML assertion (see *Mapping Default Attribute Contract Fulfillment* on page 220).

Creating an Attribute Contract

An attribute contract is the set of user attributes that you and your partner have agreed will be sent in SAML assertions for this connection (see *Attribute Contracts* on page 23). You identify these attributes on this screen.

If you are sending a "standard" name identifier (see *Choosing an Identity Mapping Method* on page 200), then the contract includes the default `SAML_SUBJECT`, which identifies the user in the assertion. You will configure this variable later to contain a user ID or another agreed-upon attribute—for instance, an email address—that uniquely identifies the user (see *Attribute Contract Fulfillment* on page 215).

Creating an attribute contract is optional if you are sending either a pseudonym or a transient identifier to your connection partner (see *Choosing an Identity Mapping Method* on page 200).

Note: If you are configuring a WS-Federation connection using JWT (see *Choosing a Connection Type* on page 194), you also need to create an attribute contract.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Attribute Contract** on the Summary screen.

   If this step is not in the list, then you have chosen to send either a pseudonym or a transient identifier without additional attributes (see *Choosing an Identity Mapping Method* on page 200).

   Note: For WS-Federation connections using SAML 1.1, the Subject Name Format is determined by the previous screen (see *WS-Federation Name ID Selections* on page 201).

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your partner.

   Tip: You can add a special attribute, `SAML_AUTHN_CTX`, to indicate to the SP (if required) the type of credentials used to authenticate to the IdP application—*authentication context*. Map a value for the authentication context on the attribute-mapping screen later in the configuration, from any available attribute source, (see *Attribute Contract Fulfillment* on page 215).

   Tip: If you are configuring a WS-Federation connection to Microsoft Windows Azure Pack, add `upn` to the JWT's attribute contract.
2. Optional: Select the Attribute Name Format.

   Note: This option is not available for SAML 1.0 connections or WS-Federation connections using JWT.

Change the default Name Format selection if you and your SP partner have agreed to a specific format (see *Name Formats* on page 24).

Note: If needed, an administrator can customize name-format alternatives via the `custom-name-formats.xml` configuration file located in this directory:

```
<pf_install>/pingfederate/server/default/data/config-store
```

3. Click **Add**.

(Optional) For SAML connections, to modify the Subject Name Format:

- Make your selection in the drop-down list and click **Done**.

  The default selection is usually applicable, unless you and your partner have agreed to a different format specification (see *Name Formats* on page 24).

  Note: This selection is not available if you are sending a pseudonym as the subject, or a transient identifier (see *Choosing an Identity Mapping Method* on page 200).

To modify an attribute name or format:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

   Note: If you change your mind, ensure that you click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made in the configuration steps.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Authentication Source Mapping

IdP adapters are responsible for handling user authentication as part of an SSO operation (see *SSO Integration Kits and Adapters* on page 19). A configured and deployed adapter in PingFederate is known as an adapter instance. The same instance may be mapped by multiple connections.

You may also deploy an SP connection to bridge a service provider to one or more identity providers.

Tip: In this scenario, PingFederate is a federation hub for both parties. (See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.)

PingFederate uses connection mapping contracts to associate this SP connection with the applicable IdP connections to the identity providers (see *Connection Mapping Contracts* on page 124).

Each connection mapping contract has its own set of attributes which you map values to the assertions.

Map one or more IdP adapter instances into each SP connection so that when a user authenticates with a particular external identity management system the user attributes are returned to PingFederate.

When adapters are restricted to certain virtual server IDs, the allowed IDs are displayed under the Virtual Server IDs column.

Regardless of how many IdP adapter instances are mapped in an SP connection, PingFederate uses only one instance to authenticate a user. Because each instance may return different user attributes, each IdP adapter mapping must define how the *attribute contract* is fulfilled; you must map attributes from each adapter—and/or attributes retrieved from your local data stores—into the assertions PingFederate sends to this SP to fulfill the attribute contract.

You begin this configuration on the Authentication Source Mapping screen, where you choose to map instances of IdP adapter or connection Mapping Contracts. If you have not yet configured an instance of the adapter you intend to use within this SP connection, see *Configuring IdP Adapters* on page 178. To review or create connection mapping contracts, see *Managing Contracts* on page 124.

To modify an existing authentication source:

- Click its Name link.

To begin configuring an Adapter Instance for this connection

- Click **Map New Adapter Instance**.

To begin configuring a connection mapping contract for this connection:

- Click **Map New Connection Contract Mapping**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Selecting an Authentication Source

Use this screen to associate an IdP adapter instance or a connection mapping contract with an SP connection.

Tip: An IdP adapter instance is available for use within an SP connection only after it has been deployed and configured in PingFederate.

You can use attributes returned from the authentication source (an adapter or a connection mapping contract) to fulfill the *attribute contract* with this partner, and/or use them to look up additional attributes in a user-data store. You make this choice on the Assertion Mapping screen (see *Selecting Mapping Method* on page 207).

- Choose an Adapter Instance from the drop-down list and click **Next**.

  (Optional) To override any IdP adapter instance, select the **Override Instance Settings** checkbox (see *Overriding IdP Adapter Instances* on page 205).

  To create or change an adapter instance, as needed, click **Manage Adapter Instances**.

To select an adapter instance:

- Choose an Adapter Instance from the drop-down list and click **Next** to continue.

  (Optional) To override any IdP adapter instance, select the **Override Instance Settings** checkbox (see *Overriding IdP Adapter Instances* on page 205).

  If the adapter instance you need is not available, click **Manage Adapter Instances** to define one or more adapter instances you need for this connection.

  Note that an adapter instance can be mapped only once per connection. However, the same adapter instance may be mapped by multiple connections.

To select a connection mapping contract:

- Choose a Connection Mapping Contract from the drop-down list and click **Next** to continue.

  If the connection mapping you need is not available, click **Manage Connection Mapping Contracts** to define one or more connection mapping contracts you need for this connection.

Note that a connection mapping contract can be mapped only once per connection. You may however map the same contract to multiple connections.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Adapter Instance** or **Connection Mapping Contract** on the Summary screen.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Overriding IdP Adapter Instances

Overrides at the connection level simplify adapter management by allowing you to create a small set of adapter instances that define the base configuration requirements and then overriding settings at the connection level as needed.

You may override any IdP adapter settings at the connection level either during or after connection mapping.

Alternatively, you can override any adapter instance to apply to several connections, see *Hierarchical Plug-in Configurations* on page 21 for more information about adapter overrides.

Note: Any changes to the base adapter instance are propagated to a connection provided the same changes are not overridden for the connection.

- Click **Override Instance Settings**.

  On each of the settings screens, make your changes, and then click **Next**. When you are finished, click **Done** to continue with IdP mapping.

  Note: Override adapter-setting screens are functionally identical to those used for creating a new adapter connection. Refer to the table below to find sections in this manual containing configuration information and procedures.

  The display of some screens listed in the table depends on the type of adapter you are configuring.

  For information about the override adapter-setting screens, depending on the type of setting, use the following table:

Override Screen	**Manual Section**
Adapter	See *Configuring an IdP Adapter* on page 180.
Actions	See *Invoking Adapter Actions* on page 180.
Extended Contract	See *Extending an Adapter Contract* on page 180.
Adapter Attributes	See *Setting Pseudonym Values and Masking* on page 181.

- To remove any adapter connection override, clear the **Override Instance Settings** checkbox, and then complete the rest of the setup.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.

2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Adapter Instance** on the Summary screen.
10. Select the **Override Instance Settings** checkbox.
11. Click **Next**.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Viewing Adapter Settings

Adapter override instance type information.

This screen is view only. This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Configuring an IdP Adapter* on page 180.

Overriding IdP Adapter Settings

- If you want to override any settings on this screen, select the override checkbox related to the field(s) you want to modify, make your changes, and then click Next.

  This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Configuring an IdP Adapter* on page 180.

Overriding Extended Contracts

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Extending an Adapter Contract* on page 180.

Overriding Adapter Actions

This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Invoking Adapter Actions* on page 180.

Overriding IdP Adapter Attributes

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Setting Pseudonym Values and Masking* on page 181.

Using the Override Instance Settings Summary Screen

- On the Override Instance Settings Summary screen, click any heading to change your adapter configuration; or click **Done** to continue.

Restricting an Authentication Source to Certain Virtual Server IDs

When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), you have the option to enforce authentication requirements by restricting an authentication source (an adapter or a connection mapping contract) to certain virtual server IDs. This optional setting can be applied to each authentication source added to the connection using virtual server IDs. By default, no restriction is imposed.

To restrict an authentication source to a subset of the available virtual server IDs:

1. Select the **Restrict Virtual Server IDs** checkbox.
2. In the **Allowed Virtual Server IDs** area, select virtual server IDs that you want to allow for this authentication source.
3. Click **Next**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Virtual Server IDs** on the Summary screen.

   Note: The Virtual Server IDs screen is only available for connections using at least one virtual server ID, see *Federation Server Identification*.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Selecting Mapping Method

You can query local user-data stores to help fulfill the *attribute contract*, in conjunction with attribute values supplied by the authentication source (an IdP adapter or a connection mapping contract).

When using data stores, you can use one or more data stores to look up attributes for a single mapping. Alternatively, you can define alternate data stores and a failsafe mapping.

- If you use only the Adapter Contract or Connection Mapping Contract values, then you map values for the attribute contract next (see *Mapping Default Attribute Contract Fulfillment* on page 220).
- If you choose to retrieve additional attributes, then you identify data stores and specify lookup queries next (see *Configuring Attribute Sources and User Lookup* on page 208).

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Mapping Method** on the Summary screen.

   Tip: To determine whether you need to look up additional values, compare the attribute contract against the adapter contract or the connection mapping contract (see *Creating an Attribute Contract* on page 202 and *Authentication Source Mapping* on page 203). If the attribute contract requires more information, determine whether local data stores can supply it. (You can also choose to use text constants or expressions for certain information—see *Mapping Default Attribute Contract Fulfillment* on page 220.)

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Configuring Attribute Sources and User Lookup

Attribute sources are specific data store or directory locations containing information that may be needed for the *attribute contract* (see *Creating an Attribute Contract* on page 202). Attribute sources can be reused across connections to other SP partners.

You can use more than one attribute source when mapping values to the attribute contract:

- Set up search parameters for your data stores, including "fall-through" searches. If any search fails, the next search executes until all searches are exhausted, at which point a configured failsafe mapping executes. If the failsafe mapping is not configured, the SSO transaction fails.

  Note: Queries are executed in the order of Attribute Sources shown. Use the up/down arrows as needed to adjust the order. Note, however, that data can originate from only one source.
- Configure separate data stores to look up attributes for a single mapping. If any search fails to find a user, then the SSO transaction fails.

To configure an attribute source:

- Click **Add Attribute Source** and complete the setup steps (see *Attribute Source Setup* on page 208 next).

To modify an attribute source configuration:

1. Click the attribute source Description link.
2. Click **Save** on the screen you change.

   Note: Depending on what you change, you may need to modify dependent data in subsequent steps, as indicated. Click **Save** or **Done** when either of those options appears.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter or Connection Contract Mapping tab.

   If this step is not listed, then this instance is configured to use values from the authentication source (an adapter or a connection mapping contract) only (see *Selecting Mapping Method* on page 207).

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Attribute Source Setup

For attribute-source setup information, refer to the sections indicated in the following steps.

Note: As you make selections on configuration screens, ensure that you allow enough time for PingFederate to access your data store and populate drop-down lists.

1. See *Selecting a Data Store* on page 209 (next section).
2. See the following sections in this manual, depending on the type of data store:

Data Store Type	Related Manual Section
JDBC	• *Selecting a JDBC Database Table and Columns* on page 210 • *Configuring a Database Filter (WHERE Clause)* on page 211
LDAP	• *Configuring an LDAP Directory Search* on page 212 • *Configuring an LDAP Filter* on page 214
Custom	• *Configuring Custom Source Filters* on page 215 • *Selecting Custom Source Fields* on page 215

3. See *Attribute Contract Fulfillment* on page 215.

Data Store Selection

Data-store configuration is the same for all attribute source and user lookup task flows. The Data Store screen allows you to define data stores to look up attributes. The values extracted are used, for example, to help fulfill attribute contracts, attribute requests, and adapter contracts.

For the appropriate attribute-source setup steps, refer to one of the following help topics:

- Browser SSO (SP Connection) IdP Adapter Mapping (see *Selecting a Data Store* on page 209).
- Attribute Query (SP Connection) User Attribute Mapping (see *Choosing a User-Data Store* on page 229).
- STS (SP Connection) IdP Token Processor Mapping (see *Configuring a Data Store for STS* on page 338).
- IdP Adapter to SP Adapter Mapping (see *Choosing a Data Store (Optional)* on page 116).

Selecting a Data Store

This screen allows you to choose a data store from a previously configured list (see *Managing Data Stores* on page 98). Attribute values extracted from this data store are used to help fulfill the attribute contract or the connection mapping contract contract for this partner (see *Creating an Attribute Contract* on page 202).

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
10. Click the attribute source Description link.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To define an attribute source:

1. Enter an Attribute Source Id to uniquely identify the data source for the mapping.

Note: This field appears only if you are retrieving additional attributes from multiple data stores using one mapping (see *Selecting Mapping Method* on page 207).

2. Use Attribute Source Description to specify an attribute source name that distinguishes this user lookup for the selected data store.

   Note: When using multiple data stores for one mapping, PingFederate appends this description to the data store type in the Source list on the Attribute Contract Fulfillment screen (see *Attribute Contract Fulfillment* on page 215).

3. Choose an Active Data Store and click **Next**.

   A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Selecting a JDBC Database Table and Columns

When you choose to use a database source for attributes, you follow this path through the configuration steps.

On this screen you begin to specify exactly where additional data can be found to complete the attribute contract when you send an assertion to this SP (see *Creating an Attribute Contract* on page 202). Only one table may be used as a source of data for a JDBC lookup.

Important: (**For MySQL users**) To allow for table and column names that may contain spaces, PingFederate inserts double quotes around the names at runtime. To avoid SQL syntax errors resulting from the quotes, add the session variable `sql_mode=ANSI_QUOTES` to the connection string of your JDBC data store instance. For example:

```
jdbc:mysql://myhost.mydomain.com:3306/pf?
sessionVariables=sql_mode=ANSI_QUOTES
```

Alternatively, you can configure the system variable `sql_mode` with the `ANSI_QUOTES` option. For more information, see *http://dev.mysql.com/doc/refman/5.7/en/server-system-variables.html*.

Field Descriptions

Field	Description
Schema	Lists the table structure that stores information within a database. Some databases, such as Oracle, require selection of a specific schema for a JDBC query. Other databases, such as MySQL, do not require selection of a schema.
Table	Displays the table(s) contained in the database. Select the table to retrieve data from the data store.
Columns to return from SELECT	Displays selected columns from the selected tables. Select the columns that are associated with the desired attributes you would like to return from the JDBC query.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).

10. Click the attribute source Description link.
11. Click **Database Table and Columns**.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To select a database table and columns for queries:

1. Choose a Schema file (when applicable) from the drop-down list.
2. Choose a Table from the drop-down list.
3. Choose a name under Columns to Return from Select and click **Add Attribute**.

   Tip: Click **Refresh** if you are updating an existing configuration and changes may have been made to the database.

   Repeat this step for other columns as needed.

   Note: You do not need to add a column here for it to be used as part of a search filter (see *Configuring a Database Filter (WHERE Clause)* on page 211 next). Add only attributes from which you need actual values to pass to the SP.

   Tip: To determine what attributes to look up during a query, click the **View Attribute Contract** link to see what information must be collected (see *Creating an Attribute Contract* on page 202). Then determine what information is coming in from the session lookup adapter (see *Selecting Mapping Method* on page 207). Information not contained in the authentication source (an adapter contract or a connection mapping contract) may be pulled from the data store look-up query.

Configuring a Database Filter (WHERE Clause)

The JDBC `WHERE` clause in PingFederate queries the data table you selected to retrieve a record associated with a particular value (or values) from the assertion. The clause is in the form:

`WHERE` *`column1=value1`* `[AND` *`column2=value2`*`] [O...]`

The left side of the first variable pair uses a column name in the database table you selected (see *Selecting a JDBC Database Table and Columns* on page 210).

The right side generally uses values passed in from your authentication source (an adapter or a connection mapping contract).

Note: If you are retrieving attributes from multiple data stores using one mapping, attributes available from other sources, if previously configured, are listed near the bottom of the screen. For more information on multiple data-store mapping, see *Multiple Data Source Attribute Mapping* on page 25.

You can also apply additional search criteria from your own database, using any other columns from the targeted table.

Tip: Click “**View List of Columns . . .**” to see a list from which to copy and paste.

For more information about `WHERE` clauses, consult your DBMS documentation.

EXAMPLE:

```
userid='${username}'
```

In this example `userid` is the name of a column in the JDBC data store. On the right side, ’`${username}`’ returns the value of the `username` variable from the IdP adapter.

Important: You *must* use the `${}` syntax to retrieve the value of the enclosed variable and use single quotation marks around the `${}` characters.

Field Description

Field	Description
Where	`WHERE` clause statements conditionally select data from a table. Enter the `WHERE` clause statement in the space provided. For example: `WHERE email='clive@company.com'`.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
8. Click the attribute source Description link.
9. Click **Database Filter** from the steps list.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To construct the `WHERE` clause:

1. Enter the statement in the space provided, following the guidelines and example above.

   The initial `WHERE` is optional.
2. Ensure the syntax and variable names are correct.

   When you click **Next**, you will map attribute values returned from the database into the attribute contract (see *Attribute Contract Fulfillment* on page 215).

Configuring an LDAP Directory Search

When you choose to use an LDAP source for attributes, you follow this path through the configuration steps.

On this screen you specify the branch of your LDAP hierarchy where you want PingFederate to look up user data.

Field Descriptions

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. This field is optional if records are located at the LDAP root.
Search Scope	Determines the node depth of the query. Select Subtree, One level or Object.
Root Object Class	The class containing the attributes you want.
Attributes to return from search	A list of attributes added from the drop-down list below. Subject DN is a default attribute, which may be used as the primary user identifier.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

Click **Manage All**, if needed, to see a full list of connections.

3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
10. Click the attribute source Description link.
11. Click **LDAP Directory Search** from the steps list or fill out the appropriate screens and advance to this screen.

    If you have not yet defined an LDAP data store, see *Selecting a Data Store* on page 209.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To select LDAP attributes:

1. Optional: Enter a Base DN.
2. Select a Search Scope.
3. Select a Root Object Class.
4. Under Attributes to return from search, choose an attribute and click **Add Attribute**.

   Note that the attribute Subject DN is always returned by default.

   Note: When connecting to Microsoft Active Directory, if you choose the memberOf attribute, an optional checkbox, Nested Groups, appears on the right. Select this checkbox if you want PingFederate to query for groups the end users belong to directly as well as indirectly through nested group membership (if any) under the Base DN.

   For example, suppose you have three groups under the Base DN, namely Canada, Washington and Seattle. Seattle is a member of Washington. Ana Smith is an end user and a member of Seattle. If the Nested Groups checkbox is selected, when PingFederate queries for Ana's memberOf attribute values, the expected results are Seattle and Washington. (When the Nested Groups checkbox is not selected (the default), the expected result is Seattle.)

   For Oracle Directory Server, choose isMemberOf under Attribute for nested group membership. For more information, see *documentation about isMemberOf from Oracle* (docs.oracle.com/cd/E29127_01/doc.111170/e28967/ismemberof-5dsat.htm).
5. Repeat the last step for other attributes as needed.

   Note: You do not need to add an attribute here for it to be used in a search filter (see *Configuring an LDAP Filter* on page 214). Add only attributes from which you need actual values to pass to the SP.

   Tip: If you need to include tokenGroups as one of the attributes, select Object as the search scope and enter a Base DN matching the Subject DN of the authenticated user—You can use variables from the authentication source (an adapter or a connection mapping contract) or results from the previous lookup in the Base DN to fulfill this requirement.

Specifying Encoding for Binary Directory Attributes

The LDAP Binary Attribute Encoding Types screen appears when a binary attribute is added on the LDAP Directory Search screen. Because binary attribute data cannot be used in an assertion, use this screen to specify which encoding type (Base64, Hex or SID) you want to apply during attribute contract fulfillment.

For example, Microsoft Office 365 uses objectGUID, an immutable Active Directory binary attribute associated with user accounts. Office 365 requires this binary data to be Base64-encoded to correlate provisioned federated user data to Active Directory accounts.

Claims-based authentication with Microsoft Outlook Web App and Exchange admin center (EAC) is another example. It requires tokenGroups (another binary attribute in Active Directory) to be SID-encoded.

Note: Attributes are specified as binary when configuring an LDAP connection (see *Specifying LDAP Binary Attributes* on page 105).

To select an attribute encoding type:

- Select the type of attribute encoding you want to apply for each attribute and click **Next**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
10. Click the attribute source Description link.
11. Click **LDAP Binary Attribute Encoding Types** from the steps list.

Configuring an LDAP Filter

The LDAP filter queries the data you selected to retrieve a record associated with a particular value (or values) from the user's session. The filter is in the form:

```
(attribute=${value}).
```

The left-side variable is an attribute you selected earlier (see *Configuring an LDAP Directory Search* on page 212).

The right side generally uses values passed in from your authentication source (an adapter or a connection mapping contract).

Note: If you are retrieving attributes from multiple data stores using one mapping, attributes available from other sources, if previously configured, are listed near the bottom of the screen. For more information on multiple data-store mapping, see *Multiple Data Source Attribute Mapping* on page 25.

You can also apply additional search criteria from your data store, using any other attributes from the targeted object classes.

Tip: Click "**View List of Available LDAP Attributes**" for a list from which you can copy and paste.

For general information about search filters, consult your LDAP documentation.

Field Descriptions

Field	Description
Filter	Narrows a search to locate requested data by either including or excluding specific records. An LDAP filter includes the attributes in the search and the value or range of values that the search is attempting to match. Searches are conducted by using three

Field	Description
	components: 1) at least one attribute (attribute data type) to search on, 2) a search filter operator that will determine what to match, and 3) the value of the attribute being sought. Searches must have at least one of each of these three components.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
10. Click the attribute source Description link.
11. Click **LDAP Filter** from the steps list.

    If you have not yet defined an LDAP data store, see *Selecting a Data Store* on page 209.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.

   Note: If you used an anonymous binding to create this LDAP connection, your access might be restricted (see *Configuring an LDAP Connection* on page 102).
2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Configuring Custom Source Filters

When you choose to use a custom source for attributes, you follow this path through the configuration steps.

On this screen you specify a filter, or lookup query, for your custom data source. This screen display and the syntax of the filter depends on your developer's implementation of the custom source SDK.

Selecting Custom Source Fields

On the Configure Custom Source Fields screen, you can choose from among the fields shown to map to the *attribute contract*. These choices are supplied by the driver implementation. Select only those needed to fulfill the attribute contract for this partner connection.

Attribute Contract Fulfillment

The last step in configuring an attribute source is to map values into the attribute contract (see *Creating an Attribute Contract* on page 202). These are the values included in assertions sent to this SP (provided the information is found in this attribute source).

You map attributes on the Attribute Contract Fulfillment screen.

Note: This is an example screen. The screen presented may look and behave differently depending on how you are mapping assertions (see *Selecting Mapping Method* on page 207).

Map each attribute to fulfill the Attribute Contract from one of these Sources:

- Adapter or Connection Mapping Contract (the authentication source)

  Values are returned from the authentication source. When you make this selection, the associated Value drop-down list is populated by the authentication source (an adapter or a connection mapping contract).

  For example, you might choose the adapter attribute username to map to `SAML_SUBJECT`.
- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- LDAP/JDBC/Custom

  Note: PingFederate appends a description in parentheses for data stores of the same type (see *Selecting a Data Store* on page 209).

  Values are returned from your attribute source. When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes you identified for this Attribute Source (see *Configuring an LDAP Directory Search* on page 212, *Selecting a JDBC Database Table and Columns* on page 210, or *Configuring Custom Source Filters* on page 215).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the authentication source (an adapter or a connection mapping contract), using the `${`*`attribute`*`}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.`*`attr-source-id.attribute`*`}`

  where *`attr-source-id`* is the Attribute Source Id value (see *Selecting a Data Store* on page 209) and `attribute` is any of the data store attributes you select.

  When using alternate data stores and/or a failsafe mapping, the Attribute Source Id field is not presented. Use the following syntax in this instance:

  `${ds.`*`attribute`*`}`

  where *`attribute`* is any of the data store attributes you select.

  Tip: Two other variables are also available: `${SAML_SUBJECT}` and `${TargetResource}`. `SAML_SUBJECT` is the initiating user (or other entity). `TargetResource` is a reference to the protected application or other resource for which the user requested SSO access; this variable is available only if specified as a query parameter for the relevant PingFederate endpoint (either as

`TargetResource` for SAML 2.0 or `TARGET` for SAML 1.x—see *Application Endpoints* on page 385).

There are a variety of reasons why you might hard code a text value.

For example, if your SP's Web application provides a service based on your company's name, you might provide that attribute value as a constant.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Sources & User Lookup** under the IdP Adapter Mapping or Connection Mapping Contract tab.

   If this step is not shown, you have elected not to look up attributes in data stores (see *Selecting Mapping Method* on page 207).
10. Click the attribute source Description link.
11. Click **Attribute Contract Fulfillment** from the steps list.

    (If you have not yet defined a data store, see *Selecting a Data Store* on page 209).

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

To map attributes:

1. Choose a Source for each Target attribute.

   See *Map each attribute to fulfill the Attribute Contract from one of these Sources:* above.
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Next**.

Specifying Issuance Criteria (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether to issue an assertion for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can SSO to protected resources.

Note: This screen does not appear if you chose to use data stores with the failsafe mapping option (see *Selecting Mapping Method* on page 207).

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Adapter or Connection Mapping Contract – Select to access attributes from the authentication source.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

- LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

  Note: PingFederate appends a description in parentheses for data stores of the same type (see *Selecting a Data Store* on page 209)

- Mapped Attributes – Select to access the required attributes.

2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).

5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Error results are handled differently for SP-initiated and IdP-initiated SSO:

   SP-Intiated SSO

   - **SAML** – The Error Result field is used by the `StatusMessage` element in the response to the SP.
   - **Template (WS-Federation)** – The Error Result field is used by the variable `$errorDetail in the sourceid-wsfed-idp-exception-template.html` template (for more information on this and other user-facing templates, see *Customizing User-Facing Screens* on page 76).

   IdP-initiated SSO

   - **Redirect** – When an `InErrorResource` URL is provided., the value of the Error Result field is used by an `ErrorDetail` query parameter in the redirect URL.
   - **Template** – When an `InErrorResource` URL is not provided, the value of the Error Result field is used by the variable `$errorDetail` in the `idp.sso.error.page.template.html` template (for more information on this and other user-facing templates, see *Customizing User-Facing Screens* on page 76).

   Note: Using an error code in the Error Result field allows the error template or a Web application to process the error result in a variety of ways—for example, a redirect to another page or e-mail to an administrator.

   If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.

6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.

8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

   Important: When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), consider using an OGNL expression to verify the virtual server ID in conjunction with other conditions, such as group membership information, to protect against unauthorized access (see *Expression Examples* on page 430).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.

- Click **Add**. Continue to add expressions, as needed.
- Click the **Test** link to input values and test the resulting output for the expression.

Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Attribute Source Summary Screen

When you have finished configuring Attribute Sources and User Lookup, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you are finished, click **Done** to continue with the rest of the configuration. If you are editing an existing connection, click **Done** on successive screens until you reach the Assertion Creation screen and then click **Save**.

Specifying a Failsafe Attribute Source

When a data store is configured and the attribute mappings under Attribute Sources & User Lookup fail to complete the *attribute contract*, you can choose to configure a set of "failsafe" Attribute Contract Fulfillment mappings. (For example, you might configure a set of attributes to identify the SSO subject as a "guest" user at the SP.) The failsafe mapping is used instead of the mapping configured with the data-store setup.

Note: This screen does not appear if you chose to retrieve attributes from multiple data stores using a single mapping (see *Selecting Mapping Method* on page 207).

Important: The attribute contract is fulfilled using either the mapping configured under Attribute Sources & User Lookup or the failsafe mapping, not both. In other words, you cannot use the failsafe mapping to fill in missing attributes when some are found via the data-store mapping setup but others are not.

The failsafe mapping is used only when *all* of the mappings configured in the data-store setup fail to return values for any reason. If any mapping succeeds (an attribute mapped to text, for example), failover does not occur.

Alternatively, you can have PingFederate stop the SSO transaction. This choice depends on your agreement with the SP.

Note: If you chose to have PingFederate stop the SSO transaction, the Attribute Contract Fulfillment screen is not presented.

To specify whether to use a failsafe attribute source:

- Make the relevant selection to use either a default set of attributes or to terminate the SSO, and then click **Next**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.

6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Failsafe Attribute Source** on the Summary screen.

   This step appears only if you chose to use alternate data stores and/or a failsafe mapping when retrieving attributes (see *Selecting Mapping Method* on page 207).

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Mapping Default Attribute Contract Fulfillment

Fulfillment of the *attribute contract* must be specified whether or not data sources are used. You accomplish this on the Attribute Contract Fulfillment screen, either by choosing to configure default mappings after setting up attribute sources (see *Attribute Contract Fulfillment* on page 215) or if you choose not to set up attribute sources (see *Selecting Mapping Method* on page 207).

Map each attribute to fulfill the Attribute Contract from one of these Sources:

- Adapter or Connection Mapping Contract (the authentication source)

  Values are returned from the authentication source. When you make this selection, the associated Value drop-down list is populated by the authentication source (an adapter or a connection mapping contract).

  For example, you might choose the adapter attribute username to map to `SAML_SUBJECT`.
- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the authentication source (an adapter or a connection mapping contract), using the `${attribute}` syntax.

  Tip: Two other variables are also available: `${SAML_SUBJECT}` and `${TargetResource}`. `SAML_SUBJECT` is the initiating user (or other entity). `TargetResource` is a reference to the protected application or other resource for which the user requested SSO access; this variable is available only if specified as a query parameter for the relevant PingFederate endpoint (either as `TargetResource` for SAML 2.0 or TARGET for SAML 1.x—see *Application Endpoints* on page 385).

To map attributes:

1. Choose a Source for each Target attribute (see descriptions of each Source under *Map each attribute to fulfill the Attribute Contract from one of these Sources:* above).
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Next**.

To reach this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Assertion Creation** under the Browser SSO tab.
6. Click **Configure Assertion Creation**.
7. Click **Authentication Source Mapping** on the Summary screen.
8. Click the authentication source name.
9. Click **Attribute Contract Fulfillment** on the Summary screen.

   If you are using data stores for attribute mapping and this step does not appear, see *Specifying a Failsafe Attribute Source* on page 219.

Note: For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), click **JWT Creation** and **Configure JWT Creation** in steps 4 and 5, respectively.

Using the Authentication Source Mapping Summary Screen

When you have finished adding a new or modifying an existing instance of an IdP Adapter or a connection mapping contract, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing configuration, click **Done**; if you want to keep your changes, click **Save** when you reach the Browser SSO screen.

Using the Assertion Creation Summary Screen

- On the Assertion Creation Summary screen, click any heading to change the configuration; or click **Done** to continue.

  If you are editing an existing configuration, be sure to click Save if you are finished.

  Note: The same steps apply to WS-Federation connections using JWT (see *Choosing a Connection Type* on page 194) in the JWT Creation Summary screen.

Configuring Protocol Settings

The Protocol Settings screen provides the launching point for configuring *bindings*, partner endpoints, and other settings needed for the selected SAML profiles (if you are using SAML 2.0—see *Choosing Profiles (SAML 2.0)* on page 198). The screen also displays configured information.

(For WS-Federation, the configuration of bindings is not applicable.)

To configure Protocol Settings, you need to know:

- For SSO profiles, the URL(s) of your SP's *Assertion Consumer Service*(s)
- For SLO profiles, the URL(s) of your SP's *Single Logout Service*(s)
- When artifact is an allowable inbound binding, the URL of your SP's *Artifact Resolution Service*(s)
- The transport configurations (*binding*s) that you will use to send and receive data for SSO/SLO connections

- Digital signature policies and certification requirements to which you and your connection partner have agreed
- XML encryption policies to which you and your connection partner have agreed

Setting Assertion Consumer Service URLs (SAML)

At this step for SAML connections, you associate bindings to the *Assertion Consumer Service* (ACS) endpoint(s) where your SP will receive assertions. This configuration applies to either SSO Profile (see *Choosing Profiles (SAML 2.0)* on page 198).

Note: The SP may request that the SAML assertion be sent to one of several URLs, via different bindings. PingFederate uses the defined URL entries on this page to validate the authentication request. However, per SAML specifications, if the request is signed, PingFederate can verify the signature instead; the ACS URL does not necessarily need to be listed here. This is useful for scenarios where an ACS URL might be dynamically generated.

Some federation use cases may require additional customizations in the assertions sent from the PingFederate IdP server to the SP, such as placing well-formed XML in the `<AttributeValue>` element or including the optional `SessionNotOnOrAfter` attribute in the `<AuthnStatement>` element. You can use OGNL expressions to fulfill these use cases.

Field Description

Field	Description
Default (SAML 2.0)	A check in this checkbox indicates that the URL configuration in that row will be used as a default.
Index (SAML 2.0)	Uniquely identifies multiple ACS endpoints.
Binding	The method of transmission: POST or Artifact.
Endpoint URL	A location to which the assertion is sent, according to partner requirements.
MessageType	The type of the message that you need to customize for this connection.
Expression	The OGNL expression to fulfill your use case.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Assertion Consumer Service URL** on the Summary screen.

To define an Endpoint URL:

1. Select the Binding your partner specifies for the Endpoint.
2. Optional: Enter an Index value — 0 or 1, for example.

   For SAML 2.0 the specifications provide for the use of index numbers to identify multiple ACS endpoints. PingFederate supplies this number automatically; however, you can manually set the number to match your partner's configuration as needed.
3. Enter the fully qualified Endpoint URL or just a relative path if you have defined a base URL (see *General Information* on page 195).
4. For SAML 2.0 connections, if this is the default (or only) endpoint, select the checkbox under Default.
5. Click **Add**.

To customize the SAML assertions:

1. Click **Show Advanced Customizations**.

   Note: Expressions must be enabled for the **Show Advanced Customizations** button to appear (see *Enabling and Disabling Expressions* on page 428).
2. Select a Message Type.
3. Enter an OGNL expression to fulfill your use case.

   Note: For more information about Message Type, available variables, and sample OGNL expressions, see *Customizing Assertions and Authentication Requests* on page 433.

Setting a Default Target URL (SAML 1.x)

This URL is used whenever PingFederate receives an SSO request from a local application that does not include the user's target resource URL at the SP site. The URL is required regardless of whether you expect your local application(s) to specify the target—to ensure that the server functions correctly during SSO events.

Field Descriptions

Field	Description
Default Target URL	The URL of the target SP resource.

Defining a Service URL (WS-Federation)

The Service URL is the WS-Federation endpoint of your SP partner where you send SAML assertions and SLO cleanup messages. The assertions are transmitted within an RSTR (Request for Security Token Response) message in response to a request for authentication from the SP. SLO cleanup messages are sent to WS-Federation SP partners when the IdP receives a user's SLO request. Such cleanup messages indicate that the user's local session has been terminated.

To protect against session token hijacking, you can specify additional allowed domains and paths in this screen. If the option to validate wreply for SLO is enabled, these additional domains and paths will also be taken into consideration as well (see *Managing Partner Redirect Validation* on page 114).

Some federation use cases may require additional customizations in the assertions sent from the PingFederate IdP server to the SP. You can use OGNL expressions to fulfill these use cases.

To define a service URL:

- Enter the fully qualified URL or just the relative path if you have defined a base URL (see *General Information* on page 195). You must include the initial slash if you are entering only a relative path.

To specify additional allowed domains and paths:

1. Indicate whether to require HTTPS.

   Important: This selection is recommended to ensure that the validation will always prevent message interception for this type of potential attack, under all conceivable permutations.
2. Enter the expected domain or IP address under Valid Domain Name.

   Use the domain only, without qualifiers. For example:

   `company.com`

   Using an initial wildcard and period for a domain name will cover multiple subdomains. For example: `*.company.com`

   covers `hr.company.com` or `email.company.com`.

   (Optional) Enter the exact path of the resource (case-sensitive) under Valid Path. Starts with a forward slash, without any wildcard characters in the path. If left blank, any path (under the specified domain or IP address) is allowed. For example:

`/app/Consumer.jsp`

allows `/app/Consumer.jsp` but rejects `/app/consumer.jsp`.

Tip: You can also enter multiple query parameters with or without a fragment.

For example: `/app/Consumer.jsp?area=West&team=IT#ref1001`

matches `/app/Consumer.jsp?area=West&team=IT#ref1001` but not `/app/Consumer.jsp?area=East&team=IT#ref1001`

(Optional) Select the Allow Any Query / Fragment checkbox if you want to allow any query parameters or fragment in the resource.

Note: When selected, no query parameter and/or fragment is allowed in the path.

Click **Add**.

3. Repeat the previous step to add additional entries as needed.
4. Click **Save**.

To customize the assertions:

1. Click **Show Advanced Customizations**.

   Note: Expressions must be enabled for the **Show Advanced Customizations** button to appear (see *Enabling and Disabling Expressions* on page 428).
2. Select a Message Type.
3. Enter an OGNL expression to fulfill your use case.

   Note: For more information about Message Type, available variables, and sample OGNL expressions, see *Customizing Assertions and Authentication Requests* on page 433.

Specifying SLO Service URLs (SAML 2.0)

At this step you associate bindings to the endpoints where your SP receives logout requests when SLO is initiated at your site and where you send SLO responses when you receive SLO requests from the SP.

This step applies only to SAML 2.0 connections when you select either SLO profile (see *Configuring IdP-Initiated SLO* on page 199 or *Configuring SP-Initiated SLO* on page 199).

Field Descriptions

Field	Description
Binding	The method of transmission: POST, Artifact, Redirect, or SOAP.
Endpoint URL	A location to which SLO logout request messages are sent, according to SP requirements.
Response URL	(Optional) A location to which SLO logout response messages are sent according to SP requirements. When omitted, the PingFederate IdP server sends logout responses to the Endpoint URL.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.

7. Click **SLO Service** URLs on the Summary screen.

To add a URL:

1. Select the Binding type.
2. Enter the fully qualified URL (or the relative path, if you have specified a base URL—see *General Information* on page 195).
3. Optional: Enter the Response URL.
4. Click **Add**.

To edit an endpoint:

1. Click **Edit** under Action for the endpoint.
2. Make your change and click **Update**.

To delete an entry:

- Click **Delete** under Action for the endpoint.

Choosing Allowable SAML Bindings (SAML 2.0)

At this step for SAML 2.0 connections, you select the *binding*(s) that your SP partner will use to send SAML authentication requests or SLO messages.

This configuration applies to SP-initiated SSO and to either SLO profile.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Allowable SAML Bindings** on the Summary screen.

Setting an Artifact Lifetime (SAML)

When you send an artifact to your SP's Assertion Consumer Service or SLO service (for SAML 2.0), an element in the message indicates how long it should be considered valid.

You can change the default value per your requirements, if needed. Also consider synchronizing clocks between your server and your partner's SAML gateway server. If clocks are not synchronized, you might need to set the artifact lifetime to a higher value.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Artifact Lifetime** on the Summary screen.

   This step appears only if you have selected the artifact binding for either an SSO or SLO Service (under SAML 2.0) at the SP site.

Specifying Artifact Resolver Locations (SAML 2.0)

This endpoint or group of endpoints is where your server will send back-channel requests to resolve *artifacts* received from your partner. The locations are also known collectively under SAML specifications as the *Artifact Resolution Service*.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Artifact Resolver Locations** on the Summary screen.

   If this step does not appear, you do not have Artifact selected under **Allowable SAML Bindings**.

To configure the Artifact Resolver Location(s):

1. Enter a URL on the Artifact Resolver Locations screen and click **Add**.

   The URL must be fully qualified (defining protocol, host, and port) unless you have entered a base URL (see *General Information* on page 195).

   Repeat this step if your SP supports multiple services. The SAML 2.0 specifications permit multiple artifact resolution services through the use of Index numbers, which PingFederate automatically supplies when you add a service. Alternatively, if needed per partner specifications, you may assign these index numbers manually.

   Note: When specifying multiple artifact resolution endpoints, each endpoint must share the same transport protocol. That is, if one endpoint uses HTTP, then all must use HTTP. Similarly, if one endpoint uses HTTPS, then all must use HTTPS.
2. Click **Next**.

Defining Signature Policy

The Signature Policy screen provides options controlling how digital signatures are used for SSO Internet messaging. The choices made on this screen depend on your partner agreement (see *Digital Signing Policy Coordination* on page 29).

Digital signing is required for SAML Response messages sent from your site via POST (or Redirect for SAML 2.0). Optionally, SSO authentication requests from the SP (SP-initiated SSO) may also be signed to enforce security. (This option appears only for SAML 2.0 connections and only if you have enabled SP-initiated SSO using the POST or redirect bindings.)

The assertions inside SAML Responses may be also be signed. When you make this choice, only the assertion portion of the Response is signed, not the complete Response. (This is the only option that appears for SAML 1.x connections.)

- Make your selection(s) and click **Next**, or just click **Next** if no additional security is required.

Configuring XML Encryption Policy (for SAML 2.0)

For SAML 2.0 configurations, in addition to using signed assertions to ensure authenticity, you and your partner may also agree to encrypt all or part of an assertion to improve privacy. This feature is commonly used if the assertion might pass through an intermediary (such as a user’s browser) and HTTPS is not used.

If the name identifier (or `SAML_SUBJECT`) of an assertion is encrypted, you and your partner may also want to encrypt the identifier in subsequent single-logout messages (if you are using an SLO profile).

Note that “The entire assertion” selection on the Encryption Policy screen includes the `SAML_SUBJECT` and all attributes.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the SP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** under the Browser SSO tab.
6. Click **Configure Protocol Settings**.
7. Click **Encryption Policy** on the Summary screen.

To define XML encryption:

1. Choose whether you want to encrypt the entire assertion or one or more attributes.
2. If you are encrypting the name-identifier attribute, use the checkboxes near the bottom of the screen to indicate whether you will also encrypt this attribute in outbound SLO messages and/or allow its encryption for inbound messages.
3. Click **Next** or **Done**.

To disable previously configured XML encryption selections:

1. Select **None** and then **Done**.
2. Click **Save** on the Protocol Settings screen.

Editing and Saving Protocol Settings

On the Summary screen, you can review or edit your Protocol Settings.

Important: When you finish editing existing settings, be sure to click **Done** on the Summary screen and then **Save** on the Protocol Settings screen. For a new connection, click **Done** and then click **Next** on the Protocol Settings screen. Save the entire connection on the Activation & Summary screen (see *Editing and Activating a Connection* on page 248).

To reconfigure saved settings:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make dependent or other changes, do so and continue by clicking **Done** until you reach the Protocol Settings screen.
3. Click **Save** on the Protocol Settings screen.

Editing and Saving Browser SSO Settings

On the Summary screen for Browser SSO, you can review or edit your SSO configuration.

Important: When you finish editing existing settings, be sure to click **Done** on the Summary screen and then **Save** on the Browser SSO screen. For a new connection, click **Done** and then click **Next** on the Browser SSO screen. Save the entire connection on the Activation & Summary screen (see *Editing and Activating a Connection* on page 248).

To reconfigure saved settings:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

If you need to make dependent or other changes, do so and continue by clicking **Done** until you reach the Browser SSO screen.

3. Click **Save** on the Browser SSO screen.

Configuring the Attribute Query Profile

At the Attribute Query step you configure your connection to respond to requests for user attributes from your partner SP, if you have chosen this option (see *Choosing Connection Options* on page 195). Attribute queries are not dependent on single sign-on but may be used independently or in conjunction with Browser SSO or provisioning to provide flexibility in how a user authenticates with SP applications (see *Attribute Query and XASP* in the “Supported Standards” chapter of *Getting Started*).

- To continue, click **Configure Attribute Query Profile**.

Defining Retrievable Attributes

On this screen you specify the user attributes you and your partner have agreed to allow in an attribute query transaction. Note that the SP may not necessarily request all of these attributes in each attribute-query request. Instead, the list simply limits the request to a subset of these attributes.

To add an attribute:

- Enter the attribute name in the text box and click **Add**.

To edit an attribute name:

1. Click **Edit** and make your change.
2. Click **Update**.

To delete an attribute:

- Click **Delete**.

Configuring Attribute Lookup

Attribute sources are specific data store or directory locations containing information that may be returned to the SP in response to an attribute request.

This portion of the attribute query configuration allows you to configure one or more data stores to look up attributes and to set up search parameters.

To configure an attribute source:

- Click **Add Attribute Source** and complete the setup steps (see *Choosing a User-Data Store* on page 229 next).

To modify an attribute source configuration:

1. Click the attribute source Description link.
2. Click **Save** on the screen you change.

Note: Depending on what you change, you may need to modify dependent data in subsequent steps, as indicated. Click **Save** or **Done** when either of those options appears.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click**Manage All**, if needed, to see a full list of connections.
3. Click **Attribute Query** under the SP Connection tab.
4. Click **Configure Attribute Query Profile**.
5. Click **Attribute Source & User Lookup** on the Summary screen.

Choosing a User-Data Store

Because no user authentication is performed in response to an attribute-query request, you cannot use attributes drawn from the user's session (see *Authentication Source Mapping* on page 203). Therefore, you must identify the data stores that contain the attributes on your system.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Attribute Query** under the SP Connection tab.
4. Click **Configure Attribute Query Profile**.
5. Click **Attribute Sources & User Lookup** on the Summary screen.
6. Click an attribute source Description link.

To define an attribute source:

1. Use Attribute Source Id to uniquely identify the data source for the mapping.
2. Use Attribute Source Description to specify an attribute source name that distinguishes this user lookup for the selected data store.

   Note: PingFederate appends this description to the data store type in the Source list on the Attribute Mapping Fulfillment screen.
3. Choose an Active Data Store and click **Next**.

   A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Configuring Data Store Lookup

The process of configuring PingFederate to look up attributes in a data store for attribute-query responses is similar to that used for SSO Attribute Sources and User Lookup. For detailed information, see the step-by-step procedures in the sections indicated below.

If you use a JDBC data store, see:

- *Selecting a JDBC Database Table and Columns* on page 210
- *Configuring a Database Filter (WHERE Clause)* on page 211

If you use an LDAP data store, see:

- *Configuring an LDAP Directory Search* on page 212
- *Configuring an LDAP Filter* on page 214

If you use a Custom data store, see:

- *Configuring Custom Source Filters* on page 215
- *Selecting Custom Source Fields* on page 215

Note that the screen text may differ slightly. In addition, note that the variable `${SAML_SUBJECT}` is available on the Database or LDAP Filter screens to retrieve the subject identifier from the Attribute Query for use in data-store query statements.

Important: When attribute queries are sent using XASP, use the variable `${SubjectDN}`—rather than `${SAML_SUBJECT}`—to retrieve the subject identifier. You may also use any of these DN-parsing variables: `${CN}`, `${OU}`, `${O}`, `${L}`, `${S}`, `${C}`, and `${DC}`.

If more than one value exists for any of the parsing variables, then they are enumerated. For example, if the Subject DN is:

```
cn=John Smith,ou=service,ou=employee
```

then you could use any of these elements in your filter qualifier:

```
${SubjectDN}=cn=John Smith,ou=service,ou=employee
```

```
${ou}=service
```

```
${ou1}=employee
```

For more information about XASP, see *Attribute Query and XASP* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide.

Attribute Mapping Fulfillment

The last step in configuring an attribute source is to map values into the assertion to be sent in response to an attribute query.

You map attributes on the Attribute Mapping Fulfillment screen.

Map each attribute into the assertion from one of these Sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Important: If you are configuring an SP connection to bridge one or more identity providers to a service provider, consider mapping the original issuer of the assertions into an attribute by selecting `Context` as the **Source** and `Authenticating Authority` as the **Value**. This is especially important when bridging multiple identity providers to one service provider—the service provider should take the information about the original issuer into consideration before granting access to protected resources.

  See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- LDAP/JDBC/Custom

  Values are returned from your attribute source. When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes you identified for this Attribute Source.

  Note: PingFederate appends a description in parentheses for each data store lookup (see *Choosing a User-Data Store* on page 229).

- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

- Text

  This can be text only, or you can mix text with references to any of the values from your user-data store using this syntax:

  ```
  ${ds.attr-source-id.attribute}
  ```

  where `attr-source-id` is the Attribute Source Id value (see *Choosing a User-Data Store* on page 229) and `attribute` is any of the data store attributes you have selected.

  There are a variety of reasons why you might hard code a text value. For example, if your SP's Web application provides a service based on your company's name, you might provide that attribute value as a constant.

Defining Issuance Criteria (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether to issue an attribute query response (see *About Token Authorization* on page 27). This extension of token authorization can be used to restrict who can access protected resources.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: For the HTTP Request selection, because it is retrieved as an object rather than text, you must generally use OGNL expressions for evaluation. Click **Show Advanced Criteria** to use expression mapping. (If that button is not displayed on the screen, expressions are not enabled—see *Enabling and Disabling Expressions* on page 428). For syntax and examples, see sections under *Constructing Expressions* on page 429.)
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source

     Note: PingFederate appends a description in parentheses for each data store lookup (see *Choosing a User-Data Store* on page 229).
   - Mapped Attributes – Select to access retrievable attributes defined for the attribute query profile.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   The Error Result field is used by the `StatusMessage` element in the SAML response to the SP.

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, the user sees a default ACCESS_DENIED error result at runtime if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the Show Advanced Criteria button to appear (see *Enabling and Disabling Expressions* on page 428).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information)

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.

- Click **Add**. Continue to add expressions, as needed.
- Click the **Test** link to input values and test the resulting output for the expression.

Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Specifying Security Policy

This screen allows you to specify the digital signing and encryption policy to which you and your partner have agreed. These selections will trigger requirements for setting up Credentials (see *Configuring Credentials* on page 232).

To configure attribute-query security policy for this partner:

- Check or clear the checkboxes and click **Next** or **Done**.

Editing and Saving Attribute Query Configurations

To reconfigure saved profiles:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Attribute Query screen.
3. Click **Save** on the Attribute Query screen.

Configuring Credentials

The Credentials screen presents a list of possible security requirements you might need, depending on the federation protocol you are using and the choices you have made.

Your connection configuration may involve any or all of the following:

- *Configuring Back-Channel Authentication* on page 232
- *Configuring Digital Signature Settings* on page 234
- *Configuring Signature Verification Settings* on page 236
- *Selecting an Encryption Certificate (SAML)* on page 238
- *Selecting a Decryption Key (SAML)* on page 238

- To continue, click **Configure Credentials**.

Configuring Back-Channel Authentication

When you configure a profile for *inbound* SAML messages via the artifact binding, you must specify authentication information for *outbound* artifact resolution requests over *SOAP* to your SP's *Artifact Resolution Service*.

Similarly, if you configure outbound Assertion Consumer Service or SLO Service URLs to use the artifact binding, then you must configure SOAP authentication requirements for inbound messages such as artifact resolution requests. If you configure outbound SLO Service URLs to use the SOAP binding, then you must also configure authentication requirements for outbound SOAP messages.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Back-Channel Authentication** on the Summary screen.

   If this step is not present, then it is not applicable to your configuration—you have not configured any profiles that use an artifact or SOAP binding or allowed artifact as an inbound SAML binding.

To configure back-channel authentication requirements for sending SOAP messages:

1. On the Back-Channel Authentication screen, click the **Configure** link to the right of the list of messages to be *sent* to your partner.
2. Make one or more selections on the Outbound SOAP Authentication Type screen:

   - HTTP Basic — you enter SOAP Basic credentials on a later screen.
   - SSL Client Certificate — you specify the certificate on a later screen.

     This option is available only if you specify an endpoint that uses SSL.
   - Use Digital Signatures (Browser SSO profile only) — you sign the message.

     You are asked to select a signing certificate on a later screen.

   For SAML 2.0, these options may be used in any combination or independently. For SAML 1.x, you must use either Basic or SSL authentication; digital signing may be added to ensure message integrity.

   By default, PingFederate validates your partner's SSL server certificate— verifying that the certificate chain is rooted by a trusted Certificate Authority and that the hostname matches the certificate's Common Name. Clear the associated checkbox if you do not want this validation to occur.
3. Click **Next**.
4. If you chose HTTP Basic at *Step 2*, enter the SOAP Username and Password to use for this partner under Basic SOAP Authentication.

   You must obtain these credentials from your partner.
5. If you are using an SSL certificate, select the certificate under SSL Authentication Certificate and click **Next**.

   If you have not yet created or imported the client SSL certificate you need into PingFederate, click **Manage Certificates** (see *SSL Client Keys and Certificates* on page 164). You need to export the certificate (only) and send it your partner.
6. On the Summary screen, click **Done**.

To configure back-channel authentication requirements for receiving SOAP messages:

1. On the Back-Channel Authentication screen, click the **Configure** link to the right of the list of messages to be *received* from your partner.
2. Select one or more options on the Inbound Authentication Type screen:

   - HTTP Basic — Enter the logon username and password your partner uses on the next screen.
   - SSL Certificate — Specify certificate verification information on a later screen.
   - Use Digital Signatures (Browser SSO profile only). . . — Incoming messages must be signed.
   - Require SSL — When selected, incoming HTTP transmissions must use a secure channel.

     You are asked to select a signature verification certificate on a later screen.

     For SAML 2.0, use these options in any combination or independently. For SAML 1.x, you must use either Basic or SSL authentication; add digital signing to ensure message integrity.
3. Click **Next**.
4. If you chose HTTP Basic at *Step 2*, enter the Username and Password under Basic Authentication (Inbound).

> **Important:** If you are configuring more than one connection that uses the artifact or HTTP profile, you must ensure that the Username is unique for each connection.

5. If you are using an SSL certificate, select Anchored or Unanchored under Certificate Verification Method.

    - Anchored — The certificate must be signed by a trusted Certificate Authority. Optionally, you may also restrict the issuer to a specific Trusted CA to mitigate potential man-in-the-middle attacks as well as to provide a means to isolate certificates used by different connections. The CA's certificate must be imported into the PingFederate Trusted CA store (see *Trusted Certificate Authorities* on page 161).
    - Unanchored — The certificate is self-signed or you want to trust a specified certificate.

    > **Note:** When anchored certificates are used between partners, certificates may be changed without sending the update to your partner. If the certificate is unanchored, any changes must be promulgated.

6. Click **Next**.
7. If you chose anchored SSL certificate verification at *Step 5* , enter the Subject DN and click **Next**.

    > **Tip:** If you have not yet defined the certificate in PingFederate or you do not know the DN, return to the previous screen and select Unanchored. Then click **Next** and click **Manage Certificates** on the SSL Verification Certificate screen to import the certificate, if needed, or to view its DN.

8. If you chose unanchored SSL certificate verification at *Step 5*, select the certificate to use for validating the SSL connection.

    If you have not yet imported the certificate into PingFederate, click **Manage Certificates**.

9. Click **Next**.
10. On the Summary screen, click **Done**.

Configuring Digital Signature Settings

This step defines the private key/certificate that you will use to sign assertions and SLO messages for this SP.

> **Note:** Digital signing is required for SSO and SLO messages sent via POST or redirect bindings. Signing is not always required for profiles using the artifact or SOAP bindings.

The step applies to both IdP- and SP-initiated SSO and to either SLO profile (see *Choosing Profiles (SAML 2.0)* on page 198) whenever *outbound* POST or redirect bindings are used. The step also is required for WS-Trust STS and for SSO if you chose to sign the SAML assertion, SAML response, or artifact resolution messages (see *Configuring Back-Channel Authentication* on page 232).

> **Note:** This step does not appear if a connection configuration does not require it.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

    Click **Manage All**, if needed, to see a full list of connections.

3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Digital Signature Settings** on the Summary screen.

To specify a certificate:

1. Select the certificate from the drop-down list.

    If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).

    > **Note:** For WS-Federation connections using JSON Web Tokens (see *Choosing a Connection Type* on page 194), only EC and RSA certificates are supported. Furthermore, RSA certificates must have a minimum key size of 2,048 bits. The drop-down list filters out certificates not meeting these requirements for your convenience.

2. Optional: If you have agreed to send your public key with the SAML message, select the checkbox to include the certificate. To include the raw key in the signature as well, select the "**Include the raw key …**" checkbox.

   Note: For WS-Trust STS connections, by default the `<KeyInfo>` element in the SAML token includes a reference to the certificate rather than the full certificate unless this box is checked.

   Note: This step is not applicable to WS-Federation connections using JSON Web Tokens.

3. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.

Configuring Automatic Certificate Rotation

After establishing a managed SP connection to PingOne, PingFederate automatically rotates the connection's signing certificate days ahead of its expiry and uploads the new signing certificate to PingOne. The number of days is configurable by adjusting the **Rotation Buffer** value in the Certificate Rotation Settings screen.

In a clustered PingFederate environment, this task is performed by the console node. When the new signing certificate is ready, the administrative console displays a message to remind the administrators to use the **Replicate Configuration** process to push the new signing certificate to all engine nodes. When the process completes, PingFederate (the console node) uploads the new signing certificate to PingOne. (For more information about the Replicate Configuration process, see *Replicating Configuration* on page 60.)

If the console node is shutdown, it will create a new signing certificate as long as it is restarted during the rotation window. It is therefore recommended not to tune the **Rotation Buffer** value too low. Optionally, PingFederate can be configured to send reminders weeks ahead of expiry (see *Configuring Runtime Notifications* on page 86).

Note: If you prefer to manually rotate the signing certificate, disable automatic certificate rotation. Note that PingFederate still automatically uploads your new signing certificate to PingOne to maintain SSO continuity through the managed SP connection.

To reach to this screen:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Certificate Rotation Settings** on the Summary screen.

To enable automatic certificate rotation:

1. Select the **Enable Signing Certificate Rotation** checkbox.
2. Optional: Modify settings, as describe below.

Field	Description
Validity (days)	The time during which the certificate is valid. The default is 1095 days (3 years).
Key Size (bites)	The number of bits used in the key. The selections are 1024, 2048 and 4096. The default is 2048.
Signature Algorithm	The signing algorithm of the certificate. The selections are RSA-SHA256, SHA384 and SHA512. The default is RSA-SHA256.
Rotation Buffer (days)	The number of days ahead of expiry that PingFederate creates a new signing certificate and updates PingOne. The default is 90 days.

