PingAccess®

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PingAccess manuals

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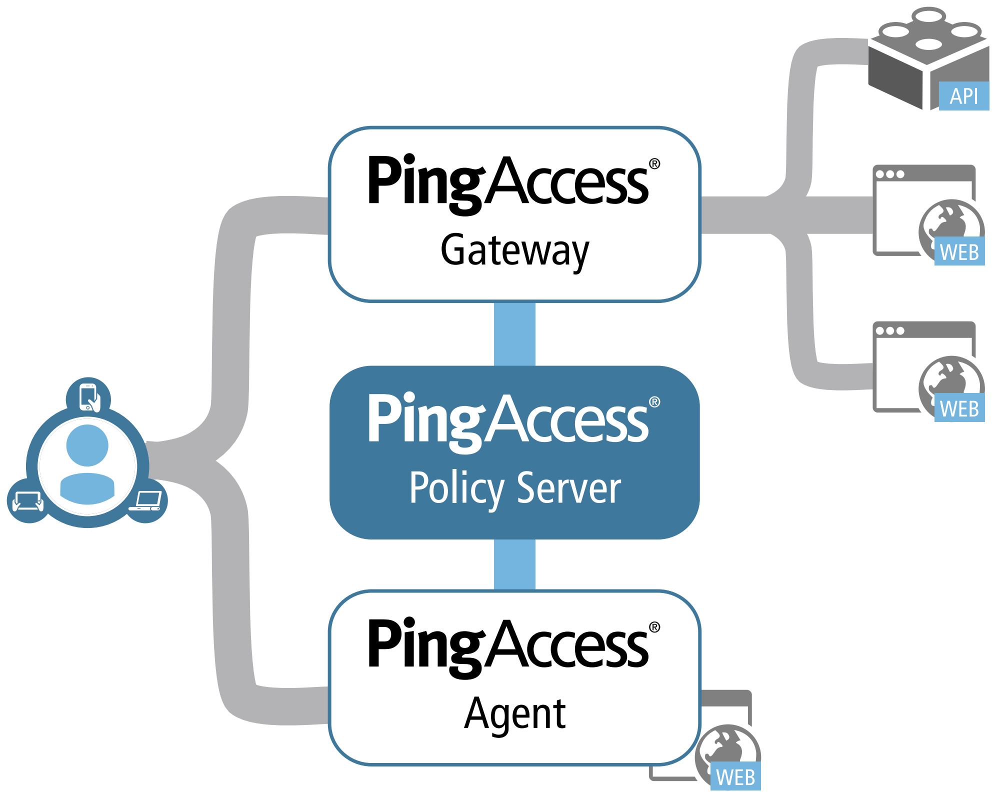
Overview and QuickStart Guide

PingAccess Overview

PingAccess is an identity-enabled access management product that protects Web Applications and APIs by applying security policies to client requests. It works in conjunction with PingFederate to integrate identity-based access management policies using a federated corporate identity store using open standards access protocols.

Access requests are either routed through a PingAccess Gateway to the target Site, or they are intercepted at the target web application server by a PingAccess Agent, which in turn coordinates access policy decisions with a PingAccess Policy Server. In either instance, policies applied to access requests for the target Application are evaluated, and PingAccess makes a policy-based decision to grant or deny access to the requested resource. When access is granted, client requests and server responses can be modified to provide additional identity information required by the target Application.



Using Virtual Hosts

Virtual Hosting enables you to host multiple server or domain names. This allows one server to share resources without requiring all sites on the server to use the same host name. For example, you may want to use multiple names on the same server so that each site name reflects the services offered rather than the actual server name where those sites are hosted.

PingAccess supports virtual hosting by serving requests bound for a set of defined server names and mapping them to requested applications. The target host header presented by the client can optionally be rewritten with the appropriate back-end host name. For example, say the host configured for Site One is `hr121.internal:80`. You configure Application One to use a virtual host of `hr.mycompany.com:80`. You associate Site One with Application One.

PingAccess listens for incoming requests for the site at `hr.mycompany.com:80`. When a client request comes in to `hr.mycompany.com:80`, PingAccess sees the request, looks at the name of the domain configured for the back-end site, and replaces the target Host header with `hr121.internal:80`.

Supporting HTTPS requests causes additional complexity due to the need for SSL/TLS certificates. Prior to availability of SNI in Java 8, an HTTPS port could only present a single certificate. In order to handle multiple Virtual Hosts you have to use a wildcard name certificate or the Subject Alternative Name (SAN) extension. With SNI available, Virtual Hosts can present different certificates on a single HTTPS port. You can assign which certificates (Key Pairs) are used by which Virtual Host on the HTTPS Listeners page - see HTTPS Listeners.

Application and Resource Evaluation

Applications represent Web applications or APIs to which a request is sent. They are defined by a context root and virtual server which must be unique. The context root is the first part of the URL path, starting with a slash (/) and can be arbitrarily long or deep - that is, it can contain any number of slashes. No wildcards are allowed in the context root. For example, `/myApp` or `/hrApps/appOne`. When a request comes in, PingAccess needs to identify the application for the request by matching the request URL prefix against the defined applications. If two or more application context roots start with the same string, PingAccess will match the longest (and therefore most specific) context root first. For example, if App1 has context root `/hrApps` and App2 has context root `/hrApps/myApp`, then a request with URL `/hrApps/myApp/page1` will match App2.

Resources represent parts of the application URL space beyond the context root that have distinct security requirements. All applications have the default Root Resource which corresponds to all URLs not handled by other resources. Any number of additional resources can be defined. Each resource can specify an arbitrary number of URL path prefixes which may contain wildcards.

Resources can be defined in any order, as ordering is not used to determine precedence. Instead, the match that is the most specific for the requested URL path prefix is used to determine which resource was requested.

For example, suppose we have application called **App1** with a Context Root of "/" and the following resources:

- **Res1** with a path prefix of `/foo`
- **Res2** with a path prefix of `/*/bar`
- **Root Resource** with the default path prefix `/`

If a user requests the resource at `/foo/bar`, PingAccess would identify the requested resource as **Res2** and make policy decisions based on that identification.

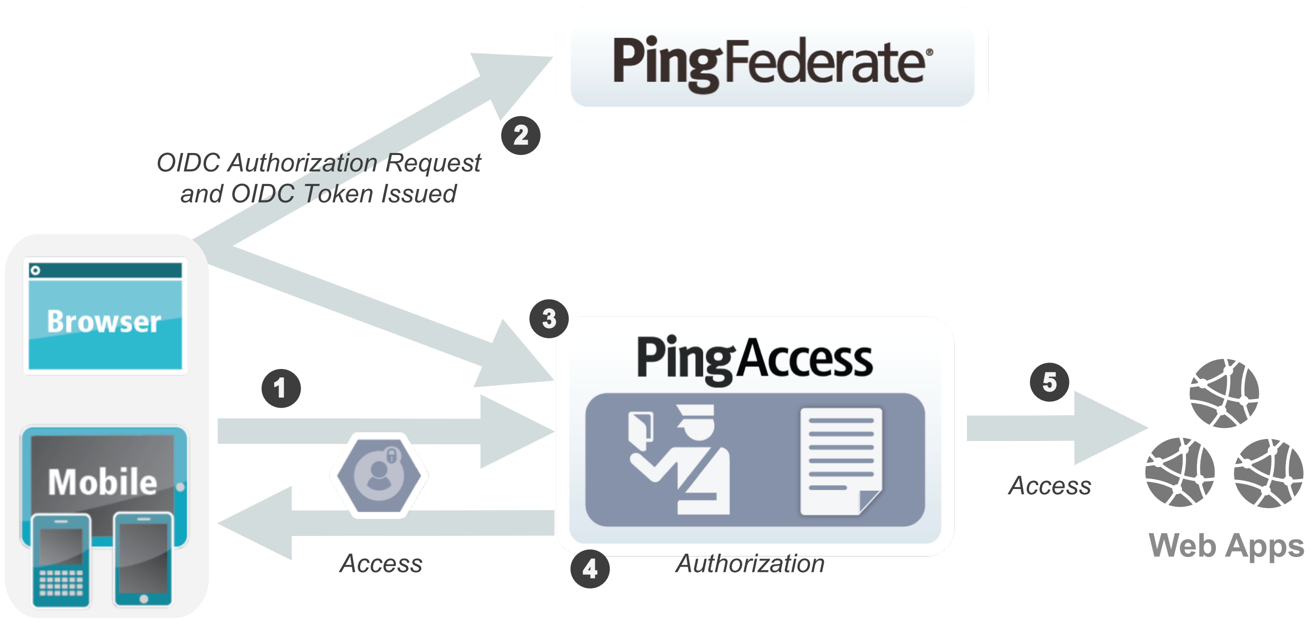
In addition, resources that are associated with an API Application Type can be defined based on the method used with the URL. For example, suppose we have an Application called **App2** defined with the following resources:

- **Res3** with a path prefix of `/foo`
- **Res4** with a prefix path of `/*/bar` for the GET method
- **Res5** with a prefix path of `/*/bar` for the PUT method

If a user requests `/foo/bar` using a GET method, PingAccess would identify the requested resource as **Res4** and make policy decisions based on that identification. A request to `/foo/bar` using a PUT method, however, would result in PingAccess identifying the requested resource as **Res5**.

WAM Session Initiation

Once a user authenticates, PingAccess applies the application and resource-level policies to the request. Once policy evaluation is passed, any required token mediation between the back-end Site and the authenticated user is performed. The user is then granted access to the Site



Processing Steps:

1. When a user requests a Web resource from PingAccess, PingAccess inspects the request for a PA Token.
2. If the PA Token is missing, PingAccess redirects the user to an OpenID Connect Provider (OP) for authentication.

   ➡ **Info:** When using an OP, an OAuth Client must already be configured in PingAccess. For steps on configuring an OAuth Client within PingFederate, see *Configuring a Client*. To then configure that OAuth Client within PingAccess, see the Web Session section on the *PingFederate* page.
3. The OP follows the appropriate authentication process, evaluates domain-level policies, and issues an OpenID Connect (OIDC) ID Token to PingAccess.
4. PingAccess validates the ID Token and issues a PA Token and sends it to the browser in a cookie during a redirect to the original target resource. Upon gaining access to the resource, PingAccess evaluates application and resource-level policies and optionally audits the request.

   ➡ **Info:** PingAccess can perform *Token Mediation* by exchanging the PA Token for the appropriate security token from the PingFederate STS or from a cache (if token mediation occurred recently).
5. PingAccess forwards the request to the target site.
6. PingAccess processes the response from the site to the browser (step not shown).

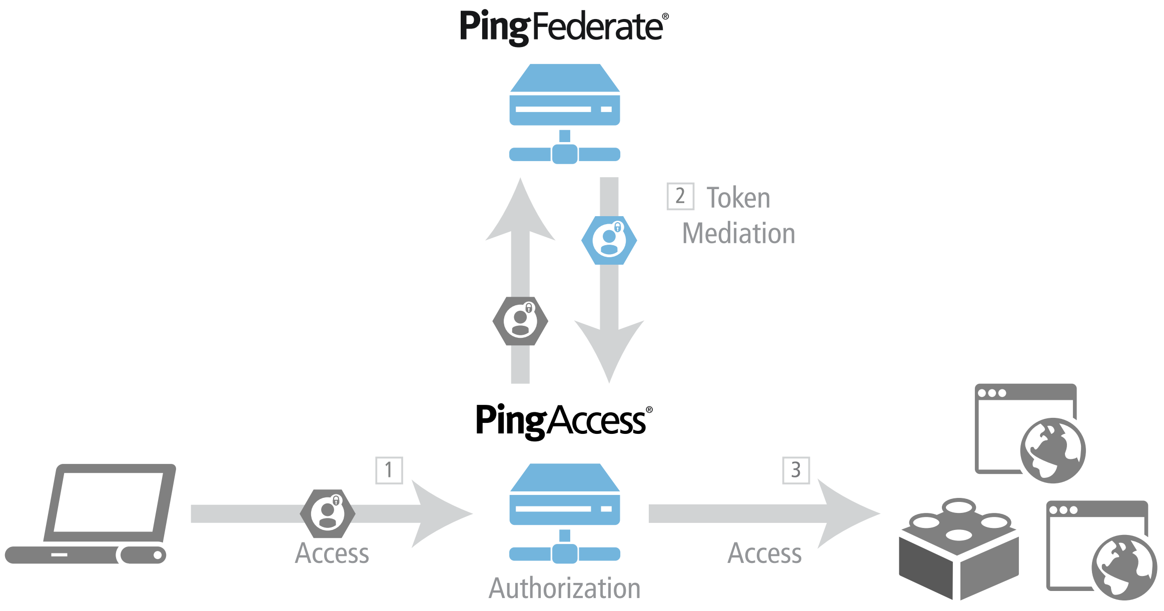
➡ **Info:** See the *Web Sessions* section for more information.

Token Mediation

When planning a PingAccess deployment, it is necessary to take stock of existing applications and their authentication requirements and mechanisms. When an existing token-based authentication mechanism is in use, retrofitting that mechanism may not always be desirable or cost-effective.

Token Mediation allows a PingAccess gateway to use a PingFederate token generator to exchange the PA Token or an OAuth Bearer Token for a security token used by the foreign authentication system. The access request is transparent to the user, allowing PingAccess to transparently manage access to systems using those foreign tokens. The request is also transparent to the protected application, which handles the access request as if it came from the user directly. Once token mediation has occurred, the token used for accessing the application is cached for future use during the session.

The following illustration shows an example of token mediation using PingFederate to exchange a PA Token or OAuth Bearer Token for a different security token.



Processing Steps:

1. A user requests a Resource from PingAccess with a PA Token or OAuth Bearer Token.

   Info: This example assumes the user has already obtained a PA Token or OAuth Bearer Token. See *Web Access Management* or *Using the OAuth Authorization Server* for details on how users authenticate with PingFederate and obtain a PA Token or OAuth Bearer Token.
2. PingAccess evaluates resource-level policies and performs token mediation by acquiring the appropriate security token from the PingFederate STS specified by the Site Authenticator.
3. PingAccess sends the request to the Site (Web application) with the appropriate token.
4. PingAccess returns the response to the client (not shown).

Server-Side Session Management

The server-side session management feature allows for tighter session control, leveraging the single logout capabilities provided by PingFederate 7.2. The ability to enforce single logout enables the following scenarios:

1. PingAccess can reject a PingAccess cookie associated with a session that has been typically based on end user driven logout.
2. The end user can initiate a logout from all PingAccess issued web sessions using a centralized logout.

This feature performs a validation check with PingFederate when protected resources are served. The OpenID Connect option must be enabled in the OAuth 2.0 Authorization Server (AS) role, and access to the OpenID Connect session revocation API must be enabled.

Using the OAuth Authorization Server

PingAccess supports the *Bearer Token Security Model* and the *Validation Grant Type* extension grant and uses an OAuth AS in the following ways:

- Works with OAuth Authorization Servers such as the PingFederate *OAuth AS* to authorize access to protected Resources.
- Protects applications by requiring an OAuth bearer access token (see *Section 2.1* of RFC 6750 for supported token transport details).
- Acts as an OAuth Resource Server, requesting validation from the OAuth AS for the bearer access token it receives from a client making a protected-resources call. The OAuth AS validates the access token and sends token attributes to PingAccess, which evaluates the returned OAuth details against policies set in the Applications section of the *Policy Manager*.
- Grants access to a Resource based on the use of Rules in combination with the OAuth AS validation.

Downloading and Installing the QuickStart Demo Application

About the PingAccess Quickstart Demo App

The PingAccess Quickstart Application is a pre-packaged web application and PingAccess/PingFederate configuration that can be used to explore the features and functionality of PingAccess.

The configuration runs on your local system. In order to use the QuickStart Application, you will need a PingAccess license to use the Quickstart Application. *Request a License Key* from Ping Identity to get started.

Download and Install the Quickstart Application

1. Navigate to the *Ping Identity Product Downloads* page and download both PingFederate and PingAccess.
2. From the same page, download the PingAccess Quickstart Demo App
3. Unzip the PingAccess Quickstart Demo App zip file, then open `pingaccess-quickstart-<version>/ReadMeFirst.pdf`
4. Follow the setup instructions included in the PDF to install the Quickstart environment

PingAccess Administrator's Guide

The PingAccess Administrator's Guide provides comprehensive reference information about configuring PingAccess.

System Tasks

Installation and Intial Setup

System Requirements

PingAccess is certified as compatible for deployment and configuration with the minimum system specifications defined below.

Software Requirements

Ping Identity has qualified the following configurations and certified that they are compatible with the product. Variations of these platforms (for example, differences in operating system version or service pack) are supported up until the point at which an issue is suspected as being caused by the platform or other required software.

Operating Systems

➡ **Info:** PingAccess has been tested with default configurations of operating system components. If your organization has customized implementations or has installed third-party plug-ins, deployment of the PingAccess server may be affected.

- Microsoft Windows Server 2008 R2 SP1
- Microsoft Windows Server 2012 Standard
- Microsoft Windows Server 2012 R2 Datacenter
- Red Hat Enterprise Linux ES 6.6
- Red Hat Enterprise Linux ES 7.0
- SUSE Linux Enterprise 11 SP3

Virtual Systems

Although Ping Identity does not qualify or recommend any specific virtual-machine (VM) products, PingAccess has been shown to run well on several, including VMWare, Xen, and Windows Hyper-V.

➡ **Info:** This list of products is provided for example purposes only. We view all products in this category equally. Ping Identity accepts no responsibility for the performance of any specific virtualization software and in no way guarantees the performance and/or interoperability of any VM software with its products.

Java Runtime Environment

- Oracle Java 7 update 75 (64-bit)
- Oracle Java 8 update 31 (64-bit)

Supported PingFederate

- PingFederate 7.3
- PingFederate 8.0

Supported Browsers for End Users

- Chrome

- Firefox
- Safari
- Internet Explorer 8 and higher
- Android 5.0
- iOS 8

Supported Browsers for Admin Console

- Chrome
- Firefox
- Internet Explorer 9 and higher

Audit Event Storage (External Database)

- Oracle 11g R2

Hardware Requirements

Info: Although it is possible to run PingAccess on less powerful hardware, the following guidelines accommodate disk space for default logging and auditing profiles and CPU resources for a moderate level of concurrent request processing.

Minimum Hardware Requirements

- 4 CPU/Cores
- 2 GB of RAM
- 2.1 GB of available hard drive space

Minimum Hardware Recommendations

- Multi-CPU/Cores (8 or more)
- 4 GB of RAM
- 2.1 GB of available hard drive space

Port Requirements

The following table summarizes the ports and protocols that PingAccess uses to communicate with external components. This information provides guidance for firewall administrators to ensure the correct ports are available across network segments.

Info: *Direction* refers to the direction of requests relative to PingAccess. *Inbound* requests are requests received by PingAccess from external components. *Outbound* requests are requests sent by PingAccess to external components.

Service (Type of Traffic)	Protocol	TCP/UDP	Default Port	Source	Destination	Direction	Description
PingAccess Administrative Console	HTTPS	TCP	9000	PingAccess Administrator browser, PingAccess administrative API REST calls, PingAccess Replica Admin and	PingAccess Administration Engine	Inbound	Used for incoming requests to the PingAccess administrative console. Configurable using the `admin.port`

Service (Type of Traffic)	Protocol	TCP/UDP	Default Port	Source	Destination	Direction	Description
				clustered Engine nodes			property in the *run.propertie* file. This port is also used by clustered engine nodes and the replica admin node to pull configuration data using the admin REST API.
PingAccess Engine	HTTP/ HTTPS	TCP	3000 [1]	Client Browser, Mobile Devices, PingFederate Engine	PingAccess Engine	Inbound	Used for incoming requests to the PingAccess runtime engine. Configurable using the *Listeners* on page 69 configuration page.
PingAccess Agent	HTTP	TCP	3030	PingAccess Agent	PingAccess Engine	Inbound	Used for incoming Agent requests to the PingAccess runtime engine. Configurable using the `agent.http.port` property of the *run.propertie* file.
PingFederate Traffic	HTTPS	TCP	9031	PingAccess Engine	PingFederate	Outbound	Used to validate OAuth Access Tokens, ID Tokens,

Service (Type of Traffic)	**Protocol**	**TCP/UDP**	**Default Port**	**Source**	**Destination**	**Direction**	**Description**
							make STS calls for Identity Mediation, and return authorized information about a user. Configurable using the *PingFederate Settings* page within PingAccess.
PingAccess Cluster Traffic	JGroups	TCP	7610	PingAccess Engine	PingAccess Engine	Inbound	Used for communications between engine nodes in a cluster. Configurable using the *run.properties* file.
PingAccess Cluster Traffic	JGroups	TCP	7710	PingAccess Engine	PingAccess Engine	Inbound	Used by other nodes in the cluster as part of the cluster's failure-detection mechanism. Configurable using the *run.properties* file.
PingAccess Cluster Traffic	JGroups	UDP	7500	PingAccess Engine	PingAccess Engine	Inbound	Used by other nodes in the same cluster to share information. Configurable using the *run.properties* file.