3. Click **Next**.

To disable automatic certificate rotation:

1. Clear the **Enable Signing Certificate Rotation** checkbox.
2. Click **Next**.

Configuring Signature Verification Settings

Under SAML 2.0 specifications, when your site receives any SAML 2.0 messages via the POST or Redirect bindings, the messages must be digitally signed. Signing is also always required for the SAML 1.x POST binding and for WS-Federation assertions, as well as incoming SAML 1.1 or 2.0 tokens for WS-Trust STS processing.

Depending on your agreement with this SP, SSO assertions, SAML 2.0 artifacts, or SOAP messages might also require signatures.

Whenever signatures are required, PingFederate provides a choice of trust models, including an option to use anchored signature-verification certificates embedded in incoming messages (see *Trust Models*). When this option is chosen in Signature Verification Settings, you must provide the Subject DN for embedded certificates coming from this partner, and the Issuer CA certificate must be part of the PingFederate trusted store (see *Trusted Certificate Authorities* on page 161).

Alternatively, you may choose to use unanchored certificates, in which case you must import your partner's public-key certificate during this configuration (or select it if it is already imported). To prevent any interruption of service due to an expired certificate, you can ask your partner for a new certificate in advance and import it as backup.

- To continue, click **Manage Signature Verification Settings**.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.

Choosing a Trust Model

This screen allows you to choose the Trust Model you want to use for signature verification (see *Trust Models* on page 29).

- Depending on the selection, the next step in this task varies:
  - For **Anchored**, the next step is to enter the Subject DN for your partner's certificate (see the next section, *Anchored Certificates--Specifying a Subject DN* on page 237).

    ⚠ **Important:** If you are using the Redirect binding for SLO, you cannot use anchored certificates because SAML 2.0 does not permit certificates to be included using this transport method.
  - For **Unanchored**, the next step is to import your partner's certificate (see *Selecting Unanchored Certificates* on page 237).

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.

5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.
7. Click **Trust Model** on the Summary screen.

Anchored Certificates--Specifying a Subject DN

When you choose to use an anchored certificate for signature verification, incoming SAML messages must contain the partner's verification certificate (see *Trust Models*). PingFederate verifies that the Issuer DN (if specified) matches that of one of the issuers in the chain, the Issuer CA is trusted and the embedded certificate's Subject DN matches the one specified on this screen. If so, PingFederate uses that certificate to verify the message signature.

To complete the configuration:

1. Enter the Subject DN or extract it from your SP partner's certificate if the certificate is stored on an accessible file system.

   Tip: To extract the Subject DN from a certificate, browse to select your SP partner's public certificate and click **Extract**.
2. Optional: Select the Restrict Issuer checkbox. Enter the Issuer DN or extract it from a certificate if it is stored on an accessible file system.

   Important: We recommend enabling this option to mitigate potential man-in-the-middle attacks as well as to provide a means to isolate certificates used by different connections.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.
7. Click **Certificate Subject DN** on the Summary screen.

Selecting Unanchored Certificates

On the Signature Verification Certificate screen, you identify your partner's imported public certificate and, optionally, a secondary certificate to use when the first expires (see *Trust Models*).

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.
7. Click **Signature Verification Certificate** on the Summary screen.

To specify a verification certificate:

1. Select the certificate from the drop-down list.

If you have not yet imported the certificate into PingFederate, click **Manage Certificates**.

2. Optional: Select a Secondary certificate for backup.

   Use this field if your partner has sent you a new certificate to replace one that is ready to expire. The server will automatically verify against the secondary certificate when the primary one expires.

Using the Summary Screen

- Click any heading to change a setting, or click **Done** if the configuration is complete, then **Done** again on the Signature Verification Settings screen.

  Be sure to click **Save** on the Credentials screen if you are editing an existing connection.

Selecting an Encryption Certificate (SAML)

To enable XML encryption of all or part of an SSO assertion, you must identify the encryption certificate you will use (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

You must also select a certificate if your requirements include encrypting an assertion in response to an attribute query (see *Specifying Security Policy* on page 232).

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Select XML Encryption Certificate**.

   If this step is not present, you have chosen not to encrypt the assertion or the `SAML_SUBJECT` (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

To identify the encryption certificate:

1. Optional: Change the default settings under Block Encryption Algorithm.

   Due to import control restrictions, the standard JRE distribution supports strong but not unlimited encryption. To use the strongest AES encryption, when permissible, download and install the appropriate version of “Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy Files” from the *Oracle download Web site* (`www.oracle.com/technetwork/java/javase/downloads/index.html`).

   For more information about XML block encryption and key transport algorithms, see the “*XML Encryption Syntax and ProcessingW3C Recommendation*” (`www.w3.org/TR/xmlenc-core/`)

   Note: As a Key Transport Algorithm, RSA-v1.5 is disabled for new connections for security reasons. If you are updating an existing connection that uses RSA-v1.5, we recommend changing the selection for increased security.
2. From the drop-down list, select the applicable certificate and click **Next**.

   If the certificate is not in the list, click **Manage Certificates** to import it.

Selecting a Decryption Key (SAML)

If `SAML_SUBJECT` is encrypted, either by itself or as part of a whole assertion, then all references to this name identifier in SLO requests from your partner may also be encrypted (if the connection uses SP-initiated SLO under SAML 2.0).

To enable XML encryption, you must identify a certificate for PingFederate to use to decrypt incoming SLO messages.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click a connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the SP Connection tab.
4. Click **Configure Credentials**.
5. Click **Select XML Decryption Key**.

   If this step is not present, you have chosen not to encrypt the assertion or the SAML_SUBJECT attribute (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

To identify the decryption key:

- From the drop-down list, select the applicable certificate and click **Next**.

  If the certificate is not in the list, click **Manage Certificates** to import it (see *Digital Signing and Decryption Keys and Certificates* on page 166).

Editing and Saving Credential Configurations

From the Summary screen you can review or edit your credentials configuration.

Important: When you finish editing existing settings, you must click **Done** on the Summary screen and then **Save** on the Credentials screen. For a new connection, click **Done** and then click **Next** on the Credentials screen. Save the entire connection on the Activation screen (see *Editing and Activating a Connection* on page 248).

Configuring Outbound Provisioning

PingFederate's Outbound Provisioning (formerly SaaS Provisioning) allows an IdP to create and maintain user accounts at standards-based partner sites using *SCIM* as well as select-proprietary provisioning partner sites that are protocol-enabled (see *Outbound Provisioning for IdPs* on page 33).

Note: This configuration task is presented in the administrative console only when you enable Outbound Provisioning (see *Choosing a Connection Type* on page 194).

- To continue, click **Configure Provisioning**.

Defining a Provisioning Target

Information on the Target screen indicates the provider's Web-service endpoint for provisioning users and, if required, credentials that PingFederate uses for authentication to the provisioning API for the service provider.

Note: The target configuration settings represented in this screen example and described in the procedure below are for the bundled PingFederate provisioning plug-in for SCIM providers. For SaaS Connector targets, please refer to documentation in your add-on distribution package, or *locate user guides online* (documentation.pingidentity.com). For SCIM provisioning to *PingOne*, an administrator can find target information by setting up an Identity Repository and enabling provisioning, or by inspecting an existing setup.

To configure the Target:

Note: First obtain the Users Resource URL from your service provider—for example, https://example.com/v1/Users. If supported by the provider, also obtain the Groups Resource URL—for example, https://example.com/v1/Groups. Also determine whether the provider supports PATCH updates (see *Step 5* below) and/or prefers full distinguished name (DNs) for group provisioning (see *Step 6*).

1. Enter the endpoint for managing users.
2. Optional: Enter the endpoint for managing groups.
3. Select the authentication method the endpoint accepts.

Select **None** if the endpoint does not require authentication.

4. If you select either **Basic Authentication** or **OAuth 2.0 Bearer Token** as the Authentication Method, enter valid credentials (User/Password) for your provider.

   Additionally, if you choose **OAuth 2.0 Bearer Token** as the Authentication Method, in order to support the password grant type, enter valid credentials for Client ID, Client Secret, and Token Endpoint URL.
5. If the SCIM provider does *not* support PATCH updates, clear the associated checkbox.

   For information about PATCH, see the *SCIM* specification (`www.simplecloud.info/specs/draft-scim-api-01.html#edit-resource-with-patch`).
6. Optional: Depending on the target-provider needs, select the option to provision groups by supplying complete LDAP DNs, rather than only Common Names (CNs), to identify groups.

   Some SCIM providers, including *PingOne* (Ping Identity's cloud identity management service), allow administrators to parse full DNs when necessary—for example, in the case of duplicate CNs—to determine group access mapping to specific applications based on other DN elements.
7. Select a Deprovision Method.

   The Deprovision Method options control the mapping to SCIM protocol messages sent to the partner. The deprovisioning is triggered by the user being removed from the monitored local identity store.

   - Delete User removes the user account.
   - Disable User deactivates the user account.
8. Click **Next**.

   Note: For some provisioning plug-ins, when you first enter or change credentials and click **Next**, PingFederate immediately tests connectivity to the target.

Specifying Custom SCIM Attributes

PingFederate supports SCIM attributes in the core schema as well as custom attributes through a schema extension.

Note: Custom attributes are optional. If your use case does not require any additional attributes, click **Next** in the Custom SCIM Attributes screen.

To support custom attributes, you must specify the schema extension and the custom attributes in the connection. There are four attribute types:

- Simple Attributes
- Simple Multi-Valued Attributes
- Complex Attributes
- Complex Multi-Valued Attributes

The following fragment illustrates a SCIM message supporting schema extension `urn:scim:schemas:extension:custom:1.0` with four attributes, one of each attribute type. The table afterward describes the details of each attribute.

```
{
  "userName":"CBrown",
  "active":true,
  "schemas":[
    "urn:scim:schemas:core:1.0",
    "urn:scim:schemas:extension:custom:1.0"
  ],
  ...
  "urn:scim:schemas:extension:custom:1.0":{
    "supervisor":"JSmith",
    "territories":[
      "Montana",
      "Idaho",
      "Wyoming"
    ],
    "options":{
      "quantity":"10000",
      "strike"  :"5.25",
      "first"   :"2017-12-01",
      "last"    :"2025-03-31"
    },
    "tablets":[
      {
        "model" :"8086",
        "serial":"5500-2020-965",
        "type"  :"office"
      },
      {
        "model" :"8088",
        "serial":"5500-2040-151",
        "type"  :"remote"
      }
    ]
  }
}
```

Attribute Name	Attribute Type	Sub-Attributes (Complex)
`supervisor`	Simple	Not Applicable
`territories`	Simple Multi-Valued	Not Applicable
`options`	Complex	`quantity`, `strike`, `first`, and `last`
`tablets`	Complex Multi-Valued	`model`, `serial`, and `type`. **Note:** `type` is a reserved sub-attribute for a complex multi-valued attribute.

Tip: For more information about SCIM and attribute types, see the Web site *www.simplecloud.info*.

To specify a schema extension:

- Specify the URI of the schema extension in the Extension namespace field.

  Tip: The default value is `urn:scim:schemas:extension:custom:1.0`. You can keep this value as long as your partner identifies custom attributes by this URI in its SCIM messages.

To add a custom attribute:

- Enter an attribute name and click **Add**. (Repeat this step to add more custom attributes as needed.)

To delete a custom attribute:

- Click **Delete** next to the custom attribute. (To undo the deletion, click **Undelete**.)

To edit a custom attribute:

- Click **Edit** next to the custom attribute to:
  - Change its attribute name
  - Set it as a simple multi-valued attribute
  - Add sub-attributes to make it a complex attribute
  - Add sub-attributes and set it as a complex multi-valued attribute

  (For more information, see *Editing Custom SCIM Attribute Options* on page 242.)

When you finish editing custom attributes, click **Next** in the Custom SCIM Attributes screen.

Editing Custom SCIM Attribute Options

For the chosen custom attribute, use the Custom SCIM Attribute Options screen to:

- Change its attribute name
- Set it as a simple multi-valued attribute
- Add sub-attributes to make it a complex attribute
- Add sub-attributes and set it as a complex multi-valued attribute

To change the name of the custom attribute:

1. Replace the current value in the Name field.
2. Click **Done**.

To define the custom attribute as a simple multi-valued attribute:

1. Select the **Is Multi-Valued** checkbox.
2. Click **Done**.

To define the custom attribute as a complex attribute:

1. Enter a sub-attribute and click **Add**. (Repeat this step to add more sub-attributes as needed.)

   Tip: Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the name of a sub-attribute. Use the **Delete**/**Undelete** links to remove a sub-attribute or cancel the deletion.
2. Click **Done**.

To define the custom attribute as a complex multi-valued attribute:

1. Enter a sub-attribute and click **Add**. (Repeat this step to add more sub-attributes as needed.)

   Tip: Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the name of a sub-attribute. Use the **Delete**/**Undelete** links to remove a sub-attribute or cancel the deletion.
2. Select the **Is Multi-Valued** checkbox.
3. Specify at least one value under the Types column for `type`, a reserved sub-attribute for a complex multi-valued attribute.

   Tip: Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the `type` value. Use the **Delete**/**Undelete** links to remove a `type` value or cancel the deletion.
4. Click **Done**.

Managing Channels

A provisioning *channel* is a mapping configuration between user attributes contained in a source user store and attributes supported or required by the targeted software-service application. You can have multiple channels to the same target as needed—for example, if your organization has separate LDAP stores (or different nodes in the same store) for various user groups needing SSO access and provisioning to the same domain.

Tip: There can be only one target domain for provisioning per connection (*Defining a Provisioning Target* on page 239). If your organization subscribes to multiple domains for which you need provisioning support, you need a separate SP connection for each domain.

Channels are created and managed from the Manage Channels screen.

To access the Manage Channels screen:

1. In the task headings for a connection, click **Outbound Provisioning**.

   If this task is not present, provisioning is not enabled (see *Choosing Roles and Protocols* on page 92).
2. On the Outbound Provisioning screen, click **Configure Provisioning**.

To configure a new channel:

- Click **Create** and follow the configuration steps.

  Tip: If you are creating a second channel to a vendor, you can copy an existing channel and make the necessary changes.

To copy a channel:

1. Click **Copy** under Action for the channel you want to copy.
2. Enter new General Info for the channel (see *Specifying Channel Information* on page 243).
3. Make any further changes needed for the new channel.

To edit a channel:

- Click the Channel Name link.

To delete a channel:

1. Under Action, click **Delete** for the channel.

   (To undo the deletion, click **Undelete**.)

   Note: The **Delete** function is not available if the channel is active (see *Channel Activation and Summary* on page 248).
2. To confirm the deletion, click **Done** and then **Save** on the Outbound Provisioning screen.

Specifying Channel Information

On the Channel Info screen, specify a unique identifier for the channel.

Tip: Adjust the Max Threads setting as needed to optimize data-transfer performance, particularly if large numbers of records need to be provisioned at the target site.

Identifying the Source Data Store

PingFederate fully supports Active Directory and the Oracle Directory Server as source user repositories for Outbound Provisioning. However, you can use other types of LDAP servers, either identifying them as Generic or registering them with PingFederate (see *Configuring an LDAP Connection* on page 102).

Information from your user-data store is used to supply mapped values for each user attribute required by the service provider (see *Mapping Attributes* on page 246).

- On the Source screen, choose the LDAP store to use for this channel.

  Note: If the correct data store is not listed, then it has not yet been identified to PingFederate; click **Manage Data Stores** to set a connection to a user store (see *Configuring an LDAP Connection* on page 102).

Modifying Source Settings

The Source Settings screen shows the default configuration of the data store selected on the previous screen, including settings used by the PingFederate provisioner to determine when user information is added, changed, or removed.

Note: In accordance with common practice, the provisioner does *not* delete deprovisioned users from target data stores. Rather their status is changed to indicate that the accounts are no longer active. For some providers (such as Google Apps), default views may need to be adjusted to show deactivated user records.

If you are using the Oracle Directory Server or Active Directory, in most cases no changes are needed on this screen unless your data store uses a customized schema.

If you are using a different LDAP directory, you must supply the required information on this screen unless you have defined a template for the data store (see *Defining an LDAP Type* on page 103).

Field Descriptions

Field	Description
Entry GUID Attribute	The name of the attribute in the data store representing the user's Globally Unique Identifier.
GUID Type	Indicates whether the GUID is stored in binary or text format. Active Directory is always binary. Other LDAP stores most often use text.
Member of Group Attribute	A multi-value user attribute containing the DNs of the groups to which an entry belongs. This attribute does not apply to some LDAP servers, including the Oracle Directory Server. The attribute below is used instead. Active Directory uses both values to provide a two-way mapping between User and Group objects.
Group Member Attribute	The name of a multi-value group attribute used to track membership in the group using either DN or GUID values.
User objectClass	The LDAP object class to which user entries belong, used to restrict search results to user entries only.
Group objectClass	The LDAP object class to which group entries belong, used to restrict search results to group entries only.
Changed Users/Groups Algorithm	The method by which PingFederate determines if user records have been updated or new records added, thus requiring provisioning updates at the target site. The three choices are: **Active Directory USN** – For Active Directory only, this algorithm queries for update sequence numbers on user records that are larger than the last time records were checked. **Timestamp** – Queries for timestamps on user records that are *not older* than the last time records were checked. This check is more efficient from the point of view of the PingFederate provisioner but can be more time consuming on the LDAP side, particularly with the Oracle Directory Server. **Timestamp No Negation** – Queries for timestamps on user records that are *newer* than the last time records were checked. This algorithm is recommended for the Oracle Directory Server.
USN Attribute	The name of the attribute used to store the update sequence number—applicable when the Active Directory algorithm is chosen above.
Timestamp Attribute	The name of the attribute used to store the timestamp on user records.
Account Status Attribute	The name of the attribute in which the user's account status (active or inactive) is stored, for example, Active Directory = `userAccountControl` and Oracle Directory Server = `nsaccountlock`.
Account Status Algorithm	The method by which PingFederate determines a user's account status. The values are: **Active Directory Bitmap** – For Active Directory, which uses a bitmap for each user entry. For more information about `userAccountControl` flags, see Microsoft's *knowledge base* (`support.microsoft.com/kb/305144`). **Flag**– For Oracle Directory Server and other LDAP directories that use a separate attribute to store the user's status. When this option is selected, the Flag Comparison Value and Flag Comparison Status fields below are also used.
Default Status	Indicates the user's status if the attribute is missing.
Flag Comparison Value	Indicates the value for the attribute (for example, `nsaccountlock`) that PingFederate expects to be returned.

Field	Description
	Used when the Account Status Algorithm is set to **Flag**.
Flag Comparison Status	Indicates whether the user is enabled or disabled when the flag has the value specified in the Flag Comparison Value field. Setting the value to *true* equals enabled while setting the value to *false* equals disabled. For example, if the Account Status Attribute is set to `nsaccountlock`, and the Flag Comparison Value is set to **true**, and the Flag Comparison Status is set to **false**, then any users with `nsaccountlock=true` are disabled. Used when the Account Status Algorithm is set to **Flag**.

Specifying a Source Location

Indicate on the Source Location screen where PingFederate should look for user records in the data store. The same location may be used to retrieve user-group DNs for maintaining corresponding groups at the service provider.

Note: Groups provisioning is supported for SCIM and the Google Apps Connector (version 2.0 and higher) but may not be supported for other SaaS Connectors. If not, the associated fields on the Source Location screen are grayed out. Support for the feature may become available in future Connector releases; contact *Ping Identity Support* (`www.pingidentity.com/support-and-downloads/support-request-form.cfm`) for more information.

After specifying the required Base DN, you have the options to provision users and groups (when applicable) based on group membership information or LDAP search results.

Field Descriptions

Field	Description
Base DN	The base Distinguished Name of the tree structure where user records and user groups are stored. PingFederate looks only at this node level or below it for user accounts and groups that need to be provisioned.
Group DN	For Users, the group Distinguished Name associated with the user store, if applicable —required if a Filter is not used (see *Filter* below). For Groups (optional and subject to support from your partner or the SaaS Connectors), the DN of the higher-level group that contains the user groups, if applicable. **Important:** If a Group DN is used for Active Directory Groups, the domain functional level must be set as follows: • For Windows Server 2003 – Windows 2000 native or Windows Server 2003. • For Windows Server 2008 – Either of the above or Windows Server 2008. • For Windows Server 2012 – Any of the above or Windows Server 2012. Refer to Windows Server documentation or support for more information. (Optional) Select the Nested Search checkbox to include users (and groups) that are members of nested groups of the specified group. Nested group membership is preserved for SCIM provisioners and SaaS vendors if both the vendors and the SaaS Connectors support hierarchical structure in groups. **Note:** Nested Search is available when Active Directory or Oracle Directory Server is selected as the source user repository (see *Identifying the Source Data Store* on page 243).
Filter	An LDAP search filter. For Users, required if a Group DN is not provided.

Field	Description
	When configuring groups provisioning, an LDAP search filter is required if a group DN (for Groups) is not provided. If both Group DN and Filter are empty, no group is provisioned. For information about LDAP filters, refer to your LDAP documentation. Note that you may need to escape any special characters. **Important:** Group DN is ignored when an LDAP search filter is provided.

Mapping Attributes

The Attribute Mapping screen provides a means of managing how attributes from your user store are mapped to SCIM attributes in the core schema as well as custom attributes through a schema extension or to the provisioning fields supported for your organization's SaaS-customer account.

Important: If you are provisioning for SCIM, your SP may make one or more optional core attributes mandatory. Refer to your SP's SCIM documentation or SCIM Resource Schema representation. For SaaS Connectors, refer to connection-template setup steps in your SaaS Connector *Quick Connection Guide* for information about any special fields and how to map them.

Tip: For non-SCIM SaaS connectors, PingFederate automatically retrieves from the vendor the Field Names shown on this screen, but only on the first pass through the screen flow. If you are using this screen to modify an existing mapping configuration, click **Refresh Fields** near the bottom of the screen to synchronize the list with the target data store if needed.

For each field, the screen provides a means of adding or modifying the mapping details (see the next section, *Specifying Mapping Details* on page 246)

Note: All required attributes listed in the Field Name column, indicated with asterisks, must be mapped. Click **View Partner Field Specifications** near the bottom-left of the screen for a summary of requirements for all fields specified for the target partner.

For some fields, PingFederate preselects LDAP attributes commonly used to store the required values.

To configure attribute mapping:

1. Click **Edit** under Action for a field.

   Tip: If you have specified any custom attributes, they are listed at the end of the Attribute Mapping screen.
2. On the Specify Attribute Mapping screen, provide mapping details.

   (For more information, see the next section, *Specifying Mapping Details* on page 246.)
3. Repeat for each attribute shown in the Field Name column as needed.

   Tip: For most fields, if you need to map more than one attribute from your data store into a single field at the target location, then you must use an OGNL expression to indicate how the attribute values are to be combined. The use of OGNL expressions may not be enabled for your PingFederate installation (see *Using Attribute Mapping Expressions* on page 428).

   The only exception is a field called LDAP Attributes Map, provided primarily to support *PingOne*-specific SCIM attributes. This field may contain multiple attributes without using OGNL.

Specifying Mapping Details

On this screen, you define specific mapping information for each field required for provisioning (and for any optional fields, as needed).

Caution: If end-users at your site are permitted to edit some of their own attributes directly in the LDAP store, ensure that the attributes are restricted and do not include any needed by the service provider to grant permissions.

To define mapping information for a standard attribute:

1. Optional: Select the Root Object Class containing a user-store attribute that you want to map to the provisioning attribute shown under Field Name.

   Note: For some fields, you may not need to map specific user attributes. If so, supply a Default Value instead—skip this step and go to *step 5*. You can also do both for certain attributes, as needed: that is, specify LDAP attributes as well as a Default Value.
2. Under Attribute, select an attribute from the class.
3. Click **Add Attribute**.
4. Repeat the steps above to add additional applicable attributes, as needed, to use in a mapping expression.

   Important: You must add an attribute for it to be used in an expression.
5. Under Value Definition, enter or select a Default Value (optional, if one or more attributes is specified above).

   A drop-down list appears for this field if the vendor requires a choice among specified values. When an expression is also supplied, the default value is sent during provisioning if an error occurs evaluating the expression.
6. If more than one attribute is used for mapping fields other than LDAP Attributes Map, enter an Expression.

   Tip: Click **Edit** to create and validate the expression.

   For information about the expression language supported by PingFederate, OGNL, see *Using Attribute Mapping Expressions* on page 428.

   Important: The use of OGNL expressions may not be enabled for your PingFederate installation (see *Enabling and Disabling Expressions* on page 428).
7. Optional: Select one or more processing Options, as defined below:

   Create Only – The field is provisioned only once and not subsequently updated.

   Note: For SCIM, the Password attribute should be passed only when creating a user or updating the password. Select **Create Only** to limit when the Password attribute is passed.

   Trim – Removes any white space from the attribute value(s).

   Mask Log Values – Determines whether sensitive information (for example, the Password attribute) will be masked in PingFederate log files, or not.

   Upper Case/Lower Case/None – Transforms the attribute value(s) to the case indicated, unless None is selected (the default).

   Parsing-->Extract CN from DN – For attributes in the form of a Distinguished Name (for example, Group DNs in Active Directory), maps only the Common Name portion of the DN.

   Parsing-->Extract Username from Email – For attributes containing an email address, maps only the username.

   Tip: For SaaS Connectors not bundled with PingFederate, refer to your SaaS Connector *Quick Connection Guide* for instructions on mapping options or requirements for particular provisioning fields.

To define mapping information for a custom attribute:

1. Select a sub attribute under Attribute ID.

   Note: Applicable only to Complex Attributes or Complex Multi-Valued Attributes (see *Specifying Custom SCIM Attributes* on page 240).
2. Optional: Select the Root Object Class containing a user-store attribute that you want to map to the provisioning attribute shown under Field Name.

   Note: For some fields, you may not need to map specific user attributes. If so, supply a Default Value instead—skip this step and go to *step 5*. You can also do both for certain attributes, as needed: that is, specify LDAP attributes as well as a Default Value.
3. Select the source attribute under LDAP Attribute.
4. Optional: Select one or more processing Options, as defined below:

Create Only – The field is provisioned only once and not subsequently updated.

Trim – Removes any white space from the attribute value(s).

Mask Log Values – Determines whether sensitive information (for example, the Password attribute) will be masked in PingFederate log files, or not.

Upper Case/Lower Case/None – Transforms the attribute value(s) to the case indicated, unless None is selected (the default).

Parsing-->Extract CN from DN – For attributes in the form of a Distinguished Name (for example, Group DNs in Active Directory), maps only the Common Name portion of the DN.

Parsing-->Extract Username from Email – For attributes containing an email address, maps only the username.

5. Optional: Enter a **Default Value**.
6. Click **Add Mapping**.

Note: For complex attributes or complex multi-valued attributes, repeat these steps to map additional sub attributes as needed.

Channel Activation and Summary

When you finish setting up a channel, you may choose to activate it immediately; or you can return to the Activation & Summary screen and activate the channel when needed. Note that the overall SP connection, when applicable, also must be active for any provisioning channels to be enabled (see *Editing and Activating a Connection*).

Caution: When a channel is activated, initial provisioning occurs as soon as the synchronization-frequency time period expires (see *Configuring Outbound Provisioning Settings* on page 96). The default is 60 seconds. Initial provisioning can consume considerable processing time, depending on the amount of data that needs to be transmitted; administrators may wish to plan accordingly.

Important: Regardless of whether you choose to activate a new channel immediately or later, if you want to save the channel configuration, click **Done** on the Summary screen and then **Save** on the connection Activation and & Summary screen. (For a new channel in an existing connection, click **Save** on the Outbound Provisioning screen.)

You can deactivate a channel at any time (for maintenance, for example). When a channel is inactive, SSO/SLO transactions may still occur (if an associated connection is active), but provisioning is suspended.

To change a channel status:

- Select either Active or Inactive and then click **Done**.

To modify a channel setting:

- If you know which step needs to be modified, click its link under the Channel tab.

  If you do not know where to change a setting, locate the currently configured setting under one of the summary headings and then click the subheading above the information.

Editing and Activating a Connection

When you finish setting up a connection, you may choose to activate it immediately.

Important: Regardless of whether you choose to activate a new connection now or later, you must click **Save** on the Summary screen for a new connection if you want to keep the configuration.

You can deactivate a connection at any time (for maintenance, for example). When a connection is inactive, all SSO or SLO transactions to or from this partner are disabled, as well as access to the WS-Trust STS for Web Service Clients associated with this connection.

Tip: The SSO Application Endpoint near the top of the Summary screen is an example URL that webmasters or Web application developers at your site might use to invoke SSO for the connection. For details about SSO and other server endpoints, including optional query parameters, see *Application Endpoints* on page 385.

To change a Connection Status:

- Select either Active or Inactive and then click **Save**.

To modify a connection setting:

1. If you know which step needs to be modified, click its link under the SP Connection tab.

   If you do not know where to change the setting, locate the currently configured data under one of the summary headings and then click the subheading above the data.
2. Change the information on the step screen and click **Save**, if available.

   If **Save** is not available, you are in the middle of a task (see *About Tasks and Steps* in *Getting Started*); click **Next** or **Done** until you reach a screen containing a **Save** button. Then click **Save** and continue as needed until you return to the Main Menu.

   If your modification requires related configuration changes, PingFederate provides error messages indicating the necessary steps and then guides you to the related screens (unless you click **Cancel**).

   Important: Be sure to click **Save** whenever that button appears, if you want to keep your changes.

Defining SP Affiliations

An SP affiliation is a SAML 2.0 specification that permits a group of service providers to make use of the same persistent name identifier for account linking (see *Account Linking* on page 22).

This may be of use when multiple service providers share a business relationship in which users need services from each affiliated provider. By agreement among the affiliation members, the same *pseudonym* can be used to populate the `SAML_SUBJECT` of assertions sent to all of the SP partners contained in this affiliation.

Note: Each connection in the affiliation must be configured to use the same IdP adapter instance for generating account links (see *Authentication Source Mapping* on page 203).

You can create or modify an SP affiliation from the Main Menu under IdP Configuration or from a list of affiliations (see *Using the Manage Affiliations Screen* on page 249).

To create an SP affiliation:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Create New** under SP Affiliations.

   Tip: See *Importing Affiliation Metadata* on page 250 for subsequent steps.

To modify or delete an affiliation:

- See *Using the Manage Affiliations Screen* on page 249.

Using the Manage Affiliations Screen

You can manage SP affiliations on this screen.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Manage All** under SP Affiliations.

To begin creating a new affiliation:

- Click **Create Affiliation** (see the next sections for more information).

To delete an affiliation:

1. Click **Delete** under Action for the affiliation you want to delete.
2. Click **Save** to confirm the deletion (or click **undelete**).

To view or modify an affiliation:

- Click the affiliation ID.

Importing Affiliation Metadata

An IdP may send a metadata file containing information that automatically specifies members of an SP affiliation for use in PingFederate.

- If you do not have a metadata file, click **Next**.

To import metadata:

1. Click **Browse** to locate and import the file and then click **Next**.
2. Review the information on the Create Affiliation page (see the next section).
3. Click **Save** on the Summary screen.

Entering Affiliation Information

Enter or modify basic information about an affiliation on the Affiliation General Info screen.

If you imported a metadata file, this information is already supplied.However, you may change the Affiliation ID or select a different Affiliation Owner, if required.

Field Descriptions

Field	Description
Affiliation ID	A unique identifier for this affiliation. This value serves as the Name ID qualifier for SAML assertions sent to affiliated SP partners.
Affiliation Owner	Any SAML 2.0 SP connection may serve as the Owner.

Managing Affiliation Membership

On the Affiliation Membership screen, you create and manage a list of SP connections to be included in the affiliation.

If you imported a metadata file, this information is already supplied. However, you may add or remove connections from the affiliation.

- To add an SP partner connection to the affiliation, select the connection from the drop-down list and click **Add**.

  Important: Each connection in the affiliation must be configured to use the same IdP adapter instance for generating account links (see *Authentication Source Mapping* on page 203).
- To remove a member of the affiliation, click **Delete** under Action for the connection and click **Save**.

  Note: If you delete an affiliation member supplied by an imported metadata file and then save the affiliation, that connection will not appear in the drop-down list for re-adding in the future.

Activating and Editing the Affiliation

From the Affiliation Management Summary screen you can activate or deactivate an SP affiliation. You also save new affiliations on this screen, or you can click heading links to go back and modify information.

To change an Affiliation Status:

- Select either Active or Inactive and then click **Save**.

  Important: Be sure to click **Save**. Otherwise, the status will not be changed.

To edit a connection:

1. Click the heading above the information you want to modify.
2. Make your change and click **Save**.

Configuring SP Auto-Connect

When your SP partner is also using PingFederate 5 or higher (or is otherwise able to provide interoperable SAML 2.0 metadata via HTTP on demand), you may choose to use Auto-Connect for that partner (see *Using Auto-Connect*). This configuration can be shared among an unlimited number of SAML 2.0 partners.

Note: You enable the SAML 2.0 Auto-Connect profile under System Settings (see *Choosing Roles and Protocols* on page 92).

Once Auto-Connect is enabled on your PingFederate server, complete the configuration from the Main Menu under IdP Configuration. This configuration entails:

- Setting up a common connection for all Auto-Connect partners
- Establishing a list of SP partner domains authorized to use the connection

Initial Setup

The basic configuration for Auto-Connect requires only:

- Defining a period of validity for *assertion*s (assertion lifetime)
- Choosing a signing certificate for assertions and other SAML messages
- Configuring assertion-creation information

All other partner-connection specifications are handled automatically at runtime.

Specifying an Assertion Lifetime

Identity-federation standards require a window of time during which an *assertion* is considered valid. Each assertion has a time-stamp XML element as well as elements indicating the allowable lifetime of the assertion (in minutes) before and after the assertion time stamp.

Field Descriptions

Field	Description
Minutes Before	The amount of time before the assertion was issued during which it is to be considered valid.
Minutes After	The amount of time after the assertion was issued during which it is to be considered valid.

To change the default times:

- Optional: Edit the desired setting(s) and click **Next** or **Save**.

Choosing a Signing Certificate

For Auto-Connect runtime processing, assertions and SLO messages must be signed, since they are sent over either the POST or redirect *binding*s (see *SAML 2.0 Profiles* in the “Supported Standards” chapter of *Getting Started*).

Note: The signing certificate is embedded in your server's Auto-Connect metadata (see *Using Auto-Connect* on page 31); there is no need to exchange certificates with your partners.

You can use the same certificate used for signing metadata (see *Configuring Auto-Connect Metadata Signing* on page 97). If you use a different certificate, ensure that it meets Auto-Connect validation requirements (see *Auto-Connect Security Model* on page 32).

To specify a certificate:

1. Select the certificate from the drop-down list.

   If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).
2. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.

Configuring Assertion Creation

Configuring *assertion* creation for Auto-Connect is similar to configuring the same settings for regular partner connections.

- Click **Configure Assertion Creation** to continue.

  For configuration information, refer to sections under *Assertion Creation* on page 200.

Auto-Connect Activation and Summary

When you finish configuring your SP Auto-Connect initial setup, you may choose to activate the common connection immediately on the Activation & Summary screen. (No runtime processing occurs until your partner's Auto-Connect gateway is also established and a user initiates an SSO or SLO event.)

Important: Regardless of whether you choose to activate a newly configured connection now or later, you must click **Save** on the Activation & Summary screen if you want to keep the configuration.

You can deactivate the connection at any time (for maintenance, for example). While a connection is inactive, all SSO or SLO transactions to or from Auto-Connect partners are disabled.

To change a Connection Status:

- Select Active or Inactive and then click **Save**.

To modify a setting:

1. Locate the currently configured setting under one of the summary headings and then click the subheading above the data.

   Note: Changes made to Auto-Connect settings will be out of sync, temporarily, with metadata caches that any currently active partners might be using. If your connection is in production, you might wish to lower your server's metadata lifetime in advance of making configuration changes (see *Configuring Auto-Connect Metadata Lifetime* on page 97).
2. Change the information and click **Save**, if available.

   If **Save** is not available, additional, dependent changes are required; click **Next** or **Done** until you reach a screen containing a **Save** button. Then click **Save** and continue as needed until you return to the Main Menu.

Specifying Allowed SP Domains

This screen provides PingFederate® with a list of trusted domain names of your Auto-Connect partners.

Normally, when PingFederate receives an authentication request from a domain in this list), the runtime engine completes the connection automatically using metadata obtained from a standard, public location— `http://`

`saml.<domain_name>`. (See *Using Auto-Connect*.) Alternatively, if an Auto-Connect partner elects not to use the standard location, you can supply the applicable URL.

Chapter 8

Service Provider SSO Configuration

In an SP role, you use the PingFederate administrative console to configure local application-integration information and to manage connections to your IdP-partner sites. You must configure Server Settings from the Main Menu to establish your site as an SP before configuring connections to IdPs (see *Choosing Roles and Protocols* on page 92).

Note that only one connection is needed per partner, even if you are integrating more than one Web application. You can configure more than one connection, however, if your partner supports multiple protocols, or supports multiple federation IDs for the same protocol (see *Federation Server Identification*).

Note: This chapter applies to configuration settings needed for browser-based SSO. While there is some cross-over information also applicable to WS-Trust STS, if you are using PingFederate *exclusively* as an STS, start with *WS-Trust STS Configuration* on page 324.

Under some conditions, you can enable SSO for an unlimited number of partners at once by configuring a single, common connection (see *Using Auto-Connect* on page 31).

You can also deploy an IdP connection to bridge an identity provider to one or more service providers through one or more connection mapping contracts (see *Federation Hub* on page 38 and *Connection Mapping Contracts* on page 124 for more information).

This chapter covers the following major topics:

- *SP Application Integration Settings* on page 254
- *Federation Settings* on page 261
- *Managing IdP Connections* on page 264
- *Configuring IdP Auto-Connect* on page 321

SP Application Integration Settings

The integration of local applications with PingFederate is the essential “last-mile” configuration that allows end-users at your IdP partner’s Web site to access your protected resources . This process is facilitated through the use of application-integration kits and a robust Software Development Kit (see *SSO Integration Kits and Adapters* on page 19).

Under Application Integration Settings on the SP Configuration sub menu, you configure the SP Adapters that PingFederate uses to create user sessions that allow SSO access to your protected resources. You can also set Default URLs to which users may be directed during SSO or SLO, and you can look up system endpoints that application developers at your site need to access PingFederate’s SSO/SLO services.

Note: If your PingFederate configuration enables the WS-Trust *STS*, the selections under Application Integration Settings also include a link for configuring plug-in **Token Generators** (see *Configuring Token Generators* on page 348).

Configuring SP Adapters

SP adapters are used to create a local-application session for a user in order to provide SSO access to your application(s) or other protected resources (see *SSO Integration Kits and Adapters* on page 19). You can configure multiple instances of adapters (based on one or more adapters) to accommodate the varying needs of your IdP partners.

Note: If you are configuring an OpenToken Adapter, see *Configuring the IdP OpenToken Adapter* on page 365.

If you configure more than one adapter instance, then you must map a target URL to at least one instance (see *Configuring Target URL Mapping* on page 257).

SP adapter setup is available only if your server is configured as an SP (see *Choosing Roles and Protocols* on page 92).

Important: If you install a new version of an adapter JAR file after setting up connections to instances of that adapter, you might need to reconfigure those connections. To find out, click each connection that uses the adapter (see *Accessing IdP Connections* on page 264). Errors indicating reconfiguration points may be presented.

- You reach this screen by clicking **Adapters** under Application Integration Settings in SP Configuration.

To create a new adapter instance:

- Click **Create New Instance**.

  See the next section.

To edit an adapter instance:

- Click the Instance Name link.

To delete an adapter instance:

1. Click **Delete** next to the Instance Name on the Manage SP Adapter Instances screen. (To undo the deletion, click **Undelete**.)

   Note: This option is inactive if the instance is referenced elsewhere, or if it is a parent to other instances. To enable deletion, click **Check Usage** to locate the configuration(s) that depend on the instance and go to each listed configuration to remove the dependencies. If the instance you want to delete is a parent, delete child instances first.
2. Click **Save** to confirm the deletion.

Creating an Adapter Instance

On the Type screen, you begin creating an instance of an adapter that PingFederate uses for creating security sessions for your applications.

Field Descriptions

Field	Description
Instance Name	A descriptive name for the adapter instance—for example, an identity management system name.
Instance ID	An internal identifier for the adapter instance. Must be alphanumeric with no spaces.
Type	A list of deployed adapter types available for creating an adapter instance for the server. A developer typically deploys any new adapter types before an administrator sets up a connection partner.
Parent Instance (Optional)	A list of configured instances for this type of adapter. If applicable, select an instance that can be used as a basis for a parent/child configuration.

To define an adapter instance:

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select the Type from the drop-down menu.

   If the adapter you need is not listed, click **Visit PingIdentity.com for additional types** to see if a suitable adapter is available from the PingFederate download site. You can also create your own adapter (see *SSO Integration Kits and Adapters* on page 19).
3. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
4. Click **Next** and enter information on subsequent screens for this adapter setup, as indicated in the following sections.

   Tip: The setup steps and information needed vary with the adapters deployed on your server (see *SSO Integration Kits and Adapters* on page 19). For information about configuring the adapter packaged with PingFederate, see *Configuring the SP OpenToken Adapter* on page 367.
5. Click **Done** on the Summary screen.
6. Click **Save** on the Manage SP Adapter Instances screen.

Configuring an Adapter Instance

Configuration parameters on the SP Adapter Instance screen vary according to the adapter you choose. These options are controlled by the adapter plug-in software (see *SSO Integration Kits and Adapters* on page 19).

- For information about configuring the OpenToken Adapter distributed with PingFederate, see *Configuring the SP OpenToken Adapter* on page 367.
- For information about configuring an adapter contained in an integration kit, locate the user guide under *Product Documentation* at *pingidentity.com*.

Choosing Adapter Actions

Adapters can be written to perform configuration assistance or validation *actions*—for example, testing a connection to Active Directory. Actions may also include generation of parameters that might need to be set manually in a configuration file.

- For information about actions available using the OpenToken Adapter, see *OpenToken Adapter Configuration* on page 364.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click **Adapters** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Actions** (if available).

To generate a properties list:

- Click **Download** under Action Invocation Link.

Extending Adapter Contracts

Adapters may be written with an option allowing administrators to add to the attributes required for creating usable sessions. This feature might be needed, for example, by a legacy application that requires different authentication than other applications under the same enterprise identity-management system.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click **Adapters** under Application Integration Settings.

3. Click an Instance Name.
4. Click **Extended Contract** (if available).

To add an attribute:

Note: If this is a child instance, select the override checkbox to modify the configuration.

1. Enter the attribute name in the text box and click **Add**.
2. Click **Done** then click **Save** on the Manage SP Adapter Instances page.

Editing and Saving SP Adapter Instances

From the Adapter Instance Summary screen, you can reach adapter settings for editing.

To edit the configuration:

1. Click the heading above the information you want to change.
2. Click **Save** on the configuration page and on the Manage SP Adapter Instances screen.

To save an adapter instance:

1. Click **Done** on the Summary screen.
2. Click **Save** on the Manage SP Adapter Instances screen.

   Note: If this is the second adapter instance you have configured, then **Save** is not yet available; you must choose whether to map the new adapter instance to an application or resource URL. In this case, click **Next** to continue (see *Configuring Target URL Mapping* on page 257 next).

Configuring Target URL Mapping

When you have more than one target session defined in an IdP connection, you must map the target URL to its target session. During SSO, the target URL requested will be compared against the URL(s) listed here until a match is found. If a match is not found, SSO will fail. Use a wildcard (*) to match multiple URLs to the same target session.

For example, this mapping configuration may be necessary in an IdP-initiated SSO scenario that connects to multiple applications at your site. For transactions initiated at your site, this mapping is needed for default situations, in cases where the target and adapter instance are not specified when the SSO/SLO is started (see *SP Endpoints* on page 387). (When this information is provided with the SP request, the mapping table is ignored.).

Furthermore, when bridging an identity provider to multiple service providers, for each service provider supporting the SAML IdP-initiated SSO profile, map the target URLs to the corresponding SP connection.

Tip: In this scenario, PingFederate is a federation hub for the identity provider and the service providers. (See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.)

Finally, if an IdP connection is associated with one (or more) SP adapter(s) and one (or more) connection mapping contract(s), you also need to map the target URLs to their respective target session.

Field Descriptions

Field	Description
URL	The target URLs that align with your configured target sessions. The URLs instruct the PingFederate SP server to route session-creation processing through an SP adapter instance or an SP connection. If the URL in the incoming request is not matched by the first entry in this table, subsequent entries are tried until a match is found. **Note:** If a target session is not allowed based on restrictions imposed (see *Restricting a Target Session to Certain Virtual Server IDs* on page 278), PingFederate tries the next entry.

Field	Description
Target Type	The type of the Target Session. If the IdP role is not activated (or is activated without any protocol for browser SSO, such as SAML or WS-Federation), Target Type defaults to “SP Adapter”.
Target Session	A selection of configured SP adapter instances or SP connections. The available values depends on the chosen Target Type.

The order of mapping is significant in that the first matching mapping, from top to bottom, determines which target session receives the request. For example, if two URLs are mapped in the following order:

URL	Session Target
`http://sp.company.com/acct101/`	`SP OpenToken`
`http://sp.company.com/*`	`Fedhub Cxn to SP`

A target URL of `http://sp.company.com/acct101/start` will be mapped to ‘`SP OpenToken`’ because the target matches the first mapping in the configuration.

If the order of the mappings is reversed, the same target will be mapped to ‘`Fedhub Cxn to SP`’ because the first mapping in the new configuration (`http://sp.company.com/*`) matches the target URL

Note that you can use only one wildcard (*) per URL.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click **Target URL Mapping** under Application Integration Settings.

To create target URL mappings:

1. Enter a URL
2. Select a Target Type. (Applicable only when the IdP role is activated with at least one protocol for browser SSO, such as SAML or WS-Federation.).
3. Select a Target Session.
4. Click **Save**.

To edit target URL mappings:

1. Click **Edit** next to the Target Session. You can change the URL, Target Type and/or Target Session. (Target Type is only applicable when the IdP role is activated with at least one protocol for browser SSO, such as SAML or WS-Federation.).
2. Click **Update**.
3. Click **Save**.

To delete target URL mappings:

1. Click **Delete** next to the Target Session.
2. Click **Save**.

   (Click **Cancel** to abort the deletion.)

To change the order of target URL mappings:

1. Click the up or down arrows at the left to rearrange the order.
2. Click **Save**.

Configuring Identity Store Provisioners

PingFederate allows you to create custom Identity Store Provisioners to bridge the inbound SCIM processing of PingFederate to your own user store. For example, you might need to create a custom Identity Store Provisioner that works with an application-specific user database schema.

Using the Software Developer Kit for PingFederate, you can create and test these custom Identity Store Provisioners (see the PingFederate *SDK Developer's Guide*).

To support custom attributes, you must add the schema extension and the custom attributes to the IdP connection. Furthermore, you need to take the expected data structure of the custom attributes into consideration when implementing the `IdentityStoreProvisioner` interface and its methods. In other words, your methods must be able to create, read, update, and delete/deactivate the custom attributes (and their sub-attributes if the custom attributes are *Complex Attributes*) to and from your user store. For more information about custom attributes, complex attributes, and other attribute types, see *Defining Custom SCIM Attributes* on page 305 and *SCIM 1.1 Core Schema* (`www.simplecloud.info/specs/draft-scim-core-schema-01.html`).

Note: The Identity Store Provisioner option is active only after you enable the Inbound Provisioning protocol on the Roles & Protocol screen (see *Choosing Roles and Protocols*).

Creating an Identity Store Provisioner Instance

On the Type screen, you begin creating an instance of an identity store that PingFederate uses to bridge the inbound SCIM processing to an external user store using a custom implementation.

Field Descriptions

Field	Description
Instance Name	A descriptive name for the provisioner instance—for example, an identity management system name.
Instance ID	An internal identifier for the provisioner instance. Must be alphanumeric with no spaces.
Type	A list of deployed provisioner types available for creating a provisioner instance for the server. A developer typically deploys any new provisioner types before an administrator sets up a connection partner. The Identity Store Provisioner Type is limited to the provisioners currently installed on your server.
Parent Instance (Optional)	A list of configured instances for this type of provisioner. If applicable, select an instance that can be used as a basis for a parent/child configuration.

To define an identity store provisioner:

1. Click **SP Configuration** on the Main Menu.
2. Click **Identity Store Provisioners** under Application Integration Settings.
3. Click **Create New Instance on the Manage Identity Store Provisioners screen**.
4. Enter the Instance Name and Instance Id on the Type screen.
5. Select the Type from the drop-down menu.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next** and enter information on subsequent screens for this identity store setup, as indicated in the following sections.

8. Click **Done** on the Summary screen.
9. Click **Save** on the **Manage Identity Store Provisioners screen**.

Defining Identity Store Provisioner Behavior

Different configuration parameters are available on the Identity Store Provisioner screen. These options are controlled by the provisioner plug-in software (see topics about identity store provisioner interfaces in the PingFederate *SDK Developer's Guide* for more information).

Extending Identity Store Provisioner Contracts

Identity Store Provisioners may be written with an option allowing administrators to add to the core attributes the plug-in instance requires. Both the core and extended contract attributes you define here must be mapped when you configure “Write Users” within an Inbound Identity Store Provisioner connection.

Tip: To keep your plug-in flexible across multiple connections (assuming a one-to-one connection-to-identity store provider setup), you might want to hard code a set of “core attributes” for all connections to fulfill, and then “extend” attributes on as needed when a partner connection depends on additional attributes.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click **Identity Store Provisioners** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Extended Contract** (if available).

To add an attribute:

Note: If this is a child instance, select the override checkbox to modify the configuration.

1. Enter the attribute name in the text box and click **Add**.
2. Click **Done** then click **Save** on the Manage Identity Store Provisioners screen.

Extending Identity Store Provisioner Contracts for Groups

Identity Store Provisioners may be written with an option allowing administrators to add to the core group attributes the plug-in instance requires. Both the core and extended group attributes you define here must be mapped when you configure “Write Groups” within an Inbound Identity Store Provisioner connection.

Tip: To keep your plug-in flexible across multiple connections (assuming a one-to-one connection-to-identity store provider setup), you might want to hard code a set of “core attributes” for all connections to fulfill, and then “extend” attributes on as needed when a partner connection depends on additional attributes.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click **Identity Store Provisioners** under Application Integration Settings.
3. Click an Instance Name.
4. Click **Extended Group Contract** (if available).

To add an attribute:

Note: If this is a child instance, select the override checkbox to modify the configuration.

Enter the attribute name in the text box and click **Add**.

Click **Done** then click **Save** on the Manage Identity Store Provisioners screen.

Editing and Saving Identity Store Provisioner Instances

From the Summary screen, you can reach identity store provisioner instance settings for editing.

To edit the configuration:

1. Click the heading above the information you want to change.
2. Make your changes.
3. Click **Done** on the configuration page and **Save** on the Manage Identity Store Provisioners screen.

To save an identity store provisioner instance:

1. Click **Done** on the Summary screen.
2. Click **Save** on the Manage Identity Store Provisioners screen.

Configuring Default URLs

As an SP, you can supply a default URL that the end-user may see when an SSO request succeeds (that is, a session is created at your site) but the target resource is not available or not specified.

Note: You can also specify default target SSO URLs for individual IdP connections, which take precedence over this global setting (see *Configuring Default Target URLs (Optional)*).

Similarly, you can specify to prompt a default URL indicating a successful SLO to the end-user (if no other page is designated).

Note: The error message is displayed only when the application calling the start-SSO endpoint does not explicitly provide its own error page URL. The default entry in this field is used to localize the message. For information about how to find and change the default English message and how use the PingFederate localization feature, see *Localization* on page 81. If localization is not needed, you may also specify a message directly in this field to change the default.

Your application or your partner's application may supply these URLs at runtime (see *SP Endpoints* on page 387), but if none is provided, PingFederate will use the default values you enter on this screenunless, in the case of SSO, a default is also defined for the connection.

Tip: If no default targets are specified here or at the connection level (for SSO), PingFederate provides built-in landing pages for the user. These Web pages are is among the templates you can modify with your own branding or other information (see *Customizing User-Facing Screens* on page 76).

Viewing SP Application Endpoints

Click **Application Endpoints** on the SP Configuration sub menu to see a list of endpoints and descriptions applicable to your federation role (IdP or SP). These endpoints are built into PingFederate and cannot be changed.

Web-application developers at your site need to know the application endpoints to initiate transactions via PingFederate (see *SSO Integration Kits and Adapters* on page 19).

Note: For specific parameters required or allowed for Application Endpoints, see *SP Endpoints* on page 387.

This screen also shows a Maintenance Endpoint that you can use to verify that the PingFederate server is running (see *System-Services Endpoints* on page 395).

Federation Settings

If your identity federation uses the SAML 2.0 XASP profile (see *Attribute Query and XASP* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide), you may need to identify the IdP connection to which an attribute request applies. If so, click **Attribute Requester Mapping** under Federation Settings on the SP Configuration sub menu to complete the configuration (see *Attribute Requester Mapping* on page 262).

Also under Federation Settings, you can view protocol endpoints that your federation partners need to know to access your services via PingFederate.

Attribute Requester Mapping

If you are using the XASP profile, the application(s) at your site must supply the Subject Distinguished Name (DN) to identify a user's X.509 authentication certificate (see *Attribute Query and XASP* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide). Optionally, an application may also supply an Issuer DN, which can be used to determine the correct IdP (Attribute Authority) to use for a set of users associated with an IdP.

Note: A `Format` query parameter must be set to a specified value for XASP (see */sp/startAttributeQuery.ping* on page 391).

On the Attribute Requester Mapping screen, you can map X.509 identifying information to connections and specify a default connection. You reach this screen from the Main Menu under Federation Settings.

Note: The Attribute Requester Mapping link does not appear on the SP Configuration sub menu unless you have enabled the SAML 2.0 protocol for the SP role (see *Choosing Roles and Protocols* on page 92). You must also select the associated XASP checkbox.

At runtime, PingFederate tries to match the certificate's Issuer DN (if provided) against the list of Issuer DN(s), in the order shown on this screen, until a match is found. If no match is found, the server tries the Subject DN(s) in order. If no match is found, the Default connection is used.

For Issuer and Subject DNs, you can use a regular expression to match different DNs to the same connection. Only one expression may be used in any single entry. DN values must be entered in all lower-case characters.

To map attribute requesters to connections:

1. Optional: Enter an Issuer DN when applicable, select a SAML 2.0 IdP Connection Name, and click **Add**.

   Repeat this step as needed for additional DNs.
2. Enter an Subject DN, select a SAML 2.0 IdP Connection Name, and click **Add**.

   Repeat this step as needed for additional DNs.
3. Select a Default IdP connection.

To edit a mapping:

1. Click **Edit** for the mapping in the Action column.
2. Make your changes and click **Update** in the Action column.
3. If you are editing an existing configuration, click **Save** to confirm the change.

To reorder the mapping list:

- Click the up or down arrow next to a DN.

To delete a mapping:

1. Click **Delete** for the mapping in the Action column.
2. If you are editing an existing configuration, click **Save** to confirm the deletion.

Viewing SP Protocol Endpoints

Click Protocol Endpoints under Federation Settings in the SP Configuration section of the Main Menu to see a list of SAML, WS-Federation, and/or WS-Trust STS endpoints—a pop-up window displays only those endpoints related to the federation protocols enabled in Server Settings (see *Choosing Roles and Protocols* on page 92). These endpoints are built into PingFederate and cannot be changed.

PingFederate provides a favorite icon for all Protocol Endpoints. For more information, see *Customizing the Favicon for Application and Protocol Endpoints* on page 84.

Your federation partners or STS clients need to know the applicable SP Services endpoints to communicate with your PingFederate server. Configured service endpoints for SAML connections are included in metadata export files (see *Exporting Metadata* on page 57).

The table below describes each endpoint:

Table 15: PingFederate SP Endpoints

Service	URL and Description
Single Logout Service (SAML 2.0)	`/sp/SLO.saml2` The URL that receives and processes logout requests and responses.
Assertion Consumer Service (SAML 2.0)	`/sp/ACS.saml2` A SAML 2.0 implementation that receives and processes assertions from an IdP. The numbers reflect the index value PingFederate uses to handle each binding.
Artifact Resolution Service (SAML 2.0)	`/sp/ARS.ssaml2` The SOAP endpoint that processes artifacts returned from a federation partner to retrieve the referenced XML message on the back channel. (See "**Important**" footnote in this table.)
Metadata Service	`/` The default endpoint (empty path) from which partners can retrieve Auto-Connect metadata (see *Using Auto-Connect* on page 31).
Assertion Consumer Service (SAML 1.x)	`/sp/acs.saml1` A SAML 1.x implementation URL that receives and processes assertions from an IdP.
Single Sign-on Service (WS-Federation)	`/sp/prp.wsf` The WS-Federation implementation URL that receives and processes security tokens and SLO messages.

WS-Trust STS (two endpoints)	`/sp/sts.wst`
	The SOAP endpoint that receives and processes SAML security-token requests from STS clients (Web Service Providers at the SP site), validating SAML tokens or validating and exchanging SAML tokens based on the configured IdP connection.
	`/pf/sts.wst`
	Initiates direct STS token-to-token exchange and token validation, from an IdP token processor to an SP token generator, when that feature is configured (see *Token Exchange Mapping* on page 120).
	Note: If multiple token-generator instances of the same type are configured for the same connection or token-to-token mapping, a query parameter, `TokenGeneratorId`, must be added to either of these endpoints—see *Configuring Token Generators* on page 348.
	(See also "**Important**" footnote in this table.)

Important: If mutual SSL/TLS is used for authentication, a secondary PingFederate listening port must be configured and used by partners or STS clients for the relevant endpoints—`*.ssaml*` and `*.wst` (see *Modifying PingFederate Properties* on page 68).

Note: For any connection using multiple virtual server IDs (see *Multiple Virtual Server IDs* on page 36), each virtual server ID has its own set of protocol endpoints. Use Metadata Export on the Server Configuration sub menu to export a connection metadata for your partner. For more information, see *Exporting Metadata* on page 57.