1. In addition to port 3000, additional engine listener ports defined in the *Listeners* on page 69 configuration need to be open as well.

Installing the Oracle JDK

The 64-bit Oracle JDK provides the supported environment for PingAccess. See *System Requirements* on page 10 for information about which JDK versions are supported.

Info: You must install the Oracle JDK before installing PingAccess.

To install the Oracle JDK for Windows and Linux:

1. Download and install Oracle JDK from *http://www.oracle.com/technetwork/java/javase/downloads/index.html*.
2. Set the `JAVA_HOME` environment variable to the JDK installation directory path. Set the variable at either the system or user level.
3. Add the JDK `/bin` directory path to the beginning of the `PATH` variable for your platform so it is available for scripts that depend on it.

Installing PingAccess

Prior to starting the installation, the following prerequisites must be met:

- Ensure you are logged on to your system with appropriate privileges to install and run an application.

  Note: On Linux, we recommend that you install and run PingAccess as a non-root user.
- The Oracle JDK must be installed and the JAVA_HOME and PATH variables are set correctly (see *Install the Oracle JDK*).
- You must have a `pingaccess.lic` license file. If you do not have one, you can request an evaluation key at the *Request a License Key page* (`www.pingidentity.com/content/pic/en/products/request-license-key.html`).

1. Extract the distribution ZIP file into your installation directory.
2. Copy your license key file to `<PA_HOME>/conf/pingaccess.lic`.

   Note: PingAccess will not start without a valid license key file.

Tip: If you are deploying PingAccess in a cluster configuration, see *Configure PingAccess Servers into a Cluster*.

Change Configuration Database Passwords

The PingAccess configuration database is protected by two passwords - a file password and a user password. These passwords both default to `2Access`, but should be changed for production environments.

Changing either password requires PingAccess be shut down.

1. Open a terminal window and change to the `<PA_HOME>/bin` directory.
2. Ensure that the `JAVA_HOME` environment variable is set correctly by executing the command `echo $JAVA_HOME`.
3. Ensure that the proper Oracle Java executable is in your path. Enter the command `java -version`. If this command returns a value indicating that the Java executable is not a supported version of Oracle Java, correct this issue before continuing.
4. Shut down PingAccess.
5. Optional: (Optional) To change the database file password, use the following commands:
   - On Windows: `dbfilepasswd.bat` *`old_password new_password`*
   - On Linux: `./dbfilepasswd.sh` *`old_password new_password`*
6. Optional: **Conditional:** If you changed the database file password, update the `pa.jdbc.filepassword` property in `<PA_HOME>/conf/run.properties` with the obfuscated password output from the command used in the preceding step.
7. Optional: (Optional) To change the database user password, use the following commands:
   - On Windows: `dbuserpasswd.bat` *`file_password old_password new_password`*

- On Linux: `./dbuserpasswd.sh` *`file_password old_password new_password`*

8. Optional: **Conditional:** If you changed the database user password, update the `pa.jdbc.password` property in `<PA_HOME>/conf/run.properties` with the obfuscated password output from the command used in the preceding step.

Starting and Stopping PingAccess

Starting PingAccess

1. In a command prompt or terminal window, change to the PingAccess `bin` directory:
   - On Linux: `cd <PA_HOME>/bin`
   - On Windows: `cd <PA_HOME>\bin`
2. Start the `run` script for the platform:
   - On Linux: `./run.sh`
   - On Windows: `run.bat`

Wait for the script to execute. PingAccess is started when you see the message “PingAccess running...” in the command window.

Stopping PingAccess

1. Press `Ctrl+C` in the command-prompt or terminal window.
2. **Conditional:** If PingAccess is running on Windows, press `y` when prompted to terminate the script.

Running PingAccess for the First Time

1. Start PingAccess by running the following script:
   - On Windows: `<PA_HOME>\bin\run.bat`
   - On Linux: `<PA_HOME>/bin/run.sh`

   Info: The `run.sh` script requires `bc`, the GNU command line calculator. To install `bc` on SUSE Linux Enterprise Server, execute the following command: `zypper install bc`.
2. Wait for the script to finish the start up. The server is started when you see the message “ `PingAccess running...`” in the command window.

   Info: If you are using the PingAccess Quick-Start Application, at this point there are additional initialization steps required to complete your setup. See the Quick-Start Application's ReadMeFirst for more information.

   Info: If you have not yet installed a PingAccess license, the server does not start up (see *Install PingAccess* for information on obtaining a license).
3. Launch your browser and go to: https://<DNS_NAME>:9000

   <DNS_NAME> is the fully-qualified name of the machine running PingAccess.
4. Sign in with the default username and password:

   Username: `Administrator`

   Password: `2Access`
5. Read and accept the license agreement.
6. Change the default administrator password on the **First Time Login** page, then click **Continue**.

   Info: The new password must conform to the rules specified by the `pa.admin.user.password.regex` property in `run.properties`.

   The PingAccess administrative console appears.

Running PingAccess as a Service

Running PingAccess as a Linux Service

PingAccess can run as a Linux service. This enables PingAccess to start automatically when Linux is started or rebooted. The service runs as `root` user by default, or a specific user if specified.

Tip: Before performing this procedure, ensure that PingAccess runs normally by manually starting the server. See *Run PingAccess for the First Time* for more infomation.

Configuring PingAccess to Run as a Linux Service

Note: The service script will only start if JAVA_HOME and PA_HOME are set and the PingAccess license file is found.

1. Copy the PingAccess script file from `<PA_HOME>/sbin/linux/pingaccess` to `/etc/init.d`.
2. (Optional) Create a new user to run PingAccess.
3. Create the folder `/var/run/pingaccess` and ensure that the user who will run the service has read and write permission to the folder.
4. Edit the script file `/etc/init.d/pingaccess` and set the values of following variables at the beginning of the script:
   - `export JAVA_HOME=` specify the Java install folder
   - `export PA_HOME=` specify the PingAccess install folder
   - `export USER=` (optional) specify user name to run the service, or leave empty for default
5. Register the service by running the command "`chkconfig --add pingaccess`" from the `/etc/init.d` folder.
6. Make the service script executable by running the command "`chmod +x pingaccess`"

Once registered, you can use the `service` command to control the pingaccess service. The available commands are:

start

Start the PingAccess Service

stop

Stop the PingAccess Service

restart

Restart the PingAccess Service

status

Show the status of the PingAccess service and the service PID

The command `service pingaccess status` displays the current status of the running PingAccess service.

Configuring Multiple Instances of PingAccess as Linux Services

For hosts running multiple instances of PingAccess that need to be started as a service, follow the procedure used for Running PingAccess as a Linux Service, but make the following modifications to the script for each service:

- Use a unique script name for each instance
- Use a separate directory structure for each instance in the filesystem
- Configure the following settings in the script file for each instance:
  - `APPNAME`: A unique value for each instance
  - `PA_HOME`: The path to the PingAccess instance
  - `JAVA_HOME`: The path to the Java installation folder
  - `USER`: Optional value for the user name used to run the service

Removing the PingAccess Linux Service

Note: The following commands must be run as the `root` user.

1. Stop the service by running `/etc/init.d/pingaccess stop`.
2. Run `chkconfig --delete pingaccess`.
3. (Optional) Delete the `/etc/init.d/pingaccess` script

Running PingAccess as a Windows Service

You can set up PingAccess to run in the background as a service on Windows running 64-bit processors.

Configuring PingAccess to Run as a Windows Service

➡ **Info:** Before performing this procedure, ensure that PingAccess runs normally by manually starting the server (see *Run PingAccess for the First Time*).

This configuration allows you to start PingAccess automatically when Windows starts.

1. Install PingAccess.

   ➡ **Info:** Ensure `JAVA_HOME` is set as a system variable (see *Install the Oracle JDK*).
2. Ensure you are logged on with full Administrator privileges.
3. Start a `Command Prompt` as an Administrator.
4. In the `Command Prompt`, run `install-service.bat`. This script is located in `<PA_HOME>\sbin\windows`.
5. Open the Windows **Control Panel** > **Administrative Tools** > **Services**.
6. Right-click **PingAccess Service** from the list of available services and select **Start**. The service starts immediately and restarts automatically on reboot. (You can change the default **Start type** setting in the **Properties** dialog.)

Removing the PingAccess Windows Service

To remove the PingAccess Windows Service, perform the following steps as an Administrator:

1. Open a `Command Prompt`
2. Change the current directory to `<PA_HOME>\sbin\windows`
3. Run `uninstall-service.bat`
4. When the script has finished, remove the PA_HOME enviornment variable from the system.

Uninstalling PingAccess

1. Shut down PingAccess. (see *Start and Stop PingAccess*).
2. Delete the PingAccess installation directory.

Clustering

PingAccess can be configured in a clustered environment to provide higher scalability and availability for critical services. While it is important to understand that there may be tradeoffs between availability and performance, PingAccess is designed to operate efficiently in a clustered environment.

PingAccess clusters are made up of three types of nodes:

Administrative Console

Provides the administrator with a configuration interface

Replica Administrative Console

Provides the administrator with the ability to recover a failed administrative console using a manual failover procedure.

Clustered Engine

Handles incoming client requests and evaluates policy decisions based on the configuration replicated from the administrative console

A load balancer is typically used to distribute the load amongst the nodes in the cluster.

Any number of clustered engines can be configured in a cluster, but only one administrative console and one replica administrative console can be configured in a cluster.

The engines and replica administrative console use a pull replication model to periodically obtain configuration updates. State information replication is not part of a default cluster configuration, but some state information can be replicated using PingAccess subclusters.

PingAccess Subclusters

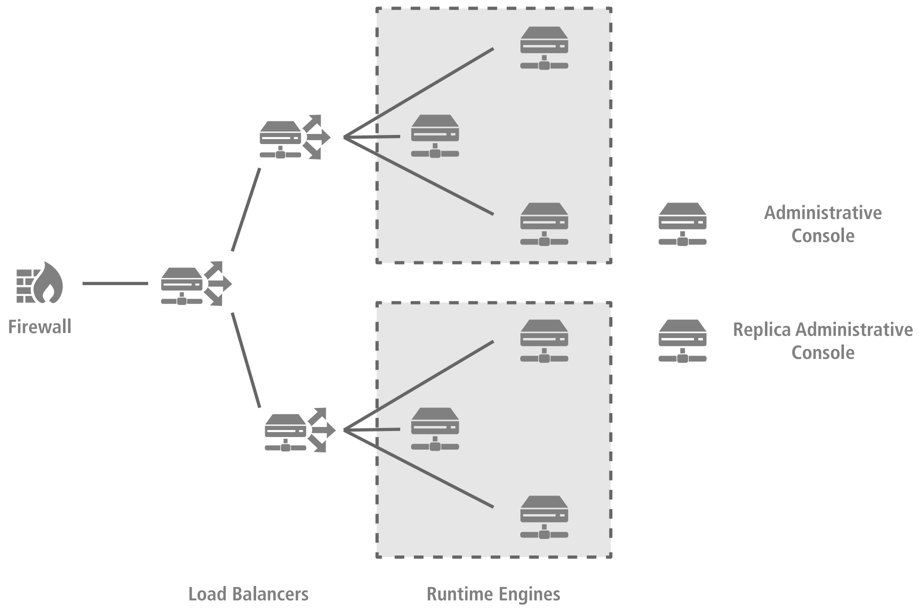
Subclusters are a method to provide better scaling of very large PingAccess deployments by allowing multiple engine nodes in the configuration to share certain information. Place an additional load balancer in front of each subcluster distribute connections to the nodes in the subcluster.

Subclusters serve three purposes:

- Providing fault-tolerance for mediated tokens if a cluster node is taken offline.
- Reducing the number of STS transactions with PingFederate when the front-end load balancer does not provide a sticky session.
- Ensure rate limits are enforced properly if the front-end load balancer does not provide a sticky session.

If token mediation and rate limiting are not used in your environment, subclustering is not necessary.

Info: This cache can be tuned using the EHCache Configuration Properties listed in the *Configuration Properties* documentation.



Configure a PingAccess Cluster

Prior to configuring your cluster, PingAccess should be set up as a `STANDALONE` server. The initial node becomes the primary administrative console, and is used to configure the rest of the cluster.

1. Install PingAccess on each cluster node
2. Navigate to **Settings** > **System** > **Clustering** and define the **Primary Administrative Node** as a *host*:*port* pair.

   The *host* must be a resolvable DNS name for the node or the node's IP address. The *port* is the TCP port PingAccess listens to for the administrative interface. The default port is `9000`.
3. If a replica administrative node will be used in the cluster, perform the following steps:
   a) Define a *host*:*port* pair for the replica node.
   b) Click to download the replica administrative node configuration file.
   c) Copy the downloaded `replica1_data.zip` file to the replica administrative node.

> **Note:** If a replica administrative node is added after the cluster has been deployed, it will be necessary to update the configuration for each engine node when the replica administrative node is added.

4. Navigate to **Settings** > **Security** > **Key Pairs** and create a new key pair to assign to the `ADMIN` listener. The key pair needs to be valid for both the primary and replica administrative nodes.

   > **Tip:** If a replica administrative node is not defined during the initial cluster configuration, you might still opt to define a subject alternative name for a future replica administrative node. This avoids having to reissue the keys when adding the replica administrative node in the future.

5. Navigate to **Settings** > **Networking** > **Listeners** and assign the newly created key pair to the `ADMIN` listener.
6. Open `conf/run.properties` in an editor and change the `pa.operational.mode` value to `CLUSTERED_CONSOLE`.
7. Restart PingAccess on the administrative node.

Perform steps 8-10 on the replica administrative node, if one has been configured.

8. Unzip `replica1_data.zip` in the *`PA_HOME`* directory.

   > **Note:** This zip file contains configuration files that may overwrite existing files on the system. If you are prompted to overwrite files, answer `Yes`.

9. Open `conf/run.properties` in an editor and change the `pa.operational.mode` value to `CLUSTERED_CONSOLE_REPLICA`
10. Start PingAccess on the replica administrative node.

For each engine node, perform steps 11-16.

11. Navigate to **Settings** > **System** > **Clustering** and click **New Engine**.
12. After defining the engine's parameters, click **Save & Download** to download the engine configuration zip file.
13. Copy *`engine_name`*`_data.zip` to the engine node.
14. On the engine node, unzip *`engine_name`*`_data.zip` in the *`PA_HOME`* directory.

    > **Note:** This zip file contains configuration files that may overwrite existing files on the system. If you are prompted to overwrite files, answer `Yes`.

15. On the engine node, open `conf/run.properties` in an editor and change the `pa.operational.mode` value to `CLUSTERED_ENGINE`.
16. Start PingAccess on the engine node.

Navigate to **Settings** > **System** > **Clustering** to check your cluster's status. If everything is configured properly, the cluster engine nodes and optional replica administrative node should show a green status icon, indicating that the cluster is operational.

You can optionally configure each node to run PingAccess as a service set to automatically run when the node is started. For more information about configuring PingAccess as a service, see *Configuring PingAccess to Run as a Linux Service* on page 16 or *Configuring PingAccess to Run as a Windows Service* on page 17 for more information.

Configure PingAccess Subclusters

1. Modify `<`*`PA_HOME`*`>/conf/run.properties` and change the `pa.cluster.interprocess.communication` value from `none` to either `tcp` or `udp`.

   > **Info:** Using UDP for the interprocess communication allows a multicast group to be used for this communication, which for a larger subcluster may be more efficient.

2. **Conditional:** If TCP is used for interprocess communication, configure the `pa.cluster.tcp.discovery.initial.hosts` value to specify a list of initial hosts to contact for group discovery.
3. **Conditional:** If UDP is used for interprocess communication, optionally configure the `pa.cluster.mcast.group.address` and `pa.cluster.mcast.group.port` values for each subcluster.

4. Update the `pa.cluster.bind.address` with the IP address of the network interface that should handle the interprocess communication traffic for the cluster.
5. Place a load balancer in front of each subcluster to distribute the load across the subcluster nodes.
6. Restart the engine nodes.

Manually Fail Over to the Replica Administrative Node

The Replica Administrative Node is intended to be used for disaster recovery purposes. If the clustered console is recoverable, then that recovery should be used rather than failing over to the Replica Administrative Node.

Warning: Only one primary administrative node should be running for the cluster at any given time.

1. Open *<PA_HOME>*`/conf/run.properties` in an editor.
2. Locate the `pa.operational.mode` line and change the value from `CLUSTERED_CONSOLE_REPLICA` to `CLUSTERED_CONSOLE`

   This change is detected while the node is running, and does not require a restart of the node.

Reinstating a Replica Administrative Node after Failing Over

Once the console has been failed over to the replica, you need to set up a new replica console again.

1. Install the new replica node.
2. Change the `run.properties` value for `pa.operational.mode` to `CLUSTERED_CONSOLE_REPLICA`
3. Go to **Settings | Clustering** and change the **Primary Administrative Node** hostname and port to the failed over node.
4. Remove the **Replica Administrative Node** public key, then change the **Replica Administrative Node** hostname and port to point to the new replica node.

   Tip: If your key pair does not include a wildcard, you will want to use the same hostname as the original console in order to avoid having to recreate the console key pair and the bootstrap.properties files for each engine.
5. Click the download icon next to the **SAVE** button to download the bootstrap file for the replica administrative node.
6. Copy the downloaded file to the new replica administrative node's *<PA_HOME>*`/conf` directory, and rename it to `bootstrap.properties`
7. Edit *<PA_HOME>*`/conf/run.properties` on the new replica administrative node and change the `pa.operational.mode` value to `CLUSTERED_CONSOLE_REPLICA`
8. Start the new replica node
9. You can verify replication has completed by monitoring the *<PA_HOME>*`/log/pingaccess.log` file and looking for the message "Configuration successfully synchronized with administrative node"

If you want to then switch back to the original console, shut down the original replica node, and fail over back to the newly created replica console. Follow the above steps a second time to re-establish the original replica node.

Configuring Logging

Security Audit Logging

The PingAccess audit logs record a selected subset of transaction log information at runtime plus additional details, intended to facilitate security auditing and regulatory compliance. The logs are located in the /logs directory of your PingAccess installation. Elements of the logs are described in the table below and configurable in the blitz4j.properties file located in <*PA_HOME*>/conf.

PingAccess generates these logs that document server events:

- pingaccess_engine_audit.log--Records transactions of configured Resources. Additionally, the log records transaction details when PingAccess sends requests to PingFederate (for example, STS, OAuth2, JWS).

- pingaccess_api_audit.log--Records PingAccess administrative API transactions. These transactions represent activity in the PingAccess administrative console. This log also records transaction activity if you are using scripts to configure PingAccess.

Audit Log Configuration

Item	Description
`%d`	Transaction time.
`exchangeId`	Identifies the ID for a specific request/response pair.
`AUDIT.authMech`	Mechanism used for authentication. Engine Auditing - Cookie (WAM session), OAuth, unknown (for example, pass-through or static assets). Pass-through assets are Resources with no policies or Web session configured. Admin Auditing - Basic, OAuth, Cookie, unknown (unknown displays only in an authentication failure).
`AUDIT.client`	IP address of the requesting client.
`AUDIT.failedRuleName`	Name of the Rule that failed. If no Rule failure occurred, this field is blank. This element is applicable only to the pingaccess_engine_audit.log.
`AUDIT.failedRuleType`	Type of Rule that failed. If no Rule failure occurred, this field is blank. This element is applicable only to the pingaccess_engine_audit.log.
`AUDIT.failedRuleClass`	The Java class of Rule that failed. If no Rule failure occurred, this field is blank. This element is applicable only to the pingaccess_engine_audit.log.
`AUDIT.failedRuleSetName`	Name of the containing Rule Set that failed. If no Rule failure occurred, this field is blank. This element is applicable only to the pingaccess_engine_audit.log.
`AUDIT.host`	PingAccess host name or IP address.
`AUDIT.targetHost`	Backend target that processed the request and generated a response to the PingAccess engine.
`AUDIT.method`	HTTP method of the request. For example, GET.
`AUDIT.resource`	Name of the Resource used to fulfill the request. This element is applicable only to the pingaccess_engine_audit.log.
`AUDIT.responseCode`	HTTP status code of the response. For example, 200.
`AUDIT.requestUri`	Request URI portion of the request (for example, /foo/ bar).
`AUDIT.subject`	Subject of the transaction.
`AUDIT.trackingId`	The PingFederate Tracking ID. This element can be used to help correlate audit information in the PingAccess audit log with information recorded in the PingFederate audit log. The value of this depends on whether the application type is `Web` or `API`. If the application type is `Web`, the value is presented as `tid:`*`<Session_Identifier>`*. The *<Session_Identifier>* can be used by the *PingFederate*

Item	Description
	Session Revocation API to revoke the session without disabling the user in the identity store. If the application type is `API`, the value is presented as `atid:<Hash>`. The *<Hash>* value is derived from the OAuth Access token for the session, and only serves as an identifier; it cannot be used for session revocation.
`AUDIT.reqReceivedMillisec`	Time in milliseconds (since 1970) that a client request was first received
`AUDIT.reqSentMillisec`	Time in milliseconds (since 1970) that the agent or engine sent a backchannel or proxy request
`AUDIT.respReceivedMillisec`	Time in milliseconds (since 1970) that the agent or engine received a response from a backchannel call or proxy request
`AUDIT.respSentMillisec`	Time in milliseconds (since 1970) that a response was sent back to the client
`AUDIT.roundTripMS`	The respSentMillisec time minus the reqReceivedMillisec time. This represents the total number of milliseconds it took PingAccess to respond to a client's request (including the proxyRoundTripMS).
`AUDIT.proxyRoundTripMS`	The respReceivedMillisec time minus the reqSentMillisec time. This represents the total number of milliseconds PingAccess was waiting for another entity to respond to a backchannel call or proxy request.

Logging

PingAccess logging is handled by the Blitz4j asynchronous logging library, configured using the `<PA_HOME>/conf/blitz4j.properties` file. Blitz4j is an extension of the Log4j framework, so the `blitz4j.properties` file is similar to a `log4j.properties` file.

Info: Audit logs are also configurable in the `blitz4j.properties` file. These logs record a selected subset of transaction log information at runtime plus additional details (see *Security Audit Logging*).

By default, logging information is output to `<PA_HOME>/logs/pingaccess.log`, and file logging uses the *rolling* file appender. PingAccess keeps a maximum of 10 log files, each with a maximum size of 100 MB. Once 10 files accumulate, PingAccess deletes the oldest. These defaults can be changed by locating and modifying the following properties in the `asynchronous file logging configuration` section of `blitz4j.properties`:

- `log4j.appender.file.File=./logs/pingaccess.log`
- `log4j.appender.file.MaxFileSize=100MB`
- `log4j.appender.file.MaxBackupIndex=10`

Tip: The default log level is `DEBUG`. We recommend that once PingAccess is configured and is in use in a production environment, logging be configured to use the lowest, most appropriate level for your needs.

In addition to the standard Blitz4j items, PingAccess adds the following custom item that can be used in the `blitz4j.properties` configuration:

Item	Description
`exchangeId`	Identifies the ID for a specific request/response pair.

For example, the following line from `blitz4j.properties` incorporates the `exchangeId` in the output:

```
log4j.appender.file.layout.ConversionPattern=%d{ISO8601} %5p
 [%X{exchangeId}] %c:%L - %m%n
```

Note: The `%X` conversion character is required for the `exchangeId` to be displayed properly.

Configuring Log Levels

Define log levels for specific package or class names in order to get more (or less) logging from a class or group of classes. If the log level is not specified for a particular package or class, the settings for the root logger are inherited.

1. Locate this line: `log4j.rootLogger=DEBUG,file`
2. Modify the first value in the comma-separated list to one of the valid log levels: `OFF`, `FATAL`, `ERROR`, `WARN`, `INFO`, `DEBUG`, `TRACE`. For example, to apply `TRACE` level logging, change `log4j.rootLogger=DEBUG,file` to `log4j.rootLogger=TRACE,file`

Configuring a Class or Package Log Level

1. Open the file *<PA_HOME>*`/conf/blitz4j.properties` in an editor and locate line containing `log4j.logger.`*<classname>*.
2. Set the first value in the comma-separated list to one of the valid log levels:

   `OFF`, `FATAL`, `ERROR`, `WARN`, `INFO`, `DEBUG`, `TRACE`.

   For example, to apply `TRACE` level logging for the `com.pingidentity` package, locate the following line: `log4j.logger.com.pingidentity=DEBUG,file` and change it to:

   `log4j.logger.com.pingidentity=TRACE,file`

Enabling Cookie Logging

Cookie logging is an optional feature in the TRACE log level.

1. Stop the PingAccess standalone or engine instance
2. Edit *<PA_HOME>*`/conf/blitz4j.properties` and uncomment the following lines:

   ```
   log4j.logger.com.pingidentity.pa.core.interceptor.CookieLoggingInterceptor=TRACE,file
   log4j.additivity.com.pingidentity.pa.core.interceptor.CookieLoggingInterceptor=false
   ```

3. Restart PingAccess.

Append Log Messages to Syslog and the Console

Additional output destinations (called *appenders*) are available. Configuration for the console and syslog appenders is included in the `blitz4j.properties` file, but not enabled by default. In the file, enable the console or syslog appenders by uncommenting and modifying the configuration entries for `log4j.appender.console` and `log4j.appender.syslog` respectively.

In addition to defining and configuring the appender using the `log4j.appender.`*`AppenderName`* properties, you must do the following:

- Enable a new appender
- Add the appender to the root logger to enable logging not specifically controlled by a package/class name logger
- Add the appender to any of the package/class name specific loggers you want appended

Enable a New Appender

1. Add the appender name to the comma delimited list of asynchronous appenders.

   For example, to enable the console logger, locate the following line:

   ```
   log4j.logger.asyncAppenders=DEBUG,file
   ```

and change it to:

```
log4j.logger.asyncAppenders=DEBUG,file,console
```

➡ **Info:** The DEBUG qualifier applied to the `asyncAppenders` does not apply DEBUG level logging to the appender. This setting exists for compatibility in configuring Blitz4j on top of Log4j. It is recommended that you do not remove this value.

Add the Appender to the Root Logger

2. Add the appender name to the `rootLogger` comma delimited list.

   For example, to add the console appender, locate the following line:

   ```
   log4j.rootLogger=DEBUG,file
   ```

   and change it to:

   ```
   log4j.rootLogger=DEBUG,file,console
   ```

Add the Appender to a Logger

3. Add the appender name to a package or classname logger.

   For example, to add the console appender to the `com.pingidentity` package-specific logger, locate the following line:

   ```
   log4j.logger.com.pingidentity=DEBUG,file
   ```

   and change it to:

   ```
   log4j.logger.com.pingidentity=DEBUG,file,console
   ```

Writing Logs to Other Formats

PingAccess provides the option of writing the administrative API and engine audit logs to an *Oracle database*.

➡ **Info:** To ensure availability of audit log information if database logging fails for any reason, enable both file and database audit logging. An automated failover from database to file logging is not currently available.

You may also configure PingAccess to write the audit logs to a differently formatted log file that can easily be digested by *Splunk*.

- *Writing Logs to Databases*
- *Writing Audit Logs for Splunk*

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. To configure PingAccess to write audit logs to a format for Splunk:

1. In `<PA_HOME>/conf/blitz4j.properties`, uncomment one or more of the preset log-appender configurations identified below:

   - **API audit logging for Splunk**: `SplunkApiAudit`
   - **Engine audit logging for Splunk**: `SplunkEngineAudit`

2. Add the appender name to the associated comma-separated list of appenders in the **Log Level Configuration** section.

   - **API audit log for Splunk**:

     Locate the `log4j.logger.apiaudit` line and add `SplunkApiAudit` to the list. For example:

```
log4j.logger.apiaudit=INFO,apiaudit,SplunkApiAudit
```

- **Engine audit log for Splunk**: Locate the `log4j.logger.engineaudit` line and add `SplunkEngineAudit` to the list. For example:

  ```
  log4j.logger.engineaudit=INFO,engineaudit,SplunkEngineAudit
  ```

3. Save the file, then restart PingAccess.
4. Download and install the Splunk Universal Forwarder on the machine running PingAccess.
5. Configure the Universal Forwarder to monitor <PA_HOME/logs>/pingaccess_api_audit_splunk.log or <PA_HOME>/logs/pingaccess_engine_audit_splunk.log.

   Info: For detailed installation and configuration instructions, consult the Splunk documentation accompanying the Universal Forwarder.

Writing Logs to Databases

You can enable database logging for the API and engine audit logs in the `blitz4j.properties` file located in your PingAccess install. Scripts are provided to create the necessary tables.

Info: To ensure availability of audit log information if database logging fails for any reason, we recommend enabling both file and database audit logging. An automated failover from database to file logging is not currently available.

1. Ensure that your database driver JAR file is installed in the *<PA_HOME>*`/lib` directory. Restart PingAccess after installing the driver.
2. In the `blitz4j.properties` file, located in the `/conf` directory, uncomment one or more of the preset appender configurations listed below:
   - **For Administrative API audit logging**: `OracleDbApiAudit`
   - **For Engine audit logging**: `OracleDbEngineAudit`
3. Replace the placeholder parameter values for each enabled appender with valid values to provide access to the database. These placeholder values are defined in the relevant `blitz4j.properties` section. We recommend that they be tested and validated prior to production deployment.

   Info: You can obfuscate the password used to access the database by running either `obfuscate.sh` or `obfuscate.bat`, located in the *<PA_HOME>* directory. Use the database password as an argument, then copy the output into the password configuration property for the appender in *<PA_HOME>*`/conf/blitz4j.properties`.
4. Add the appender name to the associated comma-separated list of appenders in the **Log Level Configuration** section.
   - **Oracle database API audit log**:Locate the `log4j.logger.apiaudit` line and add `OracleDbApiAudit` to the list. For example:

     ```
     log4j.logger.apiaudit=INFO,apiaudit,OracleDbApiAudit
     ```
   - **Oracle database engine audit log**:

     Locate the `log4j.logger.engineaudit` line and add `OracleDbEngineAudit` to the list. For example:

     ```
     log4j.logger.engineaudit=INFO,engineaudit,OracleDbEngineAudit
     ```
5. Create database tables. Scripts to create database tables are provided.

   The scripts are located in the directory:

   <PA_HOME>`/conf/blitz4j/sql-scripts`

   Info: The scripts are written to handle the default list of elements for the relevant database log-appender. Any changes to the list requires corresponding changes to the SQL table-creation script (or to the table itself if it is already created). For more information on working with this script, see the Oracle documentation.

Accessing PingAccess Interfaces

Accessing the PingAccess Administrative Console

1. Open a web browser
2. Go to `https://<DNS_NAME>:<PORT>`

   <DNS_NAME>

   The hostname or address of the PingAccess server.

   <PORT>

   The port where the administrative console listens. The default port is 9000.

   For example, `https://localhost:9000`.

Upon a successful login, PingAccess creates a backup of the current configuration to allow the administrator to revert any changes made. This backup is stored in `<PA_HOME>/data/archive`. The number of backup files can be controlled using the `pa.backup.filesToKeep` property in `run.properties`.

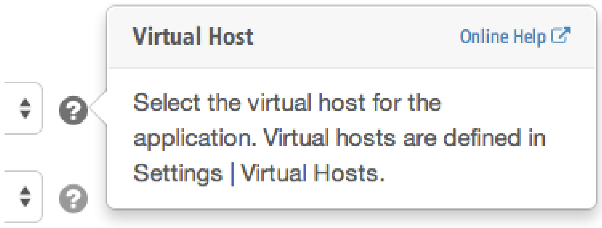
Caution: As the backup file contains your complete PingAccess configuration, ensure the file is protected with appropriate security controls in place.

Administrative Console Elements

The PingAccess Administrative Console is a rich web user interface with many icons and direct actions on objects. This page describes the techniques and icons used throughout the console.

Online Help

The Administrative Console provides extensive online help. When you hover the mouse over the help icon, a popup is presented with a brief explanation of the of the page, section, or field containing it. The popup includes a hyperlink to the relevant page of the Administrator's Manual for more detail.



Select the virtual host for the application. Virtual hosts are defined in Settings | Virtual Hosts.

Icons

- **Menu** - the menu icon indicates that one or more actions are available on the object. Click on the menu icon to see the list of actions, then click on the action to perform. Example actions are Edit, Delete and Download.
- **Edit** - the edit icon is used to modify object properties.
- **Delete** - the delete icon is used to delete the object.
- **Save** - the save icon is used to save the object values.
- **Remove** - the remove icon is used to delete objects.
- **Add** - the add icon is used to add new objects.
- **Download** - the download icon is used to download the object using the browser to the local computer.
- **Reorder** - the reorder icon is used to rearrange object order by dragging the object to the desired location.

Object Layout

Objects such as applications can be laid out in card view or row view by clicking one of the layout icons .

Object filtering

Many pages have a filter that enables narrowing down the number of available objects. As you type characters into the filter, only objects that meet the filter criteria are shown. There are also controls to limit the number of items displayed to 8, 16, or 32. If more items are available than the limit permits, the results will be split across multiple pages.

Accessing the PingAccess Administrative API

1. Send HTTP request to URL `https://<host>:<admin-port>/pa-admin-api/v1/<api-endpoint>`.
2. You must provide appropriate administrator credentials in the request.

For example, the following cURL command will return a list of all defined applications by sending a Get request to the `applications` resource:

```
curl -k -u Administrator:Password1 -H "X-Xsrf-Header:
 PingAccess" https://localhost:9000/pa-admin-api/v1/applications
```

- The `-u Administrator:Password1` parameter sends Basic Authentication header with the username `Administrator` and password `Password1`
- The `-k` parameter specifies to ignore HTTPS certificate issues
- The `-H "X-Xsrf-Header: PingAccess"` parameter sends an `X-XSRF-Header` with value `PingAccess`

Accessing the Interactive Administrative API Documentation

1. *Start PingAccess*.
2. Launch your browser and go to URL `https://<host>:<admin-port>/pa-admin-api/v1/api-docs/`. For example, `https://localhost:9000/pa-admin-api/v1/api-docs/`.
3. The browser may prompt for credentials. Enter the administrator username and password.

For example, to use the interactive Administrative API documentation to see all defined applications:

1. Click on the `/applications` endpoint to expand it.
2. Click on the `GET` method (`GET /applications`) to expand it.
3. Enter parameters values or leave all blank.
4. Click **Try It Out** button.
5. The Request URL, Response Body, Response Code, and Response Headers appear.

Performance Tuning

While PingAccess has been engineered as a high performance engine, its default configuration may not match your deployment goals nor the hardware you have available. Consult the following sections to optimize various aspects of a PingAccess deployment for maximum performance.

Info: An additional document related to performance, the PingAccess Capacity Planning Guide, is also available to customers as a performance data reference. This document is available from the *Customer Portal* (ping.force.com/Support).

Java Tuning

Tuning the Java Heap

One of the most important tuning options you can apply to the Java Virtual Machine (JVM) is to configure how much heap (memory for runtime objects) to use. The JVM grows the heap from a specified minimum to a specified maximum. If you have sufficient memory, best practice is to “fix” the size of the heap by setting minimum and maximum to the same value. This allows the JVM to reserve its entire heap at startup, optimizing organization and eliminating potentially expensive resizing.

By default, PingAccess fixes the Java heap at 512 megabytes (MB). This is a fairly small footprint and not optimal for supporting higher concurrent user loads over extended periods of activity. If you expect your deployment of PingAccess to serve more than 50 concurrent users (per PingAccess node if deploying a cluster), we recommend that you increase the heap size.

Modify the Java Heap Size

To modify heap size for the `run.sh` or `run.bat` scripts, do the following:

1. Edit the appropriate PingAccess startup script in `<PA_HOME>/bin`:
   - For Linux: `run.sh`
   - For Windows: `run.bat`
2. Specify overall heap size by modifying the `MINIMUM_HEAP` and `MAXIMUM_HEAP` parameters:
   - Modify `-Xms512m` to change the `MINIMUM_HEAP` value
   - Modify `-Xmx512m` to change the `MAXIMUM_HEAP` value

   Specify units as `m` (megabytes) or `g` (gigabytes).
3. Specify young generation size by modifying the `MINIMUM_NEW` and `MAXIMUM_NEW` variables:
   - Modify `-XX:NewSize=256m` to change the `MINIMUM_NEW` value
   - Modify `-XX:MaxNewSize=256m` to change the `MAXIMUM_NEW` value

   Set values to 50% of `MINIMUM_HEAP` and `MAXIMUM_HEAP`.

   ➡ **Info:** Not advisable if selecting the G1 collector (see *Garbage Collector Configuration* for more information).

Modify the Java Heap Size for Linux Service

Since the Linux Service uses the `run.sh` file, the service uses the that file's Java settings.

Modify the Java Heap Size for Windows Service

To modify heap size for Windows Service, do the following:

1. Edit the `PingAccessService.conf` file located in the `\sbin\windows` directory of the PingAccess install:
2. Specify overall heap size by modifying the `wrapper.java.initmemory` and `wrapper.java.maxmemory` settings. - Set the values (in megabytes) for initial and maximum heap sizes, respectively.
3. Specify young generation size by modifying the `wrapper.java.additional.11` and `wrapper.java.additional.12` settings. - Set the values (in megabytes) for initial and maximum new generation sizes, respectively.
4. Restart. The settings in the `PingAccessService.conf` file are only applied at service startup.

   ➡ **Info:** Not advisable if selecting the G1 collector (see *Garbage Collector Configuration* for more information).

Garbage Collector Configuration

Selecting the appropriate garbage collector depends on the size of the heap and available CPU resources. The following is a table of available collectors and some general guidance on when and how to use them.

Garbage Collector	Description	Modifications
Parallel	• Best used with heaps 4GB or less • Full stop-the-world copying and compacting collector • Uses all available CPUs (by default) for garbage collection	Default collector for server JVM. No modification is required to `run.sh`, `run.bat`, or the Windows Service configuration file.
Concurrent Mark Sweep (CMS)	• Best for heaps larger than 4GB with at least 8 CPU cores • Mostly a concurrent collector • Some stop-the-world phases • Non-Compacting • Can experience expensive, single threaded, full collections due to heap fragmentation	`run.sh/run.bat`: Set `GARBAGE_COLLECTOR` to -XX:`+UseConcMarkSweepGC` in the script. **Note:** Quote delimiters are required in `run.sh`, but not `run.bat`. **Windows Service**: Set `wrapper.java.additional.1C` to -XX:`+UseConcMarkSweepGC` in `PingAccessService.conf`.
Garbage First (G1)	• Best for heaps larger than 6GB with at least 8 CPU cores • Combination concurrent and parallel collector with small stop-the-world phases • Long-term replacement for CMS collector (does not suffer heap fragmentation like CMS)	`run.sh/run.bat`: Set `GARBAGE_COLLECTOR` to -XX:`+UseG1GC` in the run script. **Note:** Quote delimiters are required in `run.sh`, but not `run.bat`. Also disable `MINIMUM_NEW` and `MAXIMUM_NEW` tuning. Explicit sizing adversely affects pause time goal. To disable, comment the lines out in the script. **Windows Service**: Set `wrapper.java.additional.1C` to -:`+UseG1GC` in `PingAccessService.conf`. Also disable `wrapper.java.additional.11` and `wrapper.java.additional.12`. Explicit sizing adversely affects pause time goal. To disable, comment the lines out using `#`.

Resource Pools

Acceptor Threads

PingAccess uses a pool of threads to respond to HTTP/S requests made to the TCP port(s) in use. This applies to both administrative and runtime engine listening ports. Acceptor threads read user requests from the administrative or runtime port and pass the requests to worker threads for processing. A best practice is to use at least two acceptors for performance. On larger multiple CPU core machines, more acceptors can be used. We recommend limiting to between two and 1/4th the number of available CPU cores.

To modify, open the `run.properties` file located in the `conf` directory of your PingAccess deployment and specify the number of acceptors you want to use on the following lines:

`admin.acceptors=`*`N`*

`engine.http.acceptors=`*`N`*

`agent.http.acceptors=`*`N`*

Where *N* represents the number of acceptor threads.

Worker Threads

PingAccess uses a pool of *worker* threads to process user requests and a separate pool to process agent requests. Worker threads receive user requests from Acceptor threads, process them, respond back to the client and then return to the pool for reuse. By default, PingAccess starts with a minimum of five worker threads and grows as needed (unbounded by default). You can define the minimum and maximum number of Worker threads in each pool by adding and/or modifying properties found in the `run.properties` file.

To set values, open the `run.properties` file located in the `conf` directory of your PingAccess deployment. If the properties do not exist in the file add them.

```
engine.httptransport.coreThreadPoolSize=N
engine.httptransport.maxThreadPoolSize=N
```

and

```
agent.httptransport.coreThreadPoolSize=N
agent.httptransport.maxThreadPoolSize=N
```

Where *N* represents the number of worker threads.

Maintenance of the pool is such that if the number of threads in the pool exceeds the value of `engine.httptransport.coreThreadPoolSize`, threads idle for 60 seconds are terminated and removed from the pool. The idle timeout value is not modifiable. However, if the values of `engine.httptransport.coreThreadPoolSize` and `engine.httptransport.maxThreadPoolSize` are the same, a fixed sized pool is created and idle threads are not terminated and removed. Similarly for `agent.httptransport.coreThreadPoolSize` and `agent.httptransport.maxThreadPoolSize`.

Since the pool by default is allowed to grow and shrink based on demand, it is recommended that you tune the `engine.httptransport.coreThreadPoolSize` and `agent.httptransport.coreThreadPoolSize` (minimum) to satisfy moderate demand on the system. We recommend a minimum of 10 threads per available CPU core as a good value to support up to twice the number of concurrent users without error or significant degradation in performance.