Managing IdP Connections

As an SP, you manage connection settings to support the exchange of federation-protocol messages (SAML, WS-Federation, or WS-Trust) with an IdP or *STS* client application at your site.

Note: If you are configuring a new connection only for WS-Trust STS, follow the sections in this part of the manual up to and including *General Connection Information* on page 269. Then turn to *WS-Trust STS Configuration* on page 324.

These settings include:

- User attributes you expect to receive in an SSO assertion (including STS SAML tokens).
- User attributes that may be requested using the Attribute Query profile (if that profile is used).
- The protocol and, for SAML, the profile you will use, including detailed security specifications (the use of digital signatures, signature verification, XML encryption, and SSL). For more information, see *Supported Standards* in *Getting Started*.

To continue with the configuration, you and your connection partner must have decided this information in advance (see *Federation Planning Checklist* on page 35). Your federation partner must supply some connection settings and other information (see *Configuration Data Exchange* on page 38).

Tip: If you are configuring connections to more than one partner under SAML 2.0 specifications, or if you intend to add partners in the future, consider using Auto-Connect (see *Configuring IdP Auto-Connect* on page 321).

As an SP, you respond to user requests for SSO and SLO by creating or closing user sessions, respectively, in local applications. You integrate these applications with PingFederate by configuring them with SP adapter instances (see *Configuring SP Adapters* on page 254). In preparation for configuring a new SSO connection, you need to know which adapter instance to use (see *Configuring Target Session Mapping* on page 275). (No adapters are required for a connection that uses only the Attribute Query profile—see *Configuring the Attribute Query Option* on page 297.)

If you intend to pass attribute values to an adapter instance from a local data store, you must define the data store during this configuration, if you have not done so already (see *Managing Data Stores* on page 98).

Accessing IdP Connections

You can create, modify or import connections directly under IdP Connections. Note that the SP Configuration menu displays the four most-recently modified connections. To view a list of all IdP connections, click the **Manage All** button.

From the Main Menu

From the Main Menu under SP Configuration, you can configure a new connection, modify an existing connection, import a connection, or view connections.

Tip: To copy or delete connections or to find connection drafts, click **Manage All** (see *From the Manage Connections Screen* on page 265).

Note that long connection names are truncated for this display and the list is limited to four connections, chronologically ordered according to most recently edited. The full connection names and a complete list are displayed on the Manage Connections screen (see *From the Manage Connections Screen* on page 265).

To begin configuring a new connection:

1. Click **SP Configuration** on the Main Menu.
2. Click **Create New** under IdP Connections.

Tip: The fastest way to create a new connection is to click **Manage All** and copy the connection with similar settings (see *From the Manage Connections Screen* on page 265).

To modify a connection:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Only the four most recently edited connections are displayed. To see all connections, including drafts, click **Manage All**.
3. On the Activation & Summary screen, click the heading for the information you want to change.
4. Make your change and click **Save**.

   Note: If **Save** is not available, it means your modification requires other changes or you are editing a screen that is part of a series of subtasks. Click **Next** and continue making indicated changes. The **Done** button indicates that further changes in the task are optional. When you have no further changes, click **Done** and then click **Save** on the task summary screen.

To import a connection:

1. Click **Import**.
2. In the Import Connection screen, browse to a connection XML file.
3. Optional: Select the Allow Update checkbox. When selected, if the connection already exists, it will be overwritten.
4. Click **Import** and **Done**.

From the Manage Connections Screen

From the Manage Connections screen you can:

- Create a new connection.
- Modify or copy an existing connection.
- Continue working on a connection draft.
- Delete a connection—if it is not active or referenced in other parts of the configuration (In Use).
- Export or import individual connection configurations.

  Note: The connection export function results in an XML file that you can modify and import into the same PingFederate server or another PingFederate server acting in the same federation role (IdP or SP) at your site. You can import connections in this screen. Alternatively, you can use the Connection Management Service to complete the task (see *Importing Connections* on page 409). Finally, you also have the option to automate this process (see *Automating Configuration Migration* on page 70).
- Export metadata about a connection to expedite your partner's corresponding configuration (see *Exporting Metadata* on page 57).
- Update a SAML connection with metadata from your partner.

  Note: The update operation may require additional configuration. Reviewing the connection after the update operation is recommended.

On this screen you can also globally override transaction logging levels set for individual connections or restore connection-based logging (see *Runtime Transaction Logging* on page 49).

Tip: A check-mark icon next to a Connection Name indicates that the connection has been checked for configuration errors. For more information about connection-validation features associated with this screen, see *Managing IdP Connection Validation* on page 267.

To access the Manage Connections screen:

1. Click **SP Configuration** on the Main Menu.
2. Click **Manage All** under IdP Connections.

To begin configuring a new IdP connection:

- Click **Create Connection** on the Manage Connections screen.

To copy a connection:

1. Click **Copy** under Action for the connection you want to copy.
2. Update the Connection ID (of the partner) and the Connection Name in the General Info screen (see *General Connection Information* on page 269).
3. Make any further changes needed for the new connection.

To edit a connection or continue working on a draft:

- Click the Connection Name link.

  For a draft, you will return to where you left off.

To export a connection:

1. Click **Export Connection** under Action for the connection.
2. Save the XML file on your file system.

   You can change the name of the file, but keep the XML extension.

To import a connection:

1. Click **Import**.
2. In the Import Connection screen, browse to a connection XML file.
3. Optional: Select the Allow Update checkbox. When selected, if the connection already exists, it will be overwritten.
4. Click **Import** and **Done**.

To export connection metadata:

1. Click **Export Metadata** under Action for the connection.

   This action takes you to the Export Metadata screen flow, with the connection selection preset (see *Exporting Metadata* on page 57).
2. Complete the steps remaining in the Export Metadata screen flow (starting at *Step 4* under *To export connection metadata:* on page 57).

To update a connection with your partner's metadata:

1. Click **Update with Metadata** under Action for the connection.
2. In the Import Metadata screen, select the metadata XML file.
3. Click **Load Metadata**.
4. Click **Yes** to proceed.

   Note: Click **No** if you want to select another metadata file or stop the update process.
5. Click **Next**.
6. In the Import Certificate screen, select the verification certificate from your partner.

   Note: Applicable only if your partner provides the verification certificate outside of the metadata.
7. In the Metadata Summary screen, review the signature information to evaluate the authenticity of the metadata. Click **Done** or **Save** to complete the update operation.

   Note: If you change your mind, click **Cancel** to go back to the Manage Connection screen without updating the connection.

8. If the metadata does not contain information required by the previously selected SAML profile(s), follow the Dependency Errors page to complete the configuration.

To delete a connection:

1. Under Action, click **Delete** for the connection.

   (To undo the deletion, click **Undelete**.)

   Note: The **Delete** function is not available if the connection is Active or In Use.

2. To confirm the deletion, click **Save**.

To sort the list of connections:

- Click the arrow next to any column heading to sort the list based on that column.

  Note: The Virtual ID displays the default virtual server ID of the connection, if any (see *General Connection Information* on page 269).

To filter the list by Protocol and/or Status:

- Select a filter criterion from either or both of the drop-down lists.

To override connection-based transaction logging:

1. Select **On** under Logging Mode Override.
2. Choose the logging mode you want to use for all connections.

To restore connection-based transaction logging:

- Select **Off** under Logging Mode Override.

Managing IdP Connection Validation

By default PingFederate automatically validates all existing connections before displaying the Manage Connections screen. This validation ensures that any updates to supporting components—*adapter*s or data-store configurations, for example—have not invalidated any connection settings.

If such errors are found, a warning icon appears next to the Connection Name.

To correct errors:

- Click the Connection Name to reach the top-level task in which reconfiguration is needed, and to see the error message. Then navigate into deeper tasks using **Configure . . .** buttons to find a link to the screen that needs updating.

  (For more information about console navigation, see *About Tasks and Steps* in the “Console Navigation” chapter of *Getting Started*).

Note that the connection validation time increases with the number of connections and when connections are configured to access data stores for adapter mapping. Consequently, there may be noticeable delays in displaying the Manage Connections screen. For this reason, PingFederate provides a way to turn off the automatic validation under Server Settings (see *Setting System Options* on page 94).

When validation is turned off, administrators can check connections manually on the Manage Connections screen. A question-mark icon indicates the connection has not been validated. You may, however, still edit the connection by clicking its name.

In addition, Action links are disabled (except for **Delete**, if the connection is Inactive and/or In Use) until the connection is validated.

When automatic validation is disabled, use one of the following procedures to validate connections:

To validate a single connection:

- Click icon next to the Connection Name.

  Note: Validating a single connection does not check connectivity for any configured data-store lookups (see *Selecting an Attribute Mapping Method* on page 279). However, this check *is* performed when you access the connection for editing.

To validate all connections (including for data-store connectivity):

1. Click **Check All Connections for Errors**.
2. When prompted, click **Yes**.

Choosing an IdP Connection Type

Indicate on the Connection Type screen whether the connection to this partner is for Browser SSO, WS-Trust STS, OAuth SAML, and/or Inbound Provisioning (see *Connection Types* on page 12).

Note: You can add STS, OAuth, and Inbound Provisioning support to any existing SSO connection, or vice versa, at any time.

If your federation deployment supports multiple protocols , then for new SSO connections you can also select the applicable protocol on the Connection Type screen (see *Choosing Roles and Protocols* on page 92).

Note: If your partner's deployment also supports multiple protocols and you intend to communicate using more than one, then you must set up a separate connection for each protocol.

- To configure a connection for secure browser-based SSO, select Browser SSO Profiles and the Protocol (if necessary).
- To configure a connection for WS-Trust STS, make that selection.
- To configure an OAuth SAML Grant connection, make that selection.

  Note: This option is available only after you configure an access token plug-in (see *Access Token Management* on page 133).
- To configure an Inbound Provisioning connection, make that selection and choose to support provisioning of users only (User Support) or users and groups (User and Group Support). For groups, nested group membership, if any, are preserved.

  Note: The Inbound Provisioning option is active only after you enable the Inbound Provisioning protocol on the Roles & Protocol screen (see *Choosing Roles and Protocols* on page 92).
- Optional: If your PingFederate license manages connections by groups, then you can select a group for this connection.

  This option is not displayed for unrestricted or other types of licenses.

Choosing IdP Connection Options

On the Connection Options screen, you can choose to enable JIT Provisioning in conjunction with Browser SSO (see *Just-in-Time Provisioning* on page 34).

You can also choose to map user attributes for persistent grants used by the optional PingFederate OAuth Authorization Server (see *About OAuth* on page 15).

Note: The OAuth Attribute Mapping option is active only when the OAuth 2.0 Authorization Server (AS) role is enabled on the Roles & Protocol screen (see *Choosing Roles and Protocols* on page 92).

For SAML 2.0, you also have the option of configuring the Attribute Query profile, with or without SSO (see *Attribute Query and XASP* in the "Supported Standards" chapter of *Getting Started*).

Note: This screen is presented only for browser-based SSO connections (see *Choosing an IdP Connection Type* on page 268).

- To create a connection for browser-based SSO, ensure that Browser SSO is selected and click **Next**.

Importing IdP Metadata

If you are using one of the SAML protocols and have received a *metadata* file from your partner, click **Browse** on the Import Metadata screen, select the file, and click **Next**.

Note: If the endpoints in the metadata file share the same base URL (protocol, hostname, and port), PingFederate 7.3 uses this information to populate the Base URL field (see *General Connection Information* on page 269). Consequently, individual endpoints on other screens do not include this information—only relative paths are shown.

Note: If you are importing a signed metadata file that does not include the certificate and public key, you will be asked to import the certificate needed to verify the XML signature (see the next section).

If you are not using a metadata file, click **Next** on the Import Metadata screen.

Importing a Certificate

The Import Certificate screen appears only if the metadata file you have chosen to import is signed and the certificate needed to verify the signature is not contained in the file.

- Click **Browse** to locate and open the signature verification certificate for this partner.

Viewing the Summary

The Metadata Summary screen provides security information about an imported metadata file, including whether the file was signed and, if so, the trust status of the certificate used to verify the signature.

General Connection Information

On the General Info screen, you provide a required unique identifier and display name for a connection, as well as optional contact information. In addition, on this screen you can define a default error message that end users will see in the event that SSO fails, and you can set the level of transaction logging for this connection partner (see *Runtime Transaction Logging* on page 49).

Field Descriptions

Field	Description
Partner's Entity ID/ Issuer/ Partner's Realm (Connection ID)	(Required) The published, protocol-dependent, unique identifier of your partner. For a SAML 2.0 connection, this is your partner's SAML Entity ID. For a SAML 1.x connection, this is the Issuer your partner advertises. For a WS-Federation connection, this is your partner's Realm. This ID may have been obtained out-of-band or via a metadata file if you are using a SAML protocol (see *Exporting Metadata* on page 57). For STS-only connections, this ID can be any unique identifier
Connection Name	(Required) A plain-language identifier for the connection—for example, a company or department name. This name is displayed in the connection list on the administrative console.
Virtual Server IDs	If you want to identify your server to this connection partner using an ID other than the one you specified under Server Settings (see *Specifying Federation Information* on page 94), enter a virtual server ID in this field and click **Add**. Enter additional virtual server IDs as needed (see *Multiple Virtual Server IDs* on page 36).
Base URL	The fully qualified hostname and port on which your partner's federation deployment runs (e.g., `https://sso.theidpcompany.com:9031`). This entry is an optional convenience, allowing you to enter relative paths to specific endpoints, instead of full URLs, during the configuration process.
Company	The name of the partner company to which you are connecting.

Field	Description
Contact Name	The contact person at the partner company.
Contact Number	The phone number of the contact person at the partner company.
Contact Email	The email address for the contact person at the partner company.
Error Message	If an error occurs on this server, the end user's browser may be redirected (in a default situation) to an error page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76). The default entry in this field is used to localize the message. For information about how to find and change the default English message and how use the PingFederate localization feature, see *Localization* on page 81. If localization is not needed, you may also specify a message directly in this field to change the default.
Logging Mode	The level of transaction logging applicable for this connection (see *Runtime Transaction Logging* on page 49).

For a new connection:

- Fill in the information needed and click **Next**.

  Connection ID and Connection Name are required (see “Field Descriptions” above).

  Note that the values in Virtual Server IDs identify your own federation deployment for this connection only and override the ID you specified under Server Settings (see *Federation Server Identification*).

For an existing connection:

- If you are editing existing information, modify the fields as needed and click **Save**.

Configuring Browser SSO

Browser-based SSO (also, Browser SSO) is another term for secure SSO, which relies on a user’s Web browser and HTTP to broker XML identity-federation messaging between an IdP and an SP (in contrast to WS-Trust *STS* messaging, which is typically application-driven across the back channel and does not require browser mediation).

- To continue, click **Configure Browser SSO**.

Connection Configuration Steps

Many steps involved in setting up a federation connection are protocol-independent; that is, they are required steps for all connections, regardless of the associated standards (see *Supported Standards* chapter in *Getting Started*). Also, for any given connection, some configuration steps are required under the applicable protocol, while others are optional. Still others are required only based on certain selections. The PingTrust administrative console determines the required and optional steps based on the protocol and dynamically presents additional requirements or options based on selections.

The following sections provide sequential information about every step you might encounter while configuring browser-based SSO, regardless of the protocol you are using for a particular connection.

Note: The configuration screens represented in this chapter show “SAML 2.0” in their left corners, unless they are exclusive to WS-Federation or SAML 1.x setup requirements. When the SAML 2.0 screens are also applicable to SAML 1.x and/or WS-Federation connections, the SAML 2.0 representations and discussions also apply to the other protocols, unless otherwise indicated.

After configuring SSO settings, you will normally need to configure authentication credentials, the range of which depends on your SSO selections (see *Configuring Security Credentials* on page 314). Also, other configuration tasks may remain to be configured for new or modified connections, depending on selected connection options (see *Choosing IdP Connection Options* on page 268).

Important: For new connections you must completely configure these SSO settings and subsequent tasks before you can save the connection on the Activation & Summary screen. Until then, the *configuration is* *temporary and can be lost*; the console times out after several minutes of inactivity. At any time, however, you can click **Save Draft**, which is available on most screens after you enter General Information (see *Console Buttons* in the "Console Navigation" chapter of *Getting Started*).

Use the lists and links (or page references) below to find specific information about steps that may apply to your SSO connection requirements:

SAML 2.0 SSO Steps

- *Choosing SAML Profiles*
- *User-Session Creation*
    - *Selecting an Identity-Mapping Method* on page 274
    - *Defining an Attribute Contract* on page 274
    - *Configuring Target Session Mapping* on page 275
- *Configuring SAML Protocol Settings* on page 290
    - *Specifying SSO Service URLs (SAML)* on page 291
    - *Specifying SLO Service URLs* on page 293
    - *Choosing Allowable SAML Bindings (SAML)* on page 293
    - *Setting an Artifact Lifetime (SAML 2.0)* on page 294
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Choosing SAML Profiles

A SAML profile is the message-interchange scenario that you and your federation partner have agreed to use (see *Federation Planning Checklist* on page 35). For SAML 2.0, PingFederate supports all IdP- and SP-initiated SSO and SLO profiles.

The SAML 1.x implementation supports standard IdP-initiated SSO as well as nonstandard SP-initiated SSO.

For information on typical SSO/SLO profile configurations, including illustrations, see the “Profiles” sections in *Supported Standards* chapter in *Getting Started*.

You can configure profiles individually or all together. PingFederate presents the correct configuration steps to fit your choices. Steps that apply to one SSO or SLO profile often apply to others and are reused automatically across profiles.

Note: For SAML 1.x, IdP-initiated SSO is assumed and the specifications do not support SLO; the only choice on this screen is SP-initiated SSO (see *SAML 1.x Profiles* in the *Supported Standards* chapter of *Getting Started*).

For WS-Federation, the SAML Profiles screen is not presented.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **SAML Profiles** on the Summary screen.

To configure profiles:

1. Select the profile(s) applicable to this connection and click **Next**.

   For SAML 2.0 connections, you must select an SSO profile before you can enable SLO.
2. Continue through the remaining connection-configuration tasks.

The following topics provide more information on requirements for each SAML profile:

- *About IdP-Initiated SSO* on page 272
- *About SP-Initiated SSO* on page 272
- *About IdP-Initiated SLO* on page 273
- *About SP-Initiated SLO* on page 273

About IdP-Initiated SSO

When PingFederate is operating as an SP, the IdP-initiated SSO profile configuration defines the message-transport mechanisms (*bindings*) your enterprise has agreed to allow for receiving SAML assertions, plus any digital signature verification requirements for inbound assertions (see *Security Infrastructure*).

For illustrations of typical profile and binding scenarios, see the “Profiles” sections in the *Supported Standards* chapter in *Getting Started*.

For this configuration you need to know:

- The transport binding(s) to which you and your partner have agreed
- The certificate to be used for verifying incoming digital signatures from your IdP (optional for the artifact binding)

When Artifact is an allowable inbound SAML binding, you also need to know the endpoint(s) to your partner’s *Artifact Resolution Service*(s) and the SOAP client authentication mechanism to use: either HTTP Basic, SSL client certificates, a digital signature, or a combination of these mechanisms.

About SP-Initiated SSO

The SP-initiated SSO profile configuration defines the message-transport mechanisms (*bindings*) and security requirements for sending authentication requests and receiving assertions when your site initiates SSO transactions.

For SAML 1.x, the SP-initiated SSO profile is also known as the “destination-first” profile, which was added as a supported “non-normative” use case after the release of the SAML 2.0 specifications.

For illustrations of typical profile and binding scenarios, see the “Profiles” sections in the *Supported Standards* chapter in *Getting Started*.

For this configuration you will need to know:

- The endpoint URL(s) for your IdP's *Single Sign-on Service*(s)
- The transport *binding*s to which you and your partner have agreed (*inbound* and *outbound*)
- The certificates you will use to sign outbound authentication requests and to verify incoming digital signatures from your IdP

When Artifact is an allowable inbound SAML binding, you also need to know the endpoint(s) to your partner's *Artifact Resolution Service*(s) and the SOAP client authentication mechanism to use: either HTTP Basic, SSL client certificates, a digital signature, or a combination of these mechanisms.

About IdP-Initiated SLO

The SAML 2.0 IdP-initiated SLO profile configuration defines the message-transport mechanisms (*binding*s) and security requirements that you and your partner have agreed upon for exchanging SLO requests and responses.

Note: SLO is not supported by the SAML 1.x specifications.

For more information about SLO, see *Single Logout* in the "Supported Standards" chapter of *Getting Started*.

For this configuration you need to know:

- The transport bindings that you and your partner have agreed upon to send SLO requests and receive responses
- The certificates to be used for signing outgoing messages and for verifying incoming digital signatures from your IdP (optional for the artifact binding)
- The URL(s) of your IdP's *Single Logout Service*(s)
- The URL of your IdP's *Artifact Resolution Service*(s) (to resolve artifacts from the IdP) and SOAP client authentication requirements

About SP-Initiated SLO

The SAML 2.0 SP-initiated profile configuration for SLO defines the message-transport mechanisms (*binding*)s and security requirements that you and your partner have agreed upon for exchanging SAML requests and responses.

Note: SLO is not supported by the SAML 1.x specifications.

For more information about SLO, see *Single Logout* in the "Supported Standards" chapter of *Getting Started*.

For this configuration you need to know:

- The transport bindings that you and your partner have agreed upon to send SLO requests and receive responses
- The certificates to be used for signing outgoing messages and for verifying incoming digital signatures from your IdP (optional for the artifact binding)
- The URL(s) of your IdP's *Single Logout Service*(s)
- The URL of your IdP's *Artifact Resolution Service*(s) (to resolve artifacts from the IdP) and SOAP client authentication requirements

User-Session Creation

As an SP, you must specify how you use information sent from the IdP in SSO *assertion*s to create user sessions for enabling access to protected resources at your site.

If you are a federation hub, bridging an identity provider to one or more service providers, you must associate one or more connection mapping contracts to the IdP connection (see *Federation Hub* on page 38 and *Connection Mapping Contracts* on page 124 for more information).

For both scenarios, the configuration includes:

- Choosing an identity-mapping method (see *Selecting an Identity-Mapping Method* on page 274).
- Defining the *attribute contract* you will use with this partner, if any (see *Defining an Attribute Contract* on page 274).
- Configuring instances of one or more target sessions (see *Configuring Target Session Mapping* on page 275) and specifying how they are used to fulfill the contract.

- To continue, click **Configure User-Session Creation**.

Selecting an Identity-Mapping Method

PingFederate allows an SP to use either *account linking* or *account mapping* to associate remote users with local accounts for SSO between business partners (see *Identity Mapping* on page 22). At the Identity Mapping step, you choose which method to use with a particular IdP connection. You and your partner may want to decide in advance which option to use (see *Federation Planning Checklist* on page 35).

If your site is using account linking, then establishing an *attribute contract* is not required. Depending on your partner agreement, however, you may choose to supplement the account link with an attribute contract. In this configuration the account link is used to determine the user's identity, while the additional attributes might be used for authorization decisions, customized Web pages, and so on, at the your site (see *About Attributes* on page 23).

⚠ **Important:** If you have previously set up a configuration to use an attribute contract and want to change the configuration to use account linking without additional attributes, then the existing attribute contract will be discarded.

Account linking can be used with either a clear, standard name identifier or an opaque pseudonym.

- If you want to dynamically associate remote users with local accounts using a known attribute to identify a user—for example, a username or email address—then select **Account Mapping**.

  Account mapping uses the value passed in the SAML assertion's `SAML_SUBJECT` and associated user attributes to create an association between a remote user and a local account.

  ℹ **Tip:** if you are using PingFederate's JIT Provisioning, choose Account Mapping (see *Using Just-in-Time Provisioning* on page 298).

- If you want to create a long-term association between a remote user and a local account, then select **Account Linking** on the Identity Mapping screen.

  To set up an attribute contract to use in conjunction with account linking, select the checkbox next to "The assertion includes attributes . . ." after selecting **Account Linking**.

  ℹ **Tip:** An SP PingFederate uses a default, HyperSQL database to handle account linking. You can use your own database instead, as needed. For more information, see *Configuring an LDAP Connection* on page 102.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Identity Mapping** on the Summary screen.

Defining an Attribute Contract

An attribute contract is the set of user attributes that you and your partner have agreed will be sent in SAML assertions for this connection (see *Attribute Contracts* on page 23). You identify these attributes on this screen.

`SAML_SUBJECT` is always sent in a SAML assertion and contains the name identifier of the user requesting SSO. When you select *account mapping* as the identity mapping technique, the `SAML_SUBJECT` is available to help map the incoming user to a local ID on your system (see *Selecting an Identity-Mapping Method* on page 274).

For *account linking*, the `SAML_SUBJECT` contains an identifier that the SP server uses to make a permanent association between the remote user and a local account. The `SAML_SUBJECT` itself is not available to the SP application and thus does not appear in the Attribute Contract on this screen.

Optionally, you can mask the values of attributes (other than SAML_SUBJECT) in the log files that PingFederate writes when it receives assertions (see *Attribute Masking* on page 26).

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Attribute Contract** on the Summary screen.

   If this step is not in the list, then you have chosen to use *account linking* and specified that the IdP is not including additional attributes in the assertion (see *Selecting an Identity-Mapping Method* on page 274).

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your partner.
2. Optional: Select the checkbox under Mask Values in Log.
3. Click **Add**.

To modify an attribute name or masking selection :

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

   Note: If you change your mind, ensure that you click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made in the configuration steps.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Configuring Target Session Mapping

Remote users arriving at your site via an SSO request do so in order to use specific applications or gain access to protected resources. Based on the nature of the business relationship and the agreement with your partner, you may be expected to provide access to these applications. Therefore, integration between your federation SP server and local applications is important.

The PingFederate server for an SP uses integration adapters to identify the user to your applications based on attributes sent in an assertion. The server uses this information to create a local session that enables access to user-requested resources (the “target”) at your site. (See *SSO Integration Kits and Adapters* on page 19.)

Each adapter instance requires a set of attributes into which you map values found in the assertion. You can map additional attributes, as needed, from local data stores, or you can use static or variable text values. An adapter instance will fail to create a local session for the incoming user if it is unable to find values for each of its required attributes.

You may also deploy an IdP connection to bridge an identity provider to one or more service providers.

Tip: In this scenario, PingFederate is a federation hub for both parties. (See *Federation Hub* on page 38 and *Bridging multiple IdPs to an SP* on page 40 for more information.)

PingFederate uses connection mapping contracts to associate this IdP connection with the applicable SP connections to the service providers (see *Connection Mapping Contracts* on page 124).

Each connection mapping contract has its own set of attributes which you map values from the assertions.

You must associate at least one target session, adapter instance or a connection mapping contract, with an IdP connection. If you have multiple integration requirements—for example, if you are using more than one IdM system or an application not covered by a centralized system—then you should map multiple adapter instances. If you are bridging an identity provider to multiple service providers, you should map multiple connection mapping contracts.

When target sessions are restricted to certain virtual server IDs, the allowed IDs are displayed under the Virtual Server IDs column.

Note: If you configure multiple target sessions for a connection, PingFederate selects the applicable adapter instance or connection mapping contract at runtime based on the target resource information in the requests and your configuration (see *Configuring Target URL Mapping* on page 257).

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** on the Summary screen.

To begin mapping an adapter:

- Click **Map New Adapter Instance** and follow the configuration screens (see the following sections for more information).

To begin mapping a connection mapping contract:

- Click **Map New Connection Contract Mapping** and follow the configuration screens (see the following sections for more information).

To begin modifying an existing target session mapping:

- Click the **Adapter Instance Name** or the **Connection Mapping Contract Name**, and navigate through the steps to the information you want to change.

Choosing a Target Session

Use this screen to associate an SP adapter instance or a connection mapping contract with an IdP connection.

Tip: An SP adapter instance is available for use within an IdP connection only after it has been deployed and configured in PingFederate.

To select an adapter instance:

- Choose an adapter instance from the drop-down menu and click **Next** to continue.

  (Optional) To override any SP adapter instance, select the **Override Instance Settings** checkbox (see *Overriding SP Adapter Instances* on page 277).

  If the adapter instance you need is not available, click **Manage Adapter Instances** to define one or more adapter instances you need for this connection.

  Note that an adapter instance can be mapped only once per connection. However, the same adapter instance may be mapped by multiple connections.

  Tip: Adapter contracts for some adapters can be customized for individual connection requirements (see *Configuring SP Adapters* on page 254).

To select a connection mapping contract:

- Choose a connection mapping contract from the drop-down menu and click **Next** to continue.

  If the connection mapping contract you need is not available, click **Manage Connection Mapping Contracts** to define one or more connection mapping contracts you need for this connection.

  Note that a particular connection mapping contract can be mapped only once per connection. You may however map the same contract to multiple connections.

Overriding SP Adapter Instances

Overrides at the connection level simplify adapter management by allowing you to create a small set of adapter instances that define the base configuration requirements and then overriding settings at the connection level as needed.

You may override any SP adapter settings at the connection level either during or after connection mapping.

Alternatively, you can override any adapter instance to apply to several connections, see *Hierarchical Plug-in Configurations* on page 21 for more information about adapter overrides.

Note: Any changes to the base instance are propagated to a connection provided the same changes are not overridden for the connection.

- Click **Override Instance Settings**.

  On each of the settings screens, make your changes, and then click **Next**. When you are finished, click **Done** to continue with SP adapter mapping.

  Note: Override adapter-setting screens are functionally identical to those used for creating a new adapter connection. Refer to the table below to find sections in this manual containing configuration information and procedures.

  The display of some screens listed in the table depends on the type of adapter you are configuring.

  For information about the override adapter-setting screens, depending on the type of setting, use the following table:

Override Screen	Manual Section
Adapter	See *Configuring an Adapter Instance* on page 256.
Actions	See *Choosing Adapter Actions* on page 256.
Extended Contract	See *Extending Adapter Contracts* on page 256.

- To remove any adapter connection override, clear the **Override Instance Settings** checkbox, and then complete the rest of the setup.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Adapter Instance** on the Summary screen.
8. Select the **Override Instance Settings** checkbox.
9. Click **Next**.

Viewing SP Adapter Settings

Adapter override instance type information.

This screen is view only. This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Configuring SP Adapters* on page 254.

Overriding SP Instance Configuration Settings

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Configuring an Adapter Instance* on page 256.

Overriding an Adapter Action

- Make any changes, and then click Next.

This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Choosing Adapter Actions* on page 256.

Overriding an Extended Contract

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

This screen is functionally identical to the one used for creating a new adapter instance. For more information about this screen, see *Extending Adapter Contracts* on page 256.

Using the Override Instance Settings Summary Screen

- On the Override Instance Settings Summary screen, click any heading to change your processor configuration; or click **Done** to continue.

Restricting a Target Session to Certain Virtual Server IDs

When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), you have the option to enforce authentication requirements by restricting a target session (an adapter or a connection mapping contract) to certain virtual server IDs. This optional setting can be applied to each target session added to the connection using virtual server IDs. By default, no restriction is imposed.

To restrict a target session to a subset of the available virtual server IDs:

1. Select the **Restrict Virtual Server IDs** checkbox.
2. In the **Allowed Virtual Server IDs** area, select virtual server IDs that you want to allow for this target session.
3. Click **Next**.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** on the Summary screen.
8. Click the target session name.
9. Click **Virtual Server IDs** on the Summary screen.

Note: The Virtual Server IDs screen is only available for connections using at least one virtual server ID, see *Federation Server Identification*.

Selecting an Attribute Mapping Method

To populate the attributes required by the target session (an adapter contract or a connection mapping contract), you can use values supplied by SAML assertions from the IdP exclusively, or in addition to values retrieved from local user-data stores (see *Managing Data Stores* on page 98).

- If you choose to look up additional values, click the applicable button and then **Next**. This selection allows you to identify data sources and specify lookup queries in subsequent screens (see *Data Store Setup* on page 279 next).

  Or:

  If you choose not to look up additional values, click the applicable button (if it is not already selected) and then **Next**. This selection takes you directly to a screen where you can map attribute values from the assertion (see *Configuring Target Session Fulfillment* on page 284).

  Tip: To determine whether you need to look up additional values, compare your attribute contract against the contract of your target session (see *Defining an Attribute Contract* on page 274 and *Choosing a Target Session* on page 276). If target session requires more information, determine whether your local data stores can supply it. (You can also choose to use text constants or expressions for certain information—see *Configuring Target Session Fulfillment* on page 284.)

Data Store Setup

For data-store setup information, refer to the sections indicated in the following steps.

Note: As you make selections on configuration screens, ensure that you allow enough time for PingFederate to access your data store and populate drop-down lists.

1. See *Choosing a Data Store* on page 279.
2. See the following sections in this manual, depending on the type of data store:

Data Store Type	Related TopicManual Section
JDBC	• *Selecting a Database Table and Columns* on page 280 • *Configuring a Database Filter* on page 281
LDAP	• *Configuring a Directory Search* on page 282 • *Specifying an LDAP Filter* on page 283
Custom	• *Configuring Custom Data-Source Filters* on page 284 • *Selecting Custom Data-Source Fields* on page 284

3. See *Configuring Target Session Fulfillment* on page 284.

Choosing a Data Store

This screen allows you to choose a data store from a previously configured list (see *Managing Data Stores* on page 98). Attribute values extracted from this data store are used in combination with the values from the attribute contract to fulfill the adapter contract for this adapter instance or the connection mapping contract (see *Configuring Target Session Mapping* on page 275).

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.

4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **Data Store** on the Summary screen.

   If this step is not present, then the use of a data store has not been selected (see *Selecting a Database Table and Columns* on page 280).

To define an attribute source:

- Choose an Active Data Store and click **Next**.

  A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Selecting a Database Table and Columns

When you choose to use a database source for attributes, you follow this path through the configuration steps.

On this screen you begin to specify exactly where additional data can be found to complete the attribute contract when you send an assertion to this IdP (see *Configuring a Database Filter* on page 281). Only one table may be used as a source of data for a JDBC lookup.

> ! **Important:** **(For MySQL users)** To allow for table and column names that may contain spaces, PingFederate inserts double quotes around the names at runtime. To avoid SQL syntax errors resulting from the quotes, add the session variable `sql_mode=ANSI_QUOTES` to the connection string of your JDBC data store instance. For example:
>
> ```
> jdbc:mysql://myhost.mydomain.com:3306/pf?
> sessionVariables=sql_mode=ANSI_QUOTES
> ```
>
> Alternatively, you can configure the system variable `sql_mode` with the `ANSI_QUOTES` option. For more information, see *http://dev.mysql.com/doc/refman/5.7/en/server-system-variables.html*.

Field Descriptions

Field	Description
Schema	Lists the table structure that stores information within a database. Some databases, such as Oracle, require selection of a specific schema for a JDBC query. Other databases, such as MySQL, do not require selection of a schema.
Table	Displays the table(s) contained in the database. Select the table to retrieve data from the data store.
Columns to return from SELECT	Displays the columns available from the selected table. Select the columns that are associated with the desired attributes you would like to return from the JDBC query.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.

7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **Database Table and Columns** on the Summary screen.

   If this step is not shown, this connection is not yet configured to use a database to look up attributes. For information about changing this configuration, see *Choosing a Data Store* on page 279.

To select a database table and columns for queries:

1. Choose a Schema file (when applicable) from the drop-down list.
2. Choose a Table from the drop-down list.
3. Choose a name under Columns to Return from Select and click **Add Attribute**.

   Tip: Click **Refresh** if you are updating an existing configuration and changes may have been made to the database.

   Repeat this step for other columns as needed.

   Note: You do not need to add a column here for it to be used as part of a search filter (see *Configuring a Database Filter* on page 281 next). Add only attributes from which you need actual values to pass to the target session.

Configuring a Database Filter

On this screen you begin to specify exactly where additional data can be found to complete the attribute contract when you receive an assertion from this IdP (see *Creating an Attribute Contract*).

The JDBC `WHERE` clause queries your data store to locate a user record. Once the record is located, the configured SELECT statements retrieve the attribute values.

The clause is in the form:

```
WHERE column1=value1 [AND column2=value2] [OR ...]
```

The left side of the first variable pair uses a column name in the database table you selected (see *Selecting a Database Table and Columns* on page 280).

The right side generally uses values passed in from the assertion. Possible variables for these, including the correct syntax, are listed under Assertion Values.

You can also apply additional search criteria from your own database, using any other columns from the targeted table.

Tip: Click "**View List of Columns . . .**" to see a list from which to copy and paste.

Example:

```
userid='${username}'
```

In this example `userid` is the name of a column in the JDBC data store. On the right side, `'${username}'` returns the value of the `username` from the assertion.

Important: You *must* use the `${}` syntax to retrieve the value of the enclosed variable and use single quotation marks around the `${}` characters.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.

6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **Database Filter** on the Summary screen.

   If this step is not shown, this connection is not yet configured to use a database to look up attributes. For information about changing this configuration, see *Choosing a Data Store* on page 279.

To construct the `WHERE` clause:

1. Enter the statement in the space provided, following the guidelines and example above.

   The initial `WHERE` is optional.
2. Ensure the syntax and variable names are correct.

   When you click **Next**, you will map attribute values returned from the database into the attribute contract (see *Selecting an Attribute Mapping Method* on page 279).

Configuring a Directory Search

When you choose to use an LDAP source for attributes, you follow this path through the configuration steps.

On this screen you begin to specify exactly where additional data can be found to supply to the target session (an SP adapter or a connection mapping contract) in order to access a resource on your system.

Field Descriptions

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. This field is optional if records are located at the LDAP root.
Search Scope	Determines the node depth of the query. Select Subtree, One level or Object.
Root Object Class	Specifies the object type within the LDAP hierarchy from which attributes will be returned.
Attribute	The available attribute names for the selected directory structure. Select the names associated with the attributes that you would like to return from the query.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **LDAP Directory Search** on the Summary screen.

   If this step is not shown, this connection is not yet configured to use LDAP to look up attributes (see *Choosing a Data Store* on page 279).

To select LDAP attributes:

1. Optional: Enter a Base DN.
2. Select a Search Scope.

3. Select a Root Object Class.
4. Under Attributes to return from search, choose an attribute and click **Add Attribute**.

   Note that the attribute Subject DN is always returned by default.

   Note: When connecting to Microsoft Active Directory, if you choose the memberOf attribute, an optional checkbox, Nested Groups, appears on the right. Select this checkbox if you want PingFederate to query for groups the end users belong to directly as well as indirectly through nested group membership (if any) under the Base DN.

   For example, suppose you have three groups under the Base DN, namely Canada, Washington and Seattle. Seattle is a member of Washington. Ana Smith is an end user and a member of Seattle. If the Nested Groups checkbox is selected, when PingFederate queries for Ana's memberOf attribute values, the expected results are Seattle and Washington. (When the Nested Groups checkbox is not selected (the default), the expected result is Seattle.)

   For Oracle Directory Server, choose isMemberOf under Attribute for nested group membership. For more information, see *documentation about isMemberOf from Oracle* (docs.oracle.com/cd/E29127_01/doc.111170/e28967/ismemberof-5dsat.htm).
5. Repeat the last step for other attributes as needed.

   Note: You do not need to add an attribute here for it to be used in a search filter (see *Specifying an LDAP Filter* on page 283). Add only attributes from which you need values to map to the target session.

Specifying an LDAP Filter

The LDAP filter queries the data store to retrieve a user record associated with a particular value (or values) from the assertion. The filter is in the form:

```
(attribute=${value})
```

The left-side variable is an attribute from the data store (see *Configuring a Directory Search* on page 282).

The right side generally uses values passed in from the assertion.

You can also apply additional search criteria from your data store, using any other attributes from the targeted object classes.

Tip: Click "**View List of Available LDAP Attributes**" for a list from which you can copy and paste.

For general information about search filters, consult your LDAP documentation.

Example:

```
(UNAME=${username}).
```

In this example `UNAME` is the name of an attribute in the LDAP data store. On the right side, `${username}` returns the value of `username`. in the assertion.

Important: You *must* use the `${}` syntax to retrieve the value of the enclosed variable.

Field Description

Field	Description
Filter	A filter narrows a search to locate requested data by either including or excluding specific records. An LDAP filter includes the attributes in the search and the value or range of values that the search is attempting to match. Searches are conducted by using at least three components: 1) at least one attribute (attribute data type) to search on, 2) a search filter operator that will determine what to match, and 3) the value of the attribute being sought. Searches must have at least one of each of these three components.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **LDAP Filter** on the Summary screen.

   If this step is not shown, this connection is not configured to use LDAP to look up attributes (see *Choosing a Data Store* on page 279).

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.

   Note: If you used an anonymous binding to create this LDAP connection, your access might be restricted (see *Configuring an LDAP Connection* on page 102).
2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Configuring Custom Data-Source Filters

When you choose to use a custom source for attributes, you follow this path through the configuration steps.

On this screen you specify a filter, or lookup query, for your custom data source. This screen display and the syntax of the filter depends on your developer's implementation of the custom source SDK.

Selecting Custom Data-Source Fields

On the Configure Custom Source Fields screen, you can choose from among the fields shown to map to the target session (an adapter contract or a connection mapping contract). These choices are supplied by the driver implementation. Select only those needed to fulfill the target session.

Configuring Target Session Fulfillment

The last step in configuring a target session is to map each attribute required to a value (see *Selecting an Attribute Mapping Method* on page 279). If you integrate your applications with PingFederate through an SP adapter, these are the values that will be used to create a local session; an SSO operation fails if the SP is unable to fulfill the mapping requirements defined here. If you are bridging an identity provider to a service provider, these are the values that will be used to fulfill the connection mapping contract, which in turn will be used by the SP connection to create the assertions for the service provider (see *Federation Hub* on page 38 for more information).

Map attributes from one of these Sources:

- Account Link

  This source appears only if you have elected to use *account linking* for an SP adapter (see *Selecting an Identity-Mapping Method* on page 274). When you make this selection, the associated Value drop-down list is populated with Local User ID. Normally, you would map this identifier to target an adapter attribute that represents the local user ID. This source is not applicable to connection mapping contracts.
- Assertion

  Values are contained in the assertions from this IdP. When you make this selection, the associated Value drop-down list is populated by the attribute contract (see *Defining an Attribute Contract* on page 274).
- Context

  Values are returned from the context of the transaction at runtime.

Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

- JDBC/LDAP/Custom

  Values are returned from your query. When you make this selection, the Value list is populated by the database columns or LDAP or custom attributes you identified for this data store (see *Selecting a Database Table and Columns* on page 280,*Configuring a Directory Search* on page 282 , or *Selecting Custom Data-Source Fields* on page 284).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the incoming token assertion, using the `${`*`attribute`*`}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  ```
  ${ds.attribute}
  ```

  where *`attribute`* is any of the data store attributes you select.

  Tip: Two other variables are also available: `${SAML_SUBJECT}` and `${TargetResource}`. `SAML_SUBJECT` is the initiating user (or other entity). `TargetResource` is a reference to the protected application or other resource for which the user requested SSO access; this variable is available only if specified as a query parameter for the relevant PingFederate endpoint (either as `TargetResource` for SAML 2.0 or `TARGET` for SAML 1.x—see *Application Endpoints* on page 385).

  There are a variety of reasons why you might hard code a text value. For example, if your Web application provides a consumer service, you might want to supply a particular promotion code for this partner.

To reach this screen:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **User-Session Creation** under the Browser SSO tab.
6. Click **Configure User-Session Creation**.
7. Click **Target Session Mapping** under the User-Session Creation tab.
8. Click the target session name.
9. Click **(Adapter) Contract Fulfillment**on the Summary screen.

To map attributes:

1. Choose a Source for each Target attribute (see descriptions of each Source type above).
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.

3. Click **Done**.

Identifying Issuance Criteria (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether the user is authorized to continue the SSO transaction using the SP adapter or connect mapping contract (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access protected resources.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Assertion – Select to access attributes from the assertion.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

     Note: PingFederate appends a description in parentheses for data stores of the same type
   - Mapped Attributes – Select to access the required attributes.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Error results are handled in one of two ways:

   - **Redirect** – When an `InErrorResource` URL is provided., the value of the Error Result field is used by an `ErrorDetail` query parameter in the redirect URL.
   - **Template** – When an `InErrorResource` URL is not provided, the value of the Error Result field is used by the variable `$errorDetail` in the `idp.sso.error.page.template.htmlsp.sso.error.page.template.html` template (for more information on this and other user-facing templates, see *Customizing User-Facing Screens* on page 76).

     Note: Using an error code in the Error Result field allows the error template or a Web application to process the error result in a variety of ways—for example, a redirect to another page or e-mail to an administrator.

     If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.
6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.
8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

Important: When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), consider using an OGNL expression to verify the virtual server ID in conjunction with other conditions, such as group membership information, to protect against unauthorized access (see *Expression Examples* on page 430).

- Use the in-line editor box to enter the OGNL expression.

  For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
- Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

  Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
- Click **Add**. Continue to add expressions, as needed.
- Click the **Test** link to input values and test the resulting output for the expression.

  Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.

9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Target Session Summary Screen

When you have finished adding a new or modifying existing instance of an SP Adapter or a connection mapping contract, you can review the configuration on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing configuration, click **Done**; if you want to keep your changes, click **Save** when you reach the Browser SSO screen.

Using the Session Creation Summary Screen

- On the Session Creation Summary screen, click any heading to change the configuration; or click **Done**.

  If you are editing an existing configuration, be sure to click **Save** when you return to the Browser SSO screen, if you are finished.

Configuring OAuth Attribute Mapping

This configuration allows administrators to use assertion attributes for mapping values into OAuth persistent-grant `USER_KEY` and extended attributes (see *About OAuth* on page 15).

Note: This option is presented only when enabled for a connection (see *Choosing IdP Connection Options* on page 268).

- To continue, click **Configure OAuth Attribute Mapping**.

Choosing an OAuth Data Store

This optional configuration is the same for all OAuth attribute-mapping task flows. For detailed instructions, see *OAuth Attribute Mapping Using a Data Store* on page 157.

- If you do not need additional attributes from a data store, just click **Next** on the Data Store screen.

To reach this screen for editing

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **OAuth Attribute Mapping** under the Browser SSO tab.
6. Click **Configure OAuth Attribute Mapping**.
7. Click **Data Store** on the Summary screen.

Configuring Contract Fulfillment

The last step in configuring OAuth attribute mapping is to map attributes for the `USER_KEY` (to look up persistent OAuth grants), the extended attributes (to fulfill the access token), and `USER_NAME` (the name shown to end-users on permissions screens) for persistent access-token grants.

Note: The `USER_KEY` values must be unique across all end users because it is the identifier to store and to retrieve persistent grants. If SAML_SUBJECT uniquely identifies all end users, you can map SAML_SUBJECT to `USER_KEY`.

Map each attribute from one of the following Sources:

- Assertion

  Values are contained in the assertions from this IdP. When you make this selection, the associated Value drop-down list is populated by the token contract.
- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- JDBC/LDAP/Custom

  Values are returned from your user-data store. When you make this selection, the Value list is populated by the LDAP, JDBC or Custom attributes identified for this data store (see *Selecting a Database Table and Columns* or *Configuring a Database Filter* on page 281).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the incoming token assertion, using the `${`*`attribute`*`}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.attribute}`

  where `attribute` is any of the data store attributes you have selected.

To reach this screen

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

Click **Manage All**, if needed, to see a full list of connections.

3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **OAuth Attribute Mapping** under the Browser SSO tab.
6. Click **Configure OAuth Attribute Mapping**.
7. Click **Contract Fulfillment** on the Summary screen.

To map attributes:

1. Choose a Source for each attribute.
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Next**.

Selecting Issuance Criteria for OAuth Attribute Mapping

Use this optional screen to define criteria PingFederate can evaluate to determine whether to issue an access token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access a resource.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Assertion – Select to access attributes from the assertion.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

     Note: PingFederate appends a description in parentheses for data stores of the same type
   - Mapped Attributes – Select to access the required attributes.
2. Select an attribute name.
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Error results are handled in one of two ways:

   - **Redirect** – When an `InErrorResource` URL is provided., the value of the Error Result field is used by an `ErrorDetail` query parameter in the redirect URL.
   - **Template** – When an `InErrorResource` URL is not provided, the value of the Error Result field is used by the variable `$errorDetail` in the `idp.sso.error.page.template.htmlsp.sso.error.page.template.html` template (for more information on this and other user-facing templates, see *Customizing User-Facing Screens* on page 76).

Note: Using an error code in the Error Result field allows the error template or a Web application to process the error result in a variety of ways—for example, a redirect to another page or e-mail to an administrator.

If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.

6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.

8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

   Important: When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), consider using an OGNL expression to verify the virtual server ID in conjunction with other conditions, such as group membership information, to protect against unauthorized access (see *Expression Examples* on page 430).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

Click **Delete** under Actions for the criteria and then click **Save**.

Using the OAuth Attribute Mapping Summary Screen

When you finish the configuration, you can review it on the Summary screen.

If you need to make any changes, click the heading over the information you want to edit. When you finish, click **Done**.

Configuring SAML Protocol Settings

The Protocol Settings screen provides the launching point for configuring *bindings*, partner endpoints, and other settings needed for the selected SAML profiles (if you are using SAML 2.0—see *Choosing SAML Profiles* on page 271). The screen also displays configured information.

(For WS-Federation, the configuration of bindings is not applicable.)

To configure Protocol Settings, you need to know:

- For SP-initiated SSO profiles, the URL(s) of your IdP's *Single Sign-on Service(s)*.
- For SLO profiles, the URL(s) of your IdP's *Single Logout Service*(s)
- When artifact is an allowable inbound binding, the URL of your IdP's *Artifact Resolution Service*(s)

- The transport configurations (*binding*s) that you will use to send and receive data for SSO/SLO connections
- Digital signature policies and certification requirements to which you and your connection partner have agreed
- XML encryption policies to which you and your connection partner have agreed

- To continue, click **Configure Protocol Settings**.

  Note: After modifying any settings, you must click **Save** on the Protocol Settings screen.

Specifying SSO Service URLs (SAML)

At this step for SAML 2.0 connections, you associate bindings to the endpoints where your IdP wants PingFederate to send authentication requests when SSO is initiated at your site.

For SAML 1.x, only one endpoint is allowed, and the binding selection is not required.

Some federation use cases may require additional customizations in the authentication requests sent from the PingFederate SP server to the IdP, such as including the optional `Extensions` element in the authentication requests. You can use OGNL expressions to fulfill these use cases.

This configuration applies only to the SP-initiated SSO Profile (see *About SP-Initiated SSO* on page 272).

Field Descriptions

Field	Description
Binding (SAML 2.0)	The transport type agreed upon by you and your partner: Artifact, POST, or Redirect.
Endpoint URL	The location where your IdP receives SSO messages.
MessageType	The type of the message that you need to customize for this connection.
Expression	The OGNL expression to fulfill your use case.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **SSO Service URLs** on the Summary screen.

   If this step is not displayed, you have not selected SP-initiated SSO (see *Choosing SAML Profiles* on page 271).

To define an Endpoint URL:

1. If you are using SAML 2.0, select the Binding your partner specifies for the Endpoint.
2. Enter the fully qualified Endpoint URL or a relative path if you have defined a base URL (see *General Connection Information* on page 269).
3. If you are using SAML 2.0, click **Add**.
4. If your partner has additional SSO endpoints established under SAML 2.0, repeat the steps above.

To customize the authentication requests:

1. Click **Show Advanced Customizations**.

   Note: Expressions must be enabled for the **Show Advanced Customizations** button to appear (see *Enabling and Disabling Expressions* on page 428).
2. Select a Message Type.

3. Enter an OGNL expression to fulfill your use case.

   Note: For more information about Message Type, available variables, and sample OGNL expressions, see *Customizing Assertions and Authentication Requests* on page 433.

Specifying a Service URL (WS-Federation)

The Service URL is the WS-Federation endpoint of your IdP partner. This endpoint is where you send RST (Request for Security Token) and SLO messages.

To protect against session token hijacking, PingFederate provides an option to validate wreply for SLO. When the option is enabled, you can specify additional allowed domains and paths in this screen. PingFederate validates the locations against a consolidated list of allowed domains and paths from all active WS-Federation connections before redirecting the end users to their destinations.

Note: Settings to enter additional allowed domains and paths appear only if the option to validate wreply for SLO is enabled (see *Managing Partner Redirect Validation* on page 114).

- Enter the fully qualified URL or a relative path if you have defined a base URL (see *General Connection Information* on page 269).

To define a service URL:

- Enter the fully qualified URL or a relative path if you have defined a base URL (see *General Connection Information* on page 269).You must include the initial slash if you are entering only a relative path.

To specify additional allowed domains and paths:

1. Indicate whether to require HTTPS.

   Important: This selection is recommended to ensure that the validation will always prevent message interception for this type of potential attack, under all conceivable permutations.
2. Enter the expected domain or IP address under Valid Domain Name.

   Use the domain only, without qualifiers. For example:

   `company.com`

   Using an initial wildcard and period for a domain name will cover multiple subdomains. For example: `*.company.com`

   covers `hr.company.com` or `email.company.com`.

   (Optional) Enter the exact path of the resource (case-sensitive) under Valid Path. Starts with a forward slash, without any wildcard characters in the path. If left blank, any path (under the specified domain or IP address) is allowed. For example:

   `/app/Consumer.jsp`

   allows `/app/Consumer.jsp` but rejects `/app/consumer.jsp`.

   Tip: You can also enter multiple query parameters with or without a fragment.

   For example: `/app/Consumer.jsp?area=West&team=IT#ref1001`

   matches `/app/Consumer.jsp?area=West&team=IT#ref1001` but not `/app/Consumer.jsp?area=East&team=IT#ref1001`

   (Optional) Select the Allow Any Query / Fragment checkbox if you want to allow any query parameters or fragment in the resource.

   Note: When selected, no query parameter and/or fragment is allowed in the path.

   Click **Add**.
3. Repeat the previous step to add additional entries as needed.
4. Click **Save**.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** under the Browser SSO tab.
6. Click **Configure Protocol Settings**.
7. Click **Service URL** on the Summary screen.

Specifying SLO Service URLs

At this step you associate bindings to the endpoints where your IdP receives logout requests when SLO is initiated at your site and where you send SLO responses when you receive SLO requests from the IdP.

This step applies only for SAML 2.0 connections when you have selected an SLO profile (see *Choosing SAML Profiles* on page 271).

Field Descriptions

Field	Description
Binding	The transport type agreed upon by you and your partner: Artifact, POST, Redirect, or SOAP.
Endpoint URL	A location where your IdP receives SLO request messages.
Response URL	(Optional) A location where the IdP receives SLO logout response messages. Use this endpoint when you are part of a chain of session participants. When omitted, the PingFederate SP server sends logout responses to the Endpoint URL.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **SLO Service** on the Summary screen.

To define an Endpoint URL:

1. Select the Binding your partner specifies for the Endpoint.
2. Enter the fully qualified Endpoint URL or a relative path if you have defined a base URL (see *General Connection Information* on page 269).
3. Optional: Enter the Response URL or a relative path and click **Add**.
4. If your partner provides additional endpoints for SLO, repeat the steps above.

Choosing Allowable SAML Bindings (SAML)

At this step you configure binding(s) that the IdP will use to send SAML assertions or SLO messages (under SAML 2.0) to your PingFederate server.

This configuration applies to all profile types (see *Choosing SAML Profiles* on page 271). You and your partner can agree to standardize on one binding type or select different bindings for different profile scenarios.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Allowable SAML Bindings** on the Summary screen.

To define binding requirements for this connection:

- Make your selections and click **Next** (or **Done**).

Setting an Artifact Lifetime (SAML 2.0)

When you send an artifact to your IdP's SSO or SLO service , an element in the message indicates how long it should be considered valid.

You can change the default value per your requirements, if needed. Also consider synchronizing clocks between your server and your partner's SAML gateway server. If clocks are not synchronized, you might need to set the artifact lifetime to a higher value.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.
6. Click **Configure Protocol Settings**.
7. Click **Artifact Lifetime** on the Summary screen.

   This step appears only if you have selected the artifact binding for either a SSO or SLO Service at the IdP site.

Specifying Artifact Resolver Locations

This endpoint or group of endpoints is where your server will send back-channel requests based on *artifact*s. The location or locations are also known under SAML specifications as the *Artifact Resolution Service*. SAML 2.0 provides for multiple, indexed endpoints for the service.

Note that this screen is different for SAML 1.x implementations, for which only one endpoint is allowed.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** on the Summary screen.

6. Click **Configure Protocol Settings**.
7. Click **Artifact Resolver Locations** on the Summary screen.

   If this step does not appear, you do not have Artifact selected under **Allowable SAML Bindings**.

For a SAML 2.0 connection:

1. Enter a URL on the Artifact Resolver Locations screen and click **Add**.

   The URL must be fully qualified (defining protocol, host, and port) unless you have entered a base URL (see *General Connection Information* on page 269).

   Repeat this step if your IdP supports multiple services. The SAML 2.0 specifications permit multiple artifact resolution services through the use of Index numbers, which PingFederate automatically supplies when you add a service. Alternatively, if needed per partner specifications, you may assign these index numbers manually.

   Note: When specifying multiple artifact resolution endpoints, each endpoint must share the same transport protocol. That is, if one endpoint uses HTTP, then all must use HTTP. Similarly, if one endpoint uses HTTPS, then all must use HTTPS.
2. Click **Next**.

For a SAML 1.x connection

1. Enter the Endpoint on the Artifact Resolution Location screen.

   The URL must be fully qualified (defining transport protocol, host, and port) unless you have entered a base URL (see *General Connection Information* on page 269).
2. Optional: Enter your partner's Source ID.

   The Source ID is usually a generated value based on a federation partner's Connection ID; the SP will correctly generate the Source ID. If that is the case for this partner, then leave this field blank. If your partner uses a Source ID that is not based on the Issuer ID, then enter the Source ID supplied by your IdP partner.
3. Click **Next**.

Configuring Default Target URLs (Optional)

Use this screen to assign a default target URL for this IdP Connection configuration. Entering a URL in the Default Target URL field overrides any SP Default URL SSO setting (see *Configuring Default URLs* on page 261).

Note: SAML 1.x specifications for IdP-initiated SSO require a target URL to be specified. If the target application is specified in the URL parameter (see *IdP Endpoints* on page 385), any URL specified in the Default Target URL field on this screen will not be used for those transactions.

Configuring Signature Policy

The Signature Policy screen provides options controlling how digital signatures are used for SSO Internet messaging. The choices made on this screen depend on your partner agreement (see *Digital Signing Policy Coordination* on page 29).

Digital signing is required for SAML Response messages sent from the IdP via POST (or Redirect for SAML 2.0). Optionally, SSO authentication requests from the SP (SP-initiated SSO) may also be signed to enforce security. (This option appears only for SAML 2.0 connections and only if you have enabled SP-initiated SSO using the POST or redirect bindings.)

The assertions inside SAML Responses may be also be signed. When you make this choice, only the assertion portion of the Response is signed, not the complete Response. (This is the only option that appears for SAML 1.x connections.)

- To choose one or more enhancement options, select the second button, make your selection(s), and click **Next**.
- Otherwise, select the first option (if not already selected) and click **Next**.

Configuring XML Encryption Policy (for SAML 2.0)

For SAML 2.0 configurations, in addition to using signed assertions to ensure authenticity, you and your partner may also agree to encrypt all or part of an assertion to improve privacy. This feature is commonly used if the assertion might pass through an intermediary (such as a user's browser) and HTTPS is not used.

If the name identifier (or `SAML_SUBJECT`) of an assertion is encrypted, you and your partner may also want to encrypt the identifier in subsequent single-logout messages (if you are using an SLO profile).

Note that "The entire assertion" selection on the Encryption Policy screen includes the `SAML_SUBJECT` and all attributes.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Browser SSO** under the IdP Connection tab.
4. Click **Configure Browser SSO**.
5. Click **Protocol Settings** under the Browser SSO tab.
6. Click **Configure Protocol Settings**.
7. Click **Encryption Policy** on the Summary screen.

To define XML encryption:

1. Select Allow encrypted SAML Assertions and SLO messages.
2. Choose whether this IdP partner will encrypt the entire assertion, the `SAML_SUBJECT`, one or more other attributes, or some combination.
3. If your partner is encrypting the name-identifier attribute, use the checkboxes near the bottom of the screen to indicate whether you will encrypt this attribute in outbound SLO messages and/or allow its encryption for inbound messages.
4. Click **Next** or **Done**.

To disable previously configured XML encryption selections:

1. Select **None** and then **Done**.
2. Click **Save** on the Browser SSO screen.

Saving Protocol Settings

On the Summary screen, you can review or edit your Protocol Settings.

Important: When you finish editing existing settings, be sure to click **Done** on the Summary screen and then **Save** on the Protocol Settings screen. For a new connection, click **Done** and then click **Next** on the Protocol Settings screen. Save the entire connection on the Activation & Summary screen (see *Connection Activation and Summary* on page 322).

To reconfigure saved settings:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make dependent or other changes, do so and continue by clicking **Done** until you reach the Protocol Settings screen.
3. Click **Save** on the Protocol Settings screen.

Editing and Saving SSO Settings

On the Summary screen for Browser SSO, you can review or edit your SSO configuration.

Important: When you finish editing existing settings, be sure to click **Done** on the Summary screen and then **Save** on the Browser SSO screen. For a new connection, click **Done** and then click **Next** on the Browser SSO screen. Save the entire connection on the Activation & Summary screen (see *IdP Connection Activation and Summary* on page 320).

To reconfigure saved settings:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make dependent or other changes, do so and continue by clicking **Done** until you reach the Browser SSO screen.
3. Click **Save** on the Browser SSO screen.

Configuring the Attribute Query Option

At the Attribute Query step you configure your connection to request user attributes from your partner IdP, if you have chosen this option (see *Choosing IdP Connection Options* on page 268). Attribute queries are not dependent on single sign-on but may be used independently or in conjunction with Browser SSO or provisioning to provide flexibility in how a user authenticates with SP applications (see *Attribute Query and XASP* in the “Supported Standards” chapter of *Getting Started*).

Setting the Attribute Authority Service URL

Attribute Authority is the term used to refer to an IdP that provides user attributes to an *Attribute Requester* (your SP site). The Attribute Authority Service URL corresponds to the endpoint location where Attribute Query requests are received by your IdP partner (see *Attribute Query and XASP* in the Supported Standards chapter of *Getting Started*).

To configure the URL:

- Enter the fully qualified URL or a relative path if you have defined a base URL (see *General Connection Information* on page 269).

Mapping Attribute Names

If the application at your site uses different names for user attributes than the names defined by the Attribute Authority, then you need to map them on this screen. When the SP receives a request from a local application to send an Attribute Query to this Attribute Authority partner, the requested user attributes are replaced with the names mapped here.

This information must be predetermined in your agreement with this connection partner.

To map attributes:

1. Enter the Local Name and Remote Name of an attribute and click **Add**.

   Repeat this step for all attributes requiring mapping.
2. Click **Next**.

To edit a mapping:

1. Click **Edit** under Action for the mapping.
2. Make your change(s) and click **Update**.

   Note: If you change your mind, ensure that you click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made in this configuration.
3. Click **Done** and then **Save** on the Attribute Query screen.

Defining Security Policy

This screen allows you to specify the digital signing and encryption policy to which you and your partner have agreed. These selections will trigger requirements for setting up Credentials (see *Configuring Security Credentials* on page 314).

This screen also allows you to mask incoming attribute values in log files (see *Attribute Masking* on page 26). When you enable this selection, all user attributes returned from this IdP are masked.

To configure attribute-query security policy for this partner:

- Check or clear the check boxes and click **Next** or **Done**.

Saving the Attribute Query Configuration

On the Summary screen you can review the Attribute Query configuration.

To reconfigure saved profiles:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Attribute Query screen.
3. Click **Save** on the Attribute Query screen.

Using Just-in-Time Provisioning

PingFederate's Just-in-Time (JIT) Provisioning allows SPs to create user accounts "on the fly" during SSO events, based on attributes received from IdPs (see *Using Just-in-Time Provisioning* on page 298). An SP can also use the feature to update existing user records.

Note: This configuration task is presented in the administrative console only when JIT Provisioning is selected as an option (see *Choosing IdP Connection Options* on page 268).

- To continue, click **Configure User Provisioning**.

Selecting Attribute Sources (SAML 2.0)

For SAML 2.0 connections, the server can be configured to use only assertion attributes for user provisioning or to retrieve more attributes from the IdP in a follow-on Attribute Query transaction (see *Attribute Query and XASP* in the "Supported Standards" chapter of *Getting Started*). The User Attributes screen displays the attributes expected in the assertion from this IdP (see *Defining an Attribute Contract* on page 274).

Note: Attribute Query is a SAML 2.0 profile. For SAML 1.x and WS-Federation connections, this screen is not presented: PingFederate uses only attributes from the assertion for user provisioning.

- If you and your IdP partner have agreed to use the Attribute Query profile for provisioning, select that option before leaving this screen.

  You configure the Attribute Query profile later in the task flow, if you have not already done so (see *Configuring the Attribute Query Option* on page 297).

Identifying the User Repository

PingFederate's JIT Provisioning currently supports LDAP v3-compliant user stores and the JDBC-compliant Microsoft SQL Server 2005.

Note: We recommend using the latest version of the Microsoft SQL Server JDBC Driver (version 4 or higher), which is compatible with current and recent Server JRE versions.

- Choose the Active Data Store on the User Repository screen.

If the correct data store is not shown in the drop-down list, then PingFederate is not yet configured to access the store (see *Managing Data Stores* on page 98).

- If you are using an LDAP store, refer to the sections immediately following:
  - *Specifying an LDAP User-Record Location* on page 299
  - *Defining an LDAP Filter* on page 299
  - *Identifying Provisioning Attributes for LDAP* on page 299
- If you are using MSSQL, skip to this section:
  - *Selecting a SQL Method* on page 300

Specifying an LDAP User-Record Location

After choosing a data store, indicate where in the store PingFederate should write new user records or update existing ones. Start by specifying where user records are located in your data store.

Note: This screen appears only for LDAP data stores (see *Identifying the User Repository* on page 298).

Field Description

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. Leave this field blank if records are located at the LDAP root.

Defining an LDAP Filter

On the Unique ID screen, create an LDAP filter to identify user accounts to be provisioned (or updated) during SSO events. PingFederate uses this expression in conjunction with the Base DN (see the previous section) to locate existing account records and to add new ones.

Note: This screen appears only for LDAP data stores (see *Identifying the User Repository* on page 298).

The filter is in the form: `attribute=${value}`

Note that the statement must not be enclosed in parentheses, unlike filters used to retrieve LDAP attributes for adapter mapping (see *Specifying an LDAP Filter* on page 283).

The left-side variable is an attribute in your user-data store—click the link near the left corner of the screen to see a list of available attributes. The right side of the filter generally uses one or more attribute values passed in from the assertions (see *Defining an Attribute Contract*). Variables for these attributes, including the correct syntax, are listed under Assertion Values.

Note: If you are unfamiliar with writing LDAP queries, please refer to the documentation accompanying your LDAP installation.

Identifying Provisioning Attributes for LDAP

On the Attributes screen, select the data-store attributes to be provisioned.

Tip: Multiple-value IdP attributes are handled automatically: when you map a multi-value assertion attribute to an LDAP attribute, each value is stored separately for the LDAP attribute name. If you need to provide additional values for particular attributes, add the same attribute name to this list multiple times. You can then map the additional values on the Attribute Fulfillment screen (see *Mapping Attributes to a User Account* on page 301).

Note: This screen appears only for LDAP data stores (see *Identifying the User Repository* on page 298).

To select attributes:

1. Choose a Root Object Class and an Attribute from the drop-down lists and click **Add Attribute**.

   Repeat this step for the same attribute if needed for multi-value attributes (see "Tip" above).

Important: For the Oracle Directory Server or Active Directory, the attribute `objectClass` must be among attributes added—select <Show All Attributes> under Root Object Class to locate and add this attribute.

2. Repeat the previous step for each attribute requiring provisioning.

Selecting a SQL Method

For JDBC data stores, PingFederate allows you to map attributes directly to a single database table (the default) or to SQL stored-procedure parameters.

Note: The SQL Method screen appears only for JDBC data stores (see *Identifying the User Repository* on page 298).

- Make a selection as needed and click **Next**.

  Depending on the selection, different steps appear under the JIT Provisioning task. Refer to the manual sections indicated below for more information:
- If you are mapping attributes directly to a Table, refer to the topics sections immediately following:
  - *Specifying a Database User-Record Location* on page 300
  - *Specifying a Unique-ID Database Column* on page 300
- If you are using a Stored Procedure, skip to this section:
  - *Specifying a Stored-Procedure Location* on page 300

Specifying a Database User-Record Location

For database provisioning to a table, indicate where PingFederate should write new user records or update existing ones.

Note: This screen appears only for MSSQL data stores when Table is selected on the SQL Method screen (see the previous section, *Selecting a SQL Method* on page 300).

Field Descriptions

Field	Description
Schema	Select the table structures that store information within the database.
Table	Select the name of the database table that contains user records.
Columns to fulfill when provisioning	For the selected table, all attributes and their data types are displayed. All attributes must be mapped for the database insertion to succeed, although a null entry may be used for optional attributes (see *Mapping Attributes to a User Account* on page 301).

Specifying a Unique-ID Database Column

PingFederate uses the column specified on this screen to check whether a user record already exists for the incoming *assertion*.

Note: This screen appears only when Table is selected on the SQL Method screen (see *Selecting a SQL Method* on page 300).

- Select a column that represents a unique characteristic about the database entry for a particular user (email, for example).

Specifying a Stored-Procedure Location

If you are using a stored procedure for provisioning the user database, specify its location on this screen.

Important: The database account used by PingFederate must have access to the schema in which the stored procedure is located, as well as execute permission for the procedure.

Note: This screen appears only when Stored Procedure is selected on the SQL Method screen (see *Selecting a SQL Method* on page 300).

Field Descriptions

Field	Description
Schema	Select the table structure that contains stored procedures within the database.
Stored Procedure	Select the stored procedure needed to provision the user database.
Procedure parameters to fulfill	For the selected procedure, all parameters and their data types are displayed. You map assertion values to the parameters on the next screen.

- To see a list of attributes expected from SAML assertions, click **View Attribute Contract**.
- If the list of parameters is not or might not be current (due to any recent procedure revisions), click **Refresh**.

Mapping Attributes to a User Account

The Attribute Fulfillment screen provides a means of mapping the values of incoming attributes into local account attributes or, for JDBC stores, into SQL stored-procedure parameter values (see *Selecting a SQL Method* on page 300). You can also provide values of your own for any data store attributes (except JDBC system-managed) or for SQL procedure parameters—either as hard-coded text or derived values based on assertion attributes.

For JDBC, this screen also provides a means of testing the insertion of attribute values into the database or stored procedure.

Tip: For mapping to a database `datetime` or `smalldatetime` column, if you are not using a stored procedure to convert the incoming string value, you may use a PingFederate Java conversion method via OGNL expressions (see *Using Attribute Mapping Expressions* on page 428). Note that expressions must be enabled to use the PingFederate conversion method—see *Enabling and Disabling Expressions* on page 428.

Note: For a JDBC data store, if stored procedures are used, the note under the task bar on this screen is different than shown above and the Target Attribute column reads “Target Parameter.”

Map attributes from one of these Sources:

- Assertion

  Values are contained in the assertions from this IdP. When you make this selection, the associated Value drop-down list is populated by the attribute contract (see *Defining an Attribute Contract* on page 274).
- Context

  Values are returned from the context of the transaction at runtime—for example, *authentication context*.
- Attribute Query

  This choice appears only if you have chosen to use the Attribute Query profile for provisioning (see *Selecting Attribute Sources (SAML 2.0)* on page 298).

  To map an attribute-query value, use this syntax:

  ```
  ${query_attribute}
  ```

  You can also combine attribute-query values with references to attributes in the attribute contract. For example:

  ```
  ${query_attribute}+${attribute}
  ```

  References to attributes not contained in the attribute contract result in an Attribute Query back to the IdP partner.
- Expression (when enabled—see *Enabling and Disabling Expressions* on page 428)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

Tip: For JDBC mapping, if the data type of a Target Attribute/Parameter is `datetime` or `smalldatetime`, you can use an expression to convert date-time strings from the assertion. After selecting Expression for such attributes, click **Datetime OGNL Examples** under the text box for syntax information and examples.

- System Managed (if applicable)

  This mapping option appears only when any automatically assigned JDBC attributes are among columns to be provisioned—for example, an identity or timestamp column for the MSSQL Server.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the assertion, using the `${attribute}` syntax.

  Note: If no entry is required in a JDBC database for a column, you can leave the text box blank. A blank entry results in an empty string in the database for string data types and null for all other data types. Alternatively, for string types, you can enter `null` in the text box to explicitly set `null` in the table column.

To map attributes:

1. Choose a Source for provisioning each Target Attribute or Target Parameter (see descriptions of each Source type above).

   Note: For JDBC table mapping, select System Managed as the Source for any columns that are automatically provisioned by the database server.

   Tip: For LDAP mapping, choose Text as the Source for the `objectClass` attribute.
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped. However, for optional JDBC table columns, you may leave a text box blank (or, for string data types, enter `null` to avoid empty strings).

   Note that no value is required for System Managed attributes.

   Note: For Active Directory, enter user in the text box for `objectClass`. For the Oracle Directory Server, enter `inetOrgPerson`.
3. Click **Done**.

To test the insertion of attributes into a JDBC table or stored procedure:

1. Click the **Test insert into . . . or Test call to . . .** link.
2. For each Target Attribute or Target Parameter (for a stored procedure), enter text into the boxes under Test Value and click **Test Insert** (or **Test Stored Procedure Call**).

   For table insertions, if the test is successful, a confirmation is displayed along with the values inserted. For stored procedures, only a confirmation is displayed if the test is successful, indicating that the procedure was populated with parameter values.
3. For table insertions, unless you wish to keep test values in the database, click **Roll Back All Test Inserts**.

   If you are using a stored procedure, this option is not provided since PingFederate cannot know the result of the procedure. Database rollback, if needed, must be handled manually.
4. When finished, click **Next** or **Done**; or click the link **Return to Attribute Fulfillment** to continue or change any mapping.

Choosing an Event Trigger

On the Event Trigger screen, choose whether PingFederate initiates user provisioning only when the user identifier is new or every time your site receives a SAML assertion. In the latter case (for all assertions), an existing user account is always updated with incoming attributes.

Note: This screen does not appear for JDBC data stores if provisioning is accomplished using a stored procedure (see *Selecting a SQL Method* on page 300), because the procedure is always called for all assertions. The procedure should handle both provisioning new users and updating existing ones (if desired).

Error Handling

If user provisioning fails for any reason during SSO events, you can choose to stop the SSO or continue the process by passing assertion attributes on to your application (via the SP adapter configuration—see *Configuring Target Session Mapping* on page 275).

When SSO is aborted, the user is redirected to an error page, and the failure is written to the log and added to the Transaction Failure Count at the bottom of the administrative console.

Using the Provisioning Summary Screen

The Summary screen provides an overview of your provisioning configuration.

- When you are finished with a new configuration, click **Done** and then **Save** on the JIT Provisioning screen.

To change the configuration:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the JIT Provisioning screen.
3. Click **Save** on the JIT Provisioning screen.

Configuring Inbound Provisioning

Inbound Provisioning implements the *SCIM* protocol to provide an automated user-management service when PingFederate is configured as an SP (see *Provisioning for SPs* on page 34).

This configuration provides for two-way mapping of attributes. The first facilitates SCIM operations used to create and update records in the data store (see *Writing User Information to the Data Store* on page 307). The second allows the same SCIM client to retrieve those records and have the attribute values mapped back to their corresponding designation in the client store (see *Configuring a SCIM Response* on page 308).

The dual mapping is intended to provide greater flexibility, especially when needed for OGNL-expression transformations—for example, converting two attributes into one multi-value attribute and then back again (see *Using Attribute Mapping Expressions* on page 428).

Note: SCIM-client requests must include authentication credentials, which you configure later (see *Configuring Security Credentials* on page 314). The same credentials needed for SSO or other types of transactions enabled as part of this IdP connection, if configured, are also used for SCIM transactions.

- To continue, click **Configure Inbound Provisioning** in the Inbound Provisioning screen.

Specifying the User Repository

PingFederate currently supports AD user stores (requires an LDAPS connection to the data store) as well as custom identity store provisioners for Inbound Provisioning.

- Choose either Active Directory Data Store or Identity Store Provisioner and then specify the data store from the drop-down menu.

  Note: If the correct data store is not shown in the drop-down list, then PingFederate is not yet configured to access the store (see *Managing Data Stores* on page 98).

  If the identity store provisioner is not shown in the drop-down list, then PingFederate is not yet configured to access the store (see *Configuring Identity Store Provisioners* on page 259).

Identifying an LDAP User-Record Location

After choosing a data store, indicate where in the data store user and group records exist so PingFederate can create, read, update, or delete/disable them.

Note: This screen appears only if you are configuring an LDAP user store for provisioning.

To specify a base DN:

- Enter the base Distinguished Name of the tree structure where user records are stored. PingFederate looks only at this node level or below it for user accounts that need provisioning.

Defining a Unique ID

On the Unique ID screen, create an LDAP filter to resolve user accounts for SCIM operations. PingFederate uses this expression in conjunction with the Base DN (see the previous section) to add new account records.

Note: This screen appears only if you are configuring an LDAP user store for provisioning.

The filter is in the form:

```
attribute=${value}
```

Note: Unlike filters used to retrieve LDAP attributes for adapter mapping, do not enclose the statement in parentheses (see *Specifying an LDAP Filter* on page 283).

The left-side variable is an attribute in your user-data store—click the link near the left corner of the screen to see a list of available attributes. The right side of the filter generally uses one or more attribute values passed in from the SCIM request. Variables for these attributes, including the correct syntax, are listed under SCIM Attributes.

Note: If you are unfamiliar with writing LDAP queries, please refer to the documentation accompanying your LDAP installation.

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.
2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Defining a Unique Group ID

On the Unique Group ID screen, create an LDAP filter to resolve groups for SCIM operations. PingFederate uses this expression in conjunction with the Base DN (see the previous section) to add new groups.

Note: This screen appears only if you are configuring an LDAP user store for provisioning and the User and Group Support checkbox is selected in the Connection Type screen (see *Choosing an IdP Connection Type* on page 268).

The filter is in the form: `attribute=${value}`.

Note: Unlike filters used to retrieve LDAP attributes for adapter mapping, do not enclose the statement in parentheses (see *Specifying an LDAP Filter* on page 283).

The left-side variable is an attribute in your user-data store—click the link near the left corner of the screen to see a list of available attributes. The right side of the filter generally uses one or more attribute values passed in from the SCIM request.

Variables for these attributes, including the correct syntax, are listed under SCIM Attributes.

Note: If you are unfamiliar with writing LDAP queries, please refer to the documentation accompanying your LDAP installation.

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.

2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Defining Custom SCIM Attributes

PingFederate supports SCIM attributes in the core schema as well as custom attributes through a schema extension.

Note: Custom attributes are optional. If your use case does not require any additional attributes, click **Next** in the Custom SCIM Attributes screen.

To support custom attributes, you must specify the schema extension and the custom attributes in the connection. There are four attribute types:

- Simple Attributes
- Simple Multi-Valued Attributes
- Complex Attributes
- Complex Multi-Valued Attributes

The following fragment illustrates a SCIM message supporting schema extension `urn:scim:schemas:extension:custom:1.0` with four attributes, one of each attribute type. The table afterward describes the details of each attribute.

```
{
  "userName":"CBrown",
  "active":true,
  "schemas":[
    "urn:scim:schemas:core:1.0",
    "urn:scim:schemas:extension:custom:1.0"
  ],
  ...
  "urn:scim:schemas:extension:custom:1.0":{
    "supervisor":"JSmith",
    "territories":[
      "Montana",
      "Idaho",
      "Wyoming"
    ],
    "options":{
      "quantity":"10000",
      "strike"  :"5.25",
      "first"   :"2017-12-01",
      "last"    :"2025-03-31"
    },
    "tablets":[
      {
        "model" :"8086",
        "serial":"5500-2020-965",
        "type"  :"office"
      },
      {
        "model" :"8088",
        "serial":"5500-2040-151",
        "type"  :"remote"
      }
    ]
  }
}
```

Attribute Name	Attribute Type	Sub-Attributes (Complex)
`supervisor`	Simple	Not Applicable
`territories`	Simple Multi-Valued	Not Applicable

Attribute Name	Attribute Type	Sub-Attributes (Complex)
`options`	Complex	`quantity`, `strike`, `first`, and `last`
`tablets`	Complex Multi-Valued	`model`, `serial`, and `type`. **Note:** `type` is a reserved sub-attribute for a complex multi-valued attribute.

Tip: For more information about SCIM and attribute types, see the Web site *www.simplecloud.info*.

To specify a schema extension:

- Specify the URI of the schema extension in the Extension namespace field.

  Tip: The default value is `urn:scim:schemas:extension:custom:1.0`. You can keep this value as long as your partner identifies custom attributes by this URI in its SCIM messages.

To add a custom attribute:

- Enter an attribute name and click **Add**. (Repeat this step to add more custom attributes as needed.)

To delete a custom attribute:

- Click **Delete** next to the custom attribute. (To undo the deletion, click **Undelete**.)

To edit a custom attribute:

- Click **Edit** next to the custom attribute to:
  - Change its attribute name
  - Set it as a simple multi-valued attribute
  - Add sub-attributes to make it a complex attribute
  - Add sub-attributes and set it as a complex multi-valued attribute

  (For more information, see *Configuring Custom SCIM Attribute Options* on page 306.)

When you finish editing custom attributes, click **Next** in the Custom SCIM Attributes screen.

Configuring Custom SCIM Attribute Options

For the chosen custom attribute, use the Custom SCIM Attribute Options screen to:

- Change its attribute name
- Set it as a simple multi-valued attribute
- Add sub-attributes to make it a complex attribute
- Add sub-attributes and set it as a complex multi-valued attribute

To change the name of the custom attribute:

1. Replace the current value in the Name field.
2. Click **Done**.

To define the custom attribute as a simple multi-valued attribute:

1. Select the **Is Multi-Valued** checkbox.
2. Click **Done**.

To define the custom attribute as a complex attribute:

1. Enter a sub-attribute and click **Add**. (Repeat this step to add more sub-attributes as needed.)

> **Tip:** Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the name of a sub-attribute. Use the **Delete**/**Undelete** links to remove a sub-attribute or cancel the deletion.

2. Click **Done**.

To define the custom attribute as a complex multi-valued attribute:

1. Enter a sub-attribute and click **Add**. (Repeat this step to add more sub-attributes as needed.)

   > **Tip:** Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the name of a sub-attribute. Use the **Delete**/**Undelete** links to remove a sub-attribute or cancel the deletion.
2. Select the **Is Multi-Valued** checkbox.
3. If you have chosen Active Directory as your user store (see *Specifying the User Repository* on page 303), you must specify at least one value under the Types column for `type`, a reserved sub-attribute for a complex multi-valued attribute.

   > **Important:** If an inbound SCIM message includes this complex multi-valued attribute with multiple entries, each entry must contain the `type` sub-attribute with a unique value matching one of the values specified under the Types column. Work with you partner to identify the possible `type` values and enter them here.

   > **Note:** If you have chose Identity Store Provisioner as your user store, the `type` sub-attribute is optional.

   > **Tip:** Use the **Edit**/**Update**/**Cancel** links to make or undo a change to the `type` value. Use the **Delete**/**Undelete** links to remove a `type` value or cancel the deletion.
4. Click **Done**.

Writing User Information to the Data Store

To configure how PingFederate completes create and update operations for user accounts from a SCIM request, identify incoming attributes and map them to data-store attributes.

- Click **Configure Write Users** to continue.

Identifying Inbound Provisioning Attributes for LDAP

On the Attributes screen, select the data-store attributes you want to provision.

> **Note:** This screen appears only if you are configuring an LDAP user store for provisioning.

System Managed LDAP Attributes

Several attributes are managed internally by PingFederate and do not require mapping:

- `objectClass`
- `unicodePwd`
- `objectGUID`
- `userAccountControl`

You can override the internal management of `objectClass` and `unicodePwd` by selecting these attributes and mapping them to SCIM attributes on the Attribute Fulfillment screen. In this case, the values you supply are used. The `objectGUID` and `userAccountControl` attributes cannot be overridden and are ignored if selected.

To select attributes:

1. Choose a Root Object Class and an Attribute from the drop-down lists and click **Add Attribute**.
2. Repeat the previous step for each attribute requiring provisioning.

Mapping Attributes to User Accounts

Use this screen to map attribute values in the SCIM request to user-account attributes.

Map attributes from one of these sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Expression (when enabled—see *Enabling and Disabling Expressions* on page 428)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

  Tip: If two attribute values from a SCIM request need to be mapped to one LDAP attribute value, use an OGNL Expression to create it.
- SCIM User

  When you make this selection, the associated Value drop-down list is populated by defined components of the SCIM request.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the SCIM request, using the `${attribute}` syntax.

To map attributes:

1. Choose a Source for provisioning each Target Attribute (see descriptions of each Source type above).
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Done**.

Using the Write Users Summary Screen

The Summary screen provides an overview of the inbound provisioning configuration for request mapping.

- When you finish with a new configuration, click **Done**.

To change the configuration:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Writer Users screen.
3. Click **Next** on the Inbound Provisioning screen.

Configuring a SCIM Response

To configure a SCIM response to a request to read and return provisioned SCIM attributes, identify and map the user account attributes you want to include.

- Click **Configure Read Users** to continue.

Identifying Expected User Attributes for the SCIM Response

An attribute contract is a set of user attributes that you and your partner have agreed will be sent in a SCIM response for this connection. The attributes you mapped to user account attributes in the Write Users flow appear at the top of the screen.

Use the Available SCIM Attributes link at the bottom of the screen to include additional attributes you want to map in the SCIM response.

Optionally, you can mask the values of attributes in the log files that PingFederate writes when it sends the SCIM response.

System Managed SCIM Attributes

There are several SCIM attributes that are managed internally by PingFederate and are unavailable for inclusion in the attribute contract:

- `id`
- `active`

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your partner. To see a list of available attributes, click **Available SCIM attributes**.
2. Optional: Select the checkbox under Mask Values in Log.
3. Click **Add**.

To modify an attribute name or masking selection:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

   Note: If you change your mind, ensure that you click **Cancel** in the Actions column, not the Cancel button, which discards any other changes you might have made in the configuration steps.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Identifying LDAP Attributes for the SCIM Response

Select the LDAP attributes you want to map to attributes in the SCIM response.

Note: This screen appears only if you are configuring an LDAP user store for provisioning.

To select attributes:

1. Choose a Root Object Class and an Attribute from the drop-down lists and click **Add Attribute**.
2. Repeat the previous step for each attribute requiring provisioning.

Mapping Attributes to SCIM Response Attributes

Use this screen to map outgoing user-account attributes to SCIM responses to READ requests.

Map attributes from one of these sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Expression (when enabled—see *Enabling and Disabling Expressions* on page 428)

This option provides more complex mapping capabilities—for example, transforming outgoing values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

> **Tip:** If an LDAP attribute needs to be mapped to two attributes in a SCIM response, use an OGNL Expression to create them.

- LDAP

  Values are returned from your query. When you make this selection, the Value list is populated by the LDAP attributes you identified for this data store.
- Identity Store

  Values are returned from your query. When you make this selection, the Value list is populated by the Identity Store attributes you identified for this data store.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the SCIM request, using the `${attribute}` syntax.

To map attributes:

1. Choose a Source for provisioning each Target Attribute (see descriptions of each Source type above).
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Done**.

Using the Read Users Summary Screen

The Summary screen provides an overview of the inbound provisioning configuration for SCIM response mapping.

- When you finish with a new configuration, click **Done**.

To change the configuration:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Read Users screen.
3. Click **Save** on the Inbound Provisioning screen.

Handling SCIM Delete Requests

Use this screen to define how SCIM delete requests are handled within your user data store.

> **Important:** If the group support option is enabled (see *Choosing an IdP Connection Type* on page 268), when PingFederate receives a SCIM delete request for a group, it always removes the specified group from the data store.

> **Note:** This screen appears only if you are configuring an LDAP user store for provisioning.

- Select **Disable User** to make the user inactive within the data store. This approach might be preferred in situations where accounts must be retained for auditing reasons.

  In order to be SCIM compliant when deleting users, PingFederate returns an HTTP 404 response code for all subsequent operations related to the user-effectively treating the user as if they have been deleted from the LDAP user store (see the *SCIM protocol*).

  > **Caution:** If the user is disabled through another method, PingFederate still treats that user as if they have been deleted and returns HTTP 404 response codes for all subsequent requests.
- Select **Permanently Delete User** to remove the user from the data store.

Writing Group Information to the Data Store

To configure how PingFederate completes create and update operations for groups from a SCIM request, identify incoming attributes and map them to data-store attributes.

- Click **Configure Write Groups** to continue.

Identifying Inbound Provisioning Group Attributes for LDAP

On the Attributes screen, select the data-store attributes you want to provision.

Note: This screen appears only if you are configuring an LDAP user store for provisioning and the User and Group Support checkbox is selected in the Connection Type screen (see *Choosing an IdP Connection Type* on page 268).

System Managed LDAP Group Attributes

Several attributes are managed internally by PingFederate and do not require mapping:

- `objectClass`
- `objectGUID`
- `member`

You can override the internal management of `objectClass` by selecting and mapping it to a SCIM attribute on the Attribute Fulfillment screen. In this case, the values you supply are used. The `objectGUID` and member attributes cannot be overridden and are ignored if selected.

To select attributes:

1. Choose a Root Object Class and an Attribute from the drop-down lists and click **Add Attribute**.
2. Repeat the previous step for each attribute requiring provisioning.

Mapping Attributes to Groups

Use this screen to map attribute values in the SCIM request to group attributes.

Map attributes from one of these sources:

- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Expression (when enabled—see *Enabling and Disabling Expressions* on page 428)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

  Tip: If two attribute values from a SCIM request need to be mapped to one LDAP attribute value, use an OGNL Expression to create it.
- SCIM Group

  When you make this selection, the associated Value drop-down list is populated by defined components of the SCIM request.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the SCIM request, using the `${attribute}` syntax.

To map attributes:

1. Choose a Source for provisioning each Target Attribute (see descriptions of each Source type above).
2. Choose (or enter) a Value for each Attribute.

   All values must be mapped.
3. Click **Done**.

Using the Write Groups Summary Screen

The Summary screen provides an overview of the inbound provisioning configuration for request mapping.

- When you finish with a new configuration, click **Done**.

To change the configuration:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Write Groups screen.
3. Click **Next** on the Inbound Provisioning screen.

Configuring a SCIM Response for Groups

To configure a SCIM response to a request to read and return provisioned SCIM attributes, identify and map the group attributes you want to include.

- Click **Configure Read Groups** to continue.

Identifying Expected Group Attributes for the SCIM Response

An attribute contract is a set of group attributes that you and your partner have agreed will be sent in a SCIM response for this connection. The attributes you mapped to group attributes in the Write Groups flow appear at the top of the screen.

Use the Available SCIM Attributes link at the bottom of the screen to include additional attributes you want to map in the SCIM response.

Optionally, you can mask the values of attributes in the log files that PingFederate writes when it sends the SCIM response.

System Managed SCIM Group Attributes

There are several SCIM attributes that are managed internally by PingFederate and are unavailable for inclusion in the attribute contract:

- `id`
- `members`

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by your partner. To see a list of available attributes, click **Available SCIM attributes**.
2. Optional: Select the checkbox under Mask Values in Log.
3. Click **Add**.

To modify an attribute name or masking selection:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

> **Note:** If you change your mind, ensure that you click **Cancel** in the Actions column, not the Cancel button, which discards any other changes you might have made in the configuration steps.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Identifying LDAP Group Attributes for the SCIM Response

Select the LDAP attributes you want to map to attributes in the SCIM response.

> **Note:** This screen appears only if you are configuring an LDAP user store for provisioning and the User and Group Support checkbox is selected in the Connection Type screen (see *Choosing an IdP Connection Type* on page 268).

To select attributes:

1. Choose a Root Object Class and an Attribute from the drop-down lists and click **Add Attribute**.
2. Repeat the previous step for each attribute requiring provisioning.

Mapping Group Attributes to SCIM Response Attributes

Use this screen to map outgoing group attributes to SCIM responses to READ requests.

Map attributes from one of these sources:

- Context

  Values are returned from the context of the transaction at runtime.

  > **Note:** The HTTP Request selection is retrieved as a Java object rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.
  >
  > Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)
- Expression (when enabled—see *Enabling and Disabling Expressions* on page 428)

  This option provides more complex mapping capabilities—for example, transforming outgoing values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.

  > **Tip:** If an LDAP attribute needs to be mapped to two attributes in a SCIM response, use an OGNL Expression to create them.
- LDAP

  Values are returned from your query. When you make this selection, the Value list is populated by the LDAP attributes you identified for this data store.
- Identity Store

  Values are returned from your query. When you make this selection, the Value list is populated by the Identity Store attributes you identified for this data store.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the SCIM request, using the `${attribute}` syntax.

To map attributes:

1. Choose a Source for provisioning each Target Attribute (see descriptions of each Source type above).
2. Choose (or enter) a Value for each Attribute.

All values must be mapped.

3. Click **Done**.

Using the Read Groups Summary Screen

The Summary screen provides an overview of the inbound provisioning configuration for SCIM response mapping.

- When you finish with a new configuration, click **Done**.

To change the configuration:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Read Groups screen.
3. Click **Save** on the Inbound Provisioning screen.

Saving the Inbound Provisioning Configuration

On the Summary screen you can review the Inbound Provisioning configuration.

To reconfigure saved profiles:

1. Click the heading over the information you want to change.
2. Click **Done** on the screen containing your change.

   If you need to make additional changes, do so and continue by clicking **Done** until you reach the Inbound Provisioning screen.
3. Click **Save** on the Inbound Provisioning screen.

Configuring Security Credentials

The Credentials screen presents a list of possible security requirements you might need, depending on the federation protocol you are using and the choices you have made.

Your connection configuration may involve any or all of the following:

- *Back-Channel Authentication* on page 314
- *Digital Signature Settings* on page 316
- *Signature Verification Settings* on page 317
- *Choosing an Encryption Certificate* on page 319
- *Choosing a Decryption Key* on page 320

- To configure or modify credentials, click **Configure Credentials**.

Back-Channel Authentication

When you configure a profile for the *inbound* artifact binding, *outbound SOAP* binding, or provisioning, you must specify back-channel authentication information for sending SOAP messages, artifact resolution requests, and provisioning requests to your partner IdP.

Similarly, if you send artifacts, SOAP messages, or provisioning messages to your partner IdP, then you must configure SOAP authentication requirements for receiving SOAP responses, artifact resolution requests, or provisioning requests from your partner.

This step also applies to attribute-request configurations, since this profile always uses the SOAP back channel (see *Choosing SAML Profiles* on page 271).

Note: A yellow triangle next to a listing indicates that you have not completely configured back-channel authentication requirements.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.

   If the Back-Channel Authentication step is not shown, then it is not applicable to your configuration—you are not using the Attribute Query profile and have not configured any profiles to use the artifact or SOAP bindings.

To configure back-channel authentication requirements for sending HTTP messages:

1. On the Back-Channel Authentication screen, click the **Configure** link to the right of the list of messages to be *sent* to your partner.
2. Make one or more selections on the Outbound SOAP Authentication Type screen:

   - HTTP Basic — you enter SOAP Basic credentials on a later screen.
   - SSL Client Certificate — you specify the certificate on a later screen.

     This option is available only if you specify an endpoint that uses SSL.
   - Use Digital Signatures (Browser SSO profile only) — you sign the message.

     You are asked to select a signing certificate on a later screen.

   For SAML 2.0, these options may be used in any combination or independently. For SAML 1.x, you must use either Basic or SSL authentication; digital signing may be added to ensure message integrity.

   By default, PingFederate validates your partner's SSL server certificate— verifying that the certificate chain is rooted by a trusted Certificate Authority and that the hostname matches the certificate's Common Name. Clear the associated checkbox if you do not want this validation to occur.
3. Click **Next**.
4. If you chose HTTP Basic at *Step 2*, enter the SOAP Username and Password to use for this partner under Basic SOAP Authentication.

   You must obtain these credentials from your partner.
5. If you are using an SSL certificate, select the certificate under SSL Authentication Certificate and click **Next**.

   If you have not yet created or imported the client SSL certificate you need into PingFederate, click **Manage Certificates** (see *SSL Client Keys and Certificates* on page 164). You need to export the certificate (only) and send it your partner.
6. On the Summary screen, click **Done**.

To configure back-channel authentication requirements for receiving HTTP messages:

1. On the Back-Channel Authentication screen, click the **Configure** link to the right of the list of messages to be *received* from your partner.
2. Select one or more options on the Inbound Authentication Type screen:

   - HTTP Basic — Enter the logon username and password your partner uses on the next screen.
   - SSL Certificate — Specify certificate verification information on a later screen.
   - Use Digital Signatures (Browser SSO profile only). . . — Incoming messages must be signed.
   - Require SSL — When selected, incoming HTTP transmissions must use a secure channel.

     You are asked to select a signature verification certificate on a later screen.

     For SAML 2.0, use these options in any combination or independently. For SAML 1.x, you must use either Basic or SSL authentication; add digital signing to ensure message integrity.
3. Click **Next**.

4. If you chose HTTP Basic at *Step 2*, enter the Username and Password under Basic Authentication (Inbound).

   Important: If you are configuring more than one connection that uses the artifact or HTTP profile, you must ensure that the Username is unique for each connection.

5. If you are using an SSL certificate, select Anchored or Unanchored under Certificate Verification Method.

   - Anchored — The certificate must be signed by a trusted Certificate Authority. Optionally, you may also restrict the issuer to a specific Trusted CA to mitigate potential man-in-the-middle attacks as well as to provide a means to isolate certificates used by different connections. The CA's certificate must be imported into the PingFederate Trusted CA store (see *Trusted Certificate Authorities* on page 161).
   - Unanchored — The certificate is self-signed or you want to trust a specified certificate.

     Note: When anchored certificates are used between partners, certificates may be changed without sending the update to your partner. If the certificate is unanchored, any changes must be promulgated.

6. Click **Next**.
7. If you chose anchored SSL certificate verification at *Step 5* , enter the Subject DN and click **Next**.

   Tip: If you have not yet defined the certificate in PingFederate or you do not know the DN, return to the previous screen and select Unanchored. Then click **Next** and click **Manage Certificates** on the SSL Verification Certificate screen to import the certificate, if needed, or to view its DN.

8. If you chose unanchored SSL certificate verification at *Step 5*, select the certificate to use for validating the SSL connection.

   If you have not yet imported the certificate into PingFederate, click **Manage Certificates**.

9. Click **Next**.
10. On the Summary screen, click **Done**.

Digital Signature Settings

This step defines the private key you will use to sign SSO authentication or attribute requests (optionally) or SAML 2.0 SLO messages for this IdP. In addition, the step allows you to include "Key Info" with the XML message if you and your partner have agreed to this option.

Digital signing applies to SP-initiated SSO under SAML 2.0, when specified by your partner agreement, and to either SLO profile (see *Choosing SAML Profiles* on page 271) using the POST or redirect bindings. The step also applies if you are configuring an Attribute Query profile and have specified that you will sign attribute requests (see *Defining Security Policy* on page 298).

The step is not required for SAML 1.x IdP connections.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.

3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Digital Signature Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require digital signatures. You do not have SLO configured using the POST or redirect bindings, and you have not elected to sign either authentication or attribute requests (see *Configuring Signature Policy* on page 295 and *Defining Security Policy* on page 298).

To specify a certificate:

1. Select the certificate from the drop-down list.

   If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).

2. Optional: If you have agreed to send your public key with the SAML message, select the checkbox to include the certificate. To include the raw key in the signature as well, select the "**Include the raw key …**" checkbox.
3. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.

Signature Verification Settings

Under SAML 2.0 specifications, when your site receives any SAML 2.0 messages via the POST or Redirect bindings, the messages must be digitally signed. Signing is also always required for the SAML 1.x POST binding and for WS-Federation assertions, as well as incoming SAML 1.1 or 2.0 tokens for WS-Trust STS processing.

Depending on your agreement with this IdP, SSO assertions, SAML 2.0 artifacts, or SOAP messages might also require signatures.

Whenever signatures are required, PingFederate provides a choice of trust models, including an option to use anchored signature-verification certificates embedded in incoming messages (see *Trust Models*). When this option is chosen in Signature Verification Settings, you must provide the Subject DN for embedded certificates coming from this partner, and the Issuer CA certificate must be part of the PingFederate trusted store (see *Trusted Certificate Authorities* on page 161).

Alternatively, you may choose to use unanchored certificates, in which case you must import your partner's public-key certificate during this configuration (or select it if it is already imported). To prevent any interruption of service due to an expired certificate, you can ask your partner for a new certificate in advance and import it as backup.

- To continue, click **Manage Signature Verification Settings**.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.

Selecting a Trust Model

This screen allows you choose the Trust Model you want to use for signature verification (see *Trust Models* on page 29).

- Depending on the selection, the next step in this task varies:
  - For **Anchored**, the next step is to enter the Subject DN for your partner's certificate (see the next section, *Specifying a Subject DN* on page 318).

    Important: If you are using the Redirect binding for SLO, you cannot use anchored certificates because SAML 2.0 does not permit certificates to be included using this transport method.
  - For **Unanchored**, the next step is to import your partner's certificate (see *Selecting an Unanchored Certificate* on page 318).

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.

3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.
7. Click **Trust Model** on the Summary screen.

Specifying a Subject DN

When you choose to use an anchored certificate for signature verification, incoming SAML messages must contain the partner's verification certificate (see *Trust Models*). PingFederate verifies that the Issuer DN (if specified) matches that of one of the issuers in the chain, the Issuer CA is trusted and the embedded certificate's Subject DN matches the one specified on this screen. If so, PingFederate uses that certificate to verify the message signature.

To complete the configuration:

1. Enter the Subject DN or extract it from your IdP partner's certificate if the certificate is stored on an accessible file system.

   Tip: To extract the Subject DN from a certificate, browse to select your IdP partner's public certificate and click **Extract**.
2. Optional: Select the Restrict Issuer checkbox. Enter the Issuer DN or extract it from a certificate if it is stored on an accessible file system.

   Important: We recommend enabling this option to mitigate potential man-in-the-middle attacks as well as to provide a means to isolate certificates used by different connections.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.
7. Click **Certificate Subject DN** on the Summary screen.

Selecting an Unanchored Certificate

On the Signature Verification Certificate screen, you identify your partner's imported public certificate and, optionally, a secondary certificate to use when the first expires (see *Trust Models*).

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Signature Verification Settings** on the Summary screen.

   If this step does not appear, then your configuration does not require verification settings.
6. Click **Manage Signature Verification Settings**.

7. Click **Signature Verification Certificate** on the Summary screen.

To specify a verification certificate:

1. Select the certificate from the drop-down list.

   If you have not yet imported the certificate into PingFederate, click **Manage Certificates**.
2. Optional: Select a Secondary certificate for backup.

   Use this field if your partner has sent you a new certificate to replace one that is ready to expire. The server will automatically verify against the secondary certificate when the primary one expires.

Using the Summary Screen

- Click any heading to change a setting, or click **Done** if the configuration is complete, then **Done** again on the Signature Verification Settings screen.

  Be sure to click **Save** on the Credentials screen if you are editing an existing connection.

Choosing an Encryption Certificate

If `SAML_SUBJECT` is encrypted, either by itself or as part of a whole assertion, then all references to this name identifier in SAML 2.0 SLO requests from your site may also be encrypted (if the connection uses SP-initiated SLO). For more information, see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296.

To enable this XML encryption, you must identify an encryption certificate for this partner.

You must also choose a certificate if encryption of the Name Identifier is required for an Attribute Request profile (see *Defining Security Policy* on page 298).

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Select XML Encryption Certificate** on the Summary screen.

   If this step is not present, then you have either not configured this connection to use the SP-initiated SLO profile (see *Choosing SAML Profiles* on page 271) or you have chosen not to encrypt the assertion or the SAML_SUBJECT (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

To identify the encryption certificate:

Optional: Change the default settings under Block Encryption Algorithm.

Due to import control restrictions, the standard JRE distribution supports strong but not unlimited encryption. To use the strongest AES encryption, when permissible, download and install the appropriate version of "Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy Files" from the *Oracle download Web site* (`www.oracle.com/technetwork/java/javase/downloads/index.html`).

For more information about XML block encryption and key transport algorithms, see the *XML Encryption Syntax and ProcessingW3C Recommendation* (`www.w3.org/TR/xmlenc-core/`).

Note: As a Key Transport Algorithm, RSA-v1.5 is disabled for new connections for security reasons. If you are updating an existing connection that uses RSA-v1.5, we recommend changing the selection for increased security.

Choosing a Decryption Key

As part of XML encryption, you must identify a certificate and key for PingFederate to use to decrypt incoming assertions or assertion elements (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click a connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **Credentials** under the IdP Connection tab.
4. Click **Configure Credentials**.
5. Click **Select XML Decryption Key**.

   If this step is not present, you have not chosen to require encryption of all or part of the SAML assertion (see *Configuring XML Encryption Policy (for SAML 2.0)* on page 296).

To identify the decryption key:

- From the drop-down list, select the applicable certificate and click **Next**.

  If the certificate is not in the list, click **Manage Certificates** to import it (see *Digital Signing and Decryption Keys and Certificates* on page 166).

Saving Credential Configurations

From the Summary screen you can review or edit your credentials configuration.

Important: When you finish editing existing settings, you must click **Done** on the Summary screen and then **Save** on the Credentials screen. For a new connection, click **Done** and then click **Next** on the Credentials screen. Save the entire connection on the Activation screen (see *Connection Activation and Summary* on page 322).

IdP Connection Activation and Summary

When you finish setting up a connection, you may choose to activate it immediately.

Important: Regardless of whether you choose to activate a new connection now or later, you must click **Save** on the Summary screen for a new connection if you want to keep the configuration.

You can deactivate a connection at any time (for maintenance, for example). When a connection is inactive, all SSO or SLO transactions to or from this partner are disabled, as well as access to the WS-Trust STS for Web Service Providers associated with this connection.

Tip: The SSO Application Endpoint near the top of the Summary screen is an example URL that webmasters or Web application developers at your site might use to invoke SSO for the connection. For details about SSO and other server endpoints, including optional query parameters, see *Application Endpoints* on page 385.

To change a Connection Status:

- Select either Active or Inactive and then click **Save**.

To modify a connection setting:

1. If you know which step needs to be modified, click its link under the IdP Connection tab.

   If you do not know where to change the setting, locate the currently configured data under one of the summary headings and then click the subheading above the data.
2. Change the information on the step screen and click **Save**, if available.

If **Save** is not available, you are in the middle of a task (see *About Tasks and Steps* in *Getting Started*); click **Next** or **Done** until you reach a screen containing a **Save** button. Then click **Save** and continue as needed until you return to the Main Menu.

If your modification requires related configuration changes, PingFederate provides error messages indicating the necessary steps and then guides you to the related screens (unless you click **Cancel**).

Important: Be sure to click **Save** whenever that button appears, if you want to keep your changes.

Configuring IdP Auto-Connect

When your IdP partner is also using PingFederate 5 or higher (or is otherwise able to provide interoperable SAML 2.0 metadata via HTTP on demand), you may choose to use Auto-Connect for that partner (see *Using Auto-Connect*). This configuration can be shared among an unlimited number of SAML 2.0 partners.

Note: You enable the SAML 2.0 Auto-Connect profile under System Settings (see *Choosing Roles and Protocols* on page 92).

Once Auto-Connect is enabled on your PingFederate server, complete the configuration from the Main Menu under SP Configuration. This configuration entails:

- Setting up a common connection for all Auto-Connect partners
- Establishing a list of IdP partner domains authorized to use the connection

Configuring the Initial Setup

The basic configuration for SP Auto-Connect requires only:

- Choosing a signing certificate for authentication requests and other SAML messages
- Configuring user-session creation information

All other partner-connection specifications are handled automatically at runtime.

Choosing a Certificate

For Auto-Connect runtime processing, authentication requests and SLO messages must be signed, since they are sent over either the POST or redirect *binding*s (see *SAML 2.0 Profiles* in the “Supported Standards” chapter of *Getting Started*).

Note: The signing certificate is embedded in your server’s Auto-Connect metadata (see *Using Auto-Connect* on page 31); there is no need to exchange certificates with your partners.

You can use the same certificate used for signing metadata (see *Configuring Auto-Connect Metadata Signing* on page 97). If you use a different certificate, ensure that it meets Auto-Connect validation requirements (see *Auto-Connect Security Model* on page 32).

To specify a certificate:

1. Select the certificate from the drop-down list.

   If you have not yet created or imported your certificate into PingFederate, click **Manage Certificates** (see *Digital Signing and Decryption Keys and Certificates* on page 166).
2. Optional: Select the Signing Algorithm from the drop-down list.

   The default selection is RSA SHA256 or ECDSA SHA256, depending on the Key Algorithm value of the chosen Signing Certificate. Make a different selection if you and your connection partner have agreed to use a stronger algorithm.

Configuring User-Session Creation

Configuring user-session creation for Auto-Connect is similar to configuring the same settings for regular partner connections.

- Click **Configure User-Session Creation** to continue.

  For configuration information, refer to sections under *User-Session Creation* on page 273.

  Note: Attributes sent from the IdP via Auto-Connect are passed to your applications, regardless of whether they are listed in the *attribute contract* (see *Defining an Attribute Contract* on page 274).

Connection Activation and Summary

When you finish configuring your IdP Auto-Connect initial setup, you may choose to activate the common connection immediately on the Activation & Summary screen. (No runtime processing occurs until your partner's Auto-Connect gateway is also established and a user initiates an SSO or SLO event.)

Important: Regardless of whether you choose to activate a newly configured connection now or later, you must click **Save** on the Activation & Summary screen if you want to keep the configuration.

You can deactivate the connection at any time (for maintenance, for example). While a connection is inactive, all SSO or SLO transactions to or from Auto-Connect partners are disabled.

To change a Connection Status:

- Select Active or Inactive and then click **Save**.

To modify a setting:

1. Locate the currently configured setting under one of the summary headings and then click the subheading above the data.

   Note: Changes made to Auto-Connect settings will be out of sync, temporarily, with metadata caches that any currently active partners might be using. If your connection is in production, you might wish to lower your server's metadata lifetime in advance of making configuration changes (see *Configuring Auto-Connect Metadata Lifetime* on page 97).
2. Change the information and click **Save**, if available.

   If **Save** is not available, additional, dependent changes are required; click **Next** or **Done** until you reach a screen containing a **Save** button. Then click **Save** and continue as needed until you return to the Main Menu.

Specifying Allowed IdP Domains

This screen provides PingFederate® with a list of trusted domain names of your Auto-Connect partners.

Normally, when PingFederate receives an SSO request from a Web application at your site (see */sp/startSSO.ping*), the runtime engine completes the connection automatically using metadata obtained from a standard, public location — `http://saml.<domain_name>`. (See *Using Auto-Connect*.) Alternatively, if an Auto-Connect partner elects not to use the standard location, you can supply the applicable URL.

To add a domain:

- Enter a Domain Name and click **Add**.

To specify a URL for metadata retrieval:

1. Click **Advanced View**.
2. Enter the Domain Name if you have not already done so.
3. Enter the Metadata Service URL.

   This entry must be obtained from your Auto-Connect partner.

4. Click **Add**.

   Note: Once you have added the URL, you cannot return to the **Basic View** unless you first remove the URL value using the procedure below.

To edit an entry:

1. Click **Edit** under Action for the entry.
2. Make your change and click **Update**.

To delete an entry:

- Click **Delete** under Action for the entry.

Chapter 9

WS-Trust STS Configuration

The PingFederate WS-Trust STS provides security-token validation and creation to extend SSO access to identity-enabled Web Services (see *About WS-Trust STS* on page 13).

The chapter provides instructions for configuring the WS-Trust STS, including:.

- *Server Settings* on page 324
- *IdP Configuration for STS* on page 327
- *SP Configuration for STS* on page 348

Server Settings

To use the PingFederate WS-Trust STS for partner connections, start by enabling the WS-Trust protocol under Server Settings on the Roles and Protocols screen (see *Choosing Roles and Protocols* on page 92). Once the protocol is enabled, you must identify the STS server with a unique federation identifier for both SAML 2.0 and SAML 1.1 tokens (unless these IDs are already established for corresponding browser-based SSO protocols).

In addition, also under Server Settings, you have the option of requiring authentication globally for access to STS endpoints—(see *Configuring STS Authentication* on page 325).

Enabling the WS-Trust STS

You can enable the WS-Trust STS when you first install PingFederate (see *Starting PingFederate for the First Time* in the "Installation" chapter of *Getting Started*). If you have already installed PingFederate or are upgrading to a new version, use the following procedure.

To enable WS-Trust and make the STS available for partner connections:

1. Click **Server Configuration** on the Main Menu.
2. Click **Server Settings** under System Settings.
3. Click **Roles and Protocols** on the Summary screen.
4. Select **WS-Trust** for either the IdP or the SP role, or both, depending on your requirements.

   Note: PingFederate fully supports the STS with or without selections of any of the Browser SSO protocols listed above the WS-Trust selections. SAML 1.1 and 2.0 token handling is independent of supported SSO protocols chosen here.
5. Click **Next**.
6. On the Federation Info screen, ensure all required fields are completed.

   Note: Identifiers are needed for both SAML 2.0 and SAML 1.x to enable the STS to issue either type of token when requested. If you have not established a federation ID for either of these protocols or do not expect to use one or the other, enter a placeholder (in any format) and return later if needed. (For more information about the fields on this screen, see *Specifying Federation Information* on page 94).

7. Optional: Click **Next** to go to the WS-Trust STS Settings screen (see the next section, *Configuring STS Authentication* on page 325).
8. Click **Save** (on any screen).

Configuring STS Authentication

Server settings may be configured to require that client applications provide credentials to access the PingFederate STS. This is recommended for IdP configurations using the Username Token Processor (available separately).

For other token processors and token generators, trust in the identity of the client is conveyed within the token itself and verified as part of processing. However, administrators may want to add another layer of security by limiting access to only authenticated clients.

Note: You can configure STS authentication to either apply globally to all token formats and for all IdP and SP partner connections or token-to-token mappings or, using more fine grained controls, at the connection level via Issuance Criteria (see *Token Exchange Mapping* on page 120).

- To continue, click **Configure WS-Trust STS Authentication**.

Selecting Authentication Methods

You can choose either HTTP Basic or mutual SSL/TLS authentication (or both) on the Authentication Methods screen. (Note that if both methods are configured, *all* clients must authenticate using both, not one or the other.)

Important: If you choose mutual SSL/TLS authentication, you must configure a secondary PingFederate SSL port (see the property `pf.secondary.https.port` in the table under *Modifying PingFederate Properties* on page 68).

Configuring Basic Authentication

For HTTP Basic authentication, create username/password pairs (“Users”) for all client applications needing access to the STS.

On the HTTP Basic Authentication screen, you can also delete users and update account passwords.

To add users:

1. Click **Create User**.
2. On the User Account screen, enter a Username and Password, and confirm the password.

   Passwords must be at least six characters long, containing at least one uppercase, one lowercase, and one numeric character.
3. Click **Done**.
4. Repeat the preceding steps as needed.
5. On the HTTP Basic Authentication screen, click **Next**.

   (If you are also configuring SSL authentication, complete that configuration and click **Next** to reach the Summary screen (see *Configuring Mutual SSL Authentication* on page 326).)
6. On the Summary screen, click **Done**.
7. On the WS-Trust STS Settings screen, click **Save**.

To update an account password:

1. Click the Username.
2. On the User Account screen, enter the Current User Password and a New Password, with confirmation.

   Passwords must be at least six characters long, containing at least one uppercase, one lowercase, and one numeric character.
3. Click **Done**.
4. On the HTTP Basic Authentication screen, click **Done**.

5. On the WS-Trust STS Settings screen, click **Save**.

To delete a user:

1. Click **Delete** under Action for the Username.
2. Click **Done** (or **Next** for new configuration).
3. Click **Save** when you reach the WS-Trust STS Settings screen.

Configuring Mutual SSL Authentication

When SSL authentication is selected on the Authentication Methods screen, the configuration begins on the Mutual SSL Authentication screen.

Important: If you choose mutual SSL/TLS authentication, you must configure a secondary PingFederate SSL port (see the property `pf.secondary.https.port` in the table under *Modifying PingFederate Properties* on page 68).

- To continue, click **Configure Mutual SSL Authentication**.

Choosing Certificate Authentication Options

On the Authentication Options screen, select whether to verify client SSL certificates against a list of Subject Distinguished Names (DNs) or a list of issuer public certificates imported into PingFederate.

Note: You can choose both options. However, note that they are not used alternatively at runtime; both validations are applied.

- To continue, select one or both methods and click **Next**.

  For information about restricting access by Subject DN, see the next section. For information about restricting access by certificate, see *Managing Allowed Issuer Certificates* on page 327.

Managing Allowed Subject DNs

On the Allowed Subject DNs screen you can add, edit, or delete Subject DNs for clients allowed to access the PingFederate STS.

To add DNs:

1. Enter a valid Subject DN for a partner STS client and click **Add**.
2. Add other DNs as needed.
3. For a new configuration, click **Next** or **Done** to continue.
4. If you are finished with a new or existing configuration, continue clicking **Done** until you reach the WS-Trust STS Settings screen and then click **Save**.

To edit DNs:

1. Click **Edit** under Action for the Subject DN.
2. Make changes and click **Update**.
3. Click **Done**.
4. If you are finished with a new or existing configuration, continue clicking **Done** until you reach the WS-Trust STS Settings screen and then click **Save**.

To delete entries:

1. Click **Delete** under Action for the Subject DN.
2. Click **Done**.
3. If you are finished with a new or existing configuration, continue clicking **Done** until you reach the WS-Trust STS Settings screen and then click **Save**.

Managing Allowed Issuer Certificates

When STS access is restricted by issuer certificate, the Allowed Issuer Certificates screen provides a means of maintaining a list of valid certificates.

On this screen you can add or remove certificates.

To add certificates:

1. Select the certificate from the drop-down list and click **Add**.

   If the certificate you are looking for is not in the list, click **Manage Certificates** to import it from your file system.
2. Add other certificates as needed.
3. For a new configuration, click **Next** or **Done** to continue.
4. If you are finished with a new or existing configuration, continue clicking **Done** until you reach the WS-Trust STS Settings screen and then click **Save**.

To delete a certificate from the list:

1. Click **Remove** under Action for the Issuer Certificate.
2. Click **Done**.
3. If you are finished with a new or existing configuration, continue clicking **Done** until you reach the WS-Trust STS Settings screen and then click **Save**.

Using the Mutual SSL Summary Screen

When you have finished configuring Mutual SSL Authentication, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- To save a new or modified configuration, click **Done** on successive screens until you reach the WS-Trust STS Settings screen and then click **Save**.

Using the STS Summary Screen

When you have finished configuring WS-Trust STS Settings, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing connection, click **Done** and on the WS-Trust STS Settings screen click **Save**.

IdP Configuration for STS

This section covers the IdP configuration for the PingFederate WS-Trust STS, which involves:

- *Configuring Token Processors* on page 327
- *Managing STS Request Parameters* on page 331 (Optional)
- *Configuring SP Connections for STS* on page 332

Configuring Token Processors

Token Processors are used to validate incoming tokens and token requests to the STS (see *Token Processors and Generators* on page 13). Token Processors for SAML, OAuth, JWT tokens, and username tokens are included with the PingFederate installation. This section provides guidance on configuring “instances” of these installed Token Processors.

You must configure at least one processor in order to set up an STS connection or token-to-token mapping (see *Token Exchange Mapping* on page 120).

Important: If more than one instance of the same token-processor type is configured for a connection or token-to-token mapping, clients calling either of the PingFederate STS endpoints must add a query parameter, `TokenProcessorId`, and specify the Instance Id. (For endpoint information, see *Viewing Protocol Endpoints* on page 188.)

For example:

```
https://<pf_host>:<pf_port>/idp/sts.wst?
TokenProcessorId=saml2firstinstance
```

Additional Token Processors may be *downloaded* from the Ping Identity Web site (`www.pingidentity.com/en/products/downloads.html`). For configuration information, please consult documentation provided for the respective add-on processor.

To begin configuring Token Processors:

1. Click **IdP Configuration** on the Main Menu.
2. Click **Token Processors** under Application Integration Settings.

   If this link is not shown, ensure that the WS-Trust STS is enabled in **Server Settings** (see *Enabling the WS-Trust STS* on page 324).

To configure a new token-processor instance:

- Click **Create New Instance**.

To edit an existing instance:

- Click the Instance Name and click the step you need to change.

To delete an instance:

1. Click **Delete** next to the Instance Name. (To undo the deletion, click **Undelete**.)

   Note: This option is available only if the processor instance is not in use for a connection.
2. Click **Save** to confirm the deletion.

Selecting a Token Processor Type

The first step in creating a token-processor instance is choosing the processor type.

To define an instance:

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select the processor Type from the drop-down menu.
3. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
4. Click **Next** and enter information on the configuration screen for this token-processor instance.

   This configuration varies depending on the token processors deployed on your server. For add-on processors please consult the online documentation referenced in the download package, or look under *Product Documentation* at pingidentity.com.

   For token processors bundled with PingFederate, refer to one of the following sections:

   - *Configuring a SAML Token Processor Instance* on page 329
   - *Configuring an OAuth Token Processor Instance* on page 329
   - *Configuring a JSON Web Token (JWT) Processor Instance* on page 330
   - *Configuring a Username Token Processor Instance* on page 330

Configuring a Token Processor Instance

This configuration varies depending on the token processors deployed on your server. For add-on processors please consult the online documentation referenced in the download package, or look under *Product Documentation* at pingidentity.com.

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- *Configuring an OAuth Token Processor Instance* on page 329
- *Configuring a JSON Web Token (JWT) Processor Instance* on page 330
- *Configuring a Username Token Processor Instance* on page 330

Configuring a SAML Token Processor Instance

On the Instance Configuration screen, you may use signing-certificate DN checking to limit the valid signatures and certificates for token requests accepted for this SAML token type. (By default, the STS validates digital signatures using all trusted Certificate Authorities (CAs) imported into PingFederate.)

At minimum on this screen, you must indicate a unique identifier for the PingFederate STS. To be accepted, an incoming SAML token must contain this ID in its <audience> element.

Note: If this is a child instance, select the override checkbox to modify the configuration.

To configure the token-processor instance for certificate validation:

1. Enter a URI for Audience.

   This is the ID for the STS for either SAML 1.1 or SAML 2.0 tokens, depending on which processor you are configuring (see *Specifying Federation Information* on page 94).
2. Optional: Click the **Add a new . . .** link under Action for either Valid Certificate Issuer DNs or Valid Certificate Subject DNs.

   You can use both lists.

   Important: When both types of validation are configured, then the certificate used to validate signatures must match an entry in *both* lists. If only Subject DNs are listed on this screen, then the certificate Issuer DN is not checked and its Subject DN must match one of the entries in the Subject DNs list. If only Issuer DNs are listed here, then the certificate Subject DN is not checked and its Issuer DN must match one of the entries in the Issuer DNs list. If neither Issuer DNs nor Subject DNs are listed, then all certificates are treated as valid for purposes of verification.
3. Optional: Enter a Valid DN and click **Update**.
4. Optional: Repeat the previous steps as needed to add more DNs.

Configuring an OAuth Token Processor Instance

The PingFederate STS provides validation for OAuth Bearer tokens (see *About OAuth* on page 15).

Generally, a client would send a base64-encoded access token in order to receive a SAML token in exchange.

Note: To use this token processor, you must first configure an access-token attribute contract (see *Access Token Management* on page 133).

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

Field Descriptions

Field	Description
Access Token Manager	Select the Access Token Management plug-in instance that will be used to validate the OAuth Bearer Access Token.

Field	Description
Scope Value as Single String (optional)	If selected, the Scope value will be made available as a single space delimited set of string values. Alternatively, Scope values will be made available as a multivalue attribute.

To configure the token-processor instance for OAuth Bearer token validation:

1. Select an Access Token Manager.
2. Optional: Select the Scope Value as Single String checkbox.
3. Click **Next**.

Configuring a JSON Web Token (JWT) Processor Instance

The PingFederate STS provides validation for JSON web tokens.

Note: If this is a child instance, select the override checkbox to modify the configuration.

Field Descriptions

Field	Description
JWKS Endpoint URI	The URI of the JWKS endpoint. A set of JSON Web Keys (JWK) are downloaded from this endpoint and used for JWT signature verification.
Issuer	(Required) A unique identifier for the issuer of the JWT.
Expiry Tolerance	The amount of time (in seconds) to allow for clock skew between servers. Valid range is 0 to 3600.

To configure the token-processor instance for JWT validation:

1. Enter a JWKS Endpoint URI.
2. Enter the Issuer.
3. Enter an Expiry Tolerance.
4. Click **Next**.

Configuring a Username Token Processor Instance

The PingFederate Username Token Translator provides an Identity Provider (IdP) Token Processor for the PingFederate WS-Trust Security Token Service (STS). The Token Processor allows the STS to accept and validate a username security token from a Web Service Client (WSC) and then map user attributes into a SAML token for the WSC to send to a Web Service Provider (WSP).

Note: If this is a child instance, select the override checkbox to modify the configuration.

To configure the token-processor instance for Username Token validation:

1. On the Instance Configuration screen, click **Add a new row to 'Password Credential Validators'** to define a credential-authentication mechanism instance for the adapter.
2. Select a password credential validator from the list and click **Update**.

   Add as many validators as necessary. Use Move Up and Move Down to adjust the order in which you want PingFederate to attempt credential authentication. If the first mechanism fails to validate the credentials, PingFederate moves sequentially through the list until credential validation succeeds. If none of the defined password credential validators is able to authenticate the user's credentials, and the challenge retries maximum has been reached, the process fails.

   Note: If usernames overlap across multiple password credential validators, the failovers could lockout those accounts in their source locations.

3. Click **Next**.

Extending a Processor Contract

Token processors allow administrators to add to a built-in list of user attributes that the processor returns from an incoming token—an extended processor-*attribute contract*.

Note: This screen shows a different list of attributes for the Core Contract, depending on the Token Processor selected.

To add an attribute:

Note: If this is a child instance, select the override checkbox to modify the configuration.

- Optional: Enter the attribute name in the text box and click **Add**.

  Important: For the OAuth 2.0 Bearer Token Processor, added attributes must also be among those configured under Access Token Management (see *Defining the Access Token Attribute Contract* on page 136).

Setting Attribute Masking

On the Token Attributes screen, you can choose to mask attribute values that PingFederate logs from this processor instance at runtime (see *Attribute Masking* on page 26).

To mask an attribute in log files:

Note: If this is a child instance, select the override checkbox to modify the configuration.

- Optional: Under Mask Log Values select the attribute whose value you want to mask.

  If OGNL expressions might be used to map derived values into outgoing tokens and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).

Editing and Saving Processor Instances

From the Summary screen, you can reach processor settings for editing.

To edit the configuration:

1. Click the heading above the information you want to change.
2. Make your changes.
3. Click **Done** on the configuration page and **Save** on the Manage Token Processors screen.

To save a processor instance:

1. Click **Done** on the Summary screen.
2. Click **Save** on the Manage Token Processors screen.

Managing STS Request Parameters

As an option for configuring PingFederate to act as a WS-Trust *STS*, an administrator can define sets of *RST* metadata parameters that can be used to map attribute values into issued security tokens. After these *request contracts* are defined, you can make them available when configuring WS-Trust STS settings for SP-partner connections (see *Selecting a Request Contract* on page 334).

- To reach this screen, click **STS Request Parameters** under Application Integration Settings on the IdP Configuration sub menu.

  If this link is not present, WS-Trust is not enabled (see *Enabling the WS-Trust STS* on page 324).
- To add a new set of request parameters, click **Add New Request Contract**.
- To edit an existing contract, click its **Contract Name**.

Creating a Request Contract

On the Create Request Contract screen, identify the contract and define parameters that will be available in token requests (as associated with this contract for partner connections—see *Managing STS Request Parameters* on page 331).

Field Descriptions

Field	Description
Contract Name	A descriptive name for the Contract—for example, a Web Service Client or Provider.
Contract ID	An internal identifier—must be alphanumeric with no spaces.
Parameters to be provided in the request	A list of request parameters for this Contract (see instructions below).

To add a Parameter:

- Enter the Parameter Name in the text box and click **Add**.

To modify a Parameter Name:

1. Click **Edit** under Action for the Parameter Name.
2. Edit the name and click **Update**.

   Note: If you change your mind, be sure to click the **Cancel** *link* in the Actions column, not the **Cancel** *button*, which discards any other changes you might have made.

To delete a Parameter:

- Click **Delete** for the Parameter Name.

Configuring SP Connections for STS

You can configure an STS connection to an SP partner either in conjunction with browser-based SSO or independently.

To enable STS for a new connection, or to add the capability to an existing connection:

1. Select the WS-Trust STS option on the Connection Type screen (see *Choosing a Connection Type* on page 194).

   Note: Before this option can be selected, the WS-Trust protocol must be enabled in Server Settings (see *Server Settings* on page 324).
2. Select a Default Token Type.

   The Default Token Type, either SAML 1.1 or 2.0, is used when a Web Service client does not specify in the token request what token type the STS should issue.

   Note: The Default Token Type *does not* need to match the Protocol indicated on the screen for SSO (when applicable).

When the option is enabled, the configuration starts on the WS-Trust STS screen.

- To continue, click **Configure WS-Trust STS**.

Configuring IdP Protocol Settings

On this screen, use the **Add** button for the Partner Service Identifier field to enter one or more URLs for your partner's Web Service(s). Each of these identifiers is compared to the element `<AppliesTo>` in Requests for Security Tokens (RSTs) and may be either a complete URL or a base URL for matching variable ports or paths.

Also on this screen, options are available for adding signature or encryption protection to outgoing SAML tokens and for enabling support of two additional token-type requests:

- For SAML 1.1 and SAML 2.0, you can choose to generate a symmetric key to be used in conjunction with the “Holder of Key” designation for the assertion’s Subject Confirmation Method (for information about HoK assertions, see, for example, *Web Services Security SAML Token Profile* (docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.0.pdf).
- For SAML 2.0, you can choose to encrypt the assertion.
- Enabling the OAuth SAML Bearer Profile permits two additional token-type requests based on these OAuth grant types:
  - SAML 2.0 Bearer Assertion Grant Type
  - OAuth Access Token via SAML 2.0 Bearer Assertion Grant Type

  See *STS OAuth Integration* on page 15 for more information on the use of these token-type requests.

  Note: You can make any or all selections if you expect requests for these types of tokens. These selections are independent of the Default Token Type selected previously (see *Configuring SP Connections for STS* on page 332).

When you make one (or all) of these selections, you are asked to choose a signing or XML encryption certificate later in the connection setup, unless required certificates are already in place for an existing browser-based SSO connection. (PingFederate uses the same certificates to handle signing/encryption requirements for both Browser SSO and WS-Trust STS—for more information, see *Configuring Credentials* on page 232.)

Setting a Token Lifetime

Standards require a window of time during which a security token is considered valid. Each token has a time-stamp XML element as well as elements indicating the allowable lifetime of the token (in minutes) before and after the token time stamp.

Field Descriptions

Field	Description
Minutes Before	The amount of time before the token was issued during which it is to be considered valid.
Minutes After	The amount of time after the token was issued during which it is to be considered valid.

To change the default times:

- Optional: Edit the desired setting(s) and click **Next** or **Save**.

Configuring Token Creation

For the PingFederate STS to issue a security token in response to requests for partner services, you must indicate what user attributes are to be included in the token (the “*attribute contract*”). The attribute values sent in the token are then derived by mapping those available from the Token Processor you select (see *Fulfilling the Attribute Contract* on page 344). As with Browser SSO, the mapping can be augmented using local data stores, variable or constant text, or expressions.

Details of this configuration are handled under the Token Creation task.

- To continue, click **Configure Token Creation**.

Defining an STS Attribute Contract

An attribute contract is the set of user attributes that a Web Service Client at your site expects to receive in security tokens issued for this connection (see *Attribute Contracts* on page 23). You identify these attributes on this screen.

(This screen presents an additional option when SAML 1.1 is chosen as the Default Token Type on the Connection Type screen.)

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **Attribute Contract on the Summary screen**.

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names (including claims) expected by the requesting WSC.

   Tip: The Format attribute associated with the NameID element in outgoing SAML tokens may be set when needed by adding an attribute called `SAML_NAME_FORMAT`. The value of that attribute can then be mapped later (see *Fulfilling the Attribute Contract* on page 344).

   For information about the NameID elements and applicable URI values, locate the SAML 2.0 specification at *oasis-open.org/specs*.

   Tip: You can add a special attribute, `SAML_AUTHN_CTX`, to indicate to the SP (if required) the type of credentials used to authenticate to the IdP application—*authentication context*. Map a value for the authentication context on the attribute-mapping screen later in the configuration, from any available attribute source, including the *RST* if a requested context is specified as a request parameter (see *Fulfilling the Attribute Contract* on page 344).
2. Optional: For SAML 1.1 tokens, select the Attribute Namespace.

   This field appears only when SAML 1.1 is chosen as the Default Token Type on the Connection Type screen (see *Configuring SP Connections for STS* on page 332).

   Change the default Namespace selection if you and your SP partner have agreed to a specific namespace (see *STS Namespaces* on page 24).

   Note: If needed, an administrator can customize namespace alternatives via the `custom-name-formats.xml` configuration file located in this directory:

   ```
   <pf_install>/pingfederate/server/default/data/config-store
   ```
3. Click **Add**.

To modify an attribute name or namespace:

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Selecting a Request Contract

This optional setting allows you to use XML parameters contained in *RSTs* for token-attribute mapping (see *Managing STS Request Parameters* on page 331).

- If you are not using request parameters, click **Next** to continue.
- To use request parameters, select the checkbox and choose a Request Contract from the drop-down list.

  If the contract you want is not shown, click **Manage STS Request Parameters**.

When you choose a contract, you will enable an option to select Request from the drop-down Source list on the attribute-mapping screen (see *Fulfilling the Attribute Contract* on page 344).

IdP Token Processor Mapping

IdP token processors are responsible for validating incoming security tokens as part of an STS operation (see *Token Processors and Generators* on page 13). A configured and deployed token processor in PingFederate is known as a token processor instance. The same instance may be mapped by multiple connections.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.

To modify an existing Token Processor Instance:

- Click its Name link.

To begin configuring a Token Processor Instance for this connection:

- Click **Map New Token Processor Instance**.

Selecting a Token Processor Instance

On this screen for a new connection, choose an instance of the Token Processor needed for this connection (see *Token Processors and Generators* on page 13).

You will use attributes returned from the token processor (the token-processor contract) to fulfill the *attribute contract* required for this partner and/or use them to look up additional attributes in a user-data store. You make this choice on the next screen (see *Retrieving Additional Attributes* on page 354).

- Choose a Token Processor Instance from the drop-down list and click **Next** to continue.

  (Optional) To override any token generator instance, select the **Override Instance Settings** checkbox (see *Overriding Token Generator Instances*).

  To create or change a processor instance, as needed, click **Manage Token Processor Instances**.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.

Overriding Token Processor Instances

Overrides at the connection level simplify token management by allowing you to create a small set of token instances that define the base configuration requirements and then overriding settings at the connection level as needed.

You may override any token processor settings at the connection level either during or after connection mapping.

Alternatively, you can override any token processor instance to apply to several connections, see *Hierarchical Plug-in Configurations* on page 21 for more information about token processor overrides.

Note: Any changes to the base token processor instance are propagated to a connection provided the same changes are not overridden for the connection.

- Click **Override Instance Settings**.

  On each of the settings screens, make your changes, and then click **Next**. When you are finished, click **Done** to continue with token mapping.

  Note: Override token-setting screens are functionally identical to those used for creating a new token connection. Refer to the table below to find sections in this manual containing configuration information and procedures.

  The display of some screens listed in the table depends on the type of token you are configuring.

  For information about the override token-setting screens, depending on the type of setting, use the following table:

Override Screen	Manual Section
Instance Configuration	See *Configuring Token Processors* on page 327.
Extended Contract	See *Extending a Processor Contract* on page 331.
Token Attributes	See *Setting Attribute Masking* on page 331.

- To remove any token processor connection override, clear the **Override Instance Settings** checkbox, and then complete the rest of the setup.

Restricting a Token Processor to certain Virtual Server IDs

When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), you have the option to enforce authentication requirements by restricting a token processor to certain virtual server IDs. This optional setting can be applied to each token processor added to the connection using virtual server IDs. By default, no restriction is imposed.

To restrict a token processor to a subset of the available virtual server IDs:

1. Select the **Restrict Virtual Server IDs** checkbox.
2. In the **Allowed Virtual Server IDs** area, select virtual server IDs that you want to allow for this token processor.
3. Click **Next**.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.

8. Click the Token Generator Instance Name.
9. Click **Virtual Server IDs** on the Summary screen.

> **Note:** The Virtual Server IDs screen is only available for connections using at least one virtual server ID, see *Federation Server Identification*.

Viewing Token Processor Instance Settings

Token processor override instance type information. This screen is view only.

This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Configuring a Token Processor Instance* on page 329.

Token Processor Instance Settings

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Configuring a Token Processor Instance* on page 329.

Overriding Token Processor Extended Contracts

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Extending a Processor Contract* on page 331.

Overriding Token Processor Attributes

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Setting Attribute Masking* on page 331.

Using the Override Instance Settings Summary Screen

- On the Override Instance Settings Summary screen, click any heading to change your processor configuration; or click **Done** to continue.

Retrieving Attributes

For token creation, you can query local user-data stores to help fulfill the *attribute contract*, in conjunction with attribute values supplied by the token processor you are using with PingFederate (see *Configuring Token Processors* on page 327).

The values supplied by the token processor are shown under Token Processor Contract on the Attribute Retrieval screen.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.

7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Attribute Retrieval** on the Summary screen.

- If you choose to look up additional information, then you will identify a data store and specify lookup queries next (see the next section *Identifying a Data Store* on page 354).
- If you use only the attributes available (the default), then you will map values for the attribute contract next (see *Mapping Token Attributes* on page 359).

Tip: To determine whether you need to look up additional values, compare the attribute contract against the token-generator contract on the previous screen (see *Selecting a Token Generator Instance* on page 352). If the token-generator contract requires more information, determine whether your local data stores can supply it. (You can also choose to use text constants or expressions for certain information—see *Mapping Token Attributes* on page 359.)

Configuring STS Attribute Sources and User Lookup

Attribute sources are specific database, directory, or custom data store locations containing information that may be needed for the attribute contract (see *Defining an STS Attribute Contract* on page 333). Attribute sources can be reused across connections to other SP partners.

This portion of the connection configuration allows you to configure one or more data stores to look up attributes and to set up search parameters.

Note: Queries are executed in the order of Attribute Sources shown. Use the move up/move down controls as needed to adjust the order.

To configure an attribute source:

- Click **Add Attribute Source** and complete the setup steps (see *Configuring a Data Store for STS* on page 338).

To modify an attribute source configuration:

1. Click the attribute source Description link.
2. Click **Save** on the screen you change.

Note: Depending on what you change, you may need to modify dependent data in subsequent steps, as indicated. Click **Save** or **Done** when either of those options appears.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **Attribute Source & User Lookup** under the IdP Token Processor tab.

   If this step is not listed, then this instance is configured to use token-processor values only (see *Retrieving Attributes* on page 337).

Configuring a Data Store for STS

This screen allows you to choose a data store from a previously configured list (see *Managing Data Stores* on page 98). Attribute values extracted from one or more data stores are used to help fulfill the attribute contract (see *Defining an STS Attribute Contract* on page 333).

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **Attribute Source & User Lookup** under the IdP Token Processor Mapping tab.

   If this step is not listed, then this instance is configured to use token-processor values only (see *Retrieving Attributes* on page 337).
10. Click the attribute source Description link.

To define an attribute source:

1. Enter an Attribute Source Id to uniquely identify the data source for the mapping.
2. Use Attribute Source Description to specify an attribute source name that distinguishes this user lookup for the selected data store.

   Note: PingFederate appends this description to the data store type in the Source list on the Attribute Contract Fulfillment screen (see *Fulfilling the Attribute Contract* on page 344).
3. Choose an Active Data Store and click **Next**.

   A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Setting Up the Attribute Source

See the following sections in this manual, depending on the type of data store:

Data Store Type	Related Manual Section
JDBC	• *Selecting an STS JDBC Database Table and Columns* on page 339 • *Configuring an STS Database Filter* on page 341
LDAP	• *Configuring an LDAP Search* on page 342 • *Configuring an LDAP Filter for STS* on page 343
Custom	• *Configuring STS Custom Source Filters* on page 344 • *Selecting Custom STS Source Fields* on page 344

Selecting an STS JDBC Database Table and Columns

When you choose to use a database source for attributes, you follow this path through the configuration steps.

On this screen you begin to specify exactly where additional data can be found to complete the attribute contract when you send a security token to this SP (see *Defining an STS Attribute Contract* on page 333). Only one table may be used as a source of data for a JDBC lookup.

Important: (**For MySQL users**) To allow for table and column names that may contain spaces, PingFederate inserts double quotes around the names at runtime. To avoid SQL syntax errors resulting from the quotes, add the session variable `sql_mode=ANSI_QUOTES` to the connection string of your JDBC data store instance. For example:

```
jdbc:mysql://myhost.mydomain.com:3306/pf?
sessionVariables=sql_mode=ANSI_QUOTES
```

Alternatively, you can configure the system variable `sql_mode` with the `ANSI_QUOTES` option. For more information, see *http://dev.mysql.com/doc/refman/5.7/en/server-system-variables.html*.

Field Descriptions

Field	Description
Schema	Lists the table structure that stores information within a database. Some databases, such as Oracle, require selection of a specific schema for a JDBC query. Other databases, such as MySQL, do not require selection of a schema.
Table	The name of the table contained in the database. Use the drop-down to change the table.
Columns to return from SELECT	Displays the columns available from the selected table. Select the columns that are associated with the desired attributes you would like to return from the JDBC query.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **Database Table and Columns** under the IdP Token Processor Mapping tab.

To select a database table and columns for queries:

1. Choose a Schema file (when applicable) from the drop-down list.
2. Choose a Table from the drop-down list.
3. Choose a name under Columns to Return from Select and click **Add Attribute**.

   Tip: Click **Refresh** if you are updating an existing configuration and changes may have been made to the database.

   Repeat this step for other columns as needed.

   Note: You do not need to add a column here for it to be used as part of a search filter (see *Configuring a Database Query* on page 356 next). Add only attributes from which you need actual values to pass in a token.

   Tip: To determine what attributes to look up during a query, click the **View Attribute Contract** link to see what information must be collected (see *Defining an STS Attribute Contract* on page 333). Then determine what information is coming in from the token processor (see *Retrieving Attributes* on page 337). Information not contained in the token-processor contract may be pulled from the data store look-up query.

Configuring an STS Database Filter

The JDBC `WHERE` clause in PingFederate queries the data table you selected to retrieve a record associated with a particular value (or values) from the incoming security token. The clause is in the form:

```
WHERE column1=value1 [AND column2=value2] [OR ...]
```

The left side of the first variable pair uses a column name in the database table you selected (see *Selecting an STS JDBC Database Table and Columns* on page 339).

The right side generally uses values passed in from a token processor (variables, including the correct formatting, are listed under Token Processor Values—see *Configuring Token Processors* on page 327).

Note: If you are retrieving attributes from multiple data stores using one mapping, attributes available from other sources, if previously configured, are listed near the bottom of the screen. For more information on multiple data-store mapping, see *Multiple Data Source Attribute Mapping* on page 25.

You can also apply additional search criteria from your own database, using any other columns from the targeted table.

Tip: Click “**View List of Columns . . .**” to see a list from which to copy and paste.

For more information about `WHERE` clauses, consult your DBMS documentation.

EXAMPLE:

```
userid='${username}'
```

In this example `userid` is the name of a column in the JDBC data store. On the right side, `'${username}'` returns the value of the `username` variable from the IdP token processor.

Important: You *must* use the `${}` syntax to retrieve the value of the enclosed variable and use single quotation marks around the `${}` characters.

Field Descriptions

Field	Description
Where	`WHERE` clause statements conditionally select data from a table. Enter the `WHERE` clause statement in the space provided. For example: `WHERE email='clive@company.com'`.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **Database Filter** under the IdP Token Processor Mapping tab.

To construct the `WHERE` clause:

1. Enter the statement in the space provided, following the guidelines and example above.

   The initial `WHERE` is optional.

2. Ensure the syntax and variable names are correct.

   When you click **Next**, you will map attribute values returned from the database into the security token (see *Fulfilling the Attribute Contract* on page 344).

Configuring an LDAP Search

When you choose to use an LDAP source for attributes, you follow this path through the configuration steps.

On this screen you specify the branch of your LDAP hierarchy where you want PingFederate to look up user data.

Field Descriptions

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. This field is optional if records are located at the LDAP root.
Search Scope	Determines the node depth of the query. Select Subtree, One level or Object.
Root Object Class	The class containing the attributes you want.
Attributes to return from search	A list of attributes added from the drop-down list below. Subject DN is a default attribute, which may be used as the primary user identifier.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **LDAP Directory Search** under the IdP Token Processor Mapping tab.

To select LDAP attributes:

1. Optional: Enter a Base DN.
2. Select a Search Scope.
3. Select a Root Object Class.
4. Under Attributes to return from search, choose an attribute and click **Add Attribute**.

   Note that the attribute Subject DN is always returned by default.

   Note: When connecting to Microsoft Active Directory, if you choose the memberOf attribute, an optional checkbox, Nested Groups, appears on the right. Select this checkbox if you want PingFederate to query for groups the end users belong to directly as well as indirectly through nested group membership (if any) under the Base DN.

   For example, suppose you have three groups under the Base DN, namely Canada, Washington and Seattle. Seattle is a member of Washington. Ana Smith is an end user and a member of Seattle. If the Nested Groups checkbox is selected, when PingFederate queries for Ana’s memberOf attribute values, the expected results are Seattle and Washington. (When the Nested Groups checkbox is not selected (the default), the expected result is Seattle.)

For Oracle Directory Server, choose isMemberOf under Attribute for nested group membership. For more information, see *documentation about isMemberOf from Oracle* (docs.oracle.com/cd/E29127_01/doc.111170/e28967/ismemberof-5dsat.htm).

5. Repeat the last step for other attributes as needed.

Note: You do not need to add an attribute here for it to be used in a search filter (see *Configuring an LDAP Filter for STS* on page 343). Add only attributes from which you need actual values to pass into the outgoing security token.

Specifying Encoding for Binary Directory Attributes for STS

The LDAP Binary Attribute Encoding Types screen appears when a binary attribute is added on the LDAP Directory Search screen. Because binary attribute data cannot be used in an assertion, use this screen to specify which encoding type (Base64, Hex or SID) you want to apply during attribute contract fulfillment.

For example, Microsoft Office 365 uses objectGUID, an immutable Active Directory binary attribute associated with user accounts. Office 365 requires this binary data to be Base64-encoded to correlate provisioned federated user data to Active Directory accounts.

Claims-based authentication with Microsoft Outlook Web App and Exchange admin center (EAC) is another example. It requires tokenGroups (another binary attribute in Active Directory) to be SID-encoded.

Note: Attributes are specified as binary when configuring an LDAP connection (see *Specifying LDAP Binary Attributes* on page 105).

To select an attribute encoding type:

- Select the type of attribute encoding you want to apply for each attribute and click **Next**.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **LDAP Binary Attribute Encoding Types** under the IdP Token Processor Mapping tab.

Configuring an LDAP Filter for STS

The LDAP filter queries the data you selected to retrieve a record associated with a particular value (or values) from the incoming token. The filter is in the form:

```
attribute=${value}
```

The left-side variable is an attribute you selected earlier (see *Configuring an LDAP Search* on page 342). The right side generally uses values passed in from the security token (variables, including the correct syntax, are listed under Security Token Values—see *Configuring Token Processors* on page 327).

You can also apply additional search criteria from your data store, using any other attributes from the targeted object classes.

Tip: Click "**View List of Available LDAP Attributes**" for a list from which you can copy and paste.

For general information about search filters, consult your LDAP documentation.

Field Descriptions

Field	Description
Filter	Narrows a search to locate requested data by either including or excluding specific records. An LDAP filter includes the attributes in the search and the value or range of values that the search is attempting to match. Searches are conducted by using three components: 1) at least one attribute (attribute data type) to search on, 2) a search filter operator that will determine what to match, and 3) the value of the attribute being sought. Searches must have at least one of each of these three components.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **LDAP Filter** under the IdP Token Processor Mapping tab.

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.

   Note: If you used an anonymous binding to create this LDAP connection, your access might be restricted (see *Configuring an LDAP Connection* on page 102).
2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Configuring STS Custom Source Filters

When you choose to use a custom source for attributes, you follow this path through the configuration steps.

On this screen you specify a filter, or lookup query, for your custom data source. This screen display and the syntax of the filter depends on your developer's implementation of the custom source SDK.

Selecting Custom STS Source Fields

On the Configure Custom Source Fields screen, you can choose from among the fields shown to map to the attribute contract. These choices are supplied by the driver implementation. Select only those needed to fulfill the attribute contract for this partner connection.

WS-Trust Data Lookup Summary Screen

Use this screen to view and edit the configuration as needed. Click any heading to change the settings.

Fulfilling the Attribute Contract

You map attributes for outgoing security tokens for this partner on the Attribute Contract Fulfillment screen.

Map each attribute to fulfill the Attribute Contract from one of these Sources:

- Token

  When you make this selection, the associated Value drop-down list is populated by the token processor.
- LDAP/JDBC/Custom

Note: PingFederate appends a description in parentheses for configured data store lookups (see *Configuring STS Attribute Sources and User Lookup* on page 338).

Values are returned from your attribute source (if you are using data store—see *Retrieving Attributes* on page 337). When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes you identified as an Attribute Source (see *Configuring an LDAP Search* on page 342, *Selecting an STS JDBC Database Table and Columns* on page 339, or *Configuring STS Custom Source Filters* on page 344).

- Context

  Values are returned from the context of the transaction at runtime.

  Note: The HTTP Request and STS SSL Client Certificate Chain selections are retrieved as Java objects rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

  Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

  Note: When using the STS Basic Authentication Username, STS SSL Client Certificate's Subject DN, or STS SSL Client Certificate Chain attributes, ensure the associated authentication is enabled and configured in WS-Trust STS Settings (see *Selecting Authentication Methods* on page 325).
- Request

  Values are supplied from parameters in the token request received from the Web Service Client. This selection is available only if a Request Contract was selected earlier (see *Selecting a Request Contract* on page 334).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the incoming token assertion, using the `${attribute}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  `${ds.attr-source-id.attribute}`

  where `attr-source-id` is the Attribute Source Id value (see *Configuring STS Attribute Sources and User Lookup* on page 338) and attribute is any of the data store attributes you select.

To reach this screen for editing:

1. Click **IdP Configuration** on the Main Menu.
2. Click the connection name under SP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the SP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Creation** under the WS-Trust STS tab.
6. Click **Configure Token Creation**.
7. Click **IdP Token Processor Mapping** on the Summary screen.
8. Click the Token Processor Instance Name.
9. Click **Attribute Contract Fulfillment** under the IdP Token Processor Mapping tab.

To map attributes:

1. Choose a Source for each Target attribute.

2. Choose (or enter) a Value for each Attribute.

   See *Map each attribute to fulfill the Attribute Contract from one of these Sources:* above. All values must be mapped.
3. Click **Next**.

Selecting Issuance Criteria (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether to issue a SAML security token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access identity-enabled Web services.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request and STS SSL Client Certificate Chain selections are retrieved as Java objects rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.
   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

     Note: PingFederate appends a description in parentheses for configured data store lookups (see *Configuring Attribute Sources and User Lookup* on page 208)
   - Mapped Attributes – Select to access the required attributes.
   - Request – Select to access parameters from a request contract.
   - Token – Select to access the required attributes from the attribute contract.
2. Select an attribute name.

   Note: When using the STS Basic Authentication Username, STS SSL Client Certificate's Subject DN, or STS SSL Client Certificate Chain attributes, ensure the associated authentication is enabled and configured in WS-Trust STS Settings (see *Selecting Authentication Methods* on page 325).
3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

   Important: When using the STS SSL Client Certificate's Subject DN attribute, you must select one of the following conditions: equal to DN, not equal to DN, multi-value contains DN, or multi-value does not contain DN. These operators normalize the DN before comparison to accommodate for different string representations that are still considered equivalent (for example, case sensitivity, or whitespace).
4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).
5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   - Errors result in a `SOAP` message returned. The Error Result field is used by the `faultstring` element for SOAP 1.1 and the `Reason/Text` element for SOAP 1.2.

     For more information on SOAP, see the World Wide Web Consortium's *Simple Object Access Protocol* (`www.w3.org/TR/2000/NOTE-SOAP-20000508/#_Toc478383507`).

     Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

     If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.

6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

   Note: All criteria must pass in order for a user to be authorized.

8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

   Important: When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), consider using an OGNL expression to verify the virtual server ID in conjunction with other conditions, such as group membership information, to protect against unauthorized access (see *Expression Examples* on page 430).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Using the Mapping Summary Screen

When you have finished configuring IdP Token Processor Mapping, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing connection, click **Done** on successive screens until you reach the WS-Trust STS screen, and then click **Save**.

To save a new configuration:

1. Click **Done** to return to the IdP Token Processor Mapping screen.
2. Click **Next** to go to the Token Creation Summary screen, and then click **Done**.
3. On the Token Creation screen, click **Done**.
4. On the WS-Trust STS screen, click **Save**.

Request Error Handling

If you are using request parameters to fulfill the attribute contract and the parameter values are not supplied, you can choose whether to continue or abort the token-creation process.

Note: The Error Handling screen is presented only if a Request Contract is used for this configuration (see *Selecting a Request Contract* on page 334).

Using the Token Creation Summary Screen

When you have finished configuring Token Creation, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing connection, click **Done** on successive screens until you reach the WS-Trust STS screen, and then click **Save**.

Using the STS Summary Screen

On the WS-Trust STS Summary screen, you can review the configuration for this connection.

- If you need to make any changes to a new or existing connection, click the heading over the information you want to modify.

SP Configuration for STS

This section covers the SP configuration for STS, including:.

- *Configuring Token Generators* on page 348
- *Configuring IdP Connections for STS* on page 350

Configuring Token Generators

Token Generators are used to issue security tokens that can be consumed by Web Services at your site (see *Token Processors and Generators* on page 13). Token Generators for SAML 2.0 and SAML 1.1 tokens are included with the PingFederate installation. This section provides guidance on configuring “instances” of either of the SAML Token Generators. You must configure at least one generator in order to set up an STS connection or token-to-token mapping (see *Token Exchange Mapping* on page 120).

Important: If more than one instance of the same token-generator type is configured for a connection or token-to-token mapping, clients calling either of the PingFederate STS endpoints must add a query parameter, `TokenGeneratorId`, and specify the Instance Id. (For endpoint information, see *Viewing SP Protocol Endpoints* on page 262.)

For example: `https://<pf_host>:<pf_port>/sp/sts.wst?TokenGeneratorId=saml2firstinstance`

Additional Token Generators may be *downloaded* from the Ping Identity Web site (`www.pingidentity.com/en/products/downloads.html`). For configuration information, please consult documentation provided for the respective add-on generator.

To begin configuring SAML 1.1 or 2.0 Token Generators:

1. Click **SP Configuration** on the Main Menu.
2. Click **Token Generators** under Application Integration Settings.

   If this link is not shown, ensure that the WS-Trust STS is enabled in **Server Settings** (see *Enabling the WS-Trust STS* on page 324).

To configure a new token-generator instance:

- Click **Create New Instance**.

To edit an existing instance:

- Click the Instance Name and click the step you need to change.

To delete an instance:

1. Click **Delete** next to the Instance Name. (To undo the deletion, click **Undelete**.)

Note: This option is available only if the generator instance is not in use for a connection.

2. Click **Save** to confirm the deletion.

Selecting a Token Generator Type

The first step in creating a SAML token-generator instance is choosing the generator type.

To define an instance

1. Enter the Instance Name and Instance Id on the Type screen.
2. Select SAML 1.1 Token Generator or SAML 2.0 Token Generator from the drop-down menu.
3. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
4. Click **Next**.

Configuring a Token Generator Instance

On the Instance Configuration screen, you specify parameters for generated SAML tokens.

Note: If this is a child instance, select the override checkbox to modify the configuration.

Field Instructions

Field	Instructions
Minutes Before	Enter a numerical value. This element in a SAML token allows for any server clock variability.
Minutes After	Enter a numerical value. This element in a SAML token allows for any server clock variability.
Issuer	Enter the SAML 2.0 Entity ID or SAML 1.x Issuer specified on the Federation Information screen in Server Settings (see *Specifying Federation Information* on page 94).
Signing Certificate	Responses containing SAML tokens must be signed. If the signing certificate you need is not in the drop-down list, click **Manage Signing Certificates** near the bottom of the screen.
Signing Algorithm	Select the signing algorithm corresponding to the selected certificate. Choices include SHA1 for both RSA and DSA, RSA-SHA256, SHA384, and SHA512; as well as ECDSA-SHA256, SHA384, and SHA512.
Include Certificate in KeyInfo	If selected, the entire public certificate is included with the assertion. Otherwise, a short hash reference to the certificate is sent instead.
Include Raw Key in KeyValue	If selected, the raw key is included in the `<KeyInfo>` element as well.
Audience	This is a unique identifier for the target Web service, used for the `<audience>` element of the generated SAML token.
Confirmation Method	(Optional) Choose from among available methods: • ...cm:sender-vouches (default) • ...cm:bearer • ...cm:holder-of-key For more information, see the *WSS SAML Token Profile*.

Field	Instructions
Encryption Certificate	The WSP's public certificate for encryption, required *only* if holder-of-key is selected as the Confirmation Method. If the certificate is not yet part of the PingFederate store, click **Manage Encryption Certificates** to import it.

Extending a Generator Contract

Token generators allow administrators to add to a built-in list of user attributes that the generator includes in the outgoing token—an extended generator-attribute contract.

Note: If this is a child instance, select the override checkbox to modify the configuration.

To add an attribute:

- Enter the attribute name in the text box and click **Add**

Editing and Saving Generator Instances

From the Summary screen, you can reach token-generator settings for editing.

To edit the configuration:

1. Click the heading above the information you want to change.
2. Make your changes.
3. Click **Done** on the configuration page and **Save** on the Manage Token Generators screen.

To save a generator instance:

1. Click **Done** on the Summary screen.
2. Click **Save** on the Manage Token Generators screen.

Configuring IdP Connections for STS

You can configure an STS connection to an IdP partner either in conjunction with browser-based SSO or independently.

To enable STS for a new connection, or to add the capability to an existing connection:

- Select the WS-Trust STS option on the Connection Type screen (see *Choosing a Connection Type* on page 194).

  Note: Before this option can be selected, the WS-Trust protocol must be enabled in Server Settings (see *Server Settings* on page 324).

When the option is enabled, the configuration starts on the WS-Trust STS screen.

- To continue, click **Configure WS-Trust STS**.

Configuring STS Protocol Settings

On the Protocol Settings screen, choose whether to validate incoming SAML tokens or to validate and then also generate different tokens to enable SSO access to Web Services at your site.

Also on this screen, if incoming SAML 2.0 tokens for this connection are required to be encrypted, select the checkbox for decrypting assertions. When you make this selection, you will be required to choose a decryption certificate for this partner later in the connection configuration (if one is not already selected for Browser SSO purposes—see *Choosing a Decryption Key* on page 320).

- If you choose not to generate new tokens, then no further settings are needed for this task—click **Next** and refer to *Using the Token Generation Summary Screen* on page 362 for instructions on saving this configuration.You will be asked later to choose a certificate with which to verify the signature on the incoming SAML token (see *Configuring Signature Verification Settings* on page 236).

Configuring Token Generation

For the PingFederate STS to issue a security token that meets identity requirements of Web Services at your site, you must indicate what user attributes are included in the incoming token (the *attribute contract*). The attribute values from the incoming token can be then mapped to attributes in the token generator you select (see *Attribute Contract Fulfillment* on page 215). As with Browser SSO, the mapping can be augmented using local data stores, variable or constant text, or expressions.

Details of this configuration are handled under the Token Generation task.

- To continue, click **Configure Token Creation**.

Specifying an Attribute Contract

An attribute contract is the set of user attributes expected in incoming (see *Attribute Contracts* on page 23). You identify these attributes on this screen.

Optionally, you can mask the values of attributes (other than `SAML_SUBJECT`) in the log files that PingFederate writes when it receives security tokens (see *Attribute Masking* on page 26).

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Attribute Contract** on the Summary screen.

To add an attribute:

1. Enter the attribute name in the text box.

   Attribute names are case-sensitive and must correspond to the attribute names expected by the requester.
2. Optional: Select the checkbox under Mask Values in Log.
3. Click **Add**.

To modify an attribute name :

1. Click **Edit** under Action for the attribute.
2. Make the change and click **Update**.

To delete an attribute:

- Click **Delete** under Action for the attribute.

Mapping Token Generators

Token generators provide a mechanism through which PingFederate can generate a local token based upon an incoming SAML token, including mapping user attributes to be included in the generated token. A configured and deployed token generator in PingFederate is known as a token-generator instance.

You can map one or more token generator instances into each IdP connection to satisfy multiple session-management requirements where needed. The same instances may be mapped by multiple connections.

When token generators are restricted to certain virtual server IDs, the allowed IDs are displayed under the Virtual Server IDs column.

The configuration begins on the Token Generator Mapping & User Lookup screen. If you have not yet configured an instance of a token generator you need for this connection, see *Configuring Token Generators* on page 348.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.

To modify an existing Token Generator Instance:

- Click its Name link.

To begin configuring a Token Generator Instance for this connection:

- Click **Map New Token Generator Instance**.

Selecting a Token Generator Instance

On this screen for a new connection, choose an instance of the Token Generator needed for this connection (see *Token Processors and Generators* on page 13).

You will use attributes contained in the incoming security token to fulfill the token generator contract for this STS connection and/or use them to look up additional attributes in a user-data store. You make this choice on the next screen (see *Retrieving Attributes* on page 337).

- Choose a Token Generator Instance from the drop-down list and click **Next** to continue.

  (Optional) To override any token generator instance, select the **Override Instance Settings** checkbox (see *Overriding Token Generator Instances*).

  To create or change a Token Generator Instance, as needed, click **Manage Token Generator Instances**.

Overriding Token Generator Instances

Overrides at the connection level simplify token management by allowing you to create a small set of token instances that define the base configuration requirements and then overriding settings at the connection level as needed.

You may override any IdP token generator settings at the connection level either during or after connection mapping.

Alternatively, you can override any token generator instance to apply to several connections, see *Hierarchical Plug-in Configurations* on page 21 for more information about token generator overrides.

Note: Any changes to the base token generator instance are propagated to a connection provided the same changes are not overridden for the connection.

- Click **Override Instance Settings**.

  On each of the settings screens, make your changes, and then click **Next**. When you are finished, click **Done** to continue with token mapping.

  Note: Override token-setting screens are functionally identical to those used for creating a new token connection. Refer to the table below to find sections in this manual containing configuration information and procedures.

  The display of some screens listed in the table depends on the type of token you are configuring.

For information about the override token-setting screens, depending on the type of setting, use the following table:

Override Screen	**Manual Section**
Instance Configuration	See *Configuring a Token Generator Instance* on page 349
Extended Contract	See *Extending a Generator Contract* on page 350.

- To remove any token generator connection override, clear the **Override Instance Settings** checkbox, and then complete the rest of the setup.

Viewing Token Generator Instance Settings

Token generator override instance type information. This screen is view only.

This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Configuring a Token Generator Instance* on page 349.

Overriding Token Generator Instance Settings

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Configuring a Token Generator Instance* on page 349.

Overriding Token Generator Extended Contracts

- If you want to override any settings on this screen, select the override checkbox, make your changes, and then click **Next**.

  This screen is functionally identical to the one used for creating a new token instance. For more information about this screen, see *Extending a Generator Contract* on page 350.

Using the Override Instance Settings Summary Screen

- On the Override Instance Settings Summary screen, click any heading to change your generator configuration; or click **Done** to continue.

Restricting a Token Generator to certain Virtual Server IDs

When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), you have the option to enforce authentication requirements by restricting a token generator to certain virtual server IDs. This optional setting can be applied to each token generator added to the connection using virtual server IDs. By default, no restriction is imposed.

To restrict a token generator to a subset of the available virtual server IDs:

1. Select the **Restrict Virtual Server IDs** checkbox.
2. In the **Allowed Virtual Server IDs** area, select virtual server IDs that you want to allow for this token generator.
3. Click **Next**.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).

6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Virtual Server IDs** on the Summary screen.

Note: The Virtual Server IDs screen is only available for connections using at least one virtual server ID, see *Federation Server Identification*.

Retrieving Additional Attributes

For token generation, you can query local user-data stores to help fulfill the token-generator contract, in conjunction with attribute values supplied by the incoming token .

The values supplied by the token are shown under Attribute Contract on the Attribute Retrieval screen.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Attribute Retrieval** on the Summary screen.

- If you choose to look up additional information, then you will identify a data store and specify lookup queries next (see the next section *Identifying a Data Store* on page 354).
- If you use only the attributes available (the default), then you will map values for the attribute contract next (see *Mapping Token Attributes* on page 359).

Tip: To determine whether you need to look up additional values, compare the attribute contract against the token-generator contract on the previous screen (see *Selecting a Token Generator Instance* on page 352). If the token-generator contract requires more information, determine whether your local data stores can supply it. (You can also choose to use text constants or expressions for certain information—see *Mapping Token Attributes* on page 359.)

Identifying a Data Store

This portion of the connection configuration allows you to set up search parameters for a data store.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).

6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Data Store** under the Token Generator Mapping & User Lookup tab.

   If this step is not presented, this Token Generator Instance is not configured to look up user attributes in a data store (see *Retrieving Additional Attributes* on page 354).

To define an attribute source:

- Choose an Active Data Store and click **Next**.

  A data-store configuration must be defined under System Settings for use within a connection. If the data store you want is not shown in the drop-down menu, click **Manage Data Stores** to add it (see *Managing Data Stores* on page 98).

Configuring Attribute Lookup for WS-Trust STS

See the following sections in this manual topics, depending on the type of data store:

Data Store Type	Related Manual Section
JDBC	• *Selecting a Data Table and Columns* on page 355 • *Configuring a Database Query* on page 356
LDAP	• *Configuring LDAP Search Parameters* on page 357 • *Configuring a Directory Filter* on page 358
Custom	• *Configuring Custom Filters* on page 359 • *Selecting Custom Data Fields* on page 359

Selecting a Data Table and Columns

When you choose to use a database source for attributes, you follow this path through the configuration steps.

On this screen you begin to specify exactly where additional data can be found to complete the token-generator contract when you send to this SP (see *Retrieving Additional Attributes* on page 354). Only one table may be used as a source of data for a JDBC lookup.

Important: (**For MySQL users**) To allow for table and column names that may contain spaces, PingFederate inserts double quotes around the names at runtime. To avoid SQL syntax errors resulting from the quotes, add the session variable `sql_mode=ANSI_QUOTES` to the connection string of your JDBC data store instance. For example:

```
jdbc:mysql://myhost.mydomain.com:3306/pf?
sessionVariables=sql_mode=ANSI_QUOTES
```

Alternatively, you can configure the system variable `sql_mode` with the `ANSI_QUOTES` option. For more information, see *http://dev.mysql.com/doc/refman/5.7/en/server-system-variables.html*.

Field Descriptions

Field	Description
Schema	Lists the table structure that stores information within a database. Some databases, such as Oracle, require selection of a specific schema for a JDBC query. Other databases, such as MySQL, do not require selection of a schema.
Table	The name of the table contained in the database. Use the drop-down to change the table.
Columns to return from SELECT	Displays selected table columns. Select the columns that are associated with the desired attributes you would like to return from the JDBC query.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Database Table and Columns** under the Token Generator Mapping & User Lookup tab.

To select a database table and columns for queries:

1. Choose a Schema file (when applicable) from the drop-down list.
2. Choose a Table from the drop-down list.
3. Choose a name under Columns to Return from Select and click **Add Attribute**.

   Tip: Click **Refresh** if you are updating an existing configuration and changes may have been made to the database.

   Repeat this step for other columns as needed.

   Note: You do not need to add a column here for it to be used as part of a search filter (see *Configuring an STS Database Filter* on page 341 next). Add only attributes from which you need actual values to pass in a token.

   Tip: To determine what attributes to look up during a query, click the **View Attribute Contract** link to see what information must be collected (see *Specifying an Attribute Contract* on page 351). Then determine what information is coming in from the token processor (see *Retrieving Additional Attributes* on page 354). Information not contained in the token-processor contract may be pulled from the data store look-up query.

Configuring a Database Query

The JDBC `WHERE` clause in PingFederate queries the data table you selected to retrieve a record associated with a particular value (or values) from the incoming security token. The clause is in the form:

```
WHERE column1=value1 [AND column2=value2] [OR ...]
```

The left side of the first variable pair uses a column name in the database table you selected (see Selecting a Data Table and Columns).

The right side generally uses values passed in from the incoming SAML token (variables, including the correct formatting, are listed under Assertion Values).

You can also apply additional search criteria from your own database, using any other columns from the targeted table.

Tip: Click "**View List of Columns . . .**" to see a list from which to copy and paste.

For more information about `WHERE` clauses, consult your DBMS documentation.

EXAMPLE:

```
userid='${username}'
```

In this example `userid` is the name of a column in the JDBC data store. On the right side, `'${username}'` returns the value of the `username` variable from the IdP token processor.

⚠ **Important:** You *must* use the `${}` syntax to retrieve the value of the enclosed variable and use single quotation marks around the `${}` characters.

Field Description

Field	Description
Where	`WHERE` clause statements conditionally select data from a table. Enter the `WHERE` clause statement in the space provided. For example: `WHERE email='clive@company.com'`.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Database Filter** from the steps list under the Token Generator Mapping & User Lookup tab.

To construct the `WHERE` clause:

1. Enter the statement in the space provided, following the guidelines and example above.

   The initial `WHERE` is optional.
2. Ensure the syntax and variable names are correct.

When you click **Next**, you will map attribute values returned from the database into the security token (see *Mapping Token Attributes* on page 359).

Configuring LDAP Search Parameters

When you choose to use an LDAP source for attributes, you follow this path through the configuration steps.

On this screen you specify the branch of your LDAP hierarchy where you want PingFederate to look up user data.

Field Descriptions

Field	Description
Base DN	The base distinguished name of the tree structure in which the search begins. This field is optional if records are located at the LDAP root.
Search Scope	Determines the node depth of the query. Select Subtree, One level or Object.
Root Object Class	The class containing the attributes you want.
Attributes to return from search	A list of added from the drop-down list below. Subject DN is a default attribute, which may be used as the primary user identifier.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.

2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **LDAP Directory Search** under the Token Generator Mapping & User Lookup tab.

To select LDAP attributes:

1. Optional: Enter a Base DN.
2. Select a Search Scope.
3. Select a Root Object Class.
4. Under Attributes to return from search, choose an attribute and click **Add Attribute**.

   Note that the attribute Subject DN is always returned by default.

   Note: When connecting to Microsoft Active Directory, if you choose the memberOf attribute, an optional checkbox, Nested Groups, appears on the right. Select this checkbox if you want PingFederate to query for groups the end users belong to directly as well as indirectly through nested group membership (if any) under the Base DN.

   For example, suppose you have three groups under the Base DN, namely Canada, Washington and Seattle. Seattle is a member of Washington. Ana Smith is an end user and a member of Seattle. If the Nested Groups checkbox is selected, when PingFederate queries for Ana's memberOf attribute values, the expected results are Seattle and Washington. (When the Nested Groups checkbox is not selected (the default), the expected result is Seattle.)

   For Oracle Directory Server, choose isMemberOf under Attribute for nested group membership. For more information, see *documentation about isMemberOf from Oracle* (docs.oracle.com/cd/E29127_01/doc.111170/e28967/ismemberof-5dsat.htm).
5. Repeat the last step for other attributes as needed.

   Note: You do not need to add an attribute here for it to be used in a search filter (see *Configuring a Directory Filter* on page 358). Add only attributes from which you need actual values to pass into the outgoing security token.

Configuring a Directory Filter

The LDAP filter queries the data you selected to retrieve a record associated with a particular value (or values) from the incoming token. The filter is in the form:

```
attribute=${value}
```

The left-side variable is an attribute you selected earlier (see Configuring LDAP Search Parameters).

The right side generally uses values passed in from the incoming SAML token (variables, including the correct syntax, are listed under Assertion Values).

You can also apply additional search criteria from your data store, using any other attributes from the targeted object classes.

Tip: Click "**View List of Available LDAP Attributes**" for a list from which you can copy and paste.

For general information about search filters, consult your LDAP documentation.

Field Descriptions

Field	Description
Filter	Narrows a search to locate requested data by either including or excluding specific records. An LDAP filter includes the attributes in the search and the value or range of values that the search is attempting to match. Searches are conducted by using three components: 1) at least one attribute (attribute data type) to search on, 2) a search filter operator that will determine what to match, and 3) the value of the attribute being sought. Searches must have at least one of each of these three components.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **LDAP Filter** under the Token Generator Mapping & User Lookup tab.

To construct the LDAP filter:

1. Enter the statement in the space provided, following the guidelines and example above.

   Note: If you used an anonymous binding to create this LDAP connection, your access might be restricted (see *Configuring an LDAP Connection* on page 102).
2. Ensure the syntax and variable names are correct.
3. Click **Next**.

Configuring Custom Filters

When you choose to use a custom source for attributes, you follow this path through the configuration steps.

On this screen you specify a filter, or lookup query, for your custom data source. This screen display and the syntax of the filter depends on your developer’s implementation of the custom source SDK.

Selecting Custom Data Fields

On the Configure Custom Source Fields screen, you can choose from among the fields shown to map to the token processor contract. These choices are supplied by the driver implementation. Select only those needed to fulfill the attribute contract for this partner connection.

Mapping Token Attributes

You map attributes for outgoing security tokens for this partner on the Token Generator Contract Fulfillment screen.

Map each attribute to fulfill the Token Generator Contract from one of these Sources:

- Assertion

  When you make this selection, the associated Value drop-down list is populated by the incoming SAML token (Assertion).
- Context

Values are returned from the context of the transaction at runtime.

Note: The HTTP Request and STS SSL Client Certificate Chain selections are retrieved as Java objects rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values.

Choose Expression and then click **Edit** to enter an expression (see *Using the OGNL Edit Screen* on page 432). (If the Expression selection is not listed, then the feature is not enabled—see *Enabling and Disabling Expressions* on page 428. For syntax and examples, see sections under *Constructing Expressions* on page 429.)

Note: When using the STS Basic Authentication Username, STS SSL Client Certificate's Subject DN, or STS SSL Client Certificate Chain attributes, ensure the associated authentication is enabled and configured in WS-Trust STS Settings (see *Selecting Authentication Methods* on page 325).

- LDAP/JDBC/Custom

  Note: PingFederate appends a description in parentheses for configured data store lookups (see *Configuring STS Attribute Sources and User Lookup* on page 338).

  Values are returned from your attribute source (if you are using data store—see *Retrieving Attributes* on page 337). When you make this selection, the Value list is populated by the LDAP, JDBC, or Custom attributes you identified as an Attribute Source (see *Configuring an LDAP Search* on page 342, *Selecting an STS JDBC Database Table and Columns* on page 339, or *Configuring STS Custom Source Filters* on page 344).
- Expression (when enabled)

  This option provides more complex mapping capabilities—for example, transforming incoming values into different formats (see *Using Attribute Mapping Expressions* on page 428). All of the variables available for text entries (see below) are also available for expressions.
- Text

  The value is what you enter. This can be text only, or you can mix text with references to any of the values from the assertion, using the `${attribute}` syntax.

  You can also enter values from your data store, when applicable, using this syntax:

  ```
  ${ds.attribute}
  ```

  where *`attribute`* is any of the data store attributes you select.

To reach this screen for editing:

1. Click **SP Configuration** on the Main Menu.
2. Click the connection name under IdP Connections.

   Click **Manage All**, if needed, to see a full list of connections.
3. Click **WS-Trust STS** under the IdP Connection tab.
4. Click **Configure WS-Trust STS**.
5. Click **Token Generation** under the WS-Trust STS tab.

   If this step is not shown, token generation is not selected for the connection (see *Configuring STS Protocol Settings* on page 350).
6. Click **Configure Token Generation**.
7. Click **Token Generator Mapping & User Lookup** on the Summary screen.
8. Click the Token Generator Instance Name.
9. Click **Token Generator Contract Fulfillment** under the Token Generator Mapping & User Lookup tab.

To map attributes:

1. Choose a Source for each Target attribute.
2. Choose (or enter) a Value for each Attribute.

See *Map each attribute to fulfill the Token Generator Contract from one of these Sources:* above. All values must be mapped.

3. Click **Next**.

Selecting Issuance Criteria for Token Generation (Optional)

Use this screen to define criteria PingFederate can evaluate to determine whether to issue a security token for a user (see *About Token Authorization* on page 27). This token authorization can be used to restrict who can access identity-enabled Web services.

To configure Issuance Criteria:

1. Select a source containing attributes for token authorization.

   Associated attributes appear in the Attribute Name drop-down list:

   - Assertion – Select to access attributes from the assertion.
   - Context – Select to use values returned from the context of the transaction at runtime.

     Note: The HTTP Request and STS SSL Client Certificate Chain selections are retrieved as Java objects rather than text. For this reason, OGNL expressions are more appropriate to evaluate and return values. If you want to use an expression for authentication, skip to Step 8 below.

   - LDAP/JDBC/Custom (if a data store is configured) – Select to access attributes returned from a data source.

     Note: PingFederate appends a description in parentheses for (see *Configuring Attribute Sources and User Lookup* on page 208).

   - Mapped Attributes – Select to access the required attributes.

2. Select an attribute name.

   Note: When using the STS Basic Authentication Username, STS SSL Client Certificate's Subject DN, or STS SSL Client Certificate Chain attributes, ensure the associated authentication is enabled and configured in WS-Trust STS Settings (see *Selecting Authentication Methods* on page 325).

3. Select the Condition you want to apply.

   Note: Use multi-value conditions when you want PingFederate to verify that an attribute contains or does not contain the specified value in its attribute list. Using a single-value condition when an attribute has multiple values causes the condition to evaluate consistently to false.

   Important: When using the STS SSL Client Certificate's Subject DN attribute, you must select one of the following conditions: equal to DN, not equal to DN, multi-value contains DN, or multi-value does not contain DN. These operators normalize the DN before comparison to accommodate for different string representations that are still considered equivalent (for example, case sensitivity, or whitespace).

4. Enter an exact value for the attribute.

   Tip: You can use OGNL expressions to perform more complex evaluations, including partial matching (see step 8 for more information).

5. Optional: Use the Error Result field to customize an error code or error message for use if the token authorization fails.

   Errors result in a `SOAP` message returned. The Error Result field is used by the `faultstring` element for SOAP 1.1 and the `Reason/Text` element for SOAP 1.2.

   For more information on SOAP, see the World Wide Web Consortium's *Simple Object Access Protocol* (`www.w3.org/TR/2000/NOTE-SOAP-20000508/#_Toc478383507`).

   Note: Using an error code in the Error Result field allows an application to process the code in a variety of ways—for example, display an error message or e-mail an administrator.

   If you leave this field blank, a default ACCESS_DENIED error result is used if the authorization fails.

6. Click **Add**.
7. Repeat the steps above to add additional attributes, as needed, for each authorization criteria.

Note: All criteria must pass in order for a user to be authorized.

8. Optional: Click **Show Advanced Criteria** to configure more complex evaluations using OGNL expressions.

   Note: Expressions must be enabled for the **Show Advanced Criteria** button to appear (see *Enabling and Disabling Expressions* on page 428).

   Important: When you multiplex one connection for multiple environments (see *Connecting to a Partner in One Connection* on page 36), consider using an OGNL expression to verify the virtual server ID in conjunction with other conditions, such as group membership information, to protect against unauthorized access (see *Expression Examples* on page 430).

   - Use the in-line editor box to enter the OGNL expression.

     For more information about OGNL, see *Using Attribute Mapping Expressions* on page 428.
   - Use the Error Result box to enter an error code or an error message for use if authorization fails (see step 5 above for more information).

     Note: If the OGNL expression resolves to a string value (rather than true or false), then the returned value overrides the Error Result.
   - Click **Add**. Continue to add expressions, as needed.
   - Click the **Test** link to input values and test the resulting output for the expression.

     Note: For more information on testing OGNL expressions, see *Using the OGNL Edit Screen* on page 432. For syntax and examples, see sections under *Constructing Expressions* on page 429.
9. Click **Next** (or **Done**, if you are finished with the configuration, and then **Save** on the Manage Mappings screen).

To edit Issuance Criteria:

- Click **Edit** under Actions for the criteria.

To delete Issuance Criteria:

- Click **Delete** under Actions for the criteria and then click **Save**.

Saving the Mapping

When you have finished configuring Token Generator Mapping & User Lookup, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing connection, click **Done** on successive screens until you reach the WS-Trust STS screen, and then click **Save**.

To save a new configuration:

1. Click **Done** to return to the Token Generator Mapping & User Lookup screen.
2. Click **Next** to go to the Token Generation Summary screen, and then click **Done**.
3. On the Token Generation screen, click **Done**.
4. On the WS-Trust STS screen, click **Save**.

Using the Token Generation Summary Screen

When you have finished configuring Token Generation, you can review the configuration on the Summary screen. If you need to make any changes, click the heading over the information you want to edit.

- If you are editing an existing connection, click **Done** on successive screens until you reach the WS-Trust STS screen, and then click **Save**.

Using the WS-Trust STS Summary Screen

On the WS-Trust STS Summary screen, you can review the configuration for this connection.

- If you need to make any changes to a new or existing connection, click the heading over the information you want to modify.

Appendix A

OpenToken Adapter Configuration

In order to transfer identity and other user information between the PingFederate server and an end application, the product architecture allows for custom adapters to be deployed with the server (see *SSO Integration Kits and Adapters* on page 19).

PingFederate ships with a deployed OpenToken Adapter, which uses a secure token format (`OpenToken`) to transfer user attributes between an application and the PingFederate server. On the IdP side, the OpenToken Adapter allows the PingFederate server to receive a user's identity from the IdP application. On the SP side, the OpenToken Adapter can be used to transfer user-identity information to the target SP application.

Specialized application integration kits are available from *www.pingidentity.com*. Many kits leverage the OpenToken Adapter to integrate applications with the PingFederate server. The agent portions of the integration kits reside with the application and use the OpenToken to communicate with the OpenToken Adapter.

Note: To integrate applications for use with the OpenToken Adapter, download an integration kit for PingFederate from *www.pingidentity.com* and follow instructions for installing and using Agent Toolkits in the accompanying documentation. Follow the configuration instructions in this appendix to set up the OpenToken Adapter to use with your applications.

The following figure shows a basic IdP-initiated SSO scenario using PingFederate with the Java Integration Kit on both sides of an identity federation.

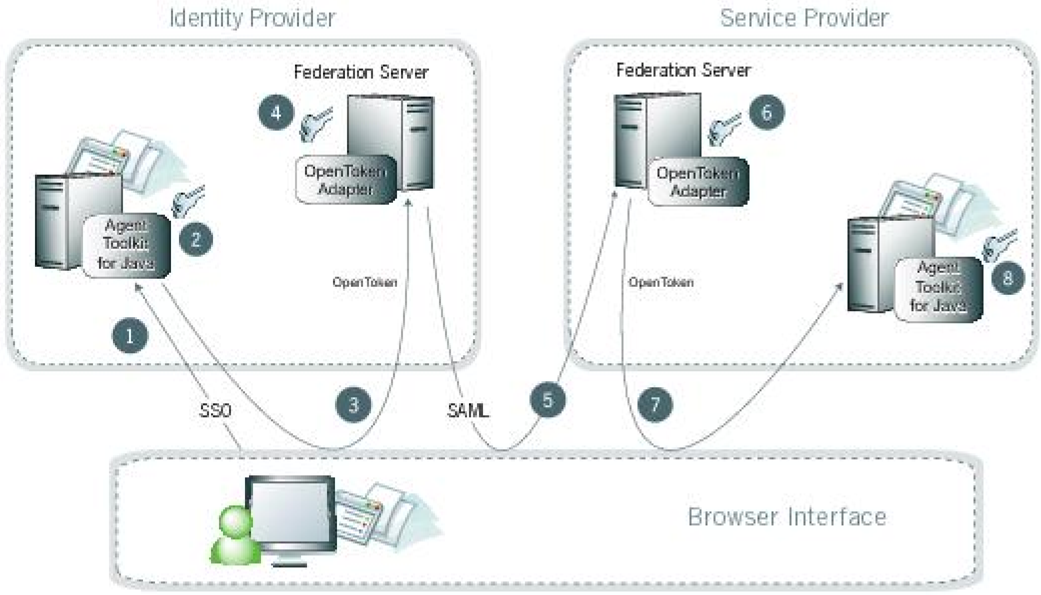

Figure 4: SP-Initiated SSO: POST/POST

Processing Steps:

1. A user initiates an SSO transaction.
2. The IdP application inserts attributes into the Agent Toolkit for Java, which encrypts the data internally and generates an `OpenToken`.
3. A request containing the `OpenToken` is redirected to the PingFederate IdP server.
4. The server invokes the OpenToken IdP Adapter, which retrieves the `OpenToken`, decrypts, parses, and passes it to the PingFederate IdP server. The PingFederate IdP server then generates a Security Assertion Markup Language (SAML) assertion.
5. The SAML assertion is sent to the SP site.
6. The PingFederate SP server parses the SAML assertion and passes the user attributes to the OpenToken SP Adapter. The Adapter encrypts the data internally and generates an `OpenToken`.
7. A request containing the `OpenToken` is redirected to the SP application.
8. The Agent Toolkit for Java decrypts and parses the `OpenToken` and makes the attributes available to the SP Application.

Configuring the IdP OpenToken Adapter

1. If you have not already done so, log on to the PingFederate administrative console.
2. Click **IdP Configuration** on the Main Menu.
3. Click **Adapters** under Application Integration Settings.
4. On the Manage IdP Adapter Instances screen, click **Create New Instance**.
5. On the adapter Type screen, enter an Instance Name and Instance Id, select OpenToken Adapter 2.5.1 (or higher) as the Type, and click **Next**.

   The Instance Id may not contain spaces or underscores.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.
8. On the IdP Adapter screen, enter the values as described for the adapter configuration.

   These values are dependent on your developer's implementation.
9. Optional: Click **Show Advanced Fields** to reconfigure default settings for the `OpenToken`, as needed.

   Refer to the on-screen field descriptions and following table for more information.

Field	Description
Transport Mode	How the token is transported to/from the application, either via a query parameter, a cookie (default), or as a form POST. **Note:** Form POST is applicable only for an SP adapter instance.
Token Name	The name of the cookie or query parameter that contains the token. This name must be unique for each adapter instance.
Cipher Suite	The algorithm, cipher mode, and key size that should be used for encrypting the token.

Field	Description
Logout Service	The URL to which the user is redirected for a single-logout event. This URL is part of an external application, which terminates the user session.
Cookie Domain	The server domain, preceded by a period (for example, `.example.com`). If no domain is specified, the value is obtained from the request.
Cookie Path	The path for the cookie that contains the token.
Token Lifetime	The duration (in seconds) for which the token is valid. Valid range is 1 to 28800.
Session Lifetime	The duration (in seconds) for which the token may be re-issued without authentication. Valid range is 1 to 259200.
Not Before Tolerance	The amount of time (in seconds) to allow for clock skew between servers. Valid range is 0 to 3600.
Force SunJCE Provider	If selected, the SunJCE provider is forced for encryption/decryption.
Use Verbose Error Messages	If selected, use verbose TokenException messages.
Obfuscate Password	If selected, the password is obfuscated and password-strength validation is applied. Clearing the checkbox allows backward compatibility with previous OpenToken agents.
Session Cookie	If selected, OpenToken is set as a session cookie (rather than a persistent cookie). Applies only if Transport Mode is set as 'Cookie'.
Secure Cookie	If selected, the OpenToken cookie is set only if the request is on a secure channel (https). Applies only if Transport Mode is set as 'Cookie'.
Delete Cookie	If selected, the token cookie is deleted immediately after consumption. This option is valid only if Transport Mode is set to 'Cookie'.
Replay Prevention	Selecting this option is recommended only if Query Parameter is chosen as the token Transport Mode and POST is used by an associated connection to send the SAML assertion. If checked, PingFederate ensures that the token can be used only once. **Note:** Checking this option may affect resource utilization and performance.
Skip Malformed Attribute Detection	If not selected, it prevents insecure content from affecting the security of your application/agent. We recommend to update your applications with the latest version of the agent. We recommend not to change the value of this flag.

10. Click **Next**.
11. On the Actions screen, click **Download** under Action Invocation Link.
12. On the next screen, click **Export** and save the properties file.

    The values in the resulting file, `agent-config.txt`, represent the console configuration and are used by the IdP application. Refer to your respective Integration Kit *User Guide* for more information.
13. Click **Next**.
14. Optional: On the Extended Contract screen, you can configure additional attributes for the adapter (see *Extending an Adapter Contract* on page 180).

    Tip: The OpenToken Adapter always extends the core contract with an attribute `userId` and fulfills it with the value of `subject` for backward compatibility reason.

    Note: If this is a child instance, select the override checkbox to modify the configuration.
15. Click **Next**.

16. On the Adapter Attributes screen, select the subject checkbox under Pseudonym (optionally, select other attributes, if you added any at *Step 12*).

    This selection is used if any of your SP partners make use of *pseudonyms* for *account linking* (see *Account Linking* on page 22).

    Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

    You can also choose to mask the values of any or all attributes that PingFederate logs from the adapter at runtime (see *Attribute Masking* on page 26).

    If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).
17. Click **Next**.
18. On the Summary screen, review the configuration and click **Done**.

    You can also click any heading to go back and change information.
19. On the Manage IdP Adapter Instances screen, click **Save**.

    Important: You must click **Save** to retain the adapter configuration.

Configuring the SP OpenToken Adapter

1. If you have not already done so, log on to the PingFederate administrative console.
2. Click **SP Configuration** on the Main Menu.
3. Click **Adapters** under Application Integration Settings.
4. On the Manage SP Adapter Instances screen, click **Create New Instance**.
5. On the adapter Type screen, enter an Instance Name and Instance Id, select OpenToken Adapter 2.5.1 (or higher) as the Type, and click **Next**.

   The Instance Id may not contain spaces or underscores.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.
8. Enter values for the adapter configuration on the Instance Configuration screen.

   These values are dependent on your developer's implementation.
9. Optional: Click **Show Advanced Fields** to reconfigure default settings for the `OpenToken`, as needed.

   Refer to the on-screen descriptions and the following table for more information.

Field	Description
Transport Mode	How the token is transported to/from the application, either via a query parameter, a cookie, or as a form POST (default). **Note:** Form POST is applicable only for an SP adapter instance.

Field	Description
Token Name	The name of the cookie or query parameter that contains the token. This name must be unique for each adapter instance.
Cipher Suite	The algorithm, cipher mode, and key size that should be used for encrypting the token.
Authentication Service	The URL to which the user is redirected for an SSO event. This URL overrides the Target Resource which is sent as a parameter to the Authentication Service.
Account Link Service	The URL to which the user is redirected for Account Linking. This URL is part of an external SP application. This external application performs user authentication and returns the local user ID inside the token.
Logout Service	The URL to which the user is redirected for a single-logout event. This URL is part of an external application, which terminates the user session.
Cookie Domain	The server domain, preceded by a period (for example, `.example.com`). If no domain is specified, the value is obtained from the request.
Cookie Path	The path for the cookie that contains the token.
Token Lifetime	The duration (in seconds) for which the token is valid. Valid range is 1 to 28800.
Session Lifetime	The duration (in seconds) for which the token may be re-issued without authentication. Valid range is 1 to 259200.
Not Before Tolerance	The amount of time (in seconds) to allow for clock skew between servers. Valid range is 0 to 3600.
Force SunJCE Provider	If selected, the SunJCE provider is forced for encryption/decryption.
Obfuscate Password	If selected the password is obfuscated and password-strength validation is applied. Clearing the checkbox allows backward compatibility with previous OpenToken agents.
Session Cookie	If selected, OpenToken is set as a session cookie (rather than a persistent cookie). Applies only if Transport Mode is set as 'Cookie'.
Secure Cookie	If selected, the OpenToken cookie is set only if the request is on a secure channel (https). Applies only if Transport Mode is set as 'Cookie'.
Send Subject as Query Parameter	Selecting this checkbox sends the Subject ID as a clear-text query parameter, if Transport Mode is set to **Query Parameter**. If Transport Mode is set to **Form POST**, the Subject ID is sent as POST data.
Subject Query Parameter	The parameter name used for the Subject ID when the Send Subject ID as Query Parameter check box is selected.
Send Extended Attributes	Extended Attributes are typically sent only within the token, but this option overrides the normal behavior and allows the attributes to be included in browser cookies or query parameters.

10. Click **Next**.
11. On the Actions screen, click **Download** under Action Invocation Link.
12. On the next screen, click **Export** and save the properties file.

    The values in the resulting file, `agent-config.txt`, are set by the console configuration and used by the SP application. Refer to your respective Integration Kit *User Guide* for more information.
13. Click **Next**.
14. Optional: On the Extended Contract screen, you can configure additional attributes for the adapter (see *Extending Adapter Contracts* on page 256).

Note: If this is a child instance, select the override checkbox to modify the configuration.

15. Click **Next**.
16. On the Summary screen, review the configuration and click **Done**.

    You can also click any heading to go back and change information.
17. On the Manage Adapter Instances screen, click **Save**.

    Important: You must click **Save** to retain the adapter configuration.

    Note: If this is the second instance of an OpenToken Adapter configuration, then you must first click **Next** and map target URLs to adapter instances (see *Configuring Target URL Mapping* on page 257).

Appendix B

HTTP Basic Adapter Configuration

Initial user authentication is normally handled outside of the PingFederate server using an application or IdM system logon module. PingFederate's adapter and application agents are typically used to integrate with these local authentication mechanisms (see *SSO Integration Kits and Adapters* on page 19).

PingFederate packages an HTTP Basic Adapter that delegates user authentication to a configured password credential validator (see *Validating Password Credentials* on page 170). This authentication mechanism validates credentials based on either an LDAP directory or a simple username validator that authenticates credentials maintained by PingFederate.

On the IdP side, when the PingFederate IdP server receives an authentication request for SP-initiated SSO or the user clicks a link for IdP-initiated SSO, the IdP server invokes the HTTP Basic Adapter and, if not already authenticated, prompts the user for local IdP credentials. The credentials are then validated using the designated password credential validator and, if validated, a SAML assertion is generated.

Configuring the HTTP Basic IdP Adapter

1. If you have not already done so, configure a password credential validator (see *Validating Password Credentials*).
2. Click **IdP Configuration** on the Main Menu.
3. Click **Adapters** under Application Integration Settings.
4. On the Manage IdP Adapter Instances screen, click **Create New Instance**.
5. On the adapter Type screen, enter an **Instance Name** and **Instance Id**, select `HTTP Basic IdP Adapter` as the **Type**.

   The **Instance Id** may not contain spaces or underscores.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.
8. On the IdP Adapter screen, click **Add a new row to 'Credential Validators'** to define a credential-authentication mechanism instance for the adapter.
9. Select a password credential validator from the list and click **Update**.

   Add as many validators as necessary. Use Move Up and Move Down to adjust the order in which you want PingFederate to attempt credential authentication. If the first mechanism fails to validate the credentials, PingFederate moves sequentially through the list until credential validation succeeds. If none of the defined password credential validators is able to authenticate the user's credentials, and the challenge retries maximum has been reached, the process fails.
10. Enter values for the adapter configuration, as described below.

Property	Description
Realm	(Required) The name of a protected area. The value of this field is sent as a part of the HTTP Basic authentication request. It appears in a dialog box that prompts the user for a username and password. **Note:** Once a user authenticates against a realm, if additional HTTP Basic adapters have the same realm, the user is not prompted to re-authenticate.
Challenge Retries	(Required) The number of attempts allowed for password authentication.

Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

11. Click **Next**.

    Note: If this is a child instance, select the override checkbox to modify the configuration.

12. On the Adapter Attributes screen, select the username checkbox under Pseudonym (and, optionally, other attributes, if available).

    This selection is used if any of your SP partners use *pseudonym*s for *account linking* (see *Account Linking* on page 22).

    Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

    You can also choose to mask the values of any or all attributes that PingFederate logs from the adapter at runtime (see *Attribute Masking* on page 26).

    If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).
13. Click **Next**.
14. On the Summary screen, review the configuration and click **Done**.

    You can also click any heading to go back and change information.
15. On the Manage IdP Adapter Instances screen, click **Save**.

    Important: You must click **Save** if you want to retain the adapter configuration.

Appendix C

HTML Form Adapter Configuration

Initial user authentication is normally handled outside of the PingFederate server using an application or IdM system logon module. PingFederate's adapter and application agents are typically used to integrate with these local authentication mechanisms (see *SSO Integration Kits and Adapters* on page 19).

PingFederate packages an HTML Form Adapter that delegates user authentication to a configured password credential validator (see *Validating Password Credentials* on page 170). This authentication mechanism validates credentials based on either an LDAP directory or a simple username validator that authenticates credentials maintained by PingFederate.

On the IdP side, when the PingFederate IdP server receives an authentication request for SP-initiated SSO or the user clicks a link for IdP-initiated SSO, the IdP server invokes the HTML Form Adapter and, if not already authenticated, prompts the user for local IdP credentials. The credentials are then validated using the designated password credential validator and, if validated, a SAML assertion is generated.

The HTML Form Adapter allows you to customize a different login page for each configured adapter instance. You can define a logout path and page or a logout redirect page. You can also enable users to change their network passwords and customize a change-password page, or redirect users to a company-hosted password management system.

PingFederate tracks login attempts per adapter instance. This capability adds a layer of protection against brute force and dictionary attacks. When the **Challenge Retries** threshold is reached, the user is locked out for one minute.

The default value for **Challenge Retries** is three. If you prefer a higher value, consider reviewing the account lockout policy of your directory servers first. For example, if the directory server's account lockout threshold is set to five and the **Challenge Retries** in the HTML Form Adapter is also set to five (or higher), the fifth single sign-on attempt could potentially lock the user accounts on the directory server.

The lockout period is customizable by modifying the **LockoutPeriod** value in `<pf_install>/pingfederate/server/default/data/config-store/com.pingidentity.common.security.AccountLockingService.xml`. This lockout is per adapter and is unlocked after the lockout period has lapsed.

Note: For a PingFederate cluster environment, modify the `com.pingidentity.common.security.AccountLockingService.xml` file on the console node and use the PingFederate administrative console to replicate the configuration to all engine nodes (see Console Configuration Push in the *Server Clustering Guide*).

Configuring the HTML Form IdP Adapter

1. If you have not already done so, configure a password credential validator (see *Validating Password Credentials*).
2. Click **IdP Configuration** on the Main Menu.
3. Click **Adapters** under Application Integration Settings.
4. On the Manage IdP Adapter Instances screen, click **Create New Instance**.

5. On the adapter Type screen, enter an **Instance Name** and **Instance Id**, select `HTML Form IdP Adapter` as the **Type**.

   The **Instance Id** may not contain spaces or underscores.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.
8. On the IdP Adapter screen, click **Add a new row to 'Credential Validators'** to define a credential-authentication mechanism instance for the adapter.
9. Select a password credential validator from the list and click **Update**.

   Add as many validators as necessary. Use Move Up and Move Down to adjust the order in which you want PingFederate to attempt credential authentication. If the first mechanism fails to validate the credentials, PingFederate moves sequentially through the list until credential validation succeeds. If none of the defined password credential validators is able to authenticate the user's credentials, and the challenge retries maximum has been reached, the process fails.
10. Enter values for the adapter configuration, as described below.

Property	Description
Challenge Retries	(Required) The account lockout threshold for this adapter instance. When the number of login failures reaches this threshold, the user is locked out for one minute. For more information, see the previous section, *HTML Form Adapter Configuration* on page 372.
Session State	How the session state is maintained between adapters of the same type. When Globally is selected, sessions are shared among other HTML Form IdP Adapter instances that use the same 'Globally' setting. When Per Adapter (the default choice) is selected, a session is tied to a specific adapter instance. When None is selected, a session is not maintained.
Session Timeout	The number of idle minutes before a session times out based on inactivity. The default value is 60 (an hour). If left blank, the lifetime falls back on the Session Max Timeout value. Ignored if None is selected for Session State. **Note:** This setting times out sessions based on inactivity.
Session Max Timeout	The maximum lifetime (in minutes) before a session expires regardless if Session Timeout has been reached, or not. The default value is 480 (8 hours). Ignored if 'None' is selected for Session State. **Note:** This setting sets a maximum lifetime, subject to inactivity timeout (based on Session Timeout). Consider the following examples: A user initiated an SSO request at 9am and has not made another SSO request since then. At 10am, the session times out based on inactivity (based on Session Timeout's default value of 60 minutes). Another user initiated an SSO request at 9am and has been making SSO requests every hour at least once. This session does not time out because the user has been actively making SSO requests; however, the session does expire at 5pm (based on Session Max Timeout's default value of 8 hours).

Property	Description
	If you leave both Session Max Timeout and Session Timeout blank, sessions do not expire (until PingFederate restarts or the sessions are cleaned up by another means). If you leave Session Max Timeout blank but set a value for Session Timeout, sessions do not expire until they time out based on inactivity. **Tip:** Session information is stored in the PF cookie. By default, the PF cookie is a session cookie; web browsers typically remove session cookies on exit. For more information, see *Extending the Lifetime of the PF Cookie* on page 82.
Login Template	(Required) Template on the IdP server that displays when prompting the user for their credentials. PingFederate allows each configured adapter instance to use a different login page template.
Logout Path	Any path in the format indicated. Setting a path invokes adapter logout functionality that is normally invoked during SAML 2.0 single-logout processing. The resulting logout URL is <PingFederate base URL>/ext/<Logout Path>. Available primarily for use cases where the partner SaaS providers who do not support SAML Single Logout (SLO) but want the users' IdP SSO sessions to end after logging out of the SaaS services. For these use cases, the SaaS providers could redirect the users to the logout URL after the users log out of their platforms. **Note:** If specified, the path should be unique across HTML Form IdP Adapter instances, including child instances.
Logout Redirect	The landing page at the SP after successful IdP logout (applicable only when Logout Path is set above).
Logout Template	Template on the IdP server to display after successful IdP logout, if Logout Redirect fails or is not provided (applicable only when Logout Path is set above).
Allow Password Changes	Enables or disables the ability for users to change their network passwords using this adapter instance. Select the checkbox to enable the change password functionality. **Note:** The LDAP Password Credential Validator (PCV) is currently the only PCV packaged with PingFederate that supports the change password feature. You can build custom PCVs using the PingFederate Software Development Kit (see the *SDK Developer's Guide* for more information).
Change Password Template	Template on the IdP server that displays when prompting users to change their password. PingFederate allows each configured adapter instance to use a different change password template.
Change Password Message Template	Template on the IdP server that notifies users their password was successfully changed.
Password Management System	URL for redirecting users to a company-specific password management system to change their password.
Password Management System Message Template	Template on the IdP server that notifies users they are being redirected to a password management system to change their password.
Login Challenge Template	Displays a configurable challenge form for two-step authentication. This template can be used, for example, to create a *RADIUS* challenge form when using the RADIUS Username/Password Credential Validator.
Enable 'Remember My Username'	Allows users to store their username as a cookie when authenticating with this adapter. Once stored, the username is pre-populated in the login form's username

Property	**Description**
	field on subsequent transactions. Select the checkbox to enable the cookie functionality. **Note:** This option is hidden when users authenticate through a Composite Adapter instance that chains this adapter behind another authentication source with an Input User Id Mapping (see “Input User Id Mapping” in *Configuring the Composite Adapter* on page 382) and the Allow Username Edits checkbox is not selected.
‘Remember My Username’ Lifetime	Number of days the cookie remains valid. Enter the number of days you want the username remembered in a cookie. The default is 30. The cookie lifetime is reset upon each successful login in which the Enable 'Remember My Username' checkbox is selected. **Note:** The value is ignored when users authenticate through a Composite Adapter instance that chains this adapter behind another authentication source with an Input User Id Mapping (see “Input User Id Mapping” in *Configuring the Composite Adapter* on page 382) and the Allow Username Edits checkbox is not selected.
Allow Username Edits During Chaining	When users authenticate through a Composite Adapter instance that chains this adapter behind another authentication source with an Input User Id Mapping (see “Input User Id Mapping” in *Configuring the Composite Adapter* on page 382) or initiate an OAuth authorization request with a **login_hint** parameter (see *Authorization Endpoint* on page 403), the username field is pre-populated in the login form; users are not allowed to edit their usernames. Select this checkbox if you want to allow users to edit the pre-populated username field in the login form. **Note:** Users who authenticate through a Composite Adapter instance without an Input User Id Mapping or this adapter directly always need to enter their usernames.
Track Authentication Time	When selected (the default), the time of authentication for each user is tracked and could be utilized by applicable use cases—for example, if an OAuth client sends an authorization request with a **max_age** parameter, such request will prompt the user to reauthenticate when the elapsed time (between the current time and the time of the previous authentication) is greater than the max_age value. (For more information about max_age, see *Authorization Endpoint* on page 403.)

11. Click **Next**.
12. Optional: On the Extended Contract screen, you can configure additional attributes for the adapter (see *Extending an Adapter Contract* on page 180).

    Note: If this is a child instance, select the override checkbox to modify the configuration.

13. Click **Next**.
14. On the Adapter Attributes screen, select the username checkbox under Pseudonym (and, optionally, other attributes, if available).

    This selection is used if any of your SP partners use *pseudonym*s for *account linking* (see *Account Linking* on page 22).

    Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

You can also choose to mask the values of any or all attributes that PingFederate logs from the adapter at runtime (see *Attribute Masking* on page 26).

If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).

15. Click **Next**.
16. On the Summary screen, review the configuration and click **Done**.

    You can also click any heading to go back and change information.
17. On the Manage IdP Adapter Instances screen, click **Save**.

    ! **Important:** You must click **Save** if you want to retain the adapter configuration.

Appendix D

Kerberos Adapter Configuration

The PingFederate Integrated Kerberos Adapter allows a PingFederate Identity Provider (IdP) server to perform single sign-on (SSO) to Service Provider (SP) applications based on Active Directory credential tokens (specifically Kerberos service tickets).

PingFederate authenticates users in the specified domain using the Kerberos v5 protocol, providing a seamless SSO experience.

On the IdP side, when PingFederate (the IdP server) receives an authentication request for SP-initiated SSO or the user clicks a link for IdP-initiated SSO, PingFederate invokes the Kerberos Adapter. When PingFederate receives a Kerberos ticket from the browser, it accesses the domain controller and validates the ticket using the Domain/ Kerberos Realm defined in PingFederate (see *Using AD Domains and Kerberos Realms* on page 175). If validation succeeds, PingFederate retrieves the username and domain from the ticket, generates a SAML assertion with the username and/or domain of the authenticated user, and passes it to the service provider.

Important: The Kerberos Adapter supports authentications by Kerberos only. If your environment requires NTLM support, you need to deploy the PingFederate IWA Integration Kit (see the *User Guide* for PingFederate IWA Integration Kit 3.1 for more information). You can safely deploy the IWA Adapter and create one or more instances of it alongside with the Kerberos Adapter.

Multiple-Domain Support

If your network uses multiple domains in a single server forest, you can configure the Kerberos Adapter for only one domain in the forest. This configuration requires a trust relationship among domains, which is established by default when subdomains or separate domains are created within the same forest.

Note: You only need to configure one domain within PingFederate if there is a trust relationship with the other domains you want to use. For more information, see *How Domain and Forest Trusts Work* (`technet.microsoft.com/en-us/library/cc773178(v=ws.10).aspx`) from Microsoft.

If you are configuring only one domain, then you also need to configure only one Service Principal Name (see *Modifying the Windows Environment* on page 377).

If your network topology consists of multiple forests without a trust relationship between them, then you must configure multiple adapter instances; map each instance a separate domain and then map these adapter instances to your SP connections that authenticate using the Kerberos Adapter.

Modifying the Windows Environment

You need to make several AD configuration changes to enable Kerberos authentication.

Note: You must have Domain Administrator permissions to make the required changes.

To integrate PingFederate and the Kerberos Adapter into your AD environment:

1. Create a domain user account that PingFederate can use to contact the Kerberos Key Distribution Center (KDC). The account should belong to the "Domain Users" group. We recommend that the password be set with no expiration.
2. Use the Windows utility `setspn` to register SPN directory properties for the account by executing the following command on the domain controller:

   ```
   setspn -s HTTP/<pf-idp.domain.name> <pf-server-account-name>
   ```

   where:

   `<pf-idp.domain.name>` is the fully qualified domain name of the PingFederate server.

   `<pf-server-account-name>` is the domain account you want to use for Kerberos authentication.

   Note: "`HTTP`" must be capitalized and followed by a forward-slash (`/`).
3. Verify that the registration was successful by executing the following command:

   ```
   setspn -l <pf-server-account-name>
   ```

   This gives you a list of SPNs for the account. Verify that `HTTP/<pf-idp.domain.name>` is one of them.

   Note: After making an SPN change, any end-users already authenticated must re-authenticate (close the browser or log off and back on) before attempting SSO.

For more information about `setspn`, see the *Setspn* article (`technet.microsoft.com/en-ca/library/cc731241.aspx`) from Microsoft.

Configuring PingFederate Access to the Domain Account

To integrate Kerberos authentication, you must give PingFederate access to the domain account.

1. Click **Server Configuration** on the Main Menu.
2. Click **Active Directory Domains/Kerberos Realms** under Authentication.
3. Enter your Domain/Realm Name and the domain account created in the previous section for PingFederate to use when contacting the KDC(s) for verifying user authentication.

   Note: For more information, see *Using AD Domains and Kerberos Realms* on page 175.

Configuring the Kerberos Adapter

1. If you have not already done so, log on to the PingFederate administrative console.
2. Click **IdP Configuration** on the Main Menu.
3. Click **Adapters** under Application Integration Settings.
4. On the Manage IdP Adapter Instances screen, click **Create New Instance**.
5. On the adapter Type screen, enter an **Instance Name** and **Instance Id**, select `Kerberos Adapter` as the Type, and click **Next**.

   The **Instance Id** may not contain spaces or underscores.
6. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
7. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.

8. On the IdP Adapter screen, select the **Domain/Realm Name** for your Windows domain. If the Domain or Realm you want does not appear, click Manage Active Directory Domains/Kerberos Realms to add it (see *Using AD Domains and Kerberos Realms* on page 175).
9. Optional: Enter a URL for redirecting the user if there are errors. This URL has an errorMessage query parameter appended to it, which contains a brief description of the error that occurred. The error page can optionally display this message on the screen to provide guidance on remedying the problem.

   Note: In the case of an error, if you define an **Error URL Redirect** and the adapter instance is included in a composite adapter, the user is redirected to the Error URL rather than continuing on to the next adapter in the chain. Leave this field blank to have the adapter continue on to the next adapter (see *Configuring the Composite Adapter* on page 382).

   When employing the errorMessage query parameter in a custom error page, adhere to Web-application security best practices to guard against common content injection vulnerabilities. If no URL is specified, the appropriate default error landing page appears. (For more information, see *Customizing User-Facing Screens* on page 76.)
10. Optional: Click **Show Advanced Fields** and make any desired changes for the following settings.

Field	Descriptions
Error Template	When selected, displays a template to provide standardized information to the end user when authentication fails. The template (`kerberos.error.template.html` in the `<pf_install>/pingfederate/server/default/conf/template` folder) uses the Velocity template engine and can be modified in a text editor to suit your particular branding and informational needs. For example, you can give the user the option to try again should authentication fail. For more information on Velocity templates, see *Customizing User-Facing Screens* on page 76.
Authentication Context Value	This may be any value agreed to with your SP partner. Standard URIs are defined in the SAML specifications (see the OASIS document *saml-authn-context-2.0-os.pdf*).

11. Click **Next**.
12. On the Adapter Attributes screen, select **Username** (and optionally **Domain/Realm Name**) to be used in constructing a unique identifier (Pseudonym) for account linking (see *Account Linking* on page 22).

    Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

    You can also choose to mask the values of any or all attributes that PingFederate logs from the adapter at runtime (see *Attribute Masking* on page 26).

    If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).
13. Click **Next**.
14. On the Summary screen, click **Done**.
15. On the Manage IdP Adapter Instances screen, click **Save**.

    Important: You must click Save if you want to retain the adapter configuration

Configuring User Browsers

This section contains configuration information needed for client-side browsers at your site in order to use the Kerberos Adapter to authenticate users.

Important: If the browsers are not properly configured, users may be prompted to authenticate manually using their network credentials or fail to SSO to the service providers.

Internet Explorer 9.0 or Higher

The browser setup for Internet Explorer (IE) may require the following modifications of Internet Options (in the Tools menu).

Tip: This configuration is not necessary under certain conditions, as described in the Note at the beginning of each step.

To configure IE for the Kerberos Adapter

1. Under the Security tab for the Local intranet, add to the list of accessible Web sites the fully qualified domain name that is part of the PingFederate URL used to start SSO (`<pf-idp.domain.name>`).

   Note: This step may be skipped if `<pf-idp.domain.name>` is internal and not fully qualified. For example, if it is `pingfederate`, you can skip the step. However, if `<pf-idp.domain.name>` is `pingfederate.company.com`, then you must add the domain to the **Sites** list, as described in the following substeps.

   a) Click **Sites**.
   b) In the next dialog box, ensure that **Include all sites that bypass the proxy server** is checked, and then click **Advanced**.
   c) Enter the fully qualified domain name (`<pf-idp.domain.name>`) and click **Add**.
   d) Click **Close** and then click **OK** to close the dialog boxes
2. Verify proxy settings.

   Note: Skip this step if a proxy is not used.

   a) Click the **Connections** tab in the Internet Options dialog.
   b) Click **LAN settings**.
   c) In the LAN Settings dialog, ensure **Use a proxy server for your LAN** is selected and click **Advanced**.
   d) In the **Proxy Settings** dialog box, enter the PingFederate IdP server's fully qualified domain name in the Exceptions field.
   e) Click **OK** twice to return to Internet Options.

   Important: Other Internet Options required for Kerberos authentication generally are part of the default IE installation. If you encounter errors at runtime, verify that the defaults have not been changed.

To check default IE browser settings:

1. In Tools | Internet Options under the Security tab, verify intranet authentication:
   a) Click **Custom Level**.
   b) In the Security Settings dialog box, scroll down to User Authentication and ensure that **Automatic logon only in the Intranet zone** is selected.
   c) Click **OK** to close the dialog box.
2. Verify that IWA is enabled:
   a) Click the **Advanced** tab.
   b) Scroll down to the Security section.
   c) Ensure that **Enable Integrated Windows Authentication** is selected.
   d) Click **OK**.

Firefox Browser

To configure Firefox for Kerberos Adapter:

1. Enter `about:config` into the address bar.
2. Search for `network.negotiate-auth.trusted-uris`.
3. Double-click to modify its value to include the name of the PingFederate server (`<pf-idp.domain.name>`).

Appendix E

Composite Adapter Configuration

For an IdP, PingFederate includes a Composite Adapter, which allows an administrator to "chain" the selection of available adapter instances for a connection. At runtime, adapter chaining means that SSO requests are passed sequentially through each adapter instance specified until one or more authentication results are found for the user.

Adapter chaining may be used to choose an adapter instance based on the method by which a user authenticated, or to integrate an organization's multi-factor authentication policy.

Configuring the Composite Adapter

1. If you have not already done so, log on to the PingFederate administrative console.
2. If you have not already done so, configure instances of IdP Adapters you want to use for adapter chaining (see *Configuring IdP Adapters* on page 178).
3. Click **IdP Configuration** on the Main Menu.
4. Click **Adapters** under Application Integration Settings.
5. On the Manage Adapter Instances screen, click **Create New Adapter Instance**.
6. On the adapter Type screen, enter an Instance Name and Instance Id, select Composite Adapter as the Type.

   The Instance Id may not contain spaces or underscores.
7. Optional: Select a **Parent Instance** from the drop-down list.

   If you are creating an instance that is similar to an existing instance, you might consider making it a child instance by specifying a parent (see *Hierarchical Plug-in Configurations* on page 21). A child instance inherits the configuration of its parent unless overridden. You can specify overrides during the rest of the setup.
8. Click **Next**.

   Note: If this is a child instance, select the override checkbox related to the settings you want to modify.
9. On the IdP Adapter screen, click **Add a new row to 'Adapters'**.

   Note: This screen may appear differently than the example above, depending on types of adapters configured on your system (see *Step 14*).
10. Select an Adapter Instance from the drop-down list.

    If a required adapter instance is not shown in the list, save or cancel this configuration and ensure that the instance has been configured *and* saved (see *Configuring IdP Adapters* on page 178).
11. Optional: Change or enter different defaults under any or all of the adjacent column headings under Adapters, as described in the following table.

Column	Description
Policy	**Required** (the default) indicates authentication via this adapter instance is needed to continue SSO processing and invoke any remaining instances in the chain. If you are integrating multi-factor authentication, use this policy for each instance.

Column	Description
	Sufficient indicates that authentication via this adapter instance is enough to satisfy requirements (along with any required instances above). Any subsequent configured instances in the chain below are *not* invoked. **Important:** For the sufficient policy to work correctly, the adapter must return control to PingFederate after any kind of a failure. Currently, not all types of adapters have this capability. For an up-to-date list of adapters tested successfully under the Sufficient policy in failure mode, see Known Issues in the PingFederate *Release Notes*.
AuthN Context Weight	If more than one adapter instance in the chain is configured to return an *authentication context*, this relative weight is used to determine which value is included in the assertion—unless the value is overridden in the next column (see AuthN Context Override, below). If weights are the same for two or more contexts, the first one processed is included in the assertion.
AuthN Context Override	If provided, this value overrides any that may be returned from the adapter instance. The value in this field may be sent in the assertion if the associated adapter instance is invoked and its AuthN Context Weight is higher than other executed instances where authentication context is available.

12. Add at least one more Adapter Instance.
13. As needed, use the **Move Down/Move Up** links under Action to re-order the entries.

    At runtime adapter chaining is sequential, starting at the top of the list.

    Important: Several types of adapters—for example, the Integrated Windows Authentication Adapter —may be configured to direct end users to an error page if authentication fails for any reason, which will halt further progress through a composite-adapter chain. Ensure that for such adapter instances the "Error URL" option is *not* used in the instance configuration, if continuation through an adapter-chaining sequence is required.
14. **Note:** If you have configured any IdP Adapter developed with version 2 (or later) of the Adapter SDK (including the HTML Form IdP Adapter and the separately available Symantec VIP Adapter), the Input User Id Mapping section appears.

    For two-factor authentication, some adapters (such as the separately available Symantec VIP Adapter) require that a unique ID be passed in from a first-factor adapter. If so, an administrator must specify the attribute containing the unique ID on this screen. (For basic information about the Adapter SDK, see the *SDK Developer's Guide*. For specific developer information about the version 2 IdP-adapter interface, refer to the Javadoc located in the `<pf_install>/pingfederate/sdk/doc` folder.)

    To pre-populate the username of an HTML Form adapter instance with an attribute from an earlier authentication source defined from step 7 through step 11:

    a) Click **Add a new row to 'Input User Id Mapping'**.
    b) Select the HTML Form adapter instance under Target Adapter.
    c) Choose a source attribute under User ID Selection.

    Note: For OAuth use cases, entries in the Input User Id Mapping section could override the **login_hint** parameter value provided by the OAuth clients. For more information about login_hint, see *Authorization Endpoint* on page 403.

    Tip: By default, the HTML Form Adapter does not allow the users to change the username if it is configured to be pre-populated with an attribute from another authentication source. You can override this restriction by enabling the Allow Username Edit option per adapter instance (see *Configuring the HTML Form IdP Adapter* on page 372).

15. Optional: If any attributes are logically equivalent across two adapter instances but have different names, click **Add a new row to 'Attribute Name Synonyms'** and enter the attribute names under Name and Synonym.

    The attribute name under Synonym and its value are used in the SAML assertion, when the two values returned from each adapter are identical. If returned values are different, both values are sent for the synonym (see the next step).

    Note: If this table is not used to identify synonymous attribute names, both names and their values are sent in the SAML assertion.

16. Optional: Change the Field Value selected for Attribute Insertion.

    For attributes of the same name configured in different adapter instances, you can change the order of returned values when the values are different. (Values are merged if they are the same.)

    By default (**Add to Back**) the value for an attribute name configured in the first instance is returned first and also listed first in the resulting SAML assertion. Then any different value from the same attribute name in a subsequently invoked instance is appended.

    The order might not matter for many attributes, but in the case of the SAML-subject attribute, only the first value in the SAML assertion may be used for an SP connection partner under normal circumstances. Click **Add to Front** to reverse the default order, if needed.

17. Click **Next**.
18. On the Extended Contract screen, **Add** attributes to be returned from each adapter instance configured on the previous screen.

    Note: Attributes must correspond exactly to any or all of the attribute names listed on the Adapter Attribute screens for each configured adapter instance.

19. Click **Next**.

    Note: If this is a child instance, select the override checkbox to modify the configuration.

20. On the Adapter Attributes screen, select at least one attribute as a Pseudonym (and, optionally, other attributes, if available).

    This selection is used if any of your SP partners make use of *pseudonym*s for account linking (see *Account Linking* on page 22).

    Note: A selection is required regardless of whether you use pseudonyms for account linking. This allows account linking to be used later without having to delete and reconfigure the adapter. Ensure that you choose at least one attribute that is unique for each user (for example, email) to prevent the same pseudonym from being assigned to multiple users.

    You can also choose to mask the values of any or all attributes that PingFederate logs from the adapter at runtime (see *Attribute Masking* on page 26). If OGNL expressions might be used to map derived values into outgoing assertions and you want those values masked, select the related checkbox under the Attribute list (see *Using Attribute Mapping Expressions* on page 428).

21. Click **Next**.
22. On the Summary screen, review the configuration and click **Done**.

    You can also click any heading to go back and change information.

23. On the Manage IdP Adapter Instances screen, click **Save**.

    Note: You must click **Save** if you want to retain the adapter configuration.

Appendix F

Application Endpoints

These endpoints provide a means, via standard HTTP, by which external applications can communicate with the PingFederate server.

The SSO and SLO endpoints for an IdP and an SP include optional parameters which you can use to specify error pages that users see in the event of an SSO or SLO failure. By default, PingFederate provides templates for these and other errors or conditions (see *Customizing User-Facing Screens* on page 76).

SP endpoints also include those available for SCIM Inbound Provisioning (see *Provisioning for SPs* on page 34).

For either SP or IdP servers, a maintenance endpoint is also provided for administrators to verify that the server is running. Endpoints applicable to both server roles also include those needed for adapter-to-adapter mapping (see *Adapter-to-Adapter Mapping* on page 115) and retrieval of WS-Trust metadata (see *WSC and WSP Support* on page 14).

PingFederate provides a favorite icon for all Application Endpoints. For more information, see *Customizing the Favicon for Application and Protocol Endpoints* on page 84.

IdP Endpoints

The following sections describe PingFederate IdP endpoints, including the query parameters that each accepts or requires. These endpoints accept either the `HTTP GET` or `POST` methods.

Note: Begin each URL with the fully qualified server name and port number of your IdP or SP PingFederate server: for example:

`https://pingidentity.com:9031/idp/startSSO.ping`.

Important: When the parameter `TargetResource` (or `TARGET`) is used and includes its own query parameters, the parameter value must be URL-encoded. Any other parameters that contain restricted characters (many SAML URNs, for example) also must be URL-encoded.

For information about URL encoding, see, for example, *HTML URL-encoding Reference* (www.w3schools.com/tags/ref_urlencode.asp).

Note: Parameters are case-sensitive.

/idp/startSSO.ping

This is the path used to initiate an unsolicited IdP-initiated SSO transaction during which a SAML response containing an assertion is sent to an SP. Typically, a systems integrator or developer creates one or more links to this endpoint in the IdP application or portal to allow users to initiate SSO to various SPs.

For information about allowing applications to retrieve configuration data from the PingFederate server over SOAP, see *Web Service Interfaces* on page 408.

The following table shows the HTTP parameters for this endpoint.

Parameter	Description

`PartnerSpId`
or
`PARTNER`
	The federation ID of the SP to whom the SAML response containing an assertion should be issued. One of these parameters is required unless the federation ID can be derived from `TargetResource` or `TARGET` (see below).

TargetResource or TARGET (optional)	For SAML 2.0, the value of either parameter is passed to the SP as the RelayState element of a SAML response message. This is the PingFederate implementation of the SAML 2.0 indicator for a desired resource at the SP during IdP-initiated SSO. For SAML 1.x, the value is sent to the SP as a parameter named TARGET. **Note:** If this parameter is not provided in the URL, then the target resource should be specified in the administrative console (see *Configuring a Default URL and Error Message* on page 187).
`InErrorResource` (optional)	Indicates where the user is redirected after an unsuccessful SSO. If this parameter is not included in the request, PingFederate redirects the user to the SSO error landing page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76).
`Binding` (optional)	Indicates the binding to be used; allowed values are URIs defined in the SAML specifications. For example, the SAML 2.0 applicable URIs are: `urn:oasis:names:tc:SAML:2.0: bindings:HTTP-Artifacturn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST` When the parameter is not used, the default ACS URL configured for the SP-partner connection is used, unless an ACS index is specified (see the next parameter, `ACSIdx`).
`ACSIdx` (optional - SAML 2.0)	Specifies the index number of partner's ACS (see *Setting Assertion Consumer Service URLs (SAML)* on page 222). Takes precedence over the Binding parameter if both are specified. If neither the binding nor index is specified in the call, the default ACS is used.
`IdpAdapterId` (optional)	Allows an application to call out what IdP adapter to use for authentication (in a configuration with multiple IdP adapters). **Note:** This parameter may be overridden by policy based on adapter selector configuration. For example, the CIDR Adapter Selector could enforce the use of a given adapter based on whether a user is on or off the network (see *Configuring Authentication Selectors* on page 182).
`RequestedFormat` (optional - SAML 2.0)	Allows control over the `NameId` format.
`vsid` (optional)	Specify the virtual server ID. When absent, PingFederate uses the default virtual server ID (if specified) for the connection (see *General Information* on page 195) or the SAML federation ID defined in Server Settings (see *Specifying Federation Information* on page 94).

/idp/startSLO.ping

This is the path used to initiate an IdP-initiated SLO (under SAML 2.0) or an OpenID Connect logout (see *Asynchronous Front-Channel Logout* on page 128). Typically, a systems integrator or developer creates one or more links to this endpoint in the protected resources of their IdP application or portal to allow users to end their sessions at various SPs. This endpoint uses the local PingFederate session to determine which SPs have been issued an SSO assertion and sends them a SAML logout request.

The following table shows the HTTP parameters for this endpoint.

Parameter	Description
`TargetResource` (optional)	Indicates where the user is redirected after a successful SLO. If this parameter is not included in the request, PingFederate uses as a default the URL for a successful SLO as entered on the IdP Default URL screen.
`InErrorResource` (optional)	Indicates where the user is redirected after an unsuccessful SLO. If this parameter is not included in the request, PingFederate redirects the user to the SLO error landing page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76).

`Binding` (optional - SAML 2.0)	Indicates the binding to be used; allowed values are URIs defined in the SAML specifications. The SAML 2.0 applicable URIs are:
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-Artifact`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-POST`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-Redirect`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:SOAP`
	When the parameter is not used, the first SLO Service URL configured for the SP-partner connection is used (see *Specifying SLO Service URLs (SAML 2.0)* on page 224).

/idp/writecdc.ping

This endpoint is used for SAML 2.0 IdP Discovery. This is the path used when the IdP wants to write to the Common Domain Cookie (CDC) held within the user's browser. The information written to the cookie indicates from which IdP this user has authenticated.

The following table shows the one HTTP query parameter for this endpoint.

Parameter	Description
`TargetResource` (optional)	Indicates where the user is redirected after successful IdP Discovery. If this parameter is not included in the request, PingFederate redirects the user to the referrer in the HTTP header. If there is no TargetResource or referrer, the call to this endpoint will fail.

System-Services Endpoints

These endpoints are the same for both IdPs and SPs and are described under *System-Services Endpoints* on page 395.

SP Endpoints

The following sections describe the PingFederate SP endpoints, including the query parameters that each accepts or requires.

Note: Begin each URL with the fully qualified server name and port number of your IdP or SP PingFederate server: for example:

`https://pingidentity.com:9031/idp/startSSO.ping`.

SP Services

These endpoints accept either the HTTP GET or POST methods.

Important: When the parameter `TargetResource` is used and includes its own query parameters, the parameter value must be URL-encoded. For information about URL encoding, see, for example, *HTML URL-encoding Reference* (http://www.w3schools.com/tags/ref_urlencode.asp).

Note: Parameters are case-sensitive.

/sp/startSSO.ping

This is the path used to initiate SP-initiated SSO. In this scenario, the SP issues an SSO request to the IdP asking for an SSO authentication response. Typically, a systems integrator or developer creates one or more links to this endpoint in SP applications to allow users to access various protected resources via SSO using the IdP as an authentication authority.

For information about allowing applications to retrieve configuration data from the PingFederate server over SOAP, see *Web Service Interfaces* on page 408.

The following table shows the HTTP parameters for this endpoint.

Note: Some parameters described below can have multiple values. Specify these values by using multiple independent query string parameters of the same name.

Parameter	Description
`PartnerIdpId` (required if more than one IdP connection is configured and `Domain` is not used)	The federation ID of the IdP that authenticates the user and issues an assertion. **Note:** This ID is case-sensitive.
`Domain` (required to invoke Auto-Connect)	The domain name associated with the requesting user's IdP (see *Using Auto-Connect* on page 31). In this case, `PartnerIdpId` cannot be used.

`TargetResource`
or
`TARGET`
(optional)
	This parameter indicates where the end-user is redirected after a successful SSO.
	Note: When this parameter is not provided in the URL, a default target resource may be specified in the administrative console, either for all IdP connections (see *Configuring Default URLs* on page 261) or for individual connections (see *Configuring Default Target URLs (Optional)* on page 295), or both.

`Binding` (optional)	Indicates the binding to be used; allowed values are URIs defined in the SAML specifications. For example, the SAML 2.0 applicable URIs are:
	`urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact`
	`urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST`
	`urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect`
	When the parameter is not used for SAML 2.0, the first SSO Service URL configured for the IdP-partner connection is used (see *Specifying SSO Service URLs (SAML)* on page 291).

`InErrorResource` (optional)	This parameter indicates where the end-user is redirected after an unsuccessful SSO. If this parameter is not included in the request, PingFederate redirects the user to the SLO error landing page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76).
`SpSessionAuthnAdapterId` (optional)	The explicit SP *adapter* instance ID indicating the adapter to use to create an authenticated session or security context.

Parameter	Description
ForceAuthn (optional - SAML 2.0)	This parameter controls the attribute of the same name in the AuthnRequest. (The default isfalse.)
IsPassive (optional - SAML 2.0)	This parameter controls the attribute of the same name in the AuthnRequest. (The default is false.)
AllowCreate (optional - SAML 2.0)	Controls the value of the AllowCreate attribute of the NameIDPolicy element in the AuthnRequest. (The default is true.)
RequestedFormat (optional - SAML 2.0)	Specifies the value for the Format attribute in the NameIDPolicy element of the AuthnRequest. If not specified, the attribute is not included in the AuthnRequest.
AuthenticatingIdpId (optional - SAML 2.0)	This parameter indicates the preferred IdP for authenticating the user through an IdP proxy. The parameter specifies the value of the IDPEntry ProviderID attribute in the Scoping element of the AuthnRequest. Multiple values are permitted in order to build a preferred list.
RequestedACSIdx (optional - SAML 2.0)	The index number of your site's Assertion Consumer Service, where you want the assertion to be sent.
RequestedAcsUrl (optional - SAML 2.0)	The URL of your site's Assertion Consumer Service, where you want the assertion to be sent.
RequestedBinding (optional - SAML 2.0)	Indicates the binding requested for the response containing the assertion; allowed values are URIs defined in the SAML specifications.
RequestedAuthnCtx (optional - SAML 2.0)	Indicates the requested authentication context of the assertion; allowed values include URIs defined in the SAML specifications (see the OASIS SAML document *saml-authn-context-2.0-os.pdf*). Multiple values are permitted in order to build a preferred list.
RequestedAuthnDeclRef (optional - SAML 2.0)	An alternative to RequestedAuthnCtx, above, indicating the requested authentication context of the assertion by declaring any URI reference (see section 2.7.2.2 of the OASIS SAML document *saml-core-2.0-os.pdf*). Multiple values are permitted in order to build a preferred list.
RequestedSPName Qualifier (optional - SAML 2.0)	Indicates that the IdP should return the given name qualifier as part of the assertion (used primarily to identify SP affiliations—see *Defining SP Affiliations* on page 249).
vsid (optional)	Specify the virtual server ID. When absent, PingFederate uses the default virtual server ID (if specified) for the connection (see *General Connection Information* on page 269) or the SAML federation ID defined in Server Settings (see *Specifying Federation Information* on page 94).

If an adapter is specified in SpSessionAuthnAdapterId, then that adapter is used to create an authenticated session for SP-initiated SSO. If there is no SpSessionAuthnAdapterId, the ultimate destination of the user after SSO (either the TargetResource or the default SSO success URL) is used along with the mappings defined in the administrative console on the Map URLs to Adapter Instances screen (see *Configuring Target URL Mapping* on page 257).

Note that adapter selection for SP-initiated SSO is similar to that for IdP-initiated SSO except that, because the adapter ID is dependent on the SAML deployment, PingFederate cannot expect it from an IdP. Therefore, it uses only the URL mapping for adapter selection for SSO.

/sp/startSLO.ping

This is the path used to initiate SP-initiated SLO. Typically, a systems integrator or developer creates one or more links to this endpoint in the protected resources of their SP application, which allows users to end a session by sending a logout request to the IdP that authenticated the session.

Note that the IdP might send additional logout request messages to other SPs when it receives a logout request from a PingFederate server acting as an SP.

The following table shows the HTTP parameters for this endpoint.

Parameter	Description
`TargetResource` (optional)	Indicates where the user is redirected after a successful SLO. If this parameter is not included in the request, PingFederate uses as a default the URL for a successful SLO, as entered on the SP Default URLs screen.

`Binding` (optional - SAML 2.0)	Indicates the binding to be used; allowed values are URIs defined in the SAML specifications. The SAML 2.0 applicable URIs are:
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-Artifact`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-POST`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:HTTP-Redirect`
	`urn:oasis:names:tc:SAML:2.0:`
	`bindings:SOAP`
	When the parameter is not used, the first SLO Service URL configured for the IdP-partner connection is used (see *Specifying SLO Service URLs (SAML 2.0)* on page 224).

`InErrorResource` (optional)	Indicates where the user is redirected after an unsuccessful SLO. If this parameter is not included in the request, PingFederate redirects the user to the SLO error landing page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76).
`SpSessionAuthnAdapterId`(optional)	The SP adapter instance ID indicating which session to terminate and which IdP will receive the logout request.
`SourceResource` (optional)	A URL indicating the origin of the logout request. It is mapped to an adapter ID in order to designate which session to terminate.

An SP PingFederate session can be associated with one or more application sessions relying on any number of IdPs as the session authority. PingFederate must choose one session to terminate and also send an SLO request to the IdP that issued the assertion that created the session. Sessions are associated with the ID of the adapter instance that created them. Once an adapter ID is determined, the first session found with that ID is used. Determination of the adapter instance ID occurs in the following order:

1. If there is a value for the `SpSessionAuthnAdapterId` parameter, it is used.
2. If there is a value for the `SourceResource` parameter, PingFederate attempts to map a URL to an adapter using that value to determine the adapter ID.
3. If there is an HTTP header value for `Referer` [sic], PingFederate attempts to map a URL to an adapter using that value to determine the adapter ID.

4. If none of the above is successful, the `TargetResource` parameter value or the value for the default SLO success URL are used to map a URL to an adapter.
5. Finally, if no adapter ID is determined, the first one in the list is used.

/sp/defederate.ping

This is the path used to terminate an account link created during SSO. Account linking provides a means for subject identification on the SP side. Links are created and terminated entirely by a user on the SP side. The link contains the name identifier from the IdP, the IdP's federation ID, the adapter instance ID, and the local user identifier.

There are no HTTP parameters for this endpoint.

You can unlink a user session only if was established during SSO using an existing account link on the SP side. If more than one SP session was established via account linking on the same PingFederate session, each of those links will be terminated by this endpoint. A local logout is also performed for any link that is terminated.

/sp/cdcstartSSO.ping

This endpoint is used for IdP-Discovery implementations (see *IdP Discovery* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide). This endpoint is similar to `/sp/startSSO.ping` and accepts the same parameters, with the exception of `PartnerIdpId` and `vsid` (see */sp/startSSO.ping* on page 388). Instead of this parameter, the server attempts to use the common domain cookie to determine the IdP.

/sp/startAttributeQuery.ping

This endpoint is used to initiate an Attribute Query with a SAML 2.0 IdP (see *Attribute Query and XASP* in the "Supported Standards" chapter of the PingFederate *Getting Started* guide).

The following table shows the HTTP parameters for this endpoint.

Note: Some parameters described below can have multiple values. Specify these values by using multiple independent query string parameters of the same name.

Parameter	Description
Subject	Uniquely identifies the user to the IdP. When user authenticates with an x.509 certificate, this is the Subject DN, which must be URL-encoded.
Issuer (optional)	The IssuerDN from the user's x.509 certificate (when XASP is used), which uniquely identifies the entity that issued the user's certificate. The parameter must be URL-encoded. **Note:** When specified this parameter overrides the Subject parameter.
`PartnerIdpId`(except for XASP)	Used to identify the specific IdP partner to which the Attribute Query should be sent. If this parameter is not present, the Subject and Issuer are used to determine the correct IdP. **Note:** For XASP, this parameter overrides both the Subject and Issuer parameters.
`Format`(required for XASP, otherwise optional)	Identifies the name-identifier format of the Subject query parameter. If included, the value must be one of the SAML 2.0 Name Identifier Format URIs (see section 8.3 of the *SAML specifications* (`docs.oasis-open.org/security/saml/v2.0/saml-core-2.0-os.pdf`). **Note:** For XASP, this parameter must be set to: `urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName` If not specified, the parameter defaults to: `urn:oasis:names:tc:SAML:1.1:nameid-format:unspecified`.

Parameter	Description
	Note: The parameter must be URL-encoded.
`AppId`	The unique identifier of the initiating application.
`SharedSecret`	Used to authenticate the initiating application. The AppId and SharedSecret must both match the application authentication settings within the PingFederate server.
`RequestedAttrName` (optional)	A name of a user attribute requested from the IdP. For each such desired user attribute, include this parameter. If this parameter is not present, then all allowable user attributes are returned from the IdP. Multiple values are permitted in order to build a preferred list.
`vsid` (optional)	Specify the virtual server ID. When absent, PingFederate uses the default virtual server ID (if specified) for the connection (see *General Information* on page 195) or the SAML federation ID defined in Server Settings (see *Specifying Federation Information* on page 94).

SCIM Inbound Provisioning Endpoints

The following sections describe the PingFederate endpoints for SCIM Inbound Provisioning (see *Inbound Provisioning* on page 34).

These endpoints are defined in the following SCIM 1.1 specifications:

- *SCIM Core Schema* (`www.simplecloud.info/specs/draft-scim-core-schema-01.html`)
- *SCIM Specification* (`www.simplecloud.info/specs/draft-scim-api-01.html`)

Note: The PingFederate implementation is described in the next couple sections, */pf-scim/v1/Users* on page 392, */pf-scim/v1/Groups* on page 393, and */pf-scim/v1/Schemas* on page 395. Developers can find additional information about the implementation via the Service Provider Configuration Endpoint (see */pf-scim/v1/ServiceProviderConfigs* on page 395).

/pf-scim/v1/Users

The `Users` endpoint is where client applications make HTTP requests to create, retrieve, update, and delete (or deactivate) users. This REST-based endpoint accepts POST, GET, PUT, and DELETE methods, as described in the following table.

Note: HTTP requests must be made using either Basic or client-certificate application authentication (see *Configuring Inbound Provisioning* on page 303). JSON is currently the only supported format for the HTTP message body.

HTTP Method	Description
POST	Sends user attributes in JSON format—defined in the SCIM Core Schema—to create a new user. If the user is successfully provisioned, the HTTP response indicates a 201 status code and contains a JSON body indicating all of the user attributes added to the datastore. The user ID is set as the id attribute in the JSON response, and the full URL to reference the user is in the HTTP response Location header. For an existing user, you can also use POST either to update or delete/disable user record by appending the user ID to the path (see the Note below) and setting the request header `X-HTTP-Method-Override` value to `PUT` or `DELETE`, respectively. (For more information, see the PUT and DELETE method descriptions below.)
GET	`/pf-scim/v1/Users`

HTTP Method	Description

	- Retrieves all attributes from all users.
	- A successful response is indicated by an HTTP 200 status code and a list of all users and their attributes.
	`/pf-scim/v1/Users/<user_id>`
	- Retrieves all attributes for the specified user (by the person's user ID value).
	- A successful response is indicated by an HTTP 200 status code as well as the attributes.
	`/pf-scim/v1/Users?attributes=<attribute>`
	- Retrieves the specified attribute from all users.
	- A successful response is indicated by an HTTP 200 status code along with a list of the specified attribute from all users.
	Note: For more information, see *3.2.2 List/Query Resources* in SCIM Specification (`www.simplecloud.info/specs/draft-scim-api-01.html#query-resources`).
	`/pf-scim/v1/Users?filter=<filter>`
	- Retrieves resources based on the filter
	- A successful response is indicated by an HTTP 200 status code and the list of resources matching the filter.
	Note: For more information, see *3.2.2.1 Filtering* in SCIM Specification (`www.simplecloud.info/specs/draft-scim-api-01.html#rfc.section.3.2.2.1`).
	Tip: You can use both the `attributes=<attribute>` and `filter=<filter>` query parameters in one query to narrow your search results.

Note: The following methods require a user ID value appended to the endpoint path: `/pf-scim/v1/Users/<user_id>`

PUT	Updates user attributes for the specified user, using JSON in the body of the HTTP request. Attributes not included in the request are set to a default value in the data store. A successful PUT operation returns an HTTP 200 status code and the entire updated user record within the response body.
DELETE	Deletes or disables the user record for the specified user. Whether a user is deleted or disabled is determined by the connection configuration (see *Handling SCIM Delete Requests* on page 310). A successful response is indicated by an HTTP 200 status code.

Note: For a list of HTTP error codes that may be returned, see the *SCIM specifications* (`www.simplecloud.info/specs/draft-scim-api-01.html#anchor6`).

/pf-scim/v1/Groups

The `Groups` endpoint is where client applications make HTTP requests to create, retrieve, update, and delete groups.

Note: Inbound provisioning for groups is optional. For more information, see *Choosing an IdP Connection Type* on page 268.

This REST-based endpoint accepts POST, GET, PUT, and DELETE methods, as described in the following table.

Note: HTTP requests must be made using either Basic or client-certificate application authentication (see *Configuring Inbound Provisioning* on page 303). JSON is currently the only supported format for the HTTP message body.

HTTP Method	Description
POST	Sends group attributes in JSON format—defined in the SCIM Core Schema—to create a new group. If the group is successfully provisioned, the HTTP response indicates a 201 status code and contains a JSON body indicating all of the group attributes added to the datastore. The group ID is set as the `id` attribute in the JSON response, and the full URL to reference the group is in the HTTP response Location header. For an existing group, you can also use POST either to update or delete the group by appending the group ID to the path (see the Note below) and setting the request header `X-HTTP-Method-Override` value to `PUT` or `DELETE`, respectively. (For more information, see the PUT and DELETE method descriptions below.)

GET	`/pf-scim/v1/Groups`
	• Retrieves all attributes from all groups.
	• A successful response is indicated by an HTTP 200 status code and a list of all groups and their attributes.
	`/pf-scim/v1/Groups/<group_id>`
	• Retrieves all attributes for the specified group (by its group ID value).
	• A successful response is indicated by an HTTP 200 status code as well as the attributes.
	`/pf-scim/v1/Groups?attributes=<attribute>`
	• Retrieves the specified attribute from all groups.
	• A successful response is indicated by an HTTP 200 status code along with a list of the specified attribute from all groups.
	Note: For more information, see *3.2.2 List/Query Resources* in SCIM Specification (`www.simplecloud.info/specs/draft-scim-api-01.html#query-resources`).
	`/pf-scim/v1/Groups?filter=<filter>`
	• Retrieves resources based on the filter
	• A successful response is indicated by an HTTP 200 status code and the list of resources matching the filter.
	Note: For more information, see *3.2.2.1 Filtering* in SCIM Specification (`www.simplecloud.info/specs/draft-scim-api-01.html#rfc.section.3.2.2.1`).
	Tip: You can use both the `attributes=<attribute>` and `filter=<filter>` query parameters in one query to narrow your search results.

Note: The following methods require a group ID value appended to the endpoint path: `/pf-scim/v1/Groups/<group_id>`

PUT	Updates group attributes for the specified group, using JSON in the body of the HTTP request. Attributes not included in the request are set to a default value in the data store.

HTTP Method	Description
	A successful PUT operation returns an HTTP 200 status code and the entire updated group record within the response body.
DELETE	Deletes the group record for the specified group. A successful response is indicated by an HTTP 200 status code.

Note: For a list of HTTP error codes that may be returned, see the *SCIM specifications* (`www.simplecloud.info/specs/draft-scim-api-01.html#anchor6`).

/pf-scim/v1/Schemas

The `Schemas` endpoint is where a client can retrieve a resource's schema. This REST-based endpoint accepts GET method as described in the following table.

Note: HTTP requests must be made using either Basic or client-certificate application authentication (see *Configuring Inbound Provisioning* on page 303). JSON is currently the only supported format for the HTTP message body.

HTTP Method	Description
GET	Retrieves the resource's schema for an IdP connection based on the authentication information. A successful response is indicated by an HTTP 200 status code as well as the results in the message body.

/pf-scim/v1/ServiceProviderConfigs

This Service Provider Configuration Endpoint is where a client can retrieve detailed information on the PingFederate SCIM 1.1 implementation. When Inbound Provisioning is enabled for an SP PingFederate server, an HTTP GET request to this endpoint returns a JSON response outlining SCIM 1.1 compliance details.

System-Services Endpoints

These endpoints apply to the PingFederate server generally, whether used as an IdP, SP, or both.

Note: Parameters are case-sensitive.

/pf/heartbeat.ping

This endpoint returns an “OK” browser message and an HTTP 200 status indication if the PingFederate server is running. If you receive an HTTP 404 error, the server associated with the endpoint is down.

Load balancers can use this endpoint to determine the status of PingFederate independently of checks used to determine the status of the supporting hardware.

You can also configure the server to provide regular status information to a network-management utility (see *Configuring Runtime Reporting* on page 87).

/pf/adapter2adapter.ping

This endpoint initiates direct IdP-to-SP adapter mapping, when that feature is configured (see *Adapter-to-Adapter Mapping* on page 115).

The following table shows the HTTP parameters for this endpoint.

Parameter	Description
TargetResource (optional)	Indicates where the user is redirected after a successful SSO. If this parameter is not included in the request, PingFederate uses as a default the URL for a successful SSO (see *Configuring Default URLs* on page 261).
SpSessionAuthnAdapterId (optional)	The SP adapter instance ID to be used. If not provided and more than one SP adapter instance is configured with adapter-to-adapter mapping, PingFederate uses configured defaults (see *Configuring Target URL Mapping* on page 257).
IdpAdapterId (optional)	Indicates the IdP adapter to use for authentication if more than one IdP adapter is configured in adapter-to-adapter mappings.
InErrorResource (optional)	Indicates where the user is redirected if the SSO is unsuccessful. If this parameter is not included in the request, PingFederate redirects the user to the SSO error landing page hosted within PingFederate (see *Customizing User-Facing Screens* on page 76).

/pf/sts.wst

This endpoint initiates direct STS token-to-token exchange and token validation from an IdP token processor to an SP token generator, when that feature is configured (see *Token Exchange Mapping* on page 120).

The following table shows the HTTP parameters for this endpoint.

Parameter	Description
TokenProcessorId	Indicates the IdP token processor to use in the mapping. Required when multiple IdP token processors are configured in token-to-token mappings.
TokenGeneratorId	Indicates the SP token generator to use in the mapping. Required when multiple SP token generators are configured in token-to-token mappings.

/pf/sts_mex.ping

This endpoint returns STS metadata for use in expediting configuration of Web- service applications.

The following table shows the HTTP parameters for this endpoint:

Parameter	Description
PartnerSpId	The Connection ID of the SP to whom the SAML token will be issued. This parameter determines the connection for which metadata will be generated.
PartnerIdpId	The Connection ID of the IdP issuing the SAML token to be consumed by PingFederate. This parameter determines the connection for which the metadata will be generated.
vsid (optional)	Specify the virtual server ID. If absent, PingFederate uses the default virtual server ID (if specified) for the connection or the federation ID defined in Server Settings (see *Specifying Federation Information* on page 94).

/pf/federation_metadata.ping

This endpoint returns WS-Federation metadata.

The following table shows the HTTP parameters for this endpoint:

Parameter	Description
PartnerSpId	The Connection ID of the SP to whom the SAML token is issued. This parameter determines the connection for which metadata is generated.

Parameter	Description
`PartnerIdpId`	The Connection ID of the IdP issuing the SAML token to be consumed by PingFederate. This parameter determines the connection for which the metadata is generated.
`vsid` (optional)	Specify the virtual server ID. If absent, PingFederate uses the default virtual server ID (if specified) for the connection or the federation ID defined in Server Settings (see *Specifying Federation Information* on page 94).

Note: If your partner fails to retrieve metadata when sending both the PartnerSpId (or the PartnerIdpId) and the vsid query parameters, perhaps it is only capable of sending one query parameter in such requests. An alternative metadata exchange endpoint that includes the virtual server ID information should resolve the issue.

To construct a metadata exchange endpoint for a specific virtual server ID:

1. Construct a JSON object containing a key-value pair of the virtual server ID as follows:

   `{"vsid":"<VirtualServerIdValue>"}`

   Example: `{"vsid":"Engineering"}`
2. Base64url-encode the JSON object.

   Example: **`eyJ2c2lkIjoiRW5naW5lZXJpbmcifQ`**
3. Insert the base64url-encoded value between `/pf/` and `/federation_metadata.ping` (or `/sts_mex.ping`). Example: `/pf/`**`eyJ2c2lkIjoiRW5naW5lZXJpbmcifQ`**`/federation_metadata.ping` (or `/pf/`**`eyJ2c2lkIjoiRW5naW5lZXJpbmcifQ`**`/sts_mex.ping`)

   For more information about base64url, see *RFC4648* (tools.ietf.org/html/rfc4648).

Appendix G

OAuth 2.0 Endpoints

The following sections describe OAuth-developer information on PingFederate endpoints for the OAuth AS.

Note: Unless otherwise indicated, these endpoints and associated parameters are defined in the OAuth 2.0 Authorization Protocol (see *OAuth 2.0* in the “Supported Standards” chapter of the PingFederate *Getting Started* guide).

Note: Begin each URL with the fully qualified server name and port number of your IdP or SP PingFederate server: for example: `https://sso.example.com:9031/as/token.oauth2`.

Token Endpoint

The token endpoint is defined in the OAuth 2.0 specification and used by the client to obtain an access token and possibly a refresh token by presenting its authorization grant. The token endpoint is used with every authorization grant except for the Implicit grant type (since an access token is issued directly from the authorization endpoint).

Endpoint: /as/token.oauth2

Note: By default per OAuth specifications, this endpoint accepts only the `HTTP POST` method.

Client Identification and Authentication

Clients can authenticate to the OAuth AS using this endpoint by presenting their client identifier and client secret either using the HTTP Basic authentication scheme (where the client identifier is the username, and the client secret is the password) or with the following HTTP request parameters:

Parameter	Description
client_id (optional)	The client identifier (see *Configuring a Client* on page 141).
client_secret (optional)	The client secret (as defined on the client management UI screen).

Whenever possible, the use of HTTP Basic is recommended over the use of the request parameters.

Clients without a client secret can use the `client_id` parameter to identify themselves to the OAuth AS and omit the `client_secret` parameter.

Grant Type Parameters

Other parameters accepted by the `/as/token.oauth2` endpoint vary by the grant type being presented and include both OAuth-defined standard parameters and PingFederate-specific parameters. The grant type of the access token request is indicated by the following parameter:

Parameter	**Description**
grant_type (required)	Indicates the type of grant being presented in exchange for an access token and possibly a refresh token. The value is an extensibility mechanism of the OAuth 2.0 specification. PingFederate supports these values: • `authorization_code` • `refresh_token` • `password` • `client_credentials` • `urn:ietf:params:oauth:grant-type:saml2-bearer` • `urn:pingidentity.com:oauth2:grant_type:validate_bearer` **Note:** Further parameters associated with each grant type are defined in the following sections.

Authorization Code Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `authorization_code`.

Parameter	**Description**
code (required)	The authorization code received from the authorization server during the redirect interaction at the authorization endpoint when the `response_type` parameter is `code` (see *Endpoint: /as/authorization.oauth2* on page 403).
code_verifier	Required if the authorization request was sent with a `code_challenge` value to reduce the risk of code interception attack (see *Authorization Endpoint* on page 403). PingFederate OAuth AS verifies the `code_verifier` value against the `code_challenge` value. If the values match, PingFederate OAuth AS returns an access token (provided that there is no other error condition); otherwise it returns an error to the client.
redirect_uri	This parameter is required if the `redirect_uri` parameter was included in the authorization request that resulted in the issuance of the code (see *Authorization Endpoint* on page 403). The value here must match the authorization-request value, if applicable. The parameter is also required for clients with multiple redirect URIs or with one URI that uses wildcards (see *Configuring a Client* on page 141).

Refresh Token Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `refresh_token`.

Parameter	**Description**
refresh_token (required)	The refresh token issued to the client during a previous access-token request.
scope (optional)	The scope of the access request expressed as a list of space-delimited, case-sensitive strings. The requested scope must be equal to or less than the scope originally granted by the resource owner. If omitted, the scope is treated as equal to that originally granted by the resource owner. Valid scope values are defined on the OAuth AS settings screen (see *Authorization Server Settings* on page 130).

Parameter	Description
	Scopes can be restricted per client using the Client Management screen (see *Client Management* on page 141).

Resource Owner Credentials (Password) Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `password`.

Parameter	Description
username (required)	The username, encoded as UTF-8.
password (required)	The password, encoded as UTF-8.
scope (optional)	The scope of the access request. Valid scope values are defined on the OAuth AS settings screen (see *Authorization Server Settings* on page 130). Scopes can be restricted per client using the Client Management screen (see *Client Management* on page 141).
validator_id (optional)	A PingFederate OAuth AS parameter indicating the instance ID of the password credential validator to be used to check the username and password (and the associated attribute mapping into the `USER_KEY` of the persistent grant). If multiple validator instances are configured and mapped and no `validator_id` is provided, each instance will be tried sequentially until one succeeds or they all fail.

Client Credentials Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `client_credentials`.

Parameter	Description
scope (optional)	The scope of the access request. Valid scope values are defined on the OAuth AS settings screen (see *Authorization Server Settings* on page 130). Scopes can be restricted per client using the Client Management screen (see *Client Management* on page 141).

Client authentication is required, which means either HTTP Basic or `client_id` and `client_secret` must be included (see *Client Identification and Authentication* on page 398).

SAML 2.0 Bearer Assertion Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `urn:ietf:params:oauth:grant-type:saml2-bearer`.

Parameter	Description
assertion (required)	A single SAML 2.0 assertion, which must be encoded using base64url, as described in *Section 5 of RFC4648* (`tools.ietf.org/html/rfc4648#section-5`).
scope (optional)	The scope of the access request. Valid scope values are defined on the OAuth AS settings screen (see *Authorization Server Settings* on page 130). Scopes can be restricted per client using the Client Management screen (see *Client Management* on page 141).

Access Token Verification/Validation Grant Type

These parameters apply when the `grant_type` parameter for `/as/token.oauth2` is set to `urn:pingidentity.com:oauth2:grant_type:validate_bearer`.

Parameter	Description
token (required)	The bearer access token to be validated.

The Validation grant type is a custom PingFederate OAuth extension that enables an RS to communicate with the OAuth AS while leveraging the established communication and encoding patterns from OAuth 2.0. The grant type allows an RS to check with the OAuth AS on the validity of a bearer access token that it has received from a client making a protected-resources call.

Client authentication is not required. For this grant type, the RS acts in the role of a client for the request/response exchange with the OAuth AS to make the validation call.

The response is a standard OAuth access-token response from the token endpoint with some extensions and minor semantic differences in the treatment of some of the parameters. The returned token is in a JSON structure with name-to-value attributes or name-to-array attributes.

The token type is `urn:pingidentity.com:oauth2:validated_token`—a URN indicating the token represents the attributes associated with the validated access token passed on the request. A `client_id` parameter is returned indicating the client identifier of the client to whom the grant was made. A `scope` parameter is returned, if the scope is greater than the default implied scope, indicating the approved scope of the grant. The `expires_in` parameter indicates for how many more seconds the token is valid (note that the value may increase on subsequent validation calls if a token lifetime extension policy is in place: see *Configuring Reference-Token Management* on page 134).

For example:

```
{
"scope":"read edit admin",
"token_type":"urn:pingidentity.com:oauth2:validated_token",
"expires_in":3172,
"client_id":"super_cool_mobile_client",
"access_token":
{
"uid":"sfHqhad9onMjXsQNI1mZP9mD7AQasmskd",
"group":["employee","sales","manager"],
"email":"someguy@example.cloud"
}
}
```

Access Token Management Parameters

access_token_manager_id (optional)

`access_token_manager_id` is the Instance ID of the desired access token manager. When specified, the PingFederate AS uses the desired access token management instance for the request if it is eligible (see *Access Token Management* on page 133); otherwise it aborts the request.

Note: When the `access_token_manager_id` parameter is specified, the PingFederate AS ignores the `aud` parameter.

aud (optional)

`aud` is the resource URI the client wants to access. The provided value is matched against resource URIs configured in access token management instances (see *Configuring Resource URIs* on page 137). When a match is found, the PingFederate AS uses the corresponding access token management instance for the request if it is eligible (see *Access Token Management* on page 133); otherwise it aborts the request.

A match can be an exact match or a partial match where the provided URI has the same scheme and authority parts and a more specific path which would be contained within the path of the preconfigured resource URI. The PingFederate AS takes an exact match over a partial match. If there are multiple partial matches, the PingFederate AS takes the partial match where the provided URI matches more specifically against the preconfigured resource URI.

Example 1: A partial match

A Resource URI of `https://app.example.local` is a partial match for the following provided URIs:

- `https://app.example.local/file1.ext`
- `https://app.example.local/path/file2.ext`
- `https://app.example.local/path/more`

Example 2: An exact match is a better match than a partial match.

Access Token Management Instances	Resource URIs

ATM1	`https://localhost:9031/app1`
	`https://localhost:9031/app2/data`
	`https://app.example.local`

ATM2	`https://localhost:9031/app1/data` `https://localhost:9031/app2/data/get`

`https://localhost:9031/app1` (a Resource URI preconfigured for ATM1) is a partial match for `https://localhost:9031/app1/data` (the provided URI). However, since `https://localhost:9031/app1/data` (a Resource URI preconfigured for ATM2) is an exact match against the provided URI, ATM2 is chosen.

Example 3: A more specific partial match is a better match

Both `https://localhost:9031/app2/data` (a Resource URI for ATM1) and `https://localhost:9031/app2/data/get` (a Resource URI for ATM2) are partial matches for `https://localhost:9031/app2/data/get/sample` (the provided URI). However, since `https://localhost:9031/app2/data/get matches` more specifically against the provided URI, ATM2 is chosen.

Token Revocation Endpoint

The token revocation endpoint is defined in the OAuth 2.0 Token Revocation (RFC 7009) specification. It allows clients to notify the authorization server that a previously obtained refresh or access token is no longer needed. The revocation request invalidates the actual token and possibly other tokens based on the same authorization grant.

Endpoint: /as/revoke_token.oauth2

Note: By default per OAuth specifications, this endpoint accepts only the `HTTP POST` method.

Important: Direct access token revocation is only supported for *Internally Managed Reference Tokens*. Access tokens of the type *JSON Web Token (JWT)* do no support direct revocation. JWT access tokens can only be indirectly revoked if the associated refresh token is revoked, and the JWT's configuration field Access Grant GUID Claim Name under Access Token Management is set.

Client Identification and Authentication for Token Revocation

Clients can authenticate to the OAuth AS using this endpoint by presenting their client identifier and client secret either using the HTTP Basic authentication scheme (where the client identifier is the username, and the client secret is the password) or with the following HTTP request parameters:

Parameter	Description
client_id (optional)	The client identifier (see *Configuring a Client* on page 141).
client_secret (optional)	The client secret (as defined on the client management UI screen).

Whenever possible, the use of HTTP Basic is recommended over the use of the request parameters.

Clients without a client secret can use the `client_id` parameter to identify themselves to the OAuth AS and omit the `client_secret` parameter.

The only time a `client_id` is not required is when Unidentified Clients are allowed in Authorization Server Settings. In this case, only tokens issued by unidentified clients will be revoked.

Parameters

The token revocation endpoint uses the following parameters using the "application/x-www-form-urlencoded" format in the HTTP request entity-body:

Parameter	Description
token (required)	The token that the client wants to revoke.
token_type_hint (optional)	A hint about the type of token submitted for revocation. PingFederate supports the following values • `access_token` • `refresh_token`

If a refresh token is revoked, then the associated access grant and access tokens will be revoked as well. If an access token is revoked, the associated access grant and refresh token remain untouched with the exception of Implicit grant types. If Reuse Existing Persistent Access Grants for GrantTypes is enabled in Authorization Server Settings then the Implicit access grant will also be revoked with the access token.

Authorization Endpoint

The authorization endpoint is defined in the OAuth 2.0 specification and is used by the OAuth AS to interact directly with resource owners, authenticate them, and obtain their authorization. Typically, an OAuth client makes an authorization request by directing a resource owner, via an HTTP user-agent, to the authorization endpoint. After completing its interaction with the resource owner, the OAuth AS redirects the resource owner's user-agent back to the client's redirect URI with the response to the authorization request.

Note: This endpoint may be used as part of an OAuth Scope Selector configuration (see *Configuring the OAuth Scope Authentication Selector* on page 185), which can affect the behavior of the endpoint. For example, the IdP parameter might be enforced or overridden by policy determined by the OAuth Scope Selector.

Endpoint: /as/authorization.oauth2

The table below shows parameters for this endpoint:

Parameter	Description
client_id (required)	The client identifier (see *Configuring a Client* on page 141).
response_mode (optional)	When set to `form_post`, the authorization response is returned to the client in an auto-POST form in accordance with the OAuth 2.0 Form Post Response Mode *specification* (openid.net/specs/oauth-v2-form-post-response-mode-1_0.html). **Note**: At the time of writing, the OAuth 2.0 Form Post Response Mode specification is in draft status (version 03).
response_type (required)	A value of `code` results in the Authorization Code grant type while a value of `token` implies the Implicit grant type. Additionally, a value of `id_token` can be requested by implicit clients.

Parameter	Description
code_challenge (optional)	Applicable only when `response_type` is code. Supply a one-time string value used to associate the authorization request with the token request to reduce the risk of code interception attack. For more information, see *OAuth Symmetric Proof of Possession for Code Extension* (tools.ietf.org/html/draft-sakimura-oauth-tcse-03). **Note:** If used, this code must be re-sent when using the authorization code to obtain an access token (see *Authorization Code Grant Type* on page 399).
redirect_uri	Required if more than one URI is configured in PingFederate for the client or if a wildcard is used for a single URI entry (see *Configuring a Client* on page 141). Optional for clients with only one specific redirect URI configured. Note that if this parameter is used, the same parameter and value must also be used in subsequent token requests (see *Authorization Code Grant Type* on page 399).
claims_locales (optional)	Specifies the end-user's preferred languages for claims being returned in a space-separated list, ordered by preference. The values must conform to guidelines defined under *IETF BCP 47*. **Tip:** You can map the claims_locales value into the persistent grants (and therefore the access tokens and/or the ID tokens) from an IdP adapter or an IdP connection by selecting `Context` under the Source column and `Requested Claims Locales` under the Value column in the Contract Fulfillment screen (see *Grant Contract Fulfillment* on page 147 or *Configuring Contract Fulfillment* on page 288).
login_hint (optional)	Provides a hint to the PingFederate AS about the end user. For example, when an OAuth client includes a login_hint in its authorization request and the authentication source is an HTML Form IdP Adapter instance, the username field in the login form is pre-populated with the login_hint value (see *Configuring the HTML Form IdP Adapter* on page 372).
max_age (optional)	The allowable elapsed time (in seconds) since the end users last authenticated. If the elapsed time exceeds the value of max_age, the end users are prompted for reauthentication. **Tip:** The HTML Form IdP Adapter supports max_age by tracking the authentication time for each user (see *Configuring the HTML Form IdP Adapter* on page 372).
scope (optional)	The scope of the access request expressed as a list of space-separated, case-sensitive strings. Valid scope values are defined on the OAuth AS settings screen (see *Authorization Server Settings* on page 130). Scopes can be restricted per client using the Client Management screen (see *Client Management* on page 141).
state (optional)	An opaque value used by the client to maintain state between the request and callback. If included, the AS returns this parameter and the given value when redirecting the user agent back to the client.
ui_locales (optional)	Specifies the end-user's preferred languages for OAuth user interactions in a space-separated list, ordered by preference. The values must conform to guidelines defined under *IETF BCP 47* (see *OAuth User-Facing Pages* on page 80 and *Localization* on page 81).
idp (or PartnerIdpId) (optional)	A PingFederate OAuth AS parameter indicating the Entity ID/Connection ID of the IdP with whom to initiate Browser SSO for user authentication.

Parameter	Description
pfidpadapterid (optional)	A PingFederate OAuth AS parameter indicating the IdP Adapter Instance ID of the adapter to use for user authentication. **Note:** This parameter may be overridden by policy based on adapter selector configuration. For example, the OAuth Scope Selector could enforce the use of a given adapter based on client-requested scopes (see *Configuring Authentication Selectors* on page 182).

If more than one source of authentication is configured in the system and no `pfidpadapterid` or `idp` parameter is provided, users are presented with an intermediate page asking them to choose among the available sources of authentication. The authentication results in a set of user attributes that must be mapped into the `USER_KEY` attribute for persistent grant storage and the `USER_NAME` attribute that is displayed on the user authorization page.

OpenID Connect Parameters

The table below displays OpenID Connect parameters for this endpoint:

Parameter	Description
acr_values (optional)	Specifies the Authentication Context Class Reference (acr) values for the AS to use when processing an Authentication Request. Express as a space-separated string, listing the values in order of preference.
id_token_hint (optional)	Includes an ID token as a hint to the PingFederate AS about the end user. If the authenticated user does not match the information stored in the ID token, the PingFederate AS rejects the authorization request and returns an error message.
nonce (optional)	Specifies a string value used to associate a Client session with an ID token and to reduce replay attacks. The value is passed through unmodified from an Authorization Request to the ID token.
prompt (optional)	Specifies whether the AS prompts the end user for reauthentication and consent. Expressed as a list of space-separated, case-sensitive ASCII string values. If included, this parameter can be used by the client to verify that the end user is still present for the current session or to bring attention to the request. PingFederate supports the following values: `none`, `login`, `consent`.

Access Token Management Parameters

access_token_manager_id (optional)

`access_token_manager_id` is the Instance ID of the desired access token manager. When specified, the PingFederate AS uses the desired access token management instance for the request if it is eligible (see *Access Token Management* on page 133); otherwise it aborts the request.

Note: When the `access_token_manager_id` parameter is specified, the PingFederate AS ignores the `aud` parameter.

aud (optional)

`aud` is the resource URI the client wants to access. The provided value is matched against resource URIs configured in access token management instances (see *Configuring Resource URIs* on page 137). When a match is found, the PingFederate AS uses the corresponding access token management instance for the request if it is eligible (see *Access Token Management* on page 133); otherwise it aborts the request.

A match can be an exact match or a partial match where the provided URI has the same scheme and authority parts and a more specific path which would be contained within the path of the preconfigured resource URI. The PingFederate AS takes an exact match over a partial match. If there are multiple partial matches, the PingFederate AS takes the partial match where the provided URI matches more specifically against the preconfigured resource URI.

Example 1: A partial match

A Resource URI of `https://app.example.local` is a partial match for the following provided URIs:

- `https://app.example.local/file1.ext`
- `https://app.example.local/path/file2.ext`
- `https://app.example.local/path/more`

Example 2: An exact match is a better match than a partial match.

Access Token Management Instances	Resource URIs

ATM1	`https://localhost:9031/app1`
	`https://localhost:9031/app2/data`
	`https://app.example.local`

ATM2	`https://localhost:9031/app1/data` `https://localhost:9031/app2/data/get`

`https://localhost:9031/app1` (a Resource URI preconfigured for ATM1) is a partial match for `https://localhost:9031/app1/data` (the provided URI). However, since `https://localhost:9031/app1/data` (a Resource URI preconfigured for ATM2) is an exact match against the provided URI, ATM2 is chosen.

Example 3: A more specific partial match is a better match

Both `https://localhost:9031/app2/data` (a Resource URI for ATM1) and `https://localhost:9031/app2/data/get` (a Resource URI for ATM2) are partial matches for `https://localhost:9031/app2/data/get/sample` (the provided URI). However, since `https://localhost:9031/app2/data/get matches` more specifically against the provided URI, ATM2 is chosen.

Grant-Management Endpoint

The grants endpoint (two are provided, one for use with parameters) is where end-users/resource owners go to view (and optionally revoke) the persistent access grants they have made. This endpoint is not part of the OAuth specification, but many OAuth providers offer a similar type of functionally. The grants displayed are those associated with the `USER_KEY` of the authenticated user. The same attribute mapping(s) from the authentication source to `USER_KEY` used for the authorization endpoint are used here to look up the user's existing grants.

Endpoints: /as/grants.oauth2 and /as/oauth_access_grants.ping

The table below shows parameters for this endpoint.

Note: Use only the endpoint `/as/grants.oauth2` with these optional parameters.

Important: When a parameter is needed for this endpoint, use only one of these options.

Parameter	Description
idp (or PartnerIdpId) (optional)	Indicates the Entity ID/Connection ID of the IdP with whom to initiate Browser SSO for user authentication.
pfidpadapterid (optional)	Indicates the IdP Adapter Instance ID of the adapter to use for user authentication. **Note:** This parameter may be overridden by policy based on adapter selector configuration. For example, the OAuth Scope Selector could

Parameter	Description
	enforce the use of a given adapter based on client-requested scopes (see *Configuring Authentication Selectors* on page 182).

If no recent user attributes are found for the session context, the user is redirected to `/as/oauth_access_grants.ping` to initiate the authentication process, which behaves in exactly the same way as the authorization endpoint (see *Token Endpoint* on page 398).

OpenID Connect Provider Metadata Endpoint

This public endpoint provides configuration information, such as the UserInfo endpoint and JSON Web Key Set endpoint, needed for OAuth Clients to interface with PingFederate using the OpenID Connect protocol (see *OpenID Connect* on page 19).

Tip: The UserInfo endpoint (`userinfo_endpoint`) is where clients send access tokens to PingFederate in exchange for a list of additional claims about the users.

The JSON Web Key Set (`jwks_uri`) endpoint returns a set of public keys that are generated and rolled automatically by PingFederate. Clients can use this information to verify the integrity of asymmetrically-signed ID Tokens.

For information about other parameters, see *OpenID Provider Metadata* in OpenID Connect Discovery 1.0 (`openid.net/specs/openid-connect-discovery-1_0.html#ProviderMetadata`).

Endpoint: /.well-known/openid-configuration

No parameters are needed for this endpoint.

Appendix H

Web Service Interfaces

PingFederate provides two built-in, SOAP-accessible Web Services related to browser SSO. These services may be used by client applications to manage partner connections and support integration of Web applications, respectively:

- Connection Management Service — Enables creation and deletion of single connection configurations in PingFederate. This service may be used to migrate connections from one server environment to another (for example, from testing or staging to production) or to create new connections in a single server programmatically.

  Tip: PingFederate provides a command-line utility that can be used to export and modify connections, as well as other administrative-console configurations, and then import them to target environments (see *Automating Configuration Migration* on page 70).
- SSO Directory Service — Provides Web application developers with information regarding partner connections and adapter instances.

  Tip: Applications accessing the Connection Management Service must first authenticate themselves to the PingFederate server. SSO Directory Service authentication is optional by default, but may be required. For more information, see *Authentication* on page 169.

PingFederate also provides the following REST-based Web Services:

- *OAuth Client Management Service* on page 414 — Useful for managing OAuth client applications, where needed (see *About OAuth* on page 15 and *Client Management* on page 141).
- *OAuth Access Grant Management Service* on page 420 — Allows retrieval and revocation of access grants.
- *Session Revocation API* on page 421 — Allows OpenID Connect Clients to query revocation status of their sessions and add end-user sessions to the revocation list.
- *PingFederate Administrative API* on page 423 — Allows developers and non-developers to change PingFederate IdP Connections settings (see *Service Provider SSO Configuration* on page 254).

Connection Management Service

The Connection Management Service supports basic connection management capabilities and is accessible only on a PingFederate server running the administrative console. This feature is useful in a variety of circumstances, but the following primary use cases were considered:

- As a utility to migrate changes to a partner connection through staging environments (for example: development, test, production).

  Changes to URLs and keys may be needed to make the connection appropriate to the next environment.
- As a way for an external application to update or delete connections programmatically, or create new ones using an exported connection XML file as a template.

The `WAR` file for this service, `pf-mgmt-ws.war`, is located in the `pingfederate/server/default/deploy2` folder.

Note: If you do not want to allow use of the service, it should not be deployed: remove the WAR file from the `deploy2` folder.

The SOAP-accessible service endpoint is `pf-mgmt-ws/ws/ConnectionMigrationMgr`.

The Web Services Description Language (WSDL) document describing this service can be retrieved from: `https://<host_server>:<admin_console_port>/pf-mgmt-ws/ws/ConnectionMigrationMgr?wsdl`

Exporting a Connection

You can export a connection either manually, using the administrative console, or programmatically, via a call to the Connection Management Service.

In either case, the exported XML complies with the standard SAML 2.0 metadata format, with extensions to capture PingFederate's proprietary configuration. Most connection configuration information is contained in the XML markup, with the exception of global configuration items such as adapter instances, data stores, and keypairs. Adapter instances and data stores are referenced by ID, and keypairs are referenced by the MD5 fingerprint of their X.509 certificate. Public certificates, such as the partner's signature verification certificate, are included completely (base-64 encoded).

Exporting Manually

For information about using the administrative console to export SP connections at an IdP site, see *Via the Manage Connections Screen* on page 190.

For information about exporting IdP connection at an SP site, see *From the Manage Connections Screen* on page 265.

Using the Connection Service

The Connection Web Service exposes the following method for exporting connections:

```
public string getConnection( String entityId, String role,) throws
 IOException
```

Code Sample

```
Service service = new Service();
Call call = (Call)service.createCall();
call.setUsername("username");
call.setPassword("password");
call.setTargetEndpointAddress("https://localhost:9999/pf-mgmt-ws/ws/
ConnectionMigrationMgr");
call.setOperationName("getConnection");
Object result = call.invoke(new Object[] {"entityId", "SP"});
```

Importing Connections

Moving a connection from one PingFederate server to another requires care, as the target server must contain the global configuration items (data stores, keypairs, and adapter instances) that the connection references. Changing the references in the XML file—either manually or programmatically—may be necessary to adjust the connection to the target PingFederate environment.

Once required changes are made to the XML file, developers can use the Connection Management Service to import the connection into a different instance of PingFederate.

Tip: Alternatively, you can import XML connection files via the PingFederate administrative console (see *Accessing Connections* on page 190 for SP connections or *Accessing IdP Connections* on page 264 for IdP connections). You can also import the connections into PingFederate manually by copying them into the directory: `<pf_install>/pingfederate/server/default/ data/connection-deployer`

PingFederate scans this directory periodically and imports connections automatically.

Caution: Manually importing a connection always overwrites an existing connection with the same ID (the Web Service provides a switch to disallow this behavior, if desired—see below).

The Web Service exposes the following method for importing connections:

```
public void saveConnection( String xml, boolean allowUpdate) throws
 IOException
```

The `xml` parameter is the complete representation of the connection retrieved by your application from an exported connection file (and optionally modified).

If `allowUpdate` is false, the Web Service can be used only to add a new connection. An error occurs if a connection already exists with the same connection ID and federation protocol in the XML. If `allowUpdate` is true and the connection already exists, it will be overwritten.

Sample Code

Below is example client code using the Apache AXIS libraries that invokes this Web Service to create a new connection:

```
Service service = new Service();
    Call call = (Call) service.createCall();
    call.setUsername("username");
    call.setPassword("password");
    String addr = "https://localhost:9999/pf-mgmt-ws/ws/
ConnectionMigrationMgr";
    call.setTargetEndpointAddress(addr);
    call.setOperationName("saveConnection");
    String xml = "<EntityDescriptor entityID=\"some_entity_id\"
  ...
  </EntityDescriptor>";
    boolean allowUpdate = false;
    call.invoke(new Object[]{xml, allowUpdate});
```

Deleting Connections

The Web Service exposes the following method for connection deletion:

```
public void deleteConnection( String entityId, String role) throws
 IOException
```

The `entityId` parameter is the Connection ID, which identifies the connection to be deleted. The role parameter is the connection role—`IDP` or `SP`.

Code Example

Below is example client code using the Apache AXIS libraries that invokes this Web Service to delete a connection:

```
Service service = new Service();
Call call = (Call) service.createCall();
call.setUsername("username");
call.setPassword("password");
call.setTargetEndpointAddress(
 "https://localhost:9999/pf-mgmt-ws/ws/ConnectionMigrationMgr"
 );
call.setOperationName("deleteConnection");
call.invoke(new Object[]{"entityid", "SP"});
```

Cluster Configuration Replication

A Web Service endpoint is available to replicate the administrative-console configuration to other nodes in a PingFederate cluster. This allows a client of this Web Service to create or update a new connection (or delete a connection) and then push the new configuration to the other cluster nodes.

The service endpoint is:

```
/pf-mgmt-ws/ws/ConfigReplication
```

The WSDL document describing this service can be retrieved from:

```
https://<host_server>:<admin_console_port>/pf-mgmt-ws/ws/ConfigReplication?
wsdl
```

The Web Service exposes the following method:

```
public void replicateConfiguration();
```

Example Code

Below is example client code using the Apache AXIS libraries that invokes the configuration replication functionality:

```
Call call2 = (Call) service.createCall();
    call2.setUsername("joe");
    call2.setPassword("test");
    String addr2 = "https://localhost:9999/pf-mgmt-ws/ws/ConfigReplication";
    call2.setTargetEndpointAddress(addr2);
    call2.setOperationName("replicateConfiguration");
    call2.invoke(new Object[]{});
```

Validation Disclaimer

The import process is not subject to the same rigorous data validation performed by the administrative user interface. Although some checks are made, it is possible to create invalid connections using the connection-migration process. Therefore, because the XML is complex and validation is limited, attempting to create an XML connection from scratch is *not recommended*. Rather, the administrative console should be used to create the initial connection. That way, changes necessary to the exported connection's XML representation can be held to a minimum, reducing the risk of compromising data integrity.

SSO Directory Service

PingFederate SSO Directory Service allows applications to retrieve configuration data from a runtime PingFederate server. (A PingFederate server in a cluster configured as an administrative console does not support this Web Service.) This service allows Web applications to avoid storing and maintaining the data locally. These types of data can be retrieved:

- A list of IdP partners
- A list of SP partners
- A list of IdP *adapter* instances
- A list of SP adapter instances

The SSO Directory Service provides information useful for integrating an application with a PingFederate server. It is a way for the application to find out dynamically which partners can be used for SSO. This means applications need not be modified when new partners are configured in PingFederate.

The `WAR` file for this module, `pf-ws.war`, is located in the `pingfederate/server/default/deploy` folder.

Note: If you do not want to allow use of the service, it should not be deployed: remove the WAR file from the `deploy` folder.

The service endpoint is `pf-ws/services/SSODirectoryService`.

The WSDL document describing this service can be retrieved from:

```
http(s)://<pf_runtime_host>:<runtime_port>/pf-ws/services/
SSODirectoryService?wsdl
```

You can retrieve a list using any of the following methods:

- `getIDPList` – Returns a list of active IdP connections configured for SP-initiated SSO. The list contains each IdP’s Connection ID and Connection Name
- `getSPList` – Returns a list of active SP connections configured for IdP-initiated SSO. The list contains each SP’s Connection ID and Connection Name

Note: For either IdP or SP lists, Connection IDs are returned as values for the XML tag `<entityId>`. Connection Names are returned as values for the XML tag `<company>` (see *SOAP Request and Response Example* on page 413).

- `getAdapterInstanceList` – Returns a list of SP adapter instances containing an ID and name.
- `getIdpAdapterInstanceList` – Returns a list of IdP adapter instances containing an ID and name.

Note: These methods do not require input parameters.

The service is also available over HTTP. The query string for retrieving any of the lists is:

```
/pf-ws/services/SSODirectoryService?method=<method_name>
```

Coding Example

When you integrate a Web application with PingFederate, use the SSO Directory Service to generate a connection or adapter list. The code needed to create any of the lists is similar.

The following Java code example retrieves an IdP list from the Web Service. The program calls the getIDPList method in the SSO Directory Service to retrieve an IdP list and print it to the console. This example uses the Apache Axis library and includes optional code for authentication to the PingFederate server (see *Authentication* on page 169). We recommend the use of HTTPS when including credentials.

```
import org.apache.axis.client.Call;
import org.apache.axis.client.Service;
import java.net.URL;
import javax.xml.namespace.QName;
import com.pingidentity.ws.SSOEntity;
public class SSODirectoryClientSample
{
   public static void main(String[] args) throws Exception
   {
    Service service = new Service();
    Call call = (Call) service.createCall();
    call.setUsername("username");
    call.setPassword("pass");
    URL serviceUrl = new URL(
       "https://localhost:9031/pf-ws/services/
         SSODirectoryService");
    QName qn = new QName("urn:BeanService", "SSOEntity");
    call.registerTypeMapping(SSOEntity.class, qn,
      new org.apache.axis.encoding.ser.BeanSerializerFactory(
          SSOEntity.class, qn),

       new org.apache.axis.encoding.ser.BeanDeserializerFactory(
           SSOEntity.class, qn));
    call.setTargetEndpointAddress( serviceUrl );
    call.setOperationName( new QName(
      "http://www.pingidentity.com/servicesSSODirectoryService",
        "getIDPList"));
    Object result = call.invoke( new Object[] {} );
    if (result instanceof SSOEntity[])
    {
       SSOEntity[] idpArray = (SSOEntity[])result;
       for (SSOEntity idp : idpArray)
      {
        System.out.println(idp.getEntityId() + " " +
          idp.getCompany());
      }
    }
    else
    {
       System.out.println("Received problem response from
          server: " + result);
    }
  }
}
```

SOAP Request and Response Example

A client application must send a SOAP request to the PingFederate server specifying the requested Web Service and the specific method. For example, the following is a typical SOAP request for an IdP list using the SSO Directory Service.

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope
    xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Body>
    <ns1:getIDPList
        soapenv:encodingStyle=
            "http://schemas.xmlsoap.org/soap/encoding/"
        xmlns:ns1=
            "https://localhost:9031/ssodir/services/
                 SSODirectoryService"/>
  </soapenv:Body>
</soapenv:Envelope>
```

The PingFederate server’s Web Service will return a response containing the list you requested. The following is an example of a typical SOAP response for an IdP list:

```
<?xml version="1.0" encoding="UTF-8" ?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/
  soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Body>
    <getIDPListResponse
        soapenv:encodingStyle=
            "http://schemas.xmlsoap.org/soap/encoding/">
      <getIDPListReturn
          soapenc:arrayType=
             "ns1:IDP[2]" xsi:type="soapenc:Array"
           xmlns:ns1="urn:BeanService"
           xmlns:soapenc=
             "http://schemas.xmlsoap.org/soap/encoding">
         <getIDPListReturn href="#id0" />
         <getIDPListReturn href="#id1" />
      </getIDPListReturn>
    </getIDPListResponse>
    <multiRef id="id0" soapenc:root="0"
        soapenv:encodingStyle=
           "http://schemas.xmlsoap.org/soap/encoding/"
          xsi:type="ns2:IDP"
         xmlns:soapenc=
            "http://schemas.xmlsoap.org/soap/encoding/"
          xmlns:ns2="urn:BeanService">
       <company xsi:type="xsd:string">MegaMarket</company>
      <entityId xsi:type="xsd:string">www.megamarket.com
       </entityId>
    </multiRef>
    <multiRef id="id1" soapenc:root="0"
        soapenv:encodingStyle=
           "http://schemas.xmlsoap.org/soap/encoding/"
          xsi:type="ns3:IDP" xmlns:ns3="urn:BeanService"
         xmlns:soapenc=
            "http://schemas.xmlsoap.org/soap/encoding/">
      <company xsi:type="xsd:string">Ping</company>
      <entityId
          xsi:type="xsd:string">pingfederate3:default:entityId
       </entityId>
    </multiRef>
  </soapenv:Body>
</soapenv:Envelope>
```

OAuth Client Management Service

PingFederate includes a REST-based Web Service for OAuth client management. The service is provided primarily for organizations with many OAuth clients, allowing programmatic management of OAuth clients, as an alternative to using the administrative console (see *Client Management* on page 141).

Note: This Web Service is active only if client records are managed in a database, rather than in XML files (the installed default storage method). For information on setting up database management for OAuth clients, see *Defining an OAuth Client Data Store* on page 109.

Tip: PingFederate administrative API can also be used to manage OAuth clients programmatically regardless if the client records are managed in XML files or in a database. For more information, see *PingFederate Administrative API* on page 423.

Endpoints

The REST resources in the following sections are URL path extensions of the PingFederate runtime endpoint: `http(s)://<pf_runtime_host>:<runtime_port>/pf-ws/rest`

For example: `https://my_corp.com:9031/pf-ws/rest/oauth/clients`

Note: `POST` and `PUT` methods described in this section require parameter name/value pairs formatted in JavaScript Object Notation (JSON).

Important: Applications must authenticate to the Web Service using HTTP Basic credentials specified in a PingFederate Password Credential Validator (see *Validating Password Credentials* on page 170). The configured Credential Validator, in turn, must be selected in the OAuth AS configuration (see *Authorization Server Settings* on page 130).

/oauth/clients

This resource accepts the methods *POST* on page 415, *PUT* on page 417 and *GET* on page 418.

POST

Description

Creates a new client based on the parameters provided in the request. Parameters correspond to administrative-console fields; for additional information, see *Client Management* on page 141.

The required MIME type isapplication/json.

JSON Parameters

Parameter	Description
clientId	(Required) A unique ID for the client.
name	(Required) A descriptive name for the client.
refreshRolling	Indicates whether a new refresh token is issued with each new access token (see *Field Descriptions* on page 142). Allowed values: `true` or `false`. When not provided, the global setting for the AS is used (see *Authorization Server Settings* on page 130).
redirectUris	The URI(s) to which the OAuth AS redirects the resource owner's user agent after authorization is obtained. *Required* for Implicit and Authorization Code grant types (see `grantTypes` below).
logoUrl	A URL for the logo presented to the user on the grant revocation page.
secret	Client password or phrase, *required* for the Client Credentials grant type unless client-certificate authentication is needed (see next two parameters).
clientCertIssuerDn	Client TLS certificate issuer, *required* for the Client Credentials grant type unless a `secret` is provided.
clientCertSubjectDn	Client TLS certificate subject, *required* for the Client Credentials grant type unless a `secret` is provided.
description	A description of what the client application does, displayed in browser when the user is prompted for authorization.
persistentGrantExpirationType	Indicates whether to override the global setting for the AS (see *Authorization Server Settings* on page 130). Allowed values: • `SERVER_DEFAULT` (the default) – Use the global setting for the AS. • `NONE` – Grants do not expire, regardless of the global setting. • `OVERRIDE_SERVER_DEFAULT` – Use with both of the `persistentGrant*` parameters below to set the expiration time period.
persistentGrantExpirationTime	An integer representing units of time for storage of persistent grants for this client—use with `persistentGrantExpirationTimeUnit` (see below) and only when `persistentGrantExpirationType` is set to `OVERRIDE_SERVER_DEFAULT`.
persistentGrantExpirationTimeUnit	Units for the expiration time set in the parameter above (if applicable). Allow values: `h` – hours `d` – days
bypassApprovalPage	If set to `true`, user consent to resource access is assumed and the approval page is not presented.
restrictScopes	If set to `true`, limits client access to a subset of the scopes defined for the AS (see *Authorization Server Settings* on page 130). Scopes are limited to the default scope

Parameter	Description
	and any listed for `restrictedScopes` (see below). If no scopes are listed and this parameter is `true`, only the default scope is available for the client.
restrictedScopes	When used with `restrictScopes`, limits access to the scope(s) provided in the JSON list, in addition to the default scope.
grantTypes	One or more grant types allowed for the client (see *Grant Types* on page 16). Allowed values: • `authorization_code` • `password`(Resource Owner Password Credentials) • `refresh_token` (Use with authorization_code and/or password grant types.) • `client_credentials` • `implicit` • `extension` (SAML 2.0 Bearer) • `urn:pingidentity.com:oauth2:grant_type:validate_ bearer` (Access Token Validation) **Note:** • At least one grant type is required. • Separate multiple values with commas.
defaultAccessTokenManagerId	The default access token manager for this client (see *Access Token Management* on page 133).
idTokenSigningAlgorithm	The JSON Web Signature (JWS) algorithm required for the ID Token. Allowed values: • `none` - No signing algorithm • `HS256` - HMAC using SHA-256 • `HS384` - HMAC using SHA-384 • `HS512` - HMAC using SHA-512 • `RS256` - RSA using SHA-256 • `RS384`- RSA using SHA-384 • `RS512` - RSA using SHA-512 • `ES256` - ECDSA using P256 Curve and SHA-256 • `ES384` - ECDSA using P384 Curve and SHA-384 • `ES512` - ECDSA using P521 Curve and SHA-512
policyGroupId	The desired Open ID Connect policy.
grantAccessSessionRevocationApi	If set to `true`, this client is allowed to access the Session Revocation API (see *Back-Channel Session Revocation* on page 129).
pingAccessLogoutCapable	If set to `true` , PingFederate sends (via the browser) logout requests to an OpenID Connect endpoint in PingAccess as part of the logout process (see *Asynchronous Front-Channel Logout* on page 128).
logoutUris	A list of client logout URI's which will be invoked when a user logs out through one of PingFederate's SLO endpoints (see *Asynchronous Front-Channel Logout* on page 128). Similar to `redirectedUris`, multiple entries are allowed.