Backend Server Connections

PingAccess provides a few options to control and optimize connections to the proxied site.

Max Connections

Connections to PingAccess are not explicitly connections to the proxied site. PingAccess creates a pool of connections, unlimited in size by default, that are multiplexed to fulfill client requests. Maintenance of the pool includes creating connections to the site when needed (if none are available) and removing connections when the **Keep Alive Timeout** is reached.

In certain situations it can be advantageous to limit the number of connections in the pool for a given Web site. If, for example, the Web site is limited to the number of concurrent connections it can handle or has specific HTTP Keep Alive settings, limiting the number of connections from PingAccess can improve overall performance by not overloading the backend server. In the event that all connections in the pool are in use, a requesting thread waits for one to become available. Assuming that response time from the backend site is sufficiently fast, the time spent waiting for a connection is likely to be less than if the system becomes overloaded.

➡ **Info:** We strongly recommended that you understand the limits and tuning of the server application being proxied. Setting the **Max Connections** value too low may create a bottleneck to the proxied site, setting the value too high (or unlimited) may cause PingAccess to overload the server.

See *Sites* for information on setting **Max Connections**.

Keep Alive Timeout

As mentioned in the previous section, the **Keep Alive Timeout** value controls how long a connection created to the proxied Site is kept in the pool for use. This value should be set lower than the HTTP Keep Alive timeout of the Site being proxied.

Configuring PingAccess to timeout the connections before the proxied server ensures that use of "stale" connections to the Site is not attempted, causing failure and retry overhead. To improve efficiency, keep the timeout value of PingAccess connections as close as possible to the timeout value of the proxied server without matching or going over that value. This depends on the time granularity afforded by the proxied HTTP server's configuration (time set in minutes, seconds, milliseconds, etc.) and may take some testing to fully optimize. As a starting point, we suggest 500 milliseconds (half a second) to one second as PingAccess transactions typically complete in less than a half a second on a properly-sized deployment. See *Sites* for information on setting **Keep Alive Timeout**.

Logging and Auditing

PingAccess uses a high performance, asynchronous logging framework to provide logging and auditing services with as low impact to overall application performance as possible.

Logging

Although logging is handled by a high performance, asynchronous logging framework, it is more efficient to the system overall to log the minimum amount of information required. We highly recommend that you review the section of the documentation for logging and adjust the level to the lowest, most appropriate level to suit your needs (see *Manage Log Files*).

Auditing

As with logging, auditing is provided by the same high performance, asynchronous logging framework. Furthermore, auditing messages can be written to a database instead of flat files, decreasing file I/O. If you do not require auditing for interactions with a Resource or between PingAccess and PingFederate, it is more efficient to disable audit logging. However, if you do require auditing services and have access to a Relational Database Management System (RDBMS), we recommend *auditing to a database*. You will see a decrease in disk I/O, which may result in increased performance depending on database resources.

Agent Tuning

Several properties in the `agent.properties` file can be configured for increased performance. See the agent documentation for *Apache* or *IIS* for more information on agent configuration and setting properties.

Max Connections

Connections from the agent to PingAccess are limited by `agent.engine.configuration.maxConnections`. The default is set to `10`. In certain situations it can be advantageous to increase the number of connections. In the event that all connections in the pool are in use, a requesting thread waits for one to become available. Assuming that response time to PingAccess is sufficiently fast, the time spent waiting for a connection is likely to be less than if the system becomes overloaded. Note that this is the maximum number of connections per worker process, and not simply the total number of workers the agent has access to. Setting `agent.engine.configuration.maxConnections` value too low may create a bottleneck to PingAccess, and setting the value too high may cause PingAccess to become overloaded.

Max Tokens

By default, the maximum number of cached tokens in an agent is unlimited. In certain situations it can be advantageous to limit the size of the cache for the agent, as a smaller cache has a smaller memory footprint, freeing up memory available to the application for servicing requests. However, when the token cache limit is reached, the least recently used token-policy mapping will be removed from the cache. If that token-policy mapping happens to be needed again, the agent will have a cache miss, resulting in the need to obtain a new token-policy mapping from PingAccess.

Upgrading PingAccess

Upgrading from PingAccess 2.1 and Later

To run the upgrade utility, you will need the following:

- The PingAccess Upgrade Utility archive
- The PingAccess 3.2 zip file
- Your PingAccess 3 license file
- Login access to the PingAccess host, as the utility is run on the host
- Basic Authentication needs to be configured and enabled for the running PingAccess instance. Administrator Single Sign-On must be disabled for the upgrade.
- The version of PingAccess you are upgrading from must be running
- Administrator credentials for the running PingAccess instance

Copy these files to the system being upgraded, and unpack the PingAccess Upgrade Utility archive.

The upgrade utility starts an instance of PingAccess 3.2 with an administrative listener on port 9001. This port number can be changed using the `run.bat/run.sh -p` parameter. This port configuration is only used for the upgrade - the default port is used by the upgraded server when the upgrade is complete.

Any warnings or errors encountered are recorded in `log/upgrade.log`, as well as on the screen while the utility is being run.

Info: During the upgrade, it is important to not make any changes to the running PingAccess environment.

Use the PingAccess Upgrade Utility to upgrade from PingAccess 2.1 or later to version 3.2.

1. Unpack the upgrade utility zip file.
2. Change to the upgrade utility's `bin` directory.
3. Run the PingAccess Upgrade Utility:
   - On Windows: `run.bat [-p` *`<admin_port>`*`]` *`<sourcePingAccessRootDir> <outputDir> <pingaccessZip> <newPingAccessLicense>`*
   - On Linux: `./run.sh [-p` *`<admin_port>`*`]` *`<sourcePingAccessRootDir> <outputDir> <pingaccessZip> <newPingAccessLicense>`*

   ```
   ./run.sh -p 9002 pingaccess-3.1.0 pingaccess-3.2.0 pingaccess-3.2.0.zip
   pa32.lic
   ```

   Parameter Definitions

   The command-line parameters are the same regardless of the platform, and are defined as follows:

Parameter	Value Description
<admin_port>	Optional port to be used by the temporary PingAccess instance run during the upgrade. The default is 9001.
<sourcePingAccessRootDir>	The PA_HOME for the source PingAccess version
<outputDir>	The target directory which will contain the unpacked PingAccess distribution

Parameter	Value Description
<pingaccessZip>	The PingAccess distribution for the target version
<newPingAccessLicense>	The path to the PingAccess license file to use for the target version

Note: In the context of an upgrade, "source" refers to the old version of PingAccess, and "target" refers to the new version.

Upgrading a PingAccess Cluster

Info: It is important for any backout plan that all nodes in a clustered PingAccess be running the same software release.

To upgrade a cluster, perform the following steps:

1. Run the upgrade utility on the administrative console
2. Change the upgraded administrative console's `admin.port` value to a temporary value.
3. Start the upgraded administrative console
4. Perform any manual post-upgrade tasks recorded in the upgrade log
5. Shut down the upgraded administrative console
6. Change the upgraded administrative console's `admin.port` value back to the original value.
7. Run the upgrade utility on each engine node
8. Shut down the entire cluster
9. Start the upgraded administrative node
10. Start each upgraded engine node

Completing the Upgrade

At the end of a successful upgrade, the PingAccess Upgrade Utility will record any manual steps that require user intervention both on-screen and in `log/upgrade.log`. When the upgrade is complete, the source PingAccess installation is left running. Collect any information needed to complete these manual steps from the running instance, then shut down the source PingAccess server and start new PingAccess 3.1.1 server to complete the manual portion of the upgrade.

If you want to see details about the migrated configuration data, examine `log/audit.log`. For more information about these tasks, see *Post-Upgrade Tasks*.

Performing Post-Upgrade Tasks

After the upgrade has completed, we recommend the following additional steps be performed:

1. Review any warnings returned by the upgrade utility and take the actions indicated in the table below.
2. Generate new obfuscated passwords for the `pa.jdbc.password`, `pa.jdbc.filepassword`, and `pa.keystore.pw` parameters in `conf/run.properties`:
   a. **Conditional:** If you are on a Linux host, run `obfuscate.sh` *`password`* .
   b. **Conditional:** If you are on a Windows host, run `obfuscate.bat` *`password`* .
   c. Copy the obfuscated password and paste it into the parameter in run.properties that corresponds to the password being re-obfuscated.
3. Review the *HTTP Requests* on page 69 configuration to ensure the use of the IP Source settings is appropriate for the environment. During the upgrade process, the **List Value Location** setting is changed from the default of **Last** to **First** to match the behavior from earlier releases.

Warning Text	Steps to Take
`Resource '`*`ResourceName`*`' contains an invalid path prefix and cannot be`	This occurs when the 2.1 path prefix contains functionality supported via a Java regex, but not by

Warning Text	Steps to Take
migrated to the target version. Manual intervention is required.	the wild card support in 3.1. The user must manually migrate the regex to 1 or more path prefixes in 3.1. For example, consider the 2.1 prefix, /(app1|app2). This can be translated to a single resource in 3.1.1 with path prefixes of /app1 and /app2.
Resource '*ResourceName*' requires a case-sensitive path. This conflicts with its containing Application, which requires a case-insensitive path. Manual intervention may be required.	The upgrade utility identifies path prefixes in 2.1 that start with /(?i) as path prefixes that are case-insensitive, and sets the case-sensitivity flag on the Application appropriately. However, if multiple resources in a new application use inconsistent case-sensitivity settings, the utility cannot determine what the case-sensitivity should be. 2.1 resources are case-sensitive by default.
Resource '*ResourceName*' requires a case-insensitive path. This conflicts with its containing Application, which requires a case-sensitive path. Manual intervention may be required.	This is the same as the previous setting, but with the requirement being for a case-insensitive path rather than a case-sensitive one.
Resource '*ResourceName*' is disabled in the source version. Resources can no longer be individually disabled. Application '*ApplicationName*' has been disabled due to this constraint.	In 2.1, individual resources can be disabled. In 3.1, only applications can be enabled/disabled. The upgrade utility takes the approach of disabling the application if any related resources are disabled. Check the final configuration and make sure this is the desired outcome. If it is not, the disabled resources need to be deleted, and the application needs to be enabled.
Path prefix for Resource '*ResourceName*' contains a '.' character. This will be treated as a literal '.' in the target version.	In a 2.1 setup, it is likely that there will be resource names that accidentally contain a '.', assuming it is a literal '.' rather than part of a regex. For example, any file extension type resources will probably not be escaping the '.'. This message is intended to bring this change in semantics to the user's attention. This action item will not show up if the user has correctly escaped the '.' character with the '\.' sequence.
Resource '*ResourceName*' could not be migrated to the target version due to Application context root conflicts. Manual intervention is required.	This message indicates that multiple resources that use the same virtual host, but a different Web Session or Site must be mapped under the same context root in the same application to preserve semantics. For example, consider the following configuration: • Resource A: • Path Prefix: /hr • Virtual Host: internal.example.com • Web Session: W • Site: Z • Resource B: • Path Prefix: /sales • Virtual host: internal.example.com • Web Session: W • Site: Z • Resource C: • Path Prefix: /payroll

Warning Text	Steps to Take
	• Virtual Host: internal.example.com • Web Session: V • Site: Z This configuration triggers this action item because these resources cannot be grouped in the same application, but they would need to be in order to preserve the semantics in the internal.example.com address space. This issue could be fixed by using rewrite rules to place Resource C or Resources A and B under a different namespace. For example, use /intranet/sales and /intranet/hr on the front-end and rewrite out the /intranet on the backend.
`Application '`*`ApplicationName`*`' contains OAuth rules, but authenticates users with a web session. Unexpected results may occur.`	2.1 allows OAuth rules to be attached Resources that use a Web Session. While this configuration is likely invalid in the first place, it would be possible to include both a PA cookie and OAuth token in requests and PA would apply policy to the requests as configured. In 3.1, however, an API application and web application are mutually exclusive so the semantics of this particular configuration cannot be preserved.
`The resource order for Virtual Host '`*`VirtualHostName`*`' has changed in the target version.`	The upgrade utility checks that the resource order is consistent before and after the upgrade. This message indicates that the resource order from 2.1 does not match 3.1. This is likely due to how context roots in applications are ordered in 3.1. For 3.1, applications are ordered based on their context root, where the longest context root is checked first during resource matching. One way to address this is to review and potentially change the Application context root values associated with the Virtual Host to avoid URL overlaps between applications.
`Application '`*`ApplicationName`*`' is no longer associated with an Identity Mapping. A Web Session or an Authorization Server is required to use Identity Mappings.`	Indicates a misconfiguration in the source version. Check whether you intended to use an Identity Mapping for the Application and associate an appropriate Web Session or Authorization Server if necessary.
`OAuth Rule with id '`*`RuleId`*`' is no longer associated with Application '`*`ApplicationName`*`' because Application '`*`ApplicationName`*`' is not an OAuth Application. Manual intervention may be required.`	Indicates a misconfiguration in the source version. Check whether the OAuth Rule is necessary to implement the desired Access Control policy.
`OAuth RuleSet with id '`*`RuleSetId`*`' is no longer associated with Application '`*`ApplicationName`*`' because Application '`*`ApplicationName`*`' is not an OAuth Application. Manual intervention may be required.`	Indicates a misconfiguration in the source version. Check whether the OAuth RuleSet is necessary to implement the desired Access Control policy.
`Resource 'ResourceName' from Application with id '`*`ApplicationId`*`'`	Indicates a Resource associated with the Application is associated with OAuth Rules. This is likely a

Warning Text	Steps to Take
`was not migrated because the Application is a Web Application while the Resource has OAuth Rules. Manual intervention may be required.`	misconfiguration, and it is necessary to evaluate whether this was intended or not.
`Upgrade created 'Availability Profile for Site '`*`SiteName`*`''. A more descriptive name may be required.`	Indicates that an Availability Profile was created for the Site during the upgrade. You may want to give the Availability Profile a more descriptive name.
`Application '`*`ApplicationName`*`' and associated Resources were not migrated. The context root of /pa is reserved. Manual intervention may be required.`	The `/pa` context root was allowed as a valid context root in PingAccess 3.0 and is no longer allowed.
`Resource '`*`ResourceName`*`' from Application with id '`*`ApplicationId`*`' was not migrated because the /pa prefix is reserved when the Application context root is /. Manual intervention may be required.`	The `/pa` path prefix was allowed as a valid path prefix in PingAccess 3.0 and is no longer allowed.
`The OAuth Groovy Script Rule no longer controls the realm in the response sent for an unauthorized OAuth request.`	With PingAccess 3.2, Realms have been moved to the Application. The `Realm` can still be set using the PingAccess Admin API interface. With the change in context for how realms are applied, it is necessary to check existing OAuth Groovy Rules to ensure that they behave as expected. This message is shown if any OAuth Groovy Rules exist in the migrated configuration.
`The property '`*`PropertyName`*`' was set to a blank value to maintain compatibility. However, it is recommended that this be set to '`*`PropertyName=PropertyValue`*	New *Security Headers Properties* on page 133 values are not set during an upgrade in order to preserve the behavior from the source release in the upgrade. If there is no reason not to in your environment, update `run.properties` with the recommended setting.
`As a security enhancement, the default value of '`*`CipherList`*`' has changed with this version of PingAccess. Your existing ciphers remain unchanged. However, it is recommended to use the default value: '`*`PropertyName=CipherList`*`'.`	This message applies to the `admin.ssl.ciphers`, `engine.ssl.ciphers`, and `agent.ssl.ciphers` lists. This message is displayed if the upgrade source version cipher lists are changed from the defaults. We recommend updating the configuration with the new default value if possible.
`The property '`*`PropertyName`*`' was set to a blank value to maintain compatibility. However, it is recommended that this be set to '`*`PropertyName=CipherList`*	This message applies to the `site.ssl.protocols`, `site.ssl.ciphers`, `pf.ssl.protocols`, and `pf.ssl.ciphers` settings. The upgrade utility sets these values as empty values in order to maintain backwards compatibility, but the recommended value should be used if possible.
`The host for VirtualHost `*`VirtualHost`*`:`*`Port`*` already has a KeyPair associated with it. The KeyPair previously associated with this VirtualHost was removed. Only one KeyPair can be associated with a given host.`	If a Virtual Host has more than one key pair associated with it, only one key pair will be associated with it after the upgrade completes. This message is displayed to indicate which key pair was used.

Warning Text	Steps to Take
`Application with name '`*`ApplicationName`*`' not migrated as the context root '`*`Path`*`' was a reserved path.`	If an Application's context root is a reserved PingAccess path, the application will not be migrated. The indicated application will need to be created with a context root that does not conflict with the reserved path.
`Resource with name '`*`ResourceName`*`' not migrated as the path '`*`Path`*`' was a reserved path.`	If an Resource path is a reserved PingAccess path, the application will not be migrated. The indicated application will need to be created with a context root that does not conflict with the reserved path.
`The CIDR Rule with name '`*`RuleName`*`' is associated with an Agent Application named '`*`ApplicationName`*`' and overrides the IP source configuration. A new Agent rule should be created that does not override the IP source.`	With changes in IP Source header handling, additional options are available to override the headers used to identify the source address. When an Agent is involved, the changes in IP source handling may cause the specified rule to not behave as expected.
`Require HTTPS option on Application '`*`ApplicationName`*`' was set to `*`Setting`*` as Virtual Host had port `*`Port`*`. Please verify this setting is correct.`	The upgrade utility attempts to set the **Require HTTPS** option based on the virtual host associated with an application during an upgrade. This message is an advisory to just verify that the setting was properly detected.
`VirtualHost '`*`VirtualHost`*`' was not migrated. An existing VirtualHost existed with the same logical name '`*`VirtualHost`*`'.`	Virtual Host names are now case-insensitive. During the upgrade, after making the names case-insensitive, a duplicate Virtual Host was identified. It will be necessary to either recreate the virtual host with a new name, or to modify the configuration so the proper Virtual Host is migrated to the upgraded system.
`Renamed Virtual Host's Hostname from '`*`VirtualHost`*`' to '`*`NewVirtualHost`*`' due to virtual host spec compliance issue`	If a Virtual Host name contains an underscore (_) character, that does not conform to host naming requirements. In this instance, the underscore will be renamed to the string `a-z`. For example, if a Virtual Host named `my_virtual_host` is migrated, the new name will be `mya-zvirtuala-zhost`.
`Removed Http Request Rule with name '`*`RuleName`*`', this Rule must be converted to a groovy script rule. Manual intervention may be required.`	When an HTTP Request Rule is migrated from an earlier release of PingAccess, rules that specify a source of `Body` are not migrated. A Groovy script rule can be used to perform a similar match, but the details of such a Groovy script require administrator intervention. A simple Groovy script rule that would perform a similar function might be: `requestBodyContains('`*`value`*`')` We advise, however, that a script be constructed that performs additional validation in order to ensure the rule passes only when desired; a generic match like this could lead to unexpected results depending on what content might be in the request body.

Restore a PingAccess Configuration Backup

PingAccess automatically creates a backup zip file each time an Administrative user authenticates to the administrative console. These backups are stored in *`<PA_HOME>`*`/data/archive`, with a maximum number of backups configurable using the `pa.backup.filesToKeep` configuration parameter in `run.properties`.

Caution: This operation will replace your current configuration settings.

To Restore a PingAccess Configuration Backup:

1. Stop PingAccess
2. Unzip the backup file *`<PA_HOME>`*
3. Restart PingAccess.

Your PingAccess configuration will now be reverted to the state in the backup archive that was restored.

Applications

Applications represent the protected web applications and APIs to which client requests are sent. Applications are composed of one or more resources and have a common Virtual Host and Context Root and correspond to a single target site. Applications also use a common Web Session and Identity Mapping. Access control and request processing rules can be applied to applications and their resources on the Policy Manager page to protect them. Applications can be protected by PingAccess Gateway or PingAccess Agent. In a gateway deployment, the target application is specified as a Site. In an agent deployment, the application destination is an Agent.

Use this page to define the applications which PingAccess protects and to which client requests are ultimately forwarded. You can use resources to partition the application into areas requiring distinct access control. Each Application contains at least a Root Resource. The combination of Virtual Server and Context Root must be unique for each Application.

Configure an Application

1. Provide a unique **Name**.
2. Enter the Application **Context Root**.

   This value must meet the following criteria:

   - It must start with `/`.
   - It can contain additional `/` path separators.
   - It must not end with `/`.
   - It must not contain wildcards or regular expression strings.
   - The combination of the **Virtual Host** and **Context Root** must be unique. The following *is* allowed and incoming requests will match the most specific path first:
     - `vhost1:443/App`
     - `vhost1:443/App/Subpath`
   - `/pa` is reserved for PingAccess and is not allowed as a **Context Root**
3. Select **Case Sensitive Path** to make request URL path matching case sensitive.
4. Select the **Virtual Host** for the Application from the list.
5. Select the **Application Type**. This value can be either `Web` or `API`.
6. **Conditional:** If the **Application Type** is `Web`, select the **Web Session** for the application from the list of defined web sessions. This option is only enabled if the **Application Type** is `Web`.
7. **Conditional:** If the **Application Type** is `API`, select the **Authorization Server** used to validate OAuth access tokens. This option is only enabled if the **Application Type** is `API`.