Example JSON

```
{"client":[
  {
  "clientId":"12345",
  "name":"Client Doe",
  "refreshRolling":"true",
  "redirectUris":[
    "http://www.url.com",
    "http://www.url2.com"
    ]
  "logoUrl":"http://www.url.com/image.gif",
  "clientCertIssuerDn":"CN=CA, dc=pingidentity, dc=com",
  "clientCertSubjectDn":"cn=MyClient, dc=pingidentity, dc=com",
  "description":"Description of the client",
  "persistentGrantExpirationType":"OVERRIDE_SERVER_DEFAULT",
  "persistentGrantExpirationTime":"3",
  "persistentGrantExpirationTimeUnit":"d",
  "bypassApprovalPage":"true",
  "restrictScopes":"true",
  "restrictedScopes":[
    "scope 1",
    "scope 2"
    ]
  "grantTypes":[
    "password",
    "refresh_token"
    ]
  }
]}
```

Returns

- 200 – Success
- 400 – Failed To Create Client

  The response contains details as to why the client creation failed.
- 401 – Invalid Credentials

  The user does not exist or is not authorized to create a client.
- 500 – Internal Server Error

  An unknown error has occurred.

PUT

Description

Updates client details for a specified client.

Note: You cannot update a client ID—you must delete the client record and create a new one.

JSON Parameters

The same parameters described for *POST* on page 415 apply for PUT with one addition: `forceSecretChange`

Use this parameter, set to `true`, in conjunction with the `secret` parameter to change a client pass phrase.

Note: If the secret parameter is used without `forceSecretChange`, the secret value is ignored.

Example JSON

```
{"client":[
{
  "clientId":"12345",
  "name":"Client Doe",
  "refreshRolling":"true",
  "redirectUris":[
    "http://www.url.com",
    "http://www.url2.com"
    ]
  "logoUrl":"http://www.url.com/image.gif",
  "forceSecretChange":"true",
  "secret":"mysecretphrase",
  "description":"Description of the client",
  "persistentGrantExpirationType":"OVERRIDE_SERVER_DEFAULT",
  "persistentGrantExpirationTime":"3",
  "persistentGrantExpirationTimeUnit":"d",
  "bypassApprovalPage":"true",
  "restrictScopes":"true",
  "restrictedScopes":[
    "scope 1",
    "scope 2"
    ]
  "grantTypes":[
    "password",
    "refresh_token"
    ]
  }
]}
```

Returns

- 200 – Success

  The body contains a list of updated clients.

  400 – Failed To Update Client

  The response contains details as to why the client could not be updated.
- 401 – Invalid Credentials

  The user does not exist or is not authorized to update a client.
- 500 – Internal Server Error

  An unknown error has occurred.

GET

Description

Retrieves details for all OAuth clients.

JSON Parameters

None.

Returns

- 200 – Success

  The body contains JSON data for all clients.

  Note: The parameter `refreshRolling` is not returned if the AS global setting is set for a client (the default).
- 400 – Failed To Retrieve Clients

  The response contains details as to why clients could not be retrieved.
- 401 – Invalid Credentials

  The user does not exist or is not authorized.
- 500 – Internal Server Error

  An unknown error has occurred.

/oauth/clients/id

This resource accepts the methods GET and DELETE.

GET

Description

Retrieves details for the specified client ID.

JSON Parameters

None.

Returns

- 200 – Success

  JSON client parameters are included.

  Note: The parameter `refreshRolling` is not returned if the AS global setting is set for a client (the default).
- 400 – Failed To Retrieve Client

  The response contains details as to why client could not be retrieved.
- 401 – Invalid Credentials

  The user does not exist or is not authorized.
- 500 – Internal Server Error

  An unknown error has occurred.

DELETE

Description

Deletes records for the specified client ID.

Returns

- 200 – Success
- 400 – Failed To Delete Client

  The response contains details as to why client could not be deleted.
- 401 – Invalid Credentials

  The user does not exist or is not authorized.
- 405 – Method Not Allowed

  The client ID was not specified.
- 500 – Internal Server Error

  An unknown error has occurred.

Logging

PingFederate records the actions performed via this endpoint in the `runtime-api.log` file. While the events themselves are not configurable, you may adjust the `log4j2.xml` configuration settings to alter the format and desired level of detail surrounding each event.

Each log entry contains information relating to the event, including:

- Time the event occurred on the PingFederate server
- Administrator username performing the action
- Authentication method
- Client IP
- HTTP method

- REST endpoint
- HTTP status code

Each of the above fields is separated by a vertical pipe (|) for ease of parsing.

OAuth Access Grant Management Service

PingFederate includes a REST-based Web Service for OAuth access grant management. This service enables retrieval and revocation of access grants for a particular client or user.

The REST resources are URL path extensions of the PingFederate runtime endpoint: `http(s)://<pf_runtime_host>:<runtime_port>/pf-ws/rest`

For example: `https://my_corp.com:9031/pf-ws/rest/oauth/clients`

Important: Applications must authenticate to the Web Service using HTTP Basic credentials specified in a PingFederate Password Credential Validator (see *Validating Password Credentials* on page 170). The configured Credential Validator, in turn, must be selected in the OAuth AS configuration (see *Authorization Server Settings* on page 130).

Endpoints: /oauth/clients/{clientId}/grants[/{grantId}] and /oauth/users/{userKey}/grants[/{grantId}]

These resources accept the methods GET which supports retrieval and DELETE which supports revocation of access grants.

Note: The Clients endpoint requires client records to be managed in a database, rather than in XML files (the installed default storage method). For information on setting up database management for OAuth clients, see *Defining an OAuth Client Data Store* on page 109.

Parameters

clientId	The client identifier to retrieve or revoke grants for (see *Configuring a Client* on page 141).
userKey	The user key to retrieve or revoke grants for. The user key is defined under IdP Adapter Mapping and Resource Owner Credentials Mapping.
grantId (optional)	Access grant identifier used to retrieve or revoke a specific grant. The value corresponds to the id field of the JSON array of grants returned from a previous `GET /oauth/clients/{clientId}/grants` or `GET /oauth/users/{userKey}/grants`. If this parameter is not specified, the request applies to all grants for the client or user.

Cross Site Request Forgery Protection

Both endpoints require the HTTP Header X-XSRF-HEADER with any value to prevent cross site request forgery.

Example request and JSON response

Request to retrieve all grants for client `im_client`:

```
GET /pf-ws/rest/oauth/clients/im_client/grants HTTP/1.1 Host: localhost:9031
Authorization: Basic YWRtaW46MkZlZGVyYXRl X-XSRF-HEADER:PingFederate
```

Response could be:

```
{
    "items": [{
        "id":"gn3T3qGVjoHL9p8HKtCSZNriwg9H3DA8",
        "userKey":"joe",
        "grantType":"IMPLICIT",
        "scopes":[],
        "clientId":"im_client",
        "issued":"2014-03-26T21:15:38.551Z",
        "updated":"2014-03-26T21:15:38.551Z"
    }]
}
```

Returns

- 200 – Success
- 204 – Success with no content returned

  Will be seen when revoking an access grant
- 401 – Invalid Credentials.

  The user does not exist or the password is incorrect.
- 404 – Not found

  Resource (user, client, or access grant) not found
- 500 – Internal Server Error

  An unknown error has occurred.

Logging

PingFederate records the actions performed via this endpoint in the `runtime-api.log` file. While the events themselves are not configurable, you may adjust the `log4j2.xml` configuration settings to alter the format and desired level of detail surrounding each event.

Each log entry contains information relating to the event, including:

- Time the event occurred on the PingFederate server
- Administrator username performing the action
- Authentication method
- Client IP
- HTTP method
- REST endpoint
- HTTP status code

Each of the above fields is separated by a vertical pipe (|) for ease of parsing.

Session Revocation API

PingFederate includes a REST-based Web Service for Back-Channel Session Revocation. This service enables OAuth clients to add sessions to the revocation list or to query their revocation status. The Grant Access to Session Revocation API option must be selected in its client configuration (see *Back-Channel Session Revocation*).

Important: OAuth clients must authenticate to the Web Service using their Client Secret values via HTTP Basic authentication or Client Certificates (see *Configuring a Client* on page 141).

Endpoint: /pf-ws/rest/sessionMgmt/revokedSris

Tip: Information about the Session Revocation API endpoint is also available in the OpenID Connect metadata (see *OpenID Connect Provider Metadata Endpoint* on page 407). Look for `ping_revoked_sris_endpoint` in the metadata.

This resource accepts the methods *POST* on page 422 and *GET* on page 422. It also requires the `X-XSRF-HEADER` HTTP header with any value to prevent cross site request forgery.

Note: The `POST` method described in this section requires the parameter name/value pair formatted in JavaScript Object Notation (JSON).

POST

Description

A POST request adds a session to the revocation list based on its session identifier (`id`) in the POST data. The value of id corresponds to that of `pi.sri` in the ID Token (see *Configuring OpenID Connect Policies* on page 137). The required `Content-Type is application/json`.

Sample POST request and responses

A POST request to add a session with a session identifier of abc123 to the revocation list:

```
POST /pf-ws/rest/sessionMgmt/revokedSris

Host: localhost:9031

Authorization: Basic YWRtaW46MkZlZGVyYXRl

X-XSRF-HEADER: PingFederate

Content-Type:application/json

{"id":"abc123"}
```

Possible HTTP response status codes:

- 201 – Created

  The session is added to the revocation list.
- 400 – Bad Request

  The `X-XSRF-HEADER` HTTP header is not found in the HTTP POST request.
- 401 – Unauthorized

  The response contains details as to why the attempt failed.
- 415 – Unsupported Media Type

  The `Content-Type: application/json` HTTP header is not found in the HTTP POST request.
- 500 – Internal Server Error

  An unknown error has occurred.

GET

Description

A GET request sends a query for the revocation status for a session with its session identifier (`id`) appended to the endpoint. The value of id corresponds to that of `pi.sri` in the ID Token (see *Configuring a Client* on page 141).

Sample GET request and responses

A GET request to query the revocation status for a session with a session identifier of abc123:

```
GET /pf-ws/rest/sessionMgmt/revokedSris/abc123

Host: localhost:9031

Authorization: Basic YWRtaW46MkZlZGVyYXRl

X-XSRF-HEADER: PingFederate
```

Possible HTTP response status codes:

- 200 – OK

  `{"id":"abc123"}` is found in the revocation list.
- 400 – Bad Request

The X-XSRF-HEADER HTTP header is not found in the HTTP POST request.

- 401 – Unauthorized

  The response contains details as to why the attempt failed.
- 404 – Not Found

  {"resultId":"session_mgmt_sri_not_revoked","message":"The SRI has not been revoked."} if the session is not found in the revocation list.
- 500 – Internal Server Error

  An unknown error has occurred.

Logging

PingFederate records the actions performed via this endpoint in the runtime-api.log file. While the events themselves are not configurable, you may adjust the log4j2.xml configuration settings to alter the format and desired level of detail surrounding each event.

Each log entry contains information relating to the event, including:

- Time the event occurred on the PingFederate server
- Administrator username performing the action
- Authentication method
- Client IP
- HTTP method
- REST endpoint
- HTTP status code

Each of the above fields is separated by a vertical pipe (|) for ease of parsing.

PingFederate Administrative API

PingFederate includes a REST-based application programming interface (API) for administrative functions. The administrative API provides a programmatic way to make configuration changes to PingFederate as an alternative to using the administrative console. The configuration changes that you can make through the administrative API include, but are not limited to:

- Server settings
- Keys and certificates
- Data stores and password credential validators
- Adapters and connections
- OAuth settings
- Cluster management

For a complete list, see *Using the API Interactive Documentation* on page 427. For known limitations, see *Release Notes*.

The administrative API supports various authentication options, see *Configuring Access to the Administrative API* on page 424 for more information.

Concurrent Access

The administrative API supports concurrent access. When concurrent API calls are made to modify the same API resource (such as the same IdP Adapter instance or the same SP connection), the last request processed by PingFederate wins.

Logging

PingFederate records actions performed via the administrative API in the `admin-api.log` file. Information includes the time of the event, the action performed, the authentication method, and other fields. For more information, see *Administrative API Audit Log* on page 48.

Configuring Access to the Administrative API

Similar to the administrative console, access to the administrative API is protected by:

- *Native authentication* — Uses credentials managed within PingFederate.
- Alternative authentication — Utilize credentials external to PingFederate through an LDAP user-data store, the RADIUS protocol, or client certificates:
  - *LDAP authentication*
  - *RADIUS authentication*
  - *Certificate-based Authentication*

For new installations, native authentication is chosen by default.

For upgrades, if the authentication method of the administrative API was not previously set (for example, when upgrading from PingFederate 7.3 or older), the upgrade utility sets the value to that of the administrative console; otherwise, it preserves the previously set value (for example, when upgrading from PingFederate 8.0 to a future release).

The authentication method for the administrative API can be changed at a later time to any of the four choices, regardless of which authentication method is chosen for the administrative console.

Besides authentication, PingFederate also provides role-based access control, as shown in the following table. The role(s) assigned to the accounts affect the results of the API calls.

Table 16: PingFederate User Access Control

Role Assignment	Access Privileges
User Admin	Create users, deactivate users, change or reset passwords, and install replacement license keys. (This role is not provided if you are using LDAP or RADIUS authentication for administrative logon, since user management is handled outside of PingFederate.)
Admin	Configure partner connections and most system settings (except user management and local key/ certificate handling).
Crypto Admin	Manage local keys and certificates.
Auditor	View-only permissions for all administrative functions.

Native Authentication

When the administrative API is protected by native authentication, access to the administrative API is restricted to the users defined in the **Account Management** screen. The API calls must be authenticated by valid credentials over HTTP Basic Authentication; otherwise, the administrative API returns an error message. The roles assigned to the users affect the results of the API calls.

1. Verify the `pf.admin.api.authentication` value in `<pf_install>/pingfederate/bin/run.properties` is set to `native`.

   Update as needed and restart PingFederate to activate this change.

   Note: In a clustered PingFederate environment, you only need to modify `run.properties` on the console node.
2. Log on to the administrative console with an account that has the role User Admin.

Important: When the administrative console is protected by an alternative console authentication (certificate-based, LDAP, or RADIUS authentication), most user-management functions are handled outside the scope of the PingFederate administrative console. Therefore, the administrative console disables the **Account Management** functionality unless the logged-on administrator has been granted the User Admin right.

To create or manage users in this scenario, add at least one external account to the role setting `userAdmin` in the configuration file for the respective authentication method. When such administrator logs on to the administrative console, the **Account Management** screen becomes available for her or him to create or manage users for the purposes of accessing the administrative API.

For more information about the alternative console authentication and the respective configuration, see *Alternative Console Authentication* on page 65.

3. Click **Server Configuration** on the Main Menu.
4. Click **Account Management** under Administrative Functions.
5. Create or manage users as needed, including assigning various PingFederate administrative roles as indicated by the **PingFederate User Access Control** table in *Configuring Access to the Administrative API* on page 424.

   Note: When assigning role(s), keep in mind that all users defined in the **Account Management** screen can be used to access the administrative API as well as the administrative console.

LDAP Authentication

When the administrative API is protected by LDAP authentication, the API calls must be authenticated by valid LDAP credentials over HTTP Basic Authentication; otherwise, the administrative API returns an error message. The LDAP authentication setup, including role assignment, is available via `<pf_install>/pingfederate/bin/ldap.properties`. The roles assigned to the LDAP accounts affect the results of the API calls.

Note: When LDAP authentication is configured, PingFederate does not lock out accounts based upon the number of failed logon attempts. Responsibility for preventing access is instead delegated to the LDAP server and enforced according to its password lockout settings.

1. Verify the `pf.admin.api.authentication` value in `<pf_install>/pingfederate/bin/run.properties` is set to `LDAP`.

   Update as needed.
2. In the `<pf_install>/pingfederate/bin/ldap.properties` file, change property values as needed for your network configuration.

   See the comments in the file for instructions and additional information.

   Important: Be sure to assign LDAP users or designated LDAP groups (or both) to at least one of the PingFederate administrative roles as indicated in the properties file. For information about permissions attached to the PingFederate roles, see the **PingFederate User Access Control** table in *Configuring Access to the Administrative API* on page 424.

   Note: When assigning role(s), keep in mind that all LDAP accounts specified in `ldap.properties` can be used to access the administrative API as well as the administrative console.

   Tip: You can also use this configuration file in conjunction with *RADIUS* authentication to determine permissions dynamically via an LDAP connection.
3. Restart PingFederate.

   Note: In a clustered PingFederate environment, you only need to modify `run.properties` and `ldap.properties` on the console node.

RADIUS Authentication

The *RADIUS* authentication setup is available via configuration files in the `<pf_install>/pingfederate/bin` folder. The RADIUS protocol provides a common approach for implementing strong authentication in a client-server configuration. The administrative API supports the protocol scenario for one-step authentication (for example, appending an OTP after the password).

When the administrative API is protected by RADIUS authentication, the API calls must be authenticated by valid credentials over HTTP Basic Authentication; otherwise, the administrative API returns an error message. The roles assigned to the accounts affect the results of the API calls.

Note: When RADIUS authentication is configured, PingFederate does not lock out accounts based upon the number of failed logon attempts. Responsibility for preventing access is instead delegated to the RADIUS server and enforced according to its password lockout settings.

Note: The NAS-IP-Address attribute is added to all Access-Request packets sent to the RADIUS server. The value is copied from the `pf.engine.bind.address` property in `run.properties`. Only IPv4 addresses are supported.

1. Verify the `pf.admin.api.authentication` value in `<pf_install>/pingfederate/bin/run.properties` is set to `RADIUS`.

   Update as needed.
2. In the `<pf_install>/pingfederate/bin/radius.properties` file, change property values as needed for your network configuration.

   See the comments in the file for instructions and additional information.

   Important: Be sure to assign RADIUS users or designated RADIUS groups (or both) to at least one of the PingFederate administrative roles as indicated in the properties file. Alternatively, you can set the `use.ldap.roles` property to `true` and use the LDAP properties file (also in the `bin` folder) to map LDAP group-based permissions to PingFederate roles. (For information about permissions attached to the PingFederate roles, see the **PingFederate User Access Control** table in *Configuring Access to the Administrative API* on page 424.)

   Note: When assigning role(s), keep in mind that all accounts specified in `radius.properties` can be used to access the administrative API as well as the administrative console.
3. Restart PingFederate.

   Note: In a clustered PingFederate environment, you only need to modify `run.properties` and `radius.properties` on the console node.

Certificate-Based Authentication

When client-certificate authentication is enabled, the API calls must be authenticated by X.509 client certificates; otherwise, the administrative API returns an error message. In addition, the corresponding root CA certificate(s) must either be contained in the Java runtime or be imported into the PingFederate's Trusted CA store (see *Trusted Certificate Authorities*).

The rest of the certificate-based authentication setup, including specifying the Issuer DN of the root CA certificate(s) and the applicable role(s) of the client certificate(s), is available via `<pf_install>/pingfederate/bin/cert_auth.properties`. The roles assigned to the certificates affect the results of the API calls.

1. Log on to the administrative console with an account that has the role Crypto Admin.
2. Ensure the client-certificate's root CA and any intermediate CA certificates are contained in the trusted store (either for the Java runtime or PingFederate, or both).

   To import a certificate, click **Trusted CAs** in the Certificate Management section under Server Configuration.

   Tip: You may wish to click the Serial number and copy the Issuer DN to use in a couple steps later.
3. Verify the `pf.admin.api.authentication` value in `<pf_install>/pingfederate/bin/run.properties` is set to `cert`.

   Update as needed.
4. In the `<pf_install>/pingfederate/bin/cert_auth.properties` file, enter the Issuer DN for the client certificate as a value for the property: `rootca.issuer.`*`x`*

where *x* is a sequential number starting at 1 (see the properties file for more information).

Important: The configuration values are case-sensitive.

If you copied the Issuer DN a couple steps earlier, paste this value.

5. Repeat the previous step for any additional CAs as needed.
6. Enter the certificate's Subject DN for the applicable PingFederate permission role(s), as described in the properties file. For information about permissions attached to the PingFederate roles, see the **PingFederate User Access Control** table in *Configuring Access to the Administrative API* on page 424.

   Important: The configuration values are case-sensitive.

   Note: When assigning role(s), keep in mind that all client certificates specified in `cert_auth.properties` can be used to access the administrative API as well as the administrative console.
7. Repeat the previous step for all client certificates as needed.
8. Restart PingFederate.

   Note: In a clustered PingFederate environment, you only need to modify `run.properties` and `cert_auth.properties` on the console node.

Using the API Interactive Documentation

PingFederate ships with interactive documentation for both developers and non-developers to explore the API endpoints, view documentation for the API, and experiment with API calls. In general, the API calls can be called from an interactive user interface, custom applications, or from command line tools such as cURL. The endpoint is only available on the `pf.admin.https.port` defined in `<pf_install>/pingfederate/bin/run.properties`.

Important: For enhanced API security, you must include `X-XSRF-Header: PingFederate` in all requests and use the `application/json` content type for PUT/POST requests.

To access the interactive documentation in PingFederate:

1. Start PingFederate.
2. Launch your browser and go to:

   `https://<DNS_NAME>:9999/pf-admin-api/api-docs/`

   where `<DNS_NAME>` is the fully qualified name of the machine running the PingFederate server.

   Note: The port number 9999 is set by default. For information on changing this setting, see *Modifying PingFederate Properties* on page 68.

To test an administrative API using the interactive documentation:

1. Click a section of the administrative API you would like to explore—for example, **/sp/idpConnections**.
2. Expand the method you want to use—for example, GET.
3. Enter any required parameters.
4. Click **Try it out**!

   The Request URL, Response Body, Response Code, and Response Headers appear.

   Note: You may be prompted to log in using administrative credentials over HTTP Basic Authentication. Enter the credentials of any existing administrator. The role of the administrator affects their access to the requested API.

Appendix I

Using Attribute Mapping Expressions

PingFederate provides an advanced option allowing administrators to map user attributes by way of an expression language. Because the option carries with it a potential for misuse, however, it is disabled in the administrative console for security reasons.

Tip: If you are upgrading to PingFederate 5.1 or higher and importing a configuration archive that uses expression mapping, the feature is enabled automatically.

This appendix describes the option, which is based on the Object-Graph Navigation Language (OGNL), and how to enable or disable it.

Caution: The security concern posed by OGNL is related to a potential for abuse by PingFederate administrative users within an organization; the concern is not related to any known external threats. We recommend, however, that the option be enabled only if required.

Enabling and Disabling Expressions

An administrator can manually enable or disable OGNL by editing a configuration file located in:

```
<pf_install>/pingfederate/server/default/data/config-store/
```

Important: If OGNL is enabled and expressions configured anywhere in the administrative console, disabling the feature causes errors during runtime processing.

To enable or disable OGNL expressions:

1. In the directory cited above, open the file:

   ```
   org.sourceid.common.ExpressionManager.xml
   ```

   Note: If you have a clustered PingFederate environment, edit the configuration file on the console node.

2. Change the value of the element named evaluate Expressions to either `true` or `false` and save the file. For example:

   ```
   <item name="evaluateExpressions">true</item>
   ```

   Note: The absence of a value (the installed default) *does not* necessarily disable the use of OGNL expressions. To facilitate backward compatibility, when no value is present, configuration archives containing expressions can be imported successfully, and further use of the feature is enabled. (The term “silent” is used for this condition in the server log.)

3. Start or restart PingFederate.

   Tip: If you are enabling OGNL to use for mapping Outbound-provisioning attributes, it is not necessary to restart the PingFederate server.

4. If you have a clustered PingFederate environment:
   a) Log on to the administrative console.
   b) Click **Server Configuration** on the Main Menu.
   c) Click **Cluster Management** under Administrative Functions.
   d) Click **Replicate Configuration**.
   e) Restart PingFederate on the engine nodes.

When you enable OGNL expressions, these expressions are available for use in multiple locations:

- The drop-down menus under Source in each of the administrative-console Fulfillment screens (the Attribute Contract Fulfillment screen, for example)
- The provisioning attribute-mapping screen (when Outbound Provisioning itself is enabled—see *Outbound Provisioning for IdPs* on page 33)
- The Show Advanced Criteria section on the Issuance Criteria screen following each of the administrative-console Fulfillment screens

When you make this selection, you can enter the expression in the text field provided. You can also test expressions (see *Using the OGNL Edit Screen* on page 432).

Constructing Expressions

OGNL is based on the Java programming language. OGNL expressions are useful for evaluating and manipulating attribute values and returning information based on the results. You can also transform a range of values into a text description or do the same for a sequence of ranges.

Use the # symbol to reference OGNL variables. For an IdP, PingFederate provides predefined OGNL variables for IdP-adapter attributes, any attributes retrieved from data stores, and attributes for token authorization. For an SP, variables are available for attributes received in an assertion, an attribute query, and attributes for token authorization. For example, the `SAML_SUBJECT` value may be retrieved using:

```
#SAML_SUBJECT
```

Note: Use the following construction for any attributes from any source that contain special characters (hyphens, for example), which cannot be parsed by OGNL: `#this.get("<attribute_name>")`

Note: Because OGNL uses the “at” symbol (@) to reference static Java methods, expressions containing the symbol must be enclosed in double quotes; otherwise, expression parsing fails. For example:

`#SAML_SUBJECT="usr@msn.com"`
not:
`#SAML_SUBJECT=usr@msn.com`

For more information, see *Using the OGNL Edit Screen* on page 432.

For more information about OGNL, including detailed user documentation, see the Apache Commons OGNL page (`commons.apache.org/ognl`).

Data Store Syntax

For data-store attributes with an attribute source ID, use this syntax:

```
#this.get("ds.attr-source-id.attribute_name")
```

For data-store attributes without an attribute source ID, use this syntax:

```
#this.get("ds.attribute_name")
```

Issuance Criteria Syntax

To access mapped attributes when configuring token-authorization expressions, use this syntax:

#this.get("mapped.attribute_name")

To access most context attributes when configuring token-authorization expressions, use this syntax:

```
#this.get("context.attribute_name")
```

To access the HTTP Request context attribute, use this syntax:

```
#this.get("context.HttpRequest").getObjectValue()
```

The returned value will be an instance of `javax.servlet.http.HttpServletRequest` (see *https://docs.oracle.com/javaee/6/api/javax/servlet/http/HttpServletRequest.html*).

Expression Examples

Below are examples of using OGNL expressions for attribute mapping and token authorization.

General

In the expression below, the value of the attribute “net-worth” is transformed first to eliminate any dollar signs or commas, then the result is evaluated to determine whether the user’s net worth falls into a “bronze,” “silver,” or “gold” category:

```
#result=#this.get("net-worth").toString(),
#result=#result.replace("$",""),
#result=#result.replace(",",""),
#result < 500000 ? "bronze" :
#result < 1000000 ? "silver" : "gold"
```

Token Authorization

The expression below verifies if a user is a member of the “Contractor” or “Employee” group:

```
#this.get("ds.ldap.memberOf")!=null?
(
  #this.get("ds.ldap.memberOf").toString().matches("(?i)
   .*CN=Contractor,cn=users,dc=company,dc=com.*|
   .*CN=Employee,cn=users,dc=company,dc=com.*")
):@java.lang.Boolean@FALSE
```

Note: The line breaks above are for publication readability only; statements calling methods whose arguments are enclosed in quotes must be entered on a single line.

The following expression extracts the domain information out of an email address (mail) and returns true if it matches a specific domain (`company.com`):

```
#this.get("mail")!=null?
(
  #email=#this.get("mail").toString(),
  #atSign="@",
  #at=#mail.indexOf(#atSign),
  #at > 0?
    (
      #domain=#mail.subject(#at+1),
      #domain.matches("(?i)company.com")
    ):false
):false
```

HTTP Request Context

The example below may be used to retrieve a value from an HTTP request object, in this case the User-Agent header, for comparison to a value required for *token authorization*.

```
#this.get("context.HttpRequest").getObjectValue().getHeader("User-
Agent").equals("somevalue")
```

STS Client Authentication Context

The STS SSL Client Certificate Chain example below checks that the issuer of the client certificate matches the specified DN.

```
#this.get("context.StsSSLClientCertChain").getObjectValue()
[1].getSubjectX500Principal().equals(new
 javax.security.auth.x500.X500Principal("CN=Ping Identity
 Engineering,OU=Engineering,O=Ping Identity,L=Denver,ST=CO,C=USA"))
```

In the example above,

`#this.get("context.StsSSLClientCertChain").getObjectValue()`

returns an array of `java.security.cert.X509Certificate` instances (see *https://docs.oracle.com/javase/7/docs/api/java/security/cert/X509Certificate.html*). This array starts with the client certificate itself.

Issuance Criteria and Multiple Virtual Server IDs

When you use virtual server IDs to connect to multiple environments in one connection (see *Connecting to a Partner in Multiple Connections* on page 37), verifying at runtime the virtual server ID in conjunction with other end-user attributes, such as group membership, protects against unauthorized access.

For instance. both the sales and the support departments of contoso.com (the IdP) have their own departmental subdomains, sales.contoso.com and support.contoso.com. The SP identifies both environments under the parent domain, contoso.com.

In this scenario, the PingFederate IdP server can be configured to include both sales.contoso.com and support.contoso.com as the virtual server IDs in the SP connection.

If you use one IdP adapter to authenticate end users from both departments, use an OGNL expression to cross-check the virtual server ID information in the request and the end user's group membership information. For example:

```
#this.get("ds.memberOf")!=null?
(
  (
    #this.get("ds.memberOf").toString().matches("(?i)
    CN=Eng,OU=E,DC=contoso,DC=com")
    &&
    #this.get("context.VirtualServerId").toString()==
    "Engineering"
  )||
  (
    #this.get("ds.memberOf").toString().matches("(?i)
    CN=Mkt,OU=M,DC=contoso,DC=com")
    &&
    #this.get("context.VirtualServerId").toString()==
    "Marketing"
  )
):false
```

Note: The line breaks above are for publication readability only; statements calling methods whose arguments are enclosed in quotes must be entered on a single line.

Using the OGNL Edit Screen

An in-line editor is available for OGNL expressions. The editor validates the expression and allows an administrator to enter input values and test the resulting output.

Note: For information about using OGNL, refer to the *Apache Commons OGNL page* (`commons.apache.org/ognl/index.html`).

- To reach the OGNL editor, click **Edit** under Actions for an expression on any of the attribute Fulfillment screens or click **Test** in the Show Advanced Criteria section on the Issuance Criteria screen.

  The **Edit** action is also available on Issuance Criteria screens for expressions (see *About Token Authorization* on page 27).

  Note: The test function does not work for the `context.httpRequest` attribute, because it's value is an object rather then text.

  Here is an example of the edit screen, from the IdP configuration flow:

To test an expression:

1. Enter an input value in the Value text box associated with the attribute.
2. Click the **Test** link near the bottom right of the screen.

   If the expression contains no errors, the result appears under Test Results.

   Important: If you make changes to an expression and want to save it, click **Update** under Actions. To discard changes, click the **Cancel** *link* under Actions; clicking the **Cancel** button near the bottom of the screen discards all changes you made in the current task.

Appendix J

Customizing Assertions and Authentication Requests

Some federation use cases may require additional customizations in the assertions sent from the PingFederate IdP server to the SP or the authentication requests sent from the PingFederate SP server to the IdP. PingFederate allows you to use OGNL expressions to fulfill these use cases on a per-connection basis. To enable OGNL expressions, see *Enabling and Disabling Expressions* on page 428

The available **Message Types** that can be customized varies depending your federation role (IdP or SP) as well as the protocol of the connection (SAML 1.x, SAML 2.0, and WS-Federation).

Once a message type is selected, you have access to a list of the **Available Variables**. By calling various methods, you can customize the assertions or the authentication requests to fulfill your use case. For more information, see:

- *Message Types and Available Variables*
- *Sample Customizations*

Message Types and Available Variables

The following tables describe the relationship between message type and available variable, as well as the corresponding class or interface information in Javadoc.

Tip: The Javadoc for PingFederate is located the `<pf_install>/pingfederate/sdk/doc` folder.

SP Connections (SAML 2.0)

Message Types	**`Available Variables`** **Classes/Interfaces in Javadoc**
AssertionType	`#AssertionType` org.sourceid.saml20.xmlbinding.assertion.AssertionType
	`#AssertionTypes` org.sourceid.saml20.xmlbinding.assertion.AssertionType[]
	`#Attributes` org.sourceid.util.log.AttributeMap
ResponseDocument	`#ResponseDocument` org.sourceid.saml20.xmlbinding.protocol.ResponseDocument
	`#Attributes` org.sourceid.util.log.AttributeMap

SP Connections (SAML 1.x)

Message Types	Available Variables
	Classes/Interfaces in Javadoc
AssertionType	#AssertionType
	org.sourceid.protocol.saml11.xml.AssertionType
	#AssertionTypes
	org.sourceid.protocol.saml11.xml.AssertionType[]
	#Attributes
	org.sourceid.util.log.AttributeMap
ResponseDocument	#ResponseDocument
	org.sourceid.protocol.samlp11.xml.ResponseDocument
	#Attributes
	org.sourceid.util.log.AttributeMap

SP Connections (WS-Federation)

Message Types	Available Variables
	Classes/Interfaces in Javadoc
AssertionType	#AssertionType
	org.sourceid.protocol.saml11.xml.AssertionType
	#Attributes
	org.sourceid.util.log.AttributeMap
RequestSecurityToken ResponseDocument	#RequestSecurityTokenResponseDocument
	org.xmlsoap.schemas.ws.x2005.x02.trust.RequestSecurityTokenResponseDocument
	#Attributes
	org.sourceid.util.log.AttributeMap

IdP Connections (SAML 2.0)

Message Type	Available Variables
	Classes/Interfaces in Javadoc
AuthnRequestDocument	#AuthnRequestDocument
	org.sourceid.saml20.xmlbinding.protocol.AuthnRequestDocument

Other Available Variables (regardless of roles and protocols)

Available Variables	Classes/Interfaces in Javadoc
`#XmlHelper`	com.pingidentity.sdk.xml.XmlHelper
`#HttpServletRequest`	javax.servlet.http.HttpServletRequest
`#HttpServletResponse`	javax.servlet.http.HttpServletResponse

Variables related to Federation Hub (regardless of message type)

Connections	Protocol	`Available Variables` Classes/Interfaces in Javadoc
SP and IdP connections	SAML 2.0	`#FedHubIncomingAuthnRequest`
		org.sourceid.saml20.xmlbinding.protocol.AuthnRequestDocument
SP connection	SAML 2.0	`#FedHubOutgoingAuthnRequest`
		org.sourceid.saml20.xmlbinding.protocol.AuthnRequestDocument
SP connection	SAML 2.0	`#FedHubIncomingAuthnResponse`
	SAML 1.x	org.sourceid.saml20.xmlbinding.protocol.ResponseDocument (SAML 20)
	WS-Federation	org.sourceid.protocol.samlp11.xml.ResponseDocument (SAML 1.x)
		org.xmlsoap.schemas.ws.x2005.x02.trust. RequestSecurityTokenResponseDocument (WS-Federation)
SP connection	SAML 2.0	`#FedHubIdpConnPartnerId`
	SAML 1.x	java.lang.String
	WS-Federation	The **Partner's Entity ID** in the IdP connection that bridges the identity provider.
SP connection	SAML 2.0	`#FedHubIdpConnProtocol`
	SAML 1.x	java.lang.String
	WS-Federation	The protocol of the IdP connection. The returned values are `SAML20`, `SAML11`, `SAML10`, or `WSFED`.
IdP connection	SAML 2.0	`#FedHubSpConnPartnerId`
	SAML 1.x	java.lang.String
	WS-Federation	The **Partner's Entity ID** in the SP connection.
IdP connection	SAML 2.0	`#FedHubSpConnProtocol`
	SAML 1.x	java.lang.String
	WS-Federation	The protocol of the IdP connection. The returned values are `SAML20`, `SAML11`, `SAML10`, or `WSFED`.

Sample Customizations

Below are examples of using OGNL expressions to customize assertions and authentication requests.

Add SessionNotOnOrAfter to Assertions

This expression adds the optional SessionNotOnOrAfter attribute in the <AuthnStatement> element and set the value to 60 minutes.

Message Type

`AssertionType`

Expression

```
#cal = new org.apache.xmlbeans.XmlCalendar(new java.util.Date()),
#cal.setTimeZone(@java.util.TimeZone@getTimeZone("UTC")),
#cal.add(@java.util.Calendar@MINUTE, 60),
#AssertionType.getAuthnStatementArray(0).setSessionNotOnOrAfter(cal)
```

Expected Assertions

```
...
<saml:AuthnStatement ... AuthnInstant="2015-03-20T16:27:37.344Z"
 SessionNotOnOrAfter="2015-03-20T17:27:37.398Z">
    <saml:AuthnContext>
      <saml:AuthnContextClassRef>...</saml:AuthnContextClassRef>
    </saml:AuthnContext>
</saml:AuthnStatement>
...
```

Use Well-Formed XML as Attribute Value

The following expression inserts well-formed XML in the `<AttributeValue>` element if the Attribute Name Format is `urn:pingidentity.com:SAML:attrname-format:xml:complex`.

Message Type

`AssertionType`

Expression

```
#i = 0,
#AssertionType.getAttributeStatementArray(0).getAttributeArray().{
  #this.getNameFormat().equals('urn:pingidentity.com:SAML:attrname-
format:xml:complex')?{
    #xml = #this.getAttributeValueArray(0).getStringValue(),
    #ast = @org.sourceid.saml20.xmlbinding.assertion.AttributeStatementType
$Factory@parse(#xml),
    #AssertionType.getAttributeStatementArray(0).setAttributeArray(#i,
 ast.getAttributeArray(0))
  }:null,
#i = #i+1
}
```

Note: The line breaks above are for publication readability only; statements calling methods whose arguments are enclosed in quotes must be entered on a single line.

In this example, we use well-formed XML as the attribute value for attributes that are configured as `urn:pingidentity.com:SAML:attrname-format:xml:complex` (a custom attribute name format added to `<pf_install>/pingfederate/server/default/data/config-store/custom-name-formats.xml`) in the Attribute Contract screen (see *Creating an Attribute Contract* on page 202). You are free to use other application logic in this workflow.

Sample Attributes and their Values

Attribute Name	`ExtAttr1`

Attribute Name Format	`urn:oasis:names:tc:SAML:2.0:attrname-format:unspecified`
Attribute Value	`123`

Attribute Name	`ExtAttr2`
Attribute Name Format	`urn:pingidentity.com:SAML:attrname-format:xml:complex`

Attribute Value

```
<saml:Attribute
 xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion"
 Name="ExtAttr2"
 NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-
format:unspecified">
    <saml:AttributeValue
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xmlns:customNs="http://www.sample.tld/customnamespace">
        <customNs:Line>Documentation</customNs:Line>
        <customNs:Line>Ping Identity</customNs:Line>
    </saml:AttributeValue>
</saml:Attribute>
```

Note: This is a well-formed XML document in one line.

Expected Results

```
...
<saml:Attribute Name="ExtAttr1"
 NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:unspecified">
    <saml:AttributeValue xsi:type="xs:string"
     xmlns:xs="http://www.w3.org/2001/XMLSchema"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        123
    </saml:AttributeValue>
</saml:Attribute>
<saml:Attribute Name="ExtAttr2"
 NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:unspecified">
    <saml:AttributeValue
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xmlns:customNs="http://www.sample.tld/customnamespace">
        <customNs:Line>Documentation</customNs:Line>
        <customNs:Line>Ping Identity</customNs:Line>
    </saml:AttributeValue>
</saml:Attribute>
...
```

Include Extensions in Authentication Requests

This expression includes the optional `Extensions` element in the authentication requests if a certain query parameter (`oid` in this example) is sent to the `/sp/startSSO.ping` endpoint to start an SP-initiated SSO request.

Message Type

`AuthnRequestDocument`

Expression

```
#element = #XmlHelper.addToSaml2Extensions(#AuthnRequestDocument,
 '<samplens:orgId name="orgId" xmlns:samplens="urn:org.sample.wms"/>'),
#value = #HttpServletRequest.getParameter('oid') == null ?
 'someDefaultValue' : #HttpServletRequest.getParameter('oid') ,
#XmlHelper.setAttribute(#element, 'value', #value)
```

Expected AuthnRequest

A GET request to `https://<pf_host>/sp/startSSO.ping?PartnerIdpId=<IdP>&oid=123` would trigger the following Extensions block:

```
<samlp:AuthnRequest ...>
  <saml:Issuer ...>...</saml:Issuer>
  <samlp:Extensions>
    <samplens:orgId name="orgId" value="123"
 xmlns:samplens="urn:org.sample.wms"/>
  </samlp:Extensions>
  ...
</samlp:AuthnRequest>
```

Appendix K

Troubleshooting

Basic troubleshooting tips are provided here to help overcome common difficulties. Help is also available from the *Support Center* at *pingidentity.com*.

This appendix contains the following sections:

Data Store Issues

Table 17: Troubleshooting Data Stores

Problem	Solution
When setting up the JDBC data store, a connection cannot be established.	Verify that the proper drivers and connectors have been installed. Also, verify the connection URL, username, and password. If unsuccessful, contact your database administrator.
Cannot connect to a Directory Service with the LDAP protocol.	Verify the connection URL, port, principal, and credentials. If unsuccessful, contact your system administrator. If using LDAP with SSL/TLS (ldaps://), ensure the LDAP server's SSL certificate is signed by a trusted certificate authority, or import the certificate into PingFederate (see *Trusted Certificate Authorities* on page 161).

Installation Issues

Table 18: Troubleshooting Installation

Problem	Solution
Error message "Not enough memory on the server"	Verify that there is at least 1,024 MB of RAM installed on the server (see *System Requirements* in the "Installation" chapter of *Getting Started*).

Runtime Issues

Table 19: Troubleshooting Runtime Issues

Problem	Solution
Certificates unexpectedly expire.	Verify that the server clocks are synchronized on both sides of the federation. Note that you can configure PingFederate to notify administrators in advance of impending certificate expiration (see *Configuring Runtime Notifications* on page 86).
Receiving CrossModule/ Network Errors	Verify network connections to the Hardware Security Modules (HSMs) are active and running. Also ensure the HSMs have not been unintentionally shut down.

Server Startup

Table 20: Troubleshooting the PingFederate Server

Problem	Solution
PingFederate does not start.	Make sure that the Java SDK is installed (see *Installing Java* in the “Installation” chapter of the PingFederate *Getting Started* guide).
The server starts but indicates the license file is not found or invalid.	Ensure a current license is installed (see *Installing PingFederate*). If the server is part of a cluster, make sure the license is installed for only one server node, then restart all nodes.

Appendix L

Glossary

access token

A data object by which a client authenticates to a Resource Server and lays claim to authorizations for accessing particular resources.

account link

A persistent name identifier that enables federation of separately established accounts among disparate domains (see also *account linking* and *pseudonym*).

account linking

A form of identity mapping among separate user accounts managed under different domains. The mapping typically involves a name identifier—which may be a pseudonym—used to link the user to each account. The identifier is persisted at the SP site to enable seamless SSO/SLO. Additional attributes may be sent with the identifier.

account mapping

A form of identity mapping by which one or more user attributes is passed in a single sign-on transaction. The attributes are used at the destination site as a means identifying the user and looking up local account information.

adapter

Plug-in software that allows PingFederate to interact with Web applications and authentication systems (see *SSO Integration Kits and Adapters* on page 19).

adapter contract

A list of attributes "hard-wired" to an adapter and conveyed generally via cookies between the adapter and application.

artifact

A reference to a SAML protocol message. The federation partner that receives the artifact dereferences it, identifying the sender, and requests the complete message in a separate SOAP transaction.

Artifact Resolution Service

The SOAP endpoint that processes artifacts returned from a federation partner to retrieve the referenced XML message. Can be used to dereference authentication requests, assertion responses, and SLO messages.

assertion

A SAML XML document that contains identifying information about a particular subject; i.e., a person, company, application, or system. A SAML assertion can contain authentication, authorization, and attribute information about the subject.

Assertion Consumer Service

A SAML-compliant portion of PingFederate in an SP role that receives and processes assertions from an IdP.

attributes

Distinct characteristics that describe a subject. If the subject is a Web site user, attributes may include a name, group affiliation, email address, etc.

attribute contract

A list of attributes, agreed to by the partners in an identity federation, representing information about a user (SAML subject). The attributes are sent from the IdP to the SP during SSO or STS processing.

attribute mapping

A form of identity mapping between IdP and SP user accounts that uses attributes to identify the user or provide supplemental information.

attribute source

An data source used to fulfill a requestor's attribute contract.

audience

The XML element in a SAML assertion that uniquely identifies a Service Provider.

authentication context

An element in a SAML assertion indicating the method or process used by an IdP to authenticate the subject of the assertion; may be used for authorization decisions or auditing compliance.

attribute source

Specific database or directory location containing data needed by an IdP to fulfill a connection partner's attribute contract or by an SP to look up additional attributes to fulfill an adapter contract.

back-channel

Server-to-server, cross-domain communication path using a protocol, typically SOAP, that does not rely on a browser as an intermediary.

binding

A mapping of SAML request and response messages to specific transport protocols (redirect, POST, or artifact).

certificate

A digital file used for identity verification and other security purposes. The certificate, which is often issued by a Certificate Authority (CA), contains a public key, which can be used to verify the originator's identity.

Certificate Revocation List

(CRL) A list of revoked signing certificates, maintained by the issuing authority at a public URL.

channel

A dedicated Outbound Provisioning configuration specific to a particular service partner, data source, and target service.

connection partner

Entities, such as companies, that are part of an identity federation. These entities are referred to as connection partners in the PingFederate configuration process.

credential

Information used to identify a subject for access purposes (e.g., username and password). A credential can also be a certificate.

Database Management System

A system for storing and maintaining user account information and attributes. The tables and columns in the RDBMS are used by PingFederate to create user look-up and attribute retrieval queries. (See *Java Database Connectivity*.)

data store

A database or directory location containing user account records and associated user attributes.

Data Encryption Standard (DES)

A symmetric-key method of encryption.

defederation

Optional user-initiated delinking of an identity federation that uses a persistent name identifier or pseudonym for account linking.

digital signature

A process for verifying the identity of the originator of an electronic document and whether the document has been intercepted or altered. The process involves message signing, signature validation, and signing policy coordination between partners.

endpoint

A terminal or gateway that generates or terminates a stream of information. For example, a PingFederate SP server contains an endpoint for the Assertion Consumer URL.

entity ID

The XML element in a SAML assertion that uniquely identifies an Identity Provider.

Extensible Markup Language

A structured, hierarchical text format—based on SGML (Standard Generalized Markup Language)—for the flexible and organized exchange of data.

grant type

The intermediate credentials that represent a resource owner authorization. Grant types are exchanged by the client with the OAuth Authorization Server in order to obtain an access token.

HTTP cookie

Information sent from a server to a Web browser to identify a registered Web site user. Once the cookie is placed in the browser, it is sent back to the server to identify the user every time the user accesses the site. PingFederate's integration adapters interface with the cookie.

HTTP header

The section of an HTTP request or response containing information about the client or the server. PingFederate can use HTTP headers to look up session information passed by the IdP’s Web application.

HTTP request parameter

A named parameter sent as part of a URL request from a browser to a Web server.

identity federation

A trust agreement between or among organizations, implemented using accepted standards, to provide user-authentication tokens and other user or system attributes securely across domains, primarily to enable cross-domain SSO.

Identity Provider

The identity source or SAML authority that authenticates a subject and provides an SP with a security assertion vouching for that authentication.

IdP-initiated SSO or SLO

An identity federation transaction in which the initial action requiring a security context from an IdP occurs at a IdP’s site. For example, the user is logged on to the IdP and requests protected resources on an SP. The IdP sends authentication information to the SP.

inbound

A direction of message flow coming into a server relative to the server’s identity federation role (IdP or SP). For an IdP, inbound messages include SAML authentication requests. For an SP, inbound messages include SAML assertions.

Java Database Connectivity (JDBC)

A Java API that allows Java programs to interact with databases.

Kerberos ticket

The security token for the Kerberos protocol.

Key Distribution Center

The control center for authentication and authorization for Kerberos.

keysize

The length (in bits) of each key in a keypair.

keypair

The private key and public key represented by a certificate. PingFederate uses the private key of its keypair(s) to generate signatures for assertions, requests, and responses, as applicable.

Lightweight Directory Access Protocol

A set of protocols used for accessing information directories. PingFederate uses the LDAP v3 protocol for user look-up and attribute processing.

metadata

The SAML 2.0 standards define a metadata exchange schema for conveying XML-formatted information between two SAML entities. Metadata includes endpoint URLs, binding types, attributes, and security-policy information.

Network Access Server

(NAS) A RADIUS client server that provides a single point of access to a protected resource.

OAuth Authorization Server

A server that issues access tokens to clients (sometimes on behalf of a resource owner) for use in authenticating a subsequent Representational State Transfer (REST) API call.

OAuth Client

An application that desires access to a resource protected by a Resource Server and interacts with an OAuth Authorization Server to obtain access tokens to do so.

Online Certificate Status Protocol

(OCSP) A standard developed by the Internet Engineering Task Force that enables applications to obtain the current status of signing certificates, indicating whether a certificate has been revoked, via HTTP.

opaque

Not readable. If a user's subject identifier is opaque, the an SSO partner cannot directly identify the user with reference to the source. An persistent identifier, or *pseudonym*, can be used for Account Linking.

outbound

A direction of message flow leaving a server. For an IdP, outbound messages include SAML assertions. For an SP, outbound messages include SAML authentication requests.

partner

See *connection partner*.

policy

A set of rules for handling security token requests in PingFederate.

portal

A Web-based application, accessed using a Web browser, that often aggregates content from multiple providers and/or serves as a central point of entry.

POST

An HTTP method of transmitting data contained in HTML forms, by which the data appears in the message body.

Primary Domain Controller

A role that is assigned to a particular server participating in a Windows network.

principal

A user, system, or process whose identity can be authenticated. See *subject*.

profiles

Rules that describe how to embed SAML assertions into and extract them out of other protocols in order to enable SSO or SLO. Profiles describe SAML request and response flows that fulfill specific use cases.

protected resource

Information, typically accessed via a Web URL, that is protected by an access management system. See *target URL*.

protocol

An agreed-upon format for transmitting data. XML format of SAML request or response messages.

pseudonym

A persistent name identifier assigned to a user and shared among entities, usually with the user’s permission, to enable SSO and SLO. Pseudonyms are often used with the SAML account linking protocol to enable SSO while preventing the discovery of the user's identity or activities.

Public Key Infrastructure

(PKI) Enables users of an unsecured public network, such as the Internet, to securely and privately exchange data and money through the use of keypairs and certificates. The PKI provides for a digital certificate that can identify an individual or an organization and directory services that can store and, when necessary, revoke the certificates.

redirect

A SAML binding that conveys a request or response by sending the user’s browser to another location. For instance, an authentication request can be sent from an SP through a browser to an IdP.

refresh token

A long-lived token used by the client to obtain a new access token without having to obtain fresh authorization from the resource owner.

Remote Authentication Dial-in User Service

(RADIUS) A networking protocol for user-access management that includes specifications for two-factor authentication.

<RequestSecurityToken>

(RST) WS-Trust or WS-Federation XML element identifying a request for validation of a security token, or for validation and then issuance of a replacement security token.

<RequestSecurityTokenResponse>

WS-Trust or WS-Federation XML element identifying a response to an RST and containing either the status of the submitted security token or both the status and (if requested and the received token is valid) a newly issued token for further SSO or Web-Services processing.

Resource Server

A server capable of accepting and responding to resource requests on which an access token is presented.

SAML

See *Security Assertion Markup Language*.

SAML authority

A security domain that issues SAML assertions.

scope

Permissions (for example, creating an event on a calendar) associated with an access token.

Secure Sockets Layer

An encryption protocol that sends data between a client and server over a secure HTTP connection.

Security Assertion Markup Language

(SAML) A standard, XML-based, message-exchange framework enabling the secure transmittal of authentication tokens and other user attributes across domains.

System for Cross-domain Identity Management

(SCIM) A REST-based protocol for provisioning and managing user identities across the Internet (see *www.simplecloud.info*).

security domain

An application or group of applications that trust a common security token used for authentication, authorization, or session management. The token is issued to a user after the user has authenticated to the security domain.

security token

A collection of information used to establish acceptable identity for security purposes. Tokens can be in binary or XML format. A SAML assertion is one kind of security token.

Security Token Service

An entity responsible for responding to WS-Trust requests for validation and issuance of security tokens used for SSO authentication to Web Services.

service-oriented architecture

A loosely coupled application architecture in which all functions or services are accessible via standard protocols. Interfaces are platform and programming-language independent.

Service Provider

A system entity that provides access to a protected resource based on authentication information supplied by an IdP.

SP-initiated SSO or SLO

An identity-federation transaction in which the initial action requiring a security context from an IdP occurs at a SP's site.

session persistence

A mechanism for identifying a user or browser for subsequent requests to a server, needed because the HTTP protocol is stateless. This information is used to lookup state information for the user—for example, items in a shopping cart. PingFederate does not implement session persistence; it facilitates the communication of session information between systems that do.

Simple Object Access Protocol

(SOAP) Defines the use of XML and HTTP to access services, objects, and servers in a platform-independent manner.

Single Logout

The process of logging a user out of multiple “session participants” or sites where the user has started an SSO session.

Single Logout Return Service

The SAML implementation endpoint URL that returns logout requests.

Single Logout Service

The SAML implementation endpoint URL that receives logout requests for processing.

Single Sign-On

(SSO) The process of authenticating an identity (signing on) at one Web site (usually with a user ID and password) and then accessing resources secured by other domains without re-authenticating.

Single Sign-on Service

The SAML implementation endpoint URL that receives authentication requests for processing.

Source ID

A 20-byte sequence used to determine an IdP’s identity.

subject

A person, computer system, or application. In the SAML context, assertions make statements about subjects. See *principal*.

target URL

The SP’s protected resource; the end destination of an SSO event. See *protected resource*.

transient name identifier

A temporary ID used to preserve user anonymity while facilitating account linking.

token authorization

A mechanism for evaluating attribute criteria available during a transaction to determine whether a user is authorized to access resources. A token in this instance can mean any type of security token—for example, SSO, session cookie, or OAuth token.

token exchange

The process by which a security token is exchanged for another security token.

token translators

An aggregate term for both token processors (used by the IdP PingFederate Security Token Service (STS) to handle different types of incoming security tokens) and token generators (used by the SP PingFederate STS to issue various types of tokens).

Uniform Resource Identifier

Identifies a Web resource with a string of characters conforming to a specified format.

Uniform Resource Locator

Identifies a resource according to its Internet location.

virtual server ID

An optional unique identifier by which an identity federation deployment can be known to a specific connection partner.

Web Services Security

A standard mechanism for securing Web Service interactions, often by binding a security token to the Web Service request.

Web Services

Nonbrowser-based, loosely coupled applications that provide modular, programming-language-independent access to specific functions and data across the Internet, via XML and standard protocols.

Web Service Client

An entity that requests a Web Service interaction. In the context of an STS, the Web Service Client would request that a security token be issued for the interaction.

Web Service Enhancement

Supplemental software for the .NET framework provided by Microsoft.

Web Service Provider

In the context of an STS, an entity that requests validation of the security token sent with a client’s request for service.

WS-SX

The OASIS committee working on WS-Trust.

WS-Trust

A standard protocol by which an application can request that an STS issue, validate, or exchange security tokens.

Appendix M

List of Acronyms

ACS	*Assertion Consumer Service*
API	Application Programmer Interface
ARS	*Artifact Resolution Service*
CA	Certificate Authority
CRL	Certificate Revocation List
CSR	Certificate Signing Request
DBMS	*Database Management System*
DMZ	Demilitarized Zone
DN	Distinguished Name (certificate identifier)
DNS	Domain Name System
EIM	Enterprise Identity Management
GUI	Graphical User Interface
HTTP	HyperText Transfer Protocol
HTTPS	Secure HyperText Transfer Protocol
IdM	Identity Management
IdP	*Identity Provider*
IP	Internet Protocol
J2SDK	Java 2 Software Development Kit
JDBC	*Java Database Connectivity (JDBC)*
LDAP	*Lightweight Directory Access Protocol*
NAS	*Network Access Server*
O	Organization
OASIS	Organization for the Advancement of Structured Information Standards
OCSP	Online Certificate Status Protocol
OU	Organizational Unit
PKI	*Public Key Infrastructure*
RADIUS	*Remote Authentication Dial-in User Service*
RDBMS	Relational Database Management System
RST	*<RequestSecurityToken>*

RSTR	*<RequestSecurityTokenResponse>*
SAML	*Security Assertion Markup Language*
SaaS	Software as a Service
SCIM	*System for Cross-domain Identity Management*
SDK	Software Development Kit
SP	*Service Provider*
SLO	*Single Logout*
SOA	*service-oriented architecture*
SOAP	*Simple Object Access Protocol*
SQL	Structured Query Language
SSL	*Secure Sockets Layer*
SSL/TLS	Secure Sockets Layer/Transport Level Security
SSO	*Single Sign-On*
SSTC	Security Services Technical Committee (of OASIS)
STS	*Security Token Service*
TCP	Transmission Control Protocol
URI	*Uniform Resource Identifier*
URL	*Uniform Resource Locator*
WCF	Windows Communication Foundation
WIF	Windows Identity Foundation
WSC	*Web Service Client*
WSP	*Web Service Provider*
WSS	Web Services Security
XASP	X.509 Attribute Sharing Profile
XML	*Extensible Markup Language*

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