Note: The PingFederate Authorization Server must be defined in **Settings** > **PingFederate**.

8. Select the application **Destination** type. This value can be either `Site` or `Agent`
9. **Conditional:** If the destination is a `Site`, select the **Site** requests are sent to when access is granted. This option is only enabled when the Destination is a `Site`.
10. **Conditional:** If HTTPS is required to access this application, select the **Require HTTPS** option. This option is only enabled when the destination is a `Site`, and if at least one non-secure HTTP listening port is defined.
11. **Conditional:** If the destination is an `Agent`, select the agent which intercepts and validates access requests for the Application. This option is only enabled when the Destination is an `Agent`.
12. **Conditional:** If needed, select the **Identity Mapping** the application will use.
13. Select **Enabled** to allow the application to process requests.
14. Click either **SAVE** or **/*** (Save and go to Resources) when finished. The latter option allows you to configure additional application resources.

Note: When you save the application, PingAccess verifies the Redirect URI for the Application's virtual host is configured in PingFederate. If PingAccess determines that the Redirect URI is not defined, you will receive the following warning:

```
Save succeeded. Unable to find a matching Redirect URI in the
 PingFederate OAuth Client configuration for [<VHost>/pa/oidc/cb]
```

If you see this warning, ensure that there is a Redirect URI that matches configured. If you have a wildcard in your Virtual Host configuration, ensure the Redirect URI list includes the same wildcard host definition, otherwise you may have a configuration that is only valid in some circumstances.

This validation is performed only if the **Application Type** is `Web`, a **Web Session** is selected, and the PingFederate Administration connection is configured.

Configure a Resource

/*

Resources represent part of Web applications or APIs which have distinct security requirements. Resources specify what path prefixes and HTTP methods they apply to. Each application has at least the Root Resource which covers any requests not covered by other defined resources, and can have any number of additional resources. The first resource to match a request is used and no further resources are examined. Resources may specify particular authentication requirements, including no authentication if the Anonymous checkbox is selected. Use this page to view and edit existing application resources and to define new resources.

Resources are evaluated from most-specific to least-specific, based on the number of path elements and their lengths. For example, given the following list of resources:

- `/*` (The default root resource)
- `/MyApp/*`
- `/MyApp/Edit/*`
- `/MyApp/Admin/*`
- `/MyApp/Admin/ListUsers*`

The processing order would be:

- `/MyApp/Admin/ListUsers*`
- `/MyApp/Admin/*`
- `/MyApp/Edit/*`
- `/MyApp/*`
- `/*` (The default root resource)

In addition, when protecting an API, the HTTP method also is considered when identifying the order.

Configure a Resource

➡ **Info:** The resource can be disabled by unchecking the **Enabled** control after the resource has been saved, or by sliding the slider associated with the resource in the resource card or list view.

1. Enter a unique **Name**. Up to 64 characters, including special characters and spaces, are allowed.
2. Enter a list of URL path prefixes (within the Context Root) that identify this resource. Prefixes must start with a slash (/) and may contain one or more wildcard characters (*). No use of wildcards is assumed, so there is a difference between `/app/` and `/app/*`.

   ➡ **Info:** The path prefix starts after the application context root and extends to the end of the URL. It must begin with a forward slash. Note that `/pa` and `/pa*` are reserved prefixes and cannot be used as a path prefix when the context root is `/`.
3. If the resource does not require authentication for access, enable the **Anonymous** option.
4. Select an **Authentication Requirements** list to define how a user authenticates to the target site. This option only applies when you specify a **Web Session** for the application. See *Authentication Requirements*.
5. Enter the **Methods** supported by the Resource. Leave the asterisk default if the Resource supports all HTTP methods, including custom methods. Defining Methods for a Resource allows more fine-grained access control policies on API Resources. For example, if you have a server optimized for writing data (POST, PUT) and a server optimized for reading data (GET), you may want to segment traffic based on the operation being performed.

   ➡ **Info:** Method selection only applies to applications of type API.
6. Select the **Audit** checkbox to log information about the transaction to the audit store.
7. Click **SAVE** when you finish.

Sites & Agents

Sites & Agents is where you define application destinations - target sites or agents. Sites are the target applications or APIs which PingAccess Gateway is protecting and to which authorized client requests are ultimately forwarded to. Site Authenticators define the authentication mechanism that target sites require to control access.

Agents are instances of PingAccess agents with which Policy Server is expecting to receive agent requests from for target applications or APIs.

Sites

Sites are the locations of applications, endpoints, or APIs in your environment that you want to protect with PingAccess Gateway.

Screen Navigation Tips

- Use the **Filter** box on the right to search-as-you-type for sites by name.
- Click on the right to toggle the page view between **Card** and **Table** view.

Create a Site

1. Click **Sites**.
2. Click **NEW SITE**.
3. Enter a unique Site **Name**.

   The **Name** can be up to 64 characters, including special characters and spaces.

4. Specify one or more **Targets** in the list of targets. The format for this is `hostname:port`. For example, you might enter `www.example.com:80`.
5. Select **Secure** if the Site is expecting HTTPS connections.
6. **Conditional:** If the site is configured for secure connections, select a **Trusted Certificate Group** from the list, or select **Trust Any** to trust any certificate presented by the listed targets.
7. To override standard HTTPS certificate hostname validation with a named hostname, enter the hostname in the **Expected Certificate Hostname** field. This field is unavailable if **Skip Hostname Verification** is selected.
8. **Conditional:** If the Site requires authentication, click the **Site Authenticators** field, then select one or more authenticators from the list. Click **x** to remove a Site Authenticator.

   A combination of Site Authenticators is useful when the back-end Site requires a form of service-level authentication, but the application itself expects end-user related identity information.

   Info: You must first configure Site Authenticators in order to populate this list (see *Configure Site Authenticators*).
9. Leave the **Use Target Host Header** check box selected to have PingAccess modify the `Host` header for the Site's Target Host and Target Port rather than the Virtual Host configured in the application. Clear this checkbox to make no changes to the `Host` header. (See *Using Virtual Hosts* for more information.)

   This is often required by target web servers to ensure they service the HTTP request with the correct internal virtual server definition.

Note: The options in steps 10-15 are available only when the **Advanced** section of the page is expanded.

10. Select an *Availability Profile*.
11. Optional: Select a *Load Balancing Strategy*, if the site contains more than one target.
12. In the **Keep Alive Timeout (ms)** box, enter the time (in milliseconds) an HTTP persistent connection to the Site can be idle before PingAccess closes the connection. The default is `30000` milliseconds.
13. In the **Max Connections** box, enter the maximum number of HTTP persistent connections you want PingAccess to have open and maintain for the Site. A value of `-1` indicates unlimited connections.
14. Leave the **Send Token** check box selected to include the PA Token in the request to the back-end Site. Clear the check box to remove the PA Token from the request.
15. Click **SAVE**.

    Note: If the target site cannot be contacted, the site is saved and a warning is displayed indicating the reason the site was not reachable.

Edit a Site

1. Enter a unique Site **Name**.

   The **Name** can be up to 64 characters, including special characters and spaces.
2. Specify one or more **Targets** in the list of targets. The format for this is `hostname:port`. For example, you might enter `www.example.com:80`.
3. Select **Secure** if the Site is expecting HTTPS connections.
4. **Conditional:** If the site is configured for secure connections, select a **Trusted Certificate Group** from the list, or select **Trust Any** to trust any certificate presented by the listed targets.
5. To override standard HTTPS certificate hostname validation with a named hostname, enter the hostname in the **Expected Certificate Hostname** field. This field is unavailable if **Skip Hostname Verification** is selected.
6. **Conditional:** If the Site requires authentication, click the **Site Authenticators** field, then select one or more authenticators from the list. Click **x** to remove a Site Authenticator.

   A combination of Site Authenticators is useful when the back-end Site requires a form of service-level authentication, but the application itself expects end-user related identity information.

   Info: You must first configure Site Authenticators in order to populate this list (see *Configure Site Authenticators*).

7. Leave the **Use Target Host Header** check box selected to have PingAccess modify the `Host` header for the Site's Target Host and Target Port rather than the Virtual Host configured in the application. Clear this checkbox to make no changes to the `Host` header. (See *Using Virtual Hosts* for more information.)

   This is often required by target web servers to ensure they service the HTTP request with the correct internal virtual server definition.

Note: The options in steps 8-12 are available only when the **Advanced** section of the page is expanded.

8. Select an *Availability Profile*.
9. Optional: Select a *Load Balancing Strategy*, if the site contains more than one target.
10. In the **Keep Alive Timeout (ms)** box, enter the time (in milliseconds) an HTTP persistent connection to the Site can be idle before PingAccess closes the connection. The default is `30000` milliseconds.
11. In the **Max Connections** box, enter the maximum number of HTTP persistent connections you want PingAccess to have open and maintain for the Site. A value of `-1` indicates unlimited connections.
12. Leave the **Send Token** check box selected to include the PA Token in the request to the back-end Site. Clear the check box to remove the PA Token from the request.
13. Click **SAVE**.

    Note: If the target site cannot be contacted, the site is saved and a warning is displayed indicating the reason the site was not reachable.

Delete a Site

1. Click the **Sites** tab.
2. Click the menu button (☰), then click 🗑 **Delete**.

   Info: If a Site is associated with an application, you cannot delete it.

Site Authenticators

When a client attempts to access a target Web Site, that Site may limit access to only authenticated clients. PingAccess integrates with those security models using Site Authenticators. PingAccess supports a variety of Site Authenticators that range from basic username/password authentication to certificate and token-based authentication. Create a Site Authenticator for the type of authentication the Site requires.

Tip: For agent deployments, use *Identity Mappings* to expose user attributes in HTTP request headers to satisfy application security requirements. Identity Mappings are available for both agent and gateway deployments.

Screen Navigation Tips

- Click *NEW SITE AUTHENTICATOR* on the right to configure a new Site Authenticator.

  Info: Site Authenticators cannot be used with Agents.
- Use the **Filter** box on the right to search-as-you-type for Site Authenticators by entering the name or the authentication type.
- Click ☰ to access the edit and delete tasks for a Site Authenticator.

  Info: If a Site Authenticator is associated with a Site, you cannot delete it.

Configure Site Authenticators

When a client attempts to access a target Web Site, that Site may limit access to only authenticated clients. PingAccess integrates with those security models using Site Authenticators. PingAccess supports a variety of Site Authenticators that range from basic username/password authentication to certificate and token-based authentication. Create a Site Authenticator for the type of authentication the Site requires. To create a Site Authenticator:

1. Enter a unique **Name**. Special characters and spaces are allowed. This name appears in the **Site Authenticator** list on the **New Site** page.
2. Select the type of authentication from the drop-down list.
   - *Basic Authentication Site Authenticator*
   - *Mutual TLS Site Authenticator*
   - *Token Mediator Site Authenticator*
3. Click **SAVE**.

Basic Authentication Site Authenticator

This Site Authenticator uses HTTP Basic authentication (username:password) to authenticate a client requesting access to a Site requiring Basic authentication.

Info: Obtain the username and password from your target Site provider.

Field	Description
Username	Defines the username required for access to the protected Site.
Password	Defines the password required for access to the protected Site.

Mutual TLS Site Authenticator

This Site Authenticator uses Key Pairs to authenticate PingAccess to a target Site. When initiating communication, PingAccess presents the client certificate from a Key Pair to the Site during the mutual TLS transaction. The Site must be able to trust this certificate in order for authentication to succeed.

Tip: Several setup steps are required for PingAccess certificate management before configuring the Mutual TLS Site Authenticator (see *Key Pairs*, and *Certificates*).

Field	Description
Key Pair	The imported/generated key pair for client authentication. Select the Key Pair you want to use to authenticate PingAccess to the target Site (see *Key Pairs*).

Token Mediator Site Authenticator

This Site Authenticator uses the PingFederate STS to exchange a PA Token for a security token, such as a WAM Token or OpenToken, that is valid at the target Site.

Field	Description
Token Generator ID	Defines the Instance Name of the Token Generator that you want to use. The Token Generator is configured in

Field	Description
	PingFederate (see *Configuring Token Generators* in the PingFederate documentation).
Logged In Cookie Name	Defines the cookie name containing the token that the target Site is expecting.
Logged Off Cookie Name	Defines the cookie name that the target Site responds with in the event of an invalid or expired token. If the PA Token is still valid, PingAccess re-obtains a valid WAM Token and makes the request to the Site again. If the Site responds with the cookie set as logged off again, PingAccess responds to the client with an access denied page.
Logged Off Cookie Value	Defines the value placed in the Logged Off Cookie to detect an invalid/expired WAM Token event.
Source Token	Defines the token type exchanged for a security token during *identity mediation*. Leave PA Cookie for Web access or select OAuth Bearer Token for API identity mediation.
Send Cookies to Browser	Allows the Token Mediator to send the backend cookie defined in the **Logged In Cookie Name** field back to the browser if the protected application has updated it. This could be used to enable a seamless SSO experience for users navigating from PingAccess protected applications to those protected by a 3rd party Web Access Management system.
Token Processor ID	Defines the Instance Name of a Token Processor that you want to use. The Token Processor is configured in PingFederate (see *Configuring Token Processors* in the PingFederate documentation). Specify this value if more than one instance of either the JWT Token Processor or the OAuth Bearer Access Token Processor is defined in PingFederate.

Agents

Agents are web server plugins that are installed on the web server hosting the target application. Agents intercept client requests to protected applications and allow or deny the request to proceed by consulting the Policy Manager or using cached information. Agents communicate with the PingAccess Policy Server via the PingAccess Agent Protocol (PAAP) which defines in detail the possible interactions between agents and Policy Server. Agents have a name to identify them and a shared secret to authenticate with to Policy Server. Agents do not need to be unique. There can be any number of agents using the same name and secret and they are all treated equally by Policy Server. This is useful in complex deployments where unique agents would be difficult to manage. Agents can be assigned as the destination for one or more applications by name.

Prior to defining an agent, import or create an Agent listener key pair and assign it to the AGENT HTTPS Listener by performing the following steps:

1. Perform the steps in the *Key Pairs* to **Import or Generate a Key Pair**. The key pair's subject or subject alternative names list need to include the host or hosts the agent will use to contact the PingAccess Policy Server.
2. Go to the **Listeners** configuration, and click the menu icon next to the **AGENT** listener, then click **Edit**.
3. Select the key pair created in step 1, then click **Save**.

4. Restart PingAccess.

Info: If the environment is clustered, check the `pingaccess.log` file on each engine to ensure replication completed before restarting each engine.

The Policy Server needs to know each agent name and it's secret. The **Agents** page lists defined agents and allows the user to create, delete, and edit agents.

The **Edit Agent** page is used to change agent fields:

Field	Description
Name	A unique name for the agent. Can be up to 64 characters and must be alphanumeric. It may not include spaces or special characters.
Description	Description of the agent and it's purpose.
PingAccess Host	The host that the agent should send PAAP agent requests to.
PingAccess Port	The port that the agent should send PAAP agent requests to. This port is defined by the agent.http.port parameter in the PingAccess run.properties file. The default value is 3030.
Shared Secrets	The generated shared secrets used to authenticate the agents. This field has buttons to remove the existing secret and download the agent `bootstrap.properties` file for a specified shared secret.
Override Request IP Source Configuration	When selected, this option enables additional controls that configure the agent to use different IP Source information than is defined in *HTTP Requests* on page 69.
Header Names	Contains an ordered list of header names that may contain one or more source IP address values.
List Value Location	When more than one value is included in a header identified in the **Header Names** field, this parameter determines whether the first value or the last value in the list is used as the source address. The default value is **Last**.
Fall Back to Last Hop IP	When selected, if none of the listed **Header Names** are found, PingAccess will use the last hop IP address as the source address. When cleared, if none of the listed **Header Names** are found, access is denied and a `Forbidden` result is returned.

Info: The PingAccess Host and Port may not be the actual host and port that Policy Server is listening to, depending on network routing configuration and network elements such as reverse proxies and load balancers. The **PingAccess Host** and **PingAccess Port** are where the agent sends its requests. For example, if you have a cluster of engines behind a load balancer, the **PingAccess Host** and **PingAccess Port** values might point to the load balancer rather than directly to an engine host in order to provide fault tolerance for the agent connectivity.

When the Agent configuration is completed, click **Save and Download** to save the configuration and download `<agent-name>_bootstrap.properties` for use with the PingAccess Agent.

The shared secret is generated by PingAccess server and identified on this page with a timestamp. Existing secrets can be deleted by clicking the ✖ (Remove) button in the secret field.

If an additional secret is needed, edit the agent and click **Save and Download** to generate and download a new Shared Secret.

Maintaining multiple keys on the server facilitates key rotation, maintaining system availability during key updates. The server will accept any of the defined shared secrets from the agent.

PingAccess can generate additional agent `boostrap.properties` files containing the specified information and a new secret which can be used to configure the agent plugin. Existing secrets can also be re-downloaded if necessary.

To re-download an existing *`<agent-name>`*`_bootstrap.properties`:

1. Edit an existing agent by clicking ≡ **Menu** > **Edit**
2. Decide which specific shared secret to use. Only one shared secret can be included in the agent properties file.
3. Click **Download** in the shared secret field of the chosen shared secret.
4. In a new browser tab or window PingAccess will bring up the file download dialog. The file name is of the form *`<agent-name>`*`_bootstrap.properties` by default.
5. Save the file, then distribute it to the intended agent installation. See either the *PingAccess Agent for Apache Installation* or the *PingAccess Agent for IIS Installation* documentation for more information.

Policy Manager

The Policy Manager is a rich drag-and-drop interface where you can manage policies by creating Rules, building Rule Sets, and applying Rules and Rule Sets to Applications and Resources. Policies are rules or set of rules applied to an application and its resources. Policies define how and when a client can access target Sites. When a client attempts to access an application resource identified in one of the policy's Rules or Rule Sets, PingAccess uses the information contained in the policy to decide whether the client can access the application resource and whether any additional actions need to take place prior to granting access. Rules can restrict access in a number of ways such as testing user attributes, time of day, request IP addresses, or OAuth access token scopes. Rules can also perform request processing such as modifying headers or rewriting URLs.

Tip: Ensure that any headers used in access control rules (such as `X-Forwarded-For`, which is used by Network Range rules) are sanitized and managed exclusively by inline infrastructure that users must be routed through before reaching PingAccess and the protected applications.

Info: Processing rules cannot be used with Agents.

Rules

Rules are the building blocks for access control and request processing. There are many types of rules, each with different behavior and a distinct set of fields to specify the rule behavior.

Create a New Rule

1. Click the + (New Rule) button in the Rule column to open the New Rule page.
2. Enter a unique **Name**. The name can be up to 64 characters long. Special characters and spaces are allowed.
3. Select the rule **Type** to use. Fields associated with that Rule type are shown.
4. Enter the required information for the type of rule you are creating.
5. Click **SAVE** when you finish.

Cross-Origin Request Rule

Cross-Origin Resource Sharing (CORS) provides a means for a web server to grant access to restricted resources (fonts, JavaScript, images, etc.) to an application served by another domain without granting access to those resources beyond a list of predefined origin servers.

Before a CORS request is sent, the originating web server generally sends a "pre-flight" `OPTIONS` request if the request from the client includes credentials. This pre-flight request is used to determine if the target server permits CORS requests to be processed from the originating web server.

PingAccess can be used to evaluate the headers provided in a CORS request to grant or deny access to resources.

Note: In addition to allowing PingAccess to evaluate the CORS request, you can also allow the request to be handled by the protected application, and let PingAccess be excluded from the process of evaluating the access request, if the target application type is `API`. In order to do this with a resource path that is protected by PingAccess and requires user authentication, configure a second resource with the same path prefix, but set the **Methods** field to `OPTIONS` and the **Anonymous** option needs to be cleared. This configuration allows the API request being made to be handled anonymously.

To Configure a Cross-Origin Request Rule

1. Enter one or more **Allowed Origins** values, clicking ✚ to add additional values.

   Important: While it is allowed, we recommend against using a value of `*` in this field. While this is a valid configuration, it is considered to be an insecure practice.
2. If additional options need to be configured, expand the **Advanced** section of the page.
3. To permit user credentials to be used in determining access, enable **Allow Credentials**.
4. To modify the **Allowed Request Headers** values, use the following options:
   - To add a new header, enter the header name, then click ✚.
   - To edit an existing header, click ✎.
   - To remove an existing header, click 🗑.

   The default headers are `Authorization`, `Content-Type`, and `Accept`.
5. To make specific response headers available to the client that originated the cross-origin request, enter the headers in the **Exposed Response Headers** field. Click ✚ to add additional headers to the list.
6. To define the Request Methods allowed in cross-origin requests, select the desired overrides in the **Overridden Request Methods** field.
7. To modify the amount of time the pre-flight **OPTIONS** request is cached, enter the maximum age (in seconds) desired in the **OPTIONS Cache Max Age** field. The default is 600 seconds.
8. Click **SAVE**

Rewrite Rules Overview

It is sometimes necessary to manipulate requests to Sites and their responses. PingAccess allows for the manipulation of the Request URI, the cookie domain, the cookie path, and three of the response headers (`Location`, `Content-Location`, and `URI`), as well as the response content.

For example, a Site is hosted on `https://server1.internalsite.com` under `/content/`. Users access the Site via the following URL in their browser:

```
https://server1.internalsite.com/content/
```

For example purposes, let's say this results in a *302 Redirect* to an `importantContent.html` page as well as setting a domain cookie for `.internalsite.com`. If you protect this Site with PingAccess (using the virtual host `publicsite.com`) under the application `/importantstuff/`, you need to rewrite the content. The information below discusses an example scenario.

Info: This example assumes that a Virtual Host, a Site, and an Application are already configured.

Create a Rewrite Content Rule

A *Rewrite Content Rule* on page 49 alters content in the HTTP Response body.

- In the Response Content-Types field, you define a response type of `text/html`.
- In the Find and Replace criteria, you specify `<a href="https://server1.internalsite.com/content/">` and `<a href="https://publicsite.com/importantstuff/">`.
- Add the Rule to the application. A query to a page with links in it that point to `https://server1.internalsite.com/content/` now point to `https://publicsite.com/importantstuff/`.

Create a Rewrite Cookie Domain Rule

A *Rewrite Cookie Domain* Rule allows the rewriting of the Domain field on cookies when they are set by the back-end site.

- In the Server-Facing Cookie Domain, you enter `internalsite.com`.
- In the Public-Facing Cookie Domain, you enter `publicsite.com`.
- Add the Rule to the application.

  Cookies associated with the domain `publicsite.com` (or `.publicsite.com`) are rewritten to pertain to `internalsite.com` (or `.internalsite.com`).

Create a Rewrite Cookie Path Rule

A *Rewrite Cookie Path* Rule converts the cookie path returned by the Site into a public-facing path.

- In the Server-Facing Cookie Path field, you enter `/content/`.
- In the Public-Facing Cookie Path field, you enter `/importantstuff/`.
- Add the Rule to the application.

  Cookies associated with a cookie path of `/content/` are rewritten to pertain to `/importantstuff/`. After configuring the rewrite Rules as discussed above, a user could access the `https://publicsite.com/importantstuff/` and PingAccess would route that request to `https://server1.internalsite.com/content/`. If the Site sends a redirect to `https://server1.internalsite.com/content/index.html`, PingAccess would return a redirect to `https://publicsite.com/importantstuff/index.html`. If the Site then returned a cookie with a domain of `.internalsite.com` and a path of `/content/`, PingAccess would rewrite that cookie to be relevant to `.publicsite.com` and `/importantstuff/`.

Create a Rewrite Response Header Rule

A *Rewrite Response Header* Rule alters the response header used in the 302 Redirect.

- In the Server-Facing URI field, you enter `https://server1.internalsite.com/content/`.
- In the Public Path field, you enter `/importantstuff/`.
- Add the Rule to the application. A query resulting in a response containing a 302 Redirect to `https://server1.internalsite.com/content/` is rewritten to `https://publicsite.com/importantstuff/`.

  ➡ **Info:** This also works for relative redirects: `/content/` is rewritten to `/importantstuff/`. It also works for the path beneath the one defined in the URI: `/content/news/index.html` is rewritten to `importantstuff/news/index.htm`.

Create a Rewrite URL Rule

A *Rewrite URL* Rule alters the Request URI.

- In the Map From field, you enter `^/importantstuff/(.*)` as the regex of the URL's path and query you want to match.

- In the Map To field, you enter `/content/$1`.
- Add the Rule to the application. A query to `https://publicsite.com/importantstuff/` results in PingAccess routing that query to `https://server1.internalsite.com/content/`.

Rewrite Content Rule

Use the Rewrite Content Rule to modify text in HTTP response bodies as it is served to the client. This rule uses a subset of the Java Regular Expression syntax that excludes look-behind constructs (for example, `\b`) and the boundary matcher (`\G`). If no Java regular expression syntax is used, the effect is to perform a case-sensitive search and replace. The most common use case for this rule is to rewrite host names within URLs contained in HTML, JavaScript or CSS content.

Info: Extensive use of Rewrite Content Rules may have significant performance implications.

This rule supports content that is either chunked or streamed from the target server. When sent to the client, the content is always chunked.

To configure a Content Rewrite Rule:

1. Name the rule.
2. Select **Rewrite Content** from the list.
3. Enter one or more **Response Content-Types** to define what type of response data the rewrite rule applies to. The default values are `text/html`, `text/plain`, and `application/json`. The list is an ordered list.

   Info: Only text-based content types are supported. Text-based content types compressed with gzip, deflate, or compress will be decompressed prior to rewrite rule processing, however the content is not then re-compressed before being sent to the client. If the originating server does not specify a content-type header, this rule has no effect.
4. Define one or more set of **Find and Replace Criteria**. If multiple criteria are specified, each operation is performed against the original content - effectively applying the rule concurrently. Changes can affect CSS, Javascript, and other text-based elements served to the client, so it is very important to craft the regular expression appropriately to avoid modifying content that wasn't intended.
5. (Optional) If necessary, increase the size of the buffer used to perform the replace operation by opening the **Advanced** options and entering a larger buffer size.

   Note: Replacement values cannot be larger than the buffer size. The minimum buffer size that can be specified is 1024 bytes; there is no maximum value.

Examples:

Example Description	Original Content	Content-Type	Find Criteria	Replacement Value	Modified Text
Rewrite URL portion of a web link	<a href="https://serverx.inside.corp/app/">	`text/html`	`serverx.inside.corp`	`www.acme.com`	<a href="https://www.acme.com/app/">
Case-sensitive text replacement	ACMEcorp	`text/html`	Ecorp	`E Corporation`	ACME Corporation
JSON Value masking	`{ "origin": "127.0.0.1, 192.168.1.1" }`	`application/json`	`(127.0.0.1, *).*"`	`***********`	`{ "origin": "127.0.0.1, ***********" }`

Example Description	Original Content	Content-Type	Find Criteria	Replacement Value	Modified Text
Replacing text inside a specified element using Java regex groups	This text is **bold**.	`text/html`	`<b>(bold)</b>`	`not $1`	This text is not bold.
Case-insensitive text replacement using a Java regex match flag	HTTP	`text/html`	`(?i)http`	`FTP`	FTP

Rewrite Cookie Domain Rule

Converts the cookie domain returned by the Site into a public-facing domain. For example, a Site places a cookie on a cookie domain such as `internalsite.com` (or `.internalsite.com`). Using the information configured in the Rewrite Cookie Domain Rule, PingAccess rewrites the `Domain` portion of the `Set-Cookie` response header with a public-facing domain such as `publicsite.com` (or `.publicsite.com`).

Info: You should only set the cookie (in the Public-Facing Cookie Domain field) to the virtual host name associated with that application or to a domain that is above. For example, `myserver.acme.com` can be set to `acme.com`.

To configure a Rewrite Cookie Domain Rule:

1. Name the Rule.
2. Select **Rewrite Cookie Domain** from the list.
3. In the **Server-Facing Cookie Domain** field, enter the domain name to use in the cookie returned by the back-end Site.
4. In the **Public-Facing Cookie Domain** field, enter the domain name you want to display in the response from PingAccess.
5. Click **SAVE**.

Rewrite Cookie Path Rule

Converts the cookie path returned by the Site into a public-facing path. This enables the details of exposed applications to be managed by PingAccess for security and request routing purposes. For example, a Site places a cookie in a server-facing cookie path such as `/content/`. Using the information configured in the Rewrite Cookie Path Rule, PingAccess rewrites the `Path` portion of the `Set-Cookie` response header with a public-facing cookie path such as `/importantstuff/`.

To configure a Rewrite Cookie Path Rule:

1. Name the Rule.
2. Select **Rewrite Cookie Path** from the list.
3. In the **Server-Facing Cookie Path** field, enter the path name where the cookie is valid for the back-end Site.
4. In the **Public-Facing Cookie Path** field, enter the path name you want to display in the response from PingAccess.
5. Click **SAVE**.

Rewrite Response Header Rule

Converts the response header value returned by the Site into a public-facing value. This Rule rewrites one of three response headers: `Location`, `Content-Location`, and `URI`. For example, the server-facing `Location` response header includes a path that begins with `/test-war/`. Using the information configured in the Rewrite Response Header Rule, PingAccess rewrites `http://private/test-war/` with a public-facing path such as `http://public/path/`.

To configure a Rewrite Response Header Rule:

1. Name the Rule.
2. Select **Rewrite Response Header** from the list.
3. In the **Server-Facing URI** box, enter the URI of the server sending the response. This must be a URI prefix containing at a minimum the protocol and hostname port information. For example: `https://server1.internalsite.com/content/` or `http://SiteHostName/path/`
4. In the **Public Path** box, enter a valid URI path that you want to write into the URI. This must be a valid URI path and begin and end with a slash (`/`). For example: `/importantstuff/` or `/`
5. Click **SAVE**.

Rewrite URL Rule

Examines the URL of every request and determines if a pattern matches. For example, you define a regular expression (regex) in the rule. If a pattern matches, PingAccess uses the information configured in the Rewrite URL Rule and rewrites that portion of the URL into a path that the Site can understand. The following table displays four example Rewrite URL Rule configurations:

Map From Value	Map To Value	Example Request	Rewrite by PingAccess
`/bank/`	`/application/`	`/bank/content.html`	`/application/content.html`
`^/bank/(.*)`	`/application/$1`	`/bank/content.html`	`/application/content.html`
`/bank/index.html`	`/application/index.jsp`	`/bank/index.html`	`/application/index.jsp`
`/bank/index.html`	`/application/index.jsp`	`/bank/index.html?query=stuff`	`/application/index.jsp?query=stuff`

To configure a Rewrite URL Rule:

1. Name the Rule.
2. Select **Rewrite URL** from the drop-down list.
3. In the **Map From** box, enter the regex of the URL's path and the query you want to match. For example: `^/bank/(.*)` This example illustrates matching the `Request-Line` in the request. The `Request-Line` begins with `/bank/` (the `^` indicates "begins with") and places the rest of the URL into the first capture group (for more information on regex patterns, see the *Oracle Java Docs*).
4. In the **Map To** box, enter the URL's path and query you want to generate. For example: `/application/$1` This example defines the replacement string, which generates `/` followed by the content of the first capture group (to better understand the use of special characters such as `\` and `$` in the replacement string, see the *Oracle Java Docs*).
5. Click **SAVE**.

Groovy Script Rule

Groovy scripts provide advanced Rule logic that extends PingAccess Rule development beyond the capabilities of the packaged *rules*. For more information on Groovy, see the *Groovy* and *Groovy Scripts* pages and the *official Groovy documentation*.

Note: Through Groovy scripts, PingAccess administrators can perform sensitive operations that could affect system behavior and security.

See *Advanced Fields* for information about error handling.

1. Enter the Groovy Script to use for Rule evaluation. For example, to create an OAuth Scope Rule that matches more than one scope, your Groovy script might contain: `hasScopes("access","portfolio")`
2. Click **SAVE** when you finish.

HTTP Request Header Rule

Examines a request and determines whether to grant access to a requested resource based on a match found in one of the specified headers in the HTTP request.

Note: See *Advanced Fields* for information about error handling.

If more than one **Field** and **Value** pair is listed, then all conditions must match in order for the rule to succeed.

To configure an HTTP Request Header Rule:

1. In the **Field** column, enter a **Header** name you want to match in order to grant or not grant the client access. For example: `Host`.
2. Enter the **Value** for the Header you want to match in order to grant or not grant the client access. For example: `localhost*`. This value can be a Java regular expression.

   Tip: If you want to match on the `Host` header, include both the host and port as the **Value**, or add a wildcard after the hostname (`host*` or `host:*`) to match what is in the HTTP request.
3. Select **Case Sensitive** if the values should be matched only if the value case is an exact match.
4. Select **Negate** if access should be denied when a match is found.

   Info: Ensure that the attribute name entered in the **Field** field is spelled correctly and exists. If you enter an attribute that does not exist and you select **Negate**, the rule will always succeed. The **Negate** control applies to the entire set of conditions specified, and passes the rule if any condition is not met.
5. If additional **Header** pairs are needed, click ✚ to add an additional row, then repeat steps 1-4.
6. Click **SAVE**.

HTTP Request Parameter Rule

Examines a request and determines whether to grant access to a requested resource based on a match found in specified form parameters of the HTTP request.

This rule determines if the parameters are passed as part of the URL query string parameters or as part of a request body submitted using an HTTP PUT or POST method. If the request is a POST request, the `content-type` must be set to `application/x-www-form-urlencoded` to process the field names in the request.

If this rule is applied to an Agent configuration, only URL query string parameters are compared, because the Agent does not receive the request body for processing.

If more than one **Field** and **Value** pair is listed, then all conditions must match in order for the rule to succeed.

Note: See *Advanced Fields* for information about error handling.

To configure an HTTP Request Parameter Rule:

1. In the **Field** column, enter a **Parameter** name you want to match in order to grant or not grant the client access. For example: `email`.
2. Enter the **Value** for the field you want to match in order to grant or deny the client access. For example, `jsmith@example.com`. This value can be a Java Regular Expression.
3. Select **Case Sensitive** if the values should be matched if the value case is an exact match.
4. Select **Negate** if when a match is found, access is not allowed.

Info: Ensure that the field name you enter is spelled correctly and exists. If you enter a field name that does not exist and you select **Negate**, the rule will always succeed. The **Negate** control applies to the entire set of conditions specified, and passes the rule if any condition is not met.

5. If additional **Parameters** pairs are needed, click ➕ to add an additional row, then repeat steps 1-4.
6. Click **SAVE**.

Network Range Rule

Examines a request and determines whether to grant access to a target Site based on whether the IP address falls within a specified range (using Classless Inter-Domain Routing notation).

Note: See *Advanced Fields* for information about error handling.

To configure a Network Range Rule:

1. Enter a **Network Range** in the field. For example, `127.0.0.1/8`. PingAccess supports both IPv4 and IPv6 addresses.
2. Select **Negate** if when a match is found, access is not allowed.
3. **Conditional:** If you wish to override source address handling defined in the **HTTP Requests** configuration, expand the **Advanced** section of the page and perform the following steps:
   a) Select the **Override Request IP Source Configuration** option.
   b) Enter the **Headers** used to define the Source IP address to use.
   c) Select the **Header Value Location** to use when multiple addresses are present in the specified header. Valid values are `Last` (the default) and `First`.
   d) Select the **Fall Back to Last Hop IP** option to determine if, when the specified **Headers** are not present, PingAccess should return a `Forbidden` result or if it should use the address of the previous hop as the source to make policy decisions.
4. Additional **Advanced** fields for handling error responses may also be defined here. See *Advanced Fields for Rules* on page 56 for more information about these fields.
5. Click **SAVE**.

OAuth Attribute Value Rule

Examines a request and determines whether to grant access to a target Service based on a match found between the attributes associated with an OAuth access token and attribute values specified in the OAuth Attribute Rule.

To configure an OAuth Attribute Value Rule:

1. Enter the **Attribute Name** you want to match to an attribute associated with an OAuth Access token. For example: Group.
2. In the **Attribute Value** box, enter a value for the attribute. For example, Sales.

   Info: If you want to match more attributes, create more OAuth Attribute Value Rules or use the OAuth Groovy Script Rule.
3. Select **Negate** if when a match is found, access is not allowed.

   Info: Verify what you enter for the attribute. If you enter an attribute that does not exist (for example, misspell it) and you select **Negate**, the rule will always succeed.
4. Click **SAVE**.

OAuth Groovy Script Rule

Determines whether to grant access to a target Site based on the results returned from a Groovy script that evaluates request details and OAuth details. This Rule allows you to create more sophisticated OAuth Scope and OAuth Attribute Value Rules.

Info: See *Groovy Scripts* for more information.

To configure an OAuth Groovy Script Rule:

1. Enter the **Groovy Script** to use for Rule evaluation.
2. **Conditional:** If you need to specify a custom Error Response Template File, expand the **Advanced** section and fill in the **Error Response Template File** and **Error Response Content Type** fields.
3. Click **SAVE**.

See *Advanced Fields* for information about error handling.

OAuth Scope Rule

Examines the contents of the PingFederate validation response and determines whether to grant access to a back-end target Site on a match found between the scopes of the validation response and scope specified in the OAuth Scope Rule. For example, a Resource may require that the OAuth Access Token contain the scope `superuser`.

Configure an OAuth Scope Rule

1. Enter the **Scope** you want to match to values returned from the Access Validator.

   Info: This is one scope requirement in the set of scopes associated with the access token.
2. Select **Negate** if when a match is found, access is not allowed.
3. Click **SAVE**.

OAuth Rule Advanced Fields

You can customize an error message to display as part of the default oauth.error.json error page rendered in the end-user's browser if Rule evaluation fails for an OAuth-type Rule--*OAuth Attribute Value*, *OAuth Groovy Script*, and *OAuth Scope*. This page is among the templates you can modify with your own branding or other information (see *Customize User-Facing Pages*).

The response status code is always 401 with an Unauthorized status message. The WWW-Authenticate header value provides information on the OAuth credential the client needs to present. For example:

HTTP/1.1 401 Unauthorized

WWW-Authenticate: Bearer realm="test"

Use the following fields to configure the error handling template and content type.

Field	Description
Error Response Template File	The template page for customizing the error message that displays if Rule evaluation fails. This template file is located in the <*PA_HOME*>/conf/template/ directory.
Error Response Content Type	The type of content for the error response so the client can properly display the response.

Rate Limiting Rule

The Rate Limiting Rule allows the administrator to define access to limit a client from overloading the server with too many requests in a specified period of time. The implementation of this rule uses a *Token Bucket* in order to control the number of incoming requests.

The way this works is that the configuration defines a number of requests and an interval that must elapse between requests. The allowed number of requests within the tine window is controlled by the **Advanced** > **Max Burst Requests** setting. For example, if the **Max Burst Requests** value is `1`, two requests are allowed in the request interval — one normal request, and one burst request.

The number of allowed requests is incremented by one at the end of each **Request Interval** if a request was not received. This continues until the number of allowed requests equals the value defined by the **Max Burst Requests** setting.

Note: Using the Rate Limiting Rule in a clustered PingAccess environment may impose stricter clock synchronization requirements for requests processed by multiple engine nodes. Alternatively, a load balancer sitting in front of a PingAccess cluster can be configured to stick the session to a specific engine, thus ensuring that the rate limiting rule is applied by a single PingAccess engine node.

1. Select a **Policy Granularity**, as defined in the following table:

Policy Granularity	Definition
`Resource`	Restricts the rate of requests based on the resource requested.
`Identity`	Restricts the rate of requests to the identity associated with the current authentication token (a PA Cookie or an OAuth token). This is the default value.
`IP`	Restricts the number of requests based on the source IP address. The IP address used to apply this policy comes from the HTTP Requests IP Source configuration options or options that override that configuration, if those options are configured.
`OAuth Client`	Restricts the number of requests to all OAuth tokens obtained by a specific **Client ID**.

2. Enter, in milliseconds, a **Request Interval**.
3. If more than `1` request should be allowed a request interval, expand the **Advanced** section of the page, and enter the number of requests to allow in the **Max Burst Requests** field.

   Note: PingAccess increases the number of available requests only after a request interval that serves no requests to the client. As a result, in the period following a cycle where the remaining allowed burst requests is reduced to `0`, no burst requests would be allowed, regardless of this setting.
4. If PingAccess should reply to the client with a `Retry-After` header instructing the client to wait for a period of time, select the **Set Retry-After Header** option.
5. To customize the error response sent to the client, modify the **Error Response Code**, **Error Response Status Message**, **Error Response Template File**, and **Error Response Content Type** fields. See *Advanced Fields for Rules* on page 56 for more information about these fields.

Time Range Rule

Examines a request and determines whether to grant access to a back-end target Site based on the request falling within a defined time frame. For example, use this Rule when you want to restrict access to specific endpoints for certain time periods, such as during the work day from 8 am to 5 pm.

To configure a Time Range Rule:

1. Enter the beginning time for the time frame in the **Start Time** field. For example: 8:00 AM.
2. Enter the ending time for the time frame in the **End Time** field. For example: 5:00 PM.

   Info: If you are using Internet Explorer or Firefox, you must enter the time in 24 hour format. For example, 5:00 PM is 17:00.
3. Select **Negate** if when a match is found, access is not allowed.
4. Click **Save** when you finish.

See *Advanced Fields* for information about error handling.

Web Session Attribute Rule

Examines a request and determines whether to grant access to a target Site based on an attribute value match found within the PA Token.

To configure a Web Session Attribute Rule:

1. Enter the **Attribute Name** that you want to match in order to grant the client access. For example, `Group`.

2. Enter the **Attribute Value** for the Attribute Name. For example, `Sales`. If the attribute has multiple values at runtime, the attribute value you specify here must match one of those values.

   Info: PA Token attributes are obtained from the PingFederate OpenID Connect Policy attribute contract (see *Configuring OpenID Connect Policies*).

3. Click ✚ to add more attributes, or click 🗑 to remove a row.
4. Select **Negate** to disallow access when a match is found.

   Info: Ensure the attribute name is spelled correctly and exists. If you enter an attribute that does not exist and you select **Negate**, the rule will always succeed.

5. Click **SAVE**.

Info: To use this Rule, we recommend that you leave the **Request Profile** checkbox selected (see *Web Sessions*), indicating that you want PingAccess to request additional profile attributes from PingFederate when requesting the ID Token.

See *Advanced Fields* for information about error handling.

Edit a Rule

1. Click ☰ on the Rule you want to edit and click ✎ Edit. The Edit Rule page appears with the same fields as when the rule was created.
2. Make your edits.
3. Click **SAVE**.

Delete a Rule

Note: A Rule that is associated with a rule set or an application cannot be deleted.

1. Click ☰ on the Rule you want to delete and click 🗑 Delete.
2. Click **DELETE** in the confirmation window.

Advanced Fields for Rules

You can customize an error message to display as part of the default error page rendered in the end-user's browser if Rule evaluation fails. This page is among the templates you can modify with your own branding or other information (see *Customize User-Facing Pages*). Use the following fields to configure the error handling.

Field	Description
Error Response Code	The HTTP status response code you want to send if Rule evaluation fails. For example, `403`.
Error Response Status Message	The HTTP status response message you want to return if Rule evaluation fails. For example, `Forbidden`.
Error Response Template File	The HTML template page for customizing the error message that displays if Rule evaluation fails. This template file is located in the `<PA_HOME>/conf/template/` directory.
Error Response Content Type	The type of content for the error response so the client can properly display the response.

Error Handling Fields for OAuth Rules

You can customize an error message to display as part of the default `oauth.error.json` error page rendered in the end-user's browser if Rule evaluation fails for any OAuth-type Rule (*OAuth Attribute Value*, *OAuth Groovy Script*, or *OAuth Scope*). This page is among the templates you can modify with your own branding or other information (see *Customize User-Facing Pages*).

The response status code is always `401` with an `Unauthorized` status message. The `WWW-Authenticate` header value provides information on the OAuth credential the client needs to present.

For example:

```
HTTP/1.1 401 Unauthorized
WWW-Authenticate: Bearer realm="test"
```

Use the following fields to configure the error handling template and content type.

Field	Description
Error Response Template File	The template page for customizing the error message that displays if Rule evaluation fails. This template file is located in the *<PA_HOME>*/conf/template/ directory.
Error Response Content Type	The type of content for the error response so the client can properly display the response.

Rule Sets

Rule Sets allow you to group multiple Rules into re-usable sets which can be applied to applications and resources. The **Rule Sets** column displays available Rule Sets.

Create a Rule Set

1. Click ✚ at the top of the **Rule Sets** column.
2. Drag-and-drop a Rule from the **Rules** column onto the box that appears.
3. Enter a name for the Rule Set in the box that appears. Special characters and spaces are allowed.
4. Select Any as the **Success Criteria** to require all Rules in the set to succeed. Select All to require just one of the Rules in the set to succeed.

   Info: When **Success Criteria** is set to **Any**, the first rule establishes the error handling and is flagged with an information icon ℹ. When **Success Criteria** is set to **All**, the first rule in the set that fails establishes the error handling.

   Note: When **Success Criteria** is set to **Any**, PingAccess flags Processing Rules in a Rule Set with a warning icon ⚠. This is considered a misconfiguration because in an **Any** Rule Set, the first Processing Rule should succeed, causing all other rules in the set to not be evaluated. If you want to use Processing Rules on protected applications as well as handle access control decisions using **Any** criteria, assign Processing Rules directly to the application or create a separate Rule Set for the Processing Rules using the **All** criteria."
5. Click 🖫 to save the Rule Set.
6. Add more Rules.

Edit a Rule Set

1. Click ≡ on the Rule Set you want to edit and click ✎ Edit, then perform any of the following operations:
   - Drag a Rule within a Rule Set up or down to re-order the Rules.
   - Click ⊗ on the Rule you want to remove from a Rule Set.
   - Click ✖ to cancel Edit mode without saving changes.
2. Click 🖫 to save your changes.

Delete a Rule Set

Note: A Rule Set that is associated with an application or resource cannot be deleted

1. Click ≡ on the Rule Set you want to delete and click Delete.
2. Click **DELETE** in the confirmation window.

Application

Apply Rules and Rule Sets to an Application

1. Select an **Application** from the list.
2. Expand the application **Resource**.
3. Drag and drop Rules and Rule Sets onto the policy drop box that appears.

Apply a Rule Set

- Drag the Rule Set onto the drop box of an expanded application or resource to add it to create a policy.

Apply a Rule

To apply a rule to a Rule Set or application, drag the rule onto the drop box of an expanded Rule Set, Application, or Resource.

Edit Rules and Rule Sets for Application

1. Select an **Application** from the list
2. Expand the application **Resource**
3. Drag and drop new Rules and Rule Sets onto the policy drop box.
4. Drag Rules and Rule Sets around in the box to change the order in which Rules are evaluated at runtime.

   Note: Ordering Rules may enhance performance. For example, to fail faster and improve performance as you move through PingAccess.
5. Click ⊗ to remove a Rule or Rule Set from an application or resource.

Settings

The Settings pages provide access to a number of global settings that control PingAccess behavior and enable definition of artifacts used by applications and resources.

Tip: For help in successfully configuring PingAccess to meet your use case, see *Configuration by Use Case*.

Access

Authentication Requirements

Authentication Requirements are policies that dictate how a user must authenticate before access is granted to a protected Web Application. Authentication methods are string values and ordered in a list by preference. At runtime, the type of authentication attempted is determined by the order of the authentication methods.

For example, a user attempts to access a PingAccess Web Application configured with an authentication requirement list containing the values (password, cert). PingAccess redirects the user to PingFederate requesting either password or certificate user authentication. PingFederate authenticates the user based on the password and issues an OIDC ID Token to PingAccess (containing the authentication method that was used). PingAccess ensures that the authentication method matched the requirements and redirects the user to the originally requested Application with the PA cookie set. The user navigates to the Application and access is granted. When the user attempts to access a more sensitive Application, configured with an authentication requirement list containing the value (cert), they are redirected to PingFederate to authenticate with a certificate.

If you configure Applications with authentication requirement lists that have no overlap. For example, one list has (password), another list (cert), a user navigating between Applications may be required to authenticate each time they visit an Application. When configuring authentication requirement lists to protect higher value Applications with step-up authentication, consider including stronger forms of authentication when configuring lower value Applications.

Configure an Authentication Requirement List

1. Enter a unique name for the Authentication Requirements list. Up to 64 characters, including special characters and spaces, are allowed.
2. Enter an authentication method. For example, `cert` or `password`.

   ➡ **Info:** The values you enter here must match the result values defined for the Requested AuthN Context Selector configured within PingFederate (see *Configuring the Requested AuthN Context Selector*).
3. Click ✚ to add the requirement.
4. Continue adding requirements.
5. Click **SAVE**.

Edit an Authentication Requirements List

1. Click ☰ for the list you want to edit and click ✎ **Edit**. The Edit Authentication Requirement page appears.
2. Make your changes.
   - Click ✎ to edit an authentication requirement.
   - Order the requirements by dragging and dropping them.
   - Click 🖫 to save edits.
   - Click ✖ to exit Edit mode without saving changes.
   - Click 🗑 to delete an authentication requirement.
3. Click **SAVE**.

Delete an Authentication Requirements List

1. Click ☰ for the list you want to delete, then click 🗑 **Delete**.
2. Click **DELETE** in the confirmation window.

Identity Mappings

Identity mappings make user attributes available as HTTP request headers to back-end sites that use them for authentication. A single Identity Mapping can expose a number of attribute values. Identity Mappings are assigned to applications.

➡ **Info:** Identity Mappings replace the Web Session Header Site Authenticator available before PingAccess 3.0.

Field	Description
Subject	Selects which attribute is used as the subject.
Attribute Name	Defines the attribute name you want to retrieve. For example, `sub`.

Field	Description
	Info: Attributes are obtained from either the PA Token or OAuth Access Token depending on the type of application this mapping is assigned to. The contract thus is either the *OpenID Connect Policy* for PA Token or the *OAuth Access Token Contract* for access token.
Header Name	Defines the HTTP request header that contains the attribute value retrieved from the PA Token. **Info:** The HTTP header you specify here is the actual header name over the HTTP protocol, not an environment variable interpreted format. For example, enter the `User-Agent` browser type identifying header as `User-Agent`, not `HTTP_USER_AGENT`.

Virtual Hosts

Virtual Hosts enable PingAccess to protect multiple application domains and hosts. A Virtual Host is defined by the host name and host port.

A wildcard (`*`) can be used either to define either any host (`*:443`, for example) or any host within a domain (`*.example.com`, for example).

Prior to availability of SNI in Java 8, an HTTPS port could only present a single certificate. In order to handle multiple Virtual Hosts you have to use a wildcard name certificate or the *Subject Alternative Name* (SAN) extension. With SNI available, Virtual Hosts can present different certificates on a single HTTPS port. You can assign which certificates (Key Pairs) are used by which Virtual Host on the HTTPS Listeners page - see *HTTPS Listeners*.

The Agent Resource Cache TTL advanced field is used to control PingAccess Agent resources for each virtual host.

Field	Description
Host	Enter the host name for the Virtual Host. For example: myHost.com. You can use a wildcard (*) to indicate that any host name is acceptable. A wildcard host may also be specified (e.g. `*.example.com`)
Port	Enter the integer port number for the Virtual Host. For example: `1234`.
Agent Resource Cache TTL	Enter an integer indicating the number of seconds the Agent can cache resources for this application. Only applies to destination of type `Agent`.

Web Sessions

Web Sessions define the policy for Web application session creation, lifetime, timeouts, and their scope. Multiple Web Sessions may be configured to scope the session to meet the needs of a target set of *applications*. This improves the security model of the session by preventing unrelated applications from impersonating the end user. Use this page to configure secure Web Sessions for use with specific applications and to configure global Web Session settings.

Manage Global Web Session Settings

The table below describes the fields for configuring global Web Session settings.

Field	Description
Number of Keys to Cache	Indicates the number of keys you want to keep in history for validation (the default is `3`). Enter how many keys you want to remain valid. For example, if you want to cache three keys and the key roll interval is every 24 hours, once a key rolls, the previous key is valid for 48 more hours.
Signing Key Roll Interval (h)	Indicates how often (in hours) PingAccess rolls the signing and encryption keys. Enter how often you want to roll the keys (the default is `24` hours). Key rollover updates keys at regular intervals to ensure the security of signed and encrypted PA Tokens.
Issuer	A published, unique identifier to be used with the Web session (The default is PingAccess). For example, set the issuer to a value that more closely represents your company. PingAccess inserts this value as the `iss` claim within the PA Token.
Signing Algorithm	The algorithm used to protect the integrity of the PA Token (the default is `ECDSA using P-256 Curve`). Select the signing algorithm you want to use from the list. PingAccess uses the algorithm when creating signed PA Tokens and when verifying signed tokens in a request from a user's browser. The algorithm is also used for signing tokens in *Token Mediation* use cases when PA Tokens are encrypted.
Encryption Algorithm	The algorithm used to encrypt and protect the integrity of the PA Token (the default is `AES 128 with CBC and HMAC SHA 256`). Select the encryption algorithm you want to use from the list. PingAccess uses the algorithm when creating encrypted PA Tokens and when verifying them from a user's browser. ➡ **Info:** Higher encryption levels are available if the administrative console supports it. To enable higher encryption levels, update the administrative console JRE to support unlimited strength security policy. ➡ **Info:** In a clustered environment, be sure to add the security policy changes to the engines as well as the administrative console for the cluster.
Cookie Name	The name of the browser cookie to contain the PA Token (the default is `PA`). Enter a name for the browser cookie.
Update Token Window (s)	The number of seconds before the idle timeout is updated in the PA token. When this time window expires, PingAccess will reissue a new PA cookie.

Web Session Fields

The table below describes the fields used to configure a Web Session. Click **SAVE** when you finish. A new Web Session card appears on the Web Session page.

Field	Description
Name	The Web Session name. Enter a unique name. Up to 64 characters, including special characters and spaces, are allowed.
Cookie Type	The type of token you want to create. An **Encrypted JWT** token uses authenticated encryption to simultaneously provide confidentiality, integrity, and authenticity of the PA Token. A **Signed JWT** token uses asymmetric cryptography with a private/public key pairing to verify the signed message and to confirm that the message was not modified during transit. **Signed JWT** is the default setting. Changing this setting may affect existing ongoing sessions, forcing the user to re-authenticate to access protected resources.
Audience	Defines who the PA Token is applicable to and is represented as a short, unique identifier. Enter a unique identifier between 1 and 32 characters. Requests are rejected that contain a PA Token with an audience that differs from what is configured in the Web Session associated with the target application. Changing this setting may affect existing ongoing sessions, forcing the user to re-authenticate to access protected resources.
OpenID Connect Login Type	Defines how the user's identity is verified based on authentication performed by an OpenID Provider and how additional profile claims are obtained. Three login profiles are supported: **Code** and **POST**, and **x_post**. Select a login profile. **Code** A standard OpenID Connect login flow that provides confidentiality for sensitive user claims. In this profile the relying party (PingAccess) makes multiple back-channel requests in order to exchange an authorization code for an ID Token and then exchange an access token for additional profile claims from the UserInfo endpoint at the provider (PingFederate). This login type is recommended for maximum security and standards interoperability. **POST** A login flow that uses the `form_post` response mode. This flow follows the *OAuth 2.0 Form Post Response Mode* draft specification. This option requires PingFederate 7.3.

Field	Description
	A form auto-POST response containing the ID Token (including profile claims) is sent to PingAccess from PingFederate via the browser after authentication. Back-channel communication between PingAccess and PingFederate is required for key management in order to validate ID Tokens. This login type is recommended for maximum performance in cases where the exchanged claims do not contain information that should be hidden from the end user. Be sure to select the **Implicit** grant type when configuring the OAuth Client within PingFederate (see *Configuring a Client*). The ID Token Signing Algorithm in PingFederate must be set to either one of the ECDSA algorithms or one of the RSA algorithms. **x_post** A login flow based on OpenID Connect that passes claims from the provider via the browser. As with the **POST** login type, select the **Implicit** grant type and use either one of the ECDSA algorithms or one of the RSA algorithms as the ID Token Signing Algorithm. **Info:** If PingFederate 7.3 is used in the environment, we recommend using **POST** rather than **x_post**, as **x_post** was defined by Ping Identity prior to the development of the OAuth 2.0 Form Post Response Mode draft specification.
Client ID	Assigned when you created the OAuth Relying Party client within PingFederate (for more information, see *Configuring a Client* in the PingFederate documentation). Enter the unique identifier (Client ID).
Client Secret	Assigned when you created the OAuth Relying Party Client within PingFederate. Required when configuring the **Code** Login Type. Enter the secret (Client Secret). **Info:** The OAuth Client you use with PingAccess Web sessions must have an OpenID Connect policy specified (for more information see *Configuring OpenID Connect Policies* in the PingFederate documentation).
Idle Timeout (m)	Defines the amount of time, in minutes, that the PA Token remains active, when no activity is detected by the user (the default is `60` minutes). Enter, in minutes, the length of time you want the PA Token to remain active when no activity is detected. Defining an idle expiration protects against unauthorized use of the resource by limiting the amount of time the session remains active when not being used. For example, idle expiration is useful when a user is no longer at the computer and does not log out of the

Field	Description
	session. When the idle expiration is reached, the session automatically terminates. **Info:** If there is an existing valid PingFederate session for the user, an idle time out of the PingAccess session may result in its re-establishment without forcing the user to log in again.
Max Timeout (m)	Defines the maximum amount of time, in minutes, that the PA Token remains active (the default is `240` minutes). Enter, in minutes, the length of time you want the PA Token to remain active. Once the PA Token expires, an authenticated user must re-authenticate. This protects against unauthorized use of a resource, ensuring that a session ends after the specified time and requiring the user to re-authenticate to continue. **Note:** This value needs to be set to a smaller value than the PingFederate Access Token Lifetime defined in the PingFederate Access Token Management instance. See *Configuring Reference-Token Management* in the *PingFederate Administrator's Manual* for more information.

The following **Advanced** fields are also available in the Web Session configuration:

Field	Description
Cookie Domain	The valid domain where the cookie is stored. Enter a valid domain for the cookie. For example, `corp.yourcompany.com`. **Info:** If you set the Cookie Domain, all of your web resources must reside within that domain. If you do not set the Cookie Domain, the PA Token is recreated for each host domain where you access applications.
Secure Cookie	Indicates that the PingAccess cookie must be sent using only HTTPS connections. Selected by default. **Note:** Setting an invalid Cookie Domain or selecting **Secure Cookie** in a non-HTTPS environment causes authentication to fail. This results in PingAccess re-directing the user to re-authenticate with PingFederate indefinitely.
HTTP-Only Cookie	When selected (the default), enables the `HttpOnly` flag on cookies that contain the PA Token. An `HttpOnly` flagged cookie is not accessible using non-HTTP methods such as calls via JavaScript (for example, referencing `document.cookie`) and therefore cannot be easily stolen via cross-site scripting.
Request Profile	When selected (the default), PingAccess requests additional profile attributes from PingFederate when

Field	Description
	requesting the ID Token. To use this feature, you must have a **profile** scope set up in PingFederate (see *Configuring a Client*). The **profile** scope is a standard OpenID Connect-defined scope that defines extended claims about a user. **Note:** The user can access all attributes by examining browser traces. While they are integrity protected to prevent changes, any sensitive or confidential attributes can be viewed should the user decode the ID Token's value.
Validate Session	When selected, PingAccess will validate sessions with the configured PingFederate instance during request processing. Use of this feature requires additional configuration in PingFederate (see *Configure Server-Side Session Management*). This option is not selected by default. Changing this setting may affect existing ongoing sessions, forcing the user to re-authenticate to access protected resources.
Refresh User Attributes	When enabled, PingAccess will periodically contact PingFederate to update user data used in evaluating policy claims. This option works in conjunction with the PingAccess Web Session Management features to automatically require user re-authentication if user attribute data used as issuance criteria for a token in PingFederate causes the token to be revoked. For example, if the PingFederate OpenID Connect Policy has issuance criteria configured to only issue a token if the account is enabled, enabling this Web Session option allows PingAccess to terminate the session the next time the user accesses a protected resource if the user's account was disabled in the user datastore. The refresh interval determines the length of time the user data is cached, so the effect of a change that results in a session being terminated may take up to 60 seconds (by default) to take effect. This interval can be tuned by adding `pa.websession.refreshSessionInterval` to `conf/run.properties` and assigning it a value in seconds. Changing this setting may affect existing ongoing sessions, forcing the user to re-authenticate to access protected resources. This option is selected by default.
Cache User Attributes	When enabled, this option causes PingAccess to cache user attributes internally for use in policy decisions. By doing this, an attribute list that is longer than the maximum cookie size can contain information used to evaluate access requests. In practice, this is 4096 bytes,

Field	Description
	although the maximum cookie size can vary depending on the browser. When this option is disabled, user attribute data is encoded, signed or encrypted (depending on the web session cookie type), and stored in the browser's cookie store. The information is sent from the browser back to PingAccess with each request. Changing this setting may affect existing ongoing sessions, forcing the user to re-authenticate to access protected resources. This option is not selected by default.
Consult Server Duration (s)	Defines the maximum amount of time, in seconds, that a PingAccess Agent caches policy decisions for the web session before sending a request to the Policy Server. This option only applies to agents. ➡ **Info:** The value used for this setting should not be larger than the Idle Timeout value, and ideally, should be defined to be a value less than half the timeout.

Application Scoped Web Sessions

PingAccess Tokens can be configured to have their Web Sessions scoped to a specific application. This improves the security model of the session by preventing unrelated applications from impersonating the end user.

Several controls exist to scope the PA Token to an application:

Audience Attribute

The audience attribute defines who the token is applicable to and is represented as a short, unique identifier. Requests are rejected that contain a PA Token with an audience that differs from what is configured in the Web Session associated with the target Resource.

Audience Suffix

The audience attribute is also used as a suffix of the cookie name to ensure uniqueness. For example, PA.businessAppAudience.

Cookie Domain

The cookie domain can also optionally be set to limit where the PA Token is sent.

➡ **Info:** In addition to these controls, parameters such as session timeout can be adjusted to match the policy requirements of each application.

Corresponding OAuth clients must be defined in PingFederate for each Web Session. Redirect URL whitelists defined in PingFederate dictate from which servers and domains the session can originate. Controlling this within PingFederate enables flexibility of the attribute contract (and its fulfillment) for that particular application. This ensures that each application and its associated policies only deal with attributes related to it.

Create a Web Session

1. On the Web Session page, click **NEW WEB SESSION**.
2. Enter the requested information on the form.
3. Click **SAVE**. A new card appears for the Web Session on the Web Session Page.

Edit a Web Session

1. Click ☰ on the Web Session you want to edit and click **Edit**.
2. Make your edits.
3. Click **SAVE**.

Delete a Web Session

Info: If the Web Session is currently associated with an application, you cannot delete it.

1. Click ☰ on the Web Session you want to delete and click Delete.
2. Click **DELETE** in the confirmation window.

Configure Server-Side Session Management

There are two ways Server-Side Session Management can be implemented:

- PingAccess can reject a PingAccess cookie associated with a PingFederate session that has been invalidated as a result of an end-user driven logout.
- The end user can initiate a logout from all PingAccess issued web sessions using a centralized logout.

The first of these scenarios provides increases both scalability and security, ensuring the PingFederate session is terminated and that subsequent session validation requests are rejected. This scenario implies a user logout from PingAccess protected resources through the invalidation of the related PingFederate session.

The second scenario provides improved performance and end user experience. When the user explicitly logs out of the PingAccess issued session, all related PingAccess cookies are deleted, ensuring the client is no longer authenticated to resources protected by PingAccess. In this scenario, the user has explicitly logged out from all of those protected services.

PingAccess needs to be configured only for the first of these two scenarios. These options are not mutually exclusive, and can be combined to provide comprehensive session management at the server.

Configure PingFederate for Session Management

To configure PingFederate to be able to revoke PingAccess session cookies:

1. Log in to the PingFederate Administrative Console
2. Navigate to **Server Settings** > **Roles & Protocols**
3. Ensure that **Enable OAuth 2.0 Authorization Server (AS) role** and **OpenID Connect** are enabled. Create or modify an existing client.
4. From the main administration page, go to **OAuth Settings** > **Authorization Server Settings**
5. Return to the main administration page, then go to **OAuth Settings** > **Client Management**
6. Create or modify an existing client.
7. Ensure that "Client Secret" is selected and enter a client secret to be used by PingAccess for authentication.
8. In the OpenID Connect section of the client's configuration page, enable "Grant Access to Session Revocation API."

   Note: This setting is the main setting that enables the server-side session management feature in PingFederate.
9. Click **SAVE** to save your changes.

Configure PingFederate For User-Initiated Single Logout

1. Select "Track User Sessions for Logout" under "OpenID Connect Settings"
2. In the OpenID Connect Policy Management page, select the policy, then enable the "Include Session Identifier in ID Token" option. (For more information about configuring an OpenID Connect Policy, see *Configuring OpenID Connect Policies* in the *PingFederate Administrator's Manual*.)

3. In the OpenID Connect section of the client's configuration page, enable **PingAccess Logout Capable**. Note that this setting is only available if you enabled the "Track user Sessions for Logout."

PingFederate is now configured to provide PingAccess with access to the PingFederate-managed session.

Configure PingAccess for Server-Side Session Management

To configure PingAccess:

1. Log in to the PingAccess administrative console
2. Click **Settings** > **Web Session**
3. Either create a new web session or edit an existing web session
4. In the **Client ID** field, enter the client name defined in PingFederate
5. Enter the client secret associated with the specified Client ID
6. Select **Validate Session** to enable the server-side session management feature
7. Click **SAVE**

Networking

Availability Profiles

Availability Profiles are used in a Site configuration to define how PingAccess classifies a backend target server as failed. Sites require the selection of an availability profile, even if only one target is provided.

A connection failure can be determined based on whether a backend target is not responding, or based on specified HTTP status codes that should be treated as failures of a specific backend target. For example, if a backend target is responding to requests with a "500 Server Error" status, it may be desirable to consider that server down even though the web service is responsive.

If multiple targets are specified in a site configuration but a load balancing strategy is not applied, then the Availability Profile will cause the first listed target in the site configuration to be used unless it fails. Secondary targets will only be used if the first target is not available.

Currently, the only availability profile type is **On-Demand**. You may wish to create different profiles for different sites based on differing site needs for retry counts, retry delays, timeouts, or HTTP status codes.

Configure a New Availability Profile

1. Go to **Settings** > **Availability Profiles**, then click **NEW AVAILABILITY PROFILE**.
2. Enter a unique descriptive name for the profile.
3. Select the **On-Demand** Type.
4. Enter the number of milliseconds to wait for a connection to be established to a backend target in the **Connect Timeout (ms)** field.
5. Enter the number of times to retry a connection to a backend target before considering the target failed in the **Max Retries** field.
6. Enter the number of milliseconds to wait between retries in the **Retry Delay (ms)** field.
7. Enter the number of seconds to wait before trying a failed target again in the **Failed Retry Timeout (s)** field.
8. Optionally enter a list of HTTP status codes that should be considered as a failure in the **Failure HTTP Status Codes** field. The sequence for this list is not important.

Edit an Existing Availability Profile

1. Go to **Settings** > **Availability Profiles**, click the icon in the upper right corner of the desired profile, then click **Edit**.
2. Make any desired changes to the profile.

3. Click **SAVE** to save your changes.

HTTP Requests

The settings for HTTP Requests are used to match a served resource with the originating client when one or more reverse proxies are between the client and the served resource. For example, when a reverse proxy sits between the client and the PingAccess server or a PingAccess agent, the additional proxy might be identified as the client. Such proxies can be configured to inject additional headers to relay the originating client address. The settings on this page allow PingAccess to be configured to identify the originating client's address using a list of alternative headers. These settings are used by the PingAccess Policy Server when evaluating network range rules as well as the **inIpRange()** Groovy script matcher.

The list of header names for the **IP Source** and **Host Source** sections is an ordered list, with the first header match being used. By default, `X-Forwarded-For` is configured for IP Source requests, and both `X-Forwarded-Host` and `Host` are configured for Host Source requests.

Info: The IP Source address settings only affect PingAccess as a Gateway; Agents will always use the address for the last hop.

In addition, the **Protocol Source** section can be used to define the header used to identify the protocol used for the original request. The default value is `X-Forwarded-Proto`.

Configure an Alternative IP Source Header

1. Enter a header name to search for in the **Header Names** list.
2. Select either `First` or `Last` for the **List Value Location** to determine whether, when a list of values is in the header, the first value or the last value in the list should be used as the IP Source value. The default value is `Last`.
3. Enable or Disable the **Fallback to Last Hop IP** checkbox to determine, if none of the listed headers is present in the request, whether the upstream IP address should be used for rule evaluation. If this value is disabled and no headers match, the network range rule will return a `Forbidden` status.
4. Click **SAVE**.

Configure an Alternative Host Source Header

1. Enter a header name to search for in the **Header Names** list.
2. Select either `First` or `Last` for the **List Value Location** to determine, when a list of values is in the header, if the first value or the last value in the list should be used as the **Host Source** value. The default value is `Last`.
3. Click **SAVE**.

Configure an Alternative Protocol Source Header

1. If necessary, expand the **Protocol Source** section of the page.
2. Enter a header name in the **Header Name** field.
3. Click **SAVE**.

Listeners

The Listeners configuration page is used to assign key pairs to the administrative, agent, and engine listeners, as well as to define additional listener ports for the PingAccess engine.

HTTPS Listeners

PingAccess listens for HTTP requests on the ADMIN, ENGINE, and AGENT ports. When HTTPS is enabled for these listeners in `run.properties`, a key pair must be assigned to the listener. See *Key Pairs* on page 73 for information on setting up a key pair. By default, the listeners are configured for HTTPS and use pre-generated key pairs associated with `localhost`.

The listeners are defined as follows:

HTTPS Listener	Setting in `run.properties` to Enable HTTPS	Purpose
ADMIN	N/A	Listens for requests for the administrative user interface and the PingAccess REST APIs. **Note:** The ADMIN listener always listens using HTTPS.
AGENT	`agent.secure`	Listens for requests from *PingAccess Agents* running on Apache or IIS web servers.
ENGINE	`engine.secure`	Listens for HTTP or HTTPS requests that are proxied to target web servers associated with *Sites* on page 40.

Info: Changes to the ENGINE Listener and Virtual Host Key Pairs assignments become effective immediately. Changes to the ADMIN and AGENT Listener Key Pairs require a restart of each PingAccess instance (engine nodes as well as the replica administrative node, if configured) in a clustered deployment.

Assign a Key Pair to a Listener

1. Click the context menu icon to the right of the listener , then select **Edit**.
2. Select the desired Key Pair from the list.
3. Click **SAVE**.

Engine Key Pairs

If PingAccess is running under Java 8, the Engine Key Pairs section of the page can be used to assign a key pair to a specific virtual host. Virtual hosts cannot be wildcard hosts, but must include a specific hostname and port. Assigning Key Pairs to Virtual Hosts is useful in situations where the main ENGINE listener Key Pair would not be valid for client TLS handshakes for requests bound for all virtual hosts protected by PingAccess. For example, if the main ENGINE Key Pair is not a wildcard certificate, or does not contain every virtual host name in the *Subject Alternative Name* (SAN) extension.

A Virtual Host may have only one Key Pair assigned to it.

Assign a Key Pair to a Virtual Host

1. Expand the **Engine Key Pairs** section of the page.
2. Click the edit icon in the row the desired key pair appears in.
3. In the **Virtual Hosts** field, select the host or hosts the key pair should be used for.
4. Click the save icon.

Engine Listeners

The Engine Listeners section lists the different ports that the PingAccess Engine listens for incoming client requests. By default, an engine listener is bound to all addresses (specified as an address of "0.0.0.0") on port 3000. The address binding can be changed in the engine's **run.properties** configuration file by changing the `engine.http.bindAddress` property.

Info: The listener port is different from the Virtual Host configuration used by Application objects in PingAccess. For example, a listener listening on port 3000 can handle requests on port 443 if the client sends a request to a reverse proxy or other port forwarding device that redirects the traffic to port 3000 on the Engine. The Host header is used to determine which Virtual Host heard the request (and thus, which Application the client requested), regardless of the Engine listener port that receives the request. See *HTTP Requests* on page 69 for more information about this header.

Define an Engine Listener

1. Click **NEW ENGINE LISTENER**.
2. Enter a descriptive name for the listener.
3. Enter the port the listener will open.

   Info: Remember to open the port in the system firewall, or the listener will not be able to process any incoming requests.
4. If the port should listen for HTTP connections, clear the **Secure** option.

   Note: By default, engine listeners listen for HTTPS connections to protect sensitive data.
5. Click **SAVE**.

Load Balancing Strategies

Load Balancing Strategies are used in a Site configuration to distribute the load between multiple backend target servers. Load balancing settings are optional, and only available if more than one target is listed for a site. This functionality can replace a load balancer appliance between the PingAccess engine nodes and the target servers, allowing for a simpler network architecture.

The load balancing strategies currently available are `Header-Based` and `Round Robin`.

The `Header-Based` strategy requires a header be included in the request that defines the target to select from the **Site** configuration. This strategy has an option to fall back if the requested target is unavailable, or if the header is missing from the request.

The `Round Robin` strategy has a sticky session option that permits a browser session to be pinned to a persistent backend target. This strategy works in conjunction with the availability profile to select a target based on its availability, and the load balancer will not select a target that is in a failed state.

Configure a Load Balancing Strategy

1. Go to **Settings** > **Networking** > **Load Balancing Strategies**
2. Click **NEW LOAD BALANCING STRATEGY**
3. Enter a unique descriptive name for the strategy
4. Select either `Header-Based` or `Round Robin` for the **Type**
5. Configure the options for the selected Load Balancing Strategy type:
   - For a `Header-Based` Load Balancing Strategy:
     1. In the **Header Name** field, enter the name of the header that contains the selected target host.
     2. If desired, expand the **Advanced** section and select the **Fall Back to First Available Host** option to tell PingAccess to use the first available target defined for the site if the target specified in the header is not available or if the header is not present in the request.

        Note: If this option is not enabled and the specified target is not available or the request header is not present, the client will receive a `Service Unavailable` response.
   - For a `Round Robin` Load Balancing Strategy:
     1. If browser sessions should not be pinned to a persistent backend target, deselect the **Sticky Session Enabled** option. This option is enabled by default.
     2. If the **Sticky Session Enabled** option is enabled, enter a cookie name to use in the **Cookie Name** field. This cookie is used by the PingAccess engine to track the persistent backend targets for a session.

Note: When a web session is defined, the **Cookie Name** field defines a cookie prefix to use. The rest of the cookie name comes from the **Audience** field in the *Web Session*.

Edit a Load Balancing Strategy

1. Go to **Settings** > **Networking** > **Load Balancing Strategies**
2. Click the menu icon in the upper right corner of the desired profile, then click **Edit**.
3. Make any desired changes to the profile.
4. Click **SAVE**. Changes are immediately applied to the configuration.

Security

Certificates

Administrators import certificates into PingAccess to establish anchors used to define trust to certificates presented during secure HTTPS connections. Outbound secure HTTPS connections such as communication with PingFederate for OAuth access token validation, identity mediation, and communication with a target Site require a certificate trusted by PingAccess. If one does not exist, communication is not allowed.

Certificates used by PingAccess may be issued by a CA or self-signed. CA-issued certificates are recommended to simplify trust establishment and minimize routine certificate management operations. Implementations of an X.509-based PKI (PKIX) typically have a set of root CAs that are trusted, and the root certificates are used to establish chains of trust to certificates presented by a client or a server during communication.

The following formats for X.509 certificates are supported:

- Base64 encoded DER (PEM)
- Binary encoded DER

A Certificate Group is a trusted set of anchor certificates used when authenticating outbound secure HTTPS connections. The Java Trust Store group contains all the certificates included in the keystore located in the Java installation at `$JAVA_HOME/lib/security/cacerts`. This group of certificates contains well-known, trusted CAs. If you are connecting to Sites that make use of certificates signed by a CA in the Java Trust Store, you do not need to create an additional Trusted Certificate Group for that CA. You cannot manage the Java Trust Store group from the PingAccess administrative console. Expand a section for steps to import and manage certificates and create and manage trusted certificate groups.

Import a Certificate

1. Click ✚ . The New Certificate page appears.
2. Click **CHOOSE FILE** to locate the certificate.
3. Highlight the file, then click **Open**.
4. Click **SAVE** to import the certificate. A new certificate row appears on the Certificates page.

Note: If the Certificate is either expired or not yet valid, PingAccess displays a warning, but the import will proceed.

Delete a Certificate

1. Click ≡ on the certificate you want to delete, then click 🗑 Delete.
2. Click **DELETE** in the confirmation window.

Info: If the certificate is associated with a Trusted Certificate Group, you cannot delete it.

Add Certificate to a Trusted Certificate Group

1. Hover the cursor over the certificate row you want to move. The move cursor appears.
2. Drag and drop the certificate onto the Trusted Certificate Group.

Create a Trusted Certificate Group

1. Click ✚ to create a new Trusted Certificate Group.
2. Drag-and-drop a certificate onto the box that appears. A new group appears at the bottom of the Trusted Certificate Groups list.
3. Enter a name for the group in the box that appears.
4. Drag-and-drop more certificates onto the Certificates box for the group.
5. Select the **Use Java Trust Store** checkbox to set the new group to include the Java Trust Store group. For example, if you create your own intermediate CA certificate that is signed by a well-known CA in the Java Trust Store.
6. Select the **Skip certificate date checks** checkbox to allow PingAccess to ignore date-related errors for certificates that are not yet valid or have expired.
7. Click 🖫 to save the group.

Edit a Trusted Certificate Group

1. Click ≡ for the group you want to edit and click ✎ Edit.
   - Edit the group name and optionally set it to include the Java Trust Store group. For example, if you create your own intermediate CA certificate that is signed by a well-known CA in the Java Trust Store.
   - Expand the group and drag-and-drop certificates onto the Certificates box.
   - Click ⊗ for a certificate you want to remove.
   - Click ✖ to exit Edit mode without saving changes.
2. Click 🖫 to save your changes.

Remove Certificate from a Trusted Certificate Group

1. Expand the Trusted Certificate Group containing the certificate you want to remove.
2. Click ⊗ on the certificate you want to remove.

Delete a Trusted Certificate Group

1. Click ≡ on the group you want to remove and click 🗑 Delete.
2. Click **DELETE** in the confirmation window.

Key Pairs

PingAccess provides built-in Key Pairs, which are required for secure HTTPS communication. A Key Pair includes a private key and an X.509 certificate. The certificate includes a public key and the metadata about the owner of the private key.

PingAccess listens for client requests on the administrative console port and on the PingAccess engine port. To enable these ports for HTTPS, the first time you start up PingAccess, it generates and assigns a Key Pair for each port. These generated Key Pairs are initially assigned on the *HTTPS Listeners* page.

Additionally, Key Pairs are used by the *Mutual TLS Site Authenticator* to authenticate PingAccess to a target Site. When initiating communication, PingAccess presents the client certificate from a Key Pair to the Site during the mutual TLS transaction. The Site must be able to trust this certificate in order for authentication to succeed..

➡ **Info:** Ensure that the administrative console node and engines in a *cluster* have the same cryptographic configuration. For example, if you generate an elliptic curve Key Pair on the administrative console and the engines in the cluster are not configured to support elliptic curve Key Pairs, then the engines are not able to use that Key Pair for the engine *HTTPS Listeners* or as the Key Pair in a *Mutual TLS Site Authenticator*. Cryptographic configuration differences are often caused by having a Java Cryptographic Extension with limited strength providers installed (see the *Oracle Java documentation* for more information).

Use this page to manage Key Pairs and to import or generate additional Key Pairs to secure access to the PingAccess administrative console and for incoming HTTPS requests at runtime as well as for use with the Mutual TLS Site Authenticator.

Import an Existing Key Pair

Use this function to import a Key Pair from a PKCS#12 file. Click **IMPORT** and enter the requested information on the form.

1. In the **Alias** field, enter a name that identifies the Key Pair. Special characters and spaces are allowed. This name identifies the Key Pair when assigning the Key Pair to various configurations such as *HTTPS Listeners*.
2. Enter the **Password** used to protect the PKCS#12 file. PingAccess uses the password to read the file.
3. Click **CHOOSE FILE** to locate the PKCS#12 file.
4. Highlight the file and click **Open**.
5. Click **SAVE** to import the file.

Note: If the Key Pair is either expired or not yet valid, PingAccess displays a warning, but the import will proceed.

Generate a New Key Pair

Use this function to generate a Key Pair and the self-signed certificate.

1. Click + **NEW KEY PAIR**
2. Enter the fields required for the Key Pair.
3. Click **SAVE**.

Generate a Certificate Signing Request

Generate a Certificate Signing Request (CSR) to establish more security and trust than using a self-signed certificate.

1. Go to **Settings** > **Security** > **Key Pairs** and click the menu button on a defined key pair.
2. Click Generate CSR. PingAccess automatically generates a CSR file.
3. Save the file on your system.
4. Provide this file to a Certificate Authority (CA). The CA signs the file and provides a CSR Response that you can upload and use to replace the self-signed certificate. If the CA is well known, its certificates are installed by default in most browsers, and the user is not prompted to trust an unknown certificate.

Import a Certificate Signing Request Response

Import a CSR Response to replace the self-signed certificate in a Key Pair. Click **CSR Response** and fill out the form.

Note: Before you import the CSR Response, import the signing CA certificate into PingAccess and add it to a *Trusted Certificate Group*.

1. Select the **Trusted Certificate Group** to use for validating that the certificate in the CSR Response is correctly formed.
2. Choose the CSR Response file.
3. **UPLOAD** the file.

Download a Certificate

Download a certificate when you need to configure a peer to trust a certificate used by PingAccess. For example, download the certificate for the Key Pair used by a *Mutual TLS Site Authenticator* and configure the target Site to trust the certificate.

1. Click Download Cert. PingAccess automatically downloads the certificate from the Key Pair.
2. Save the file on your system.

Delete a Key Pair

Info: If a Key Pair is currently in use, you cannot delete it.

1. To delete a Key Pair, click **Delete** .
2. Click **DELETE** in the confirmation window. PingAccess removes the Key Pair from the system.

System

Admin Authentication

The default PingAccess administrator authentication method used to protect the administrative console is basic authentication (username and password). Change the default method to any PingAccess supported authentication method using the **Settings** > **System** > **Admin Authentication** page.

Info: We recommend changing the default administrator authentication method to *Single Sign-On (SSO) Authentication*, leveraging the OpenID Connect Provider (OP) features of PingFederate to manage multiple administrators.

Basic Authentication

The authentication default for the PingAccess administrative console is HTTP Basic Authentication. Basic Authentication uses the HTTP Authorization header to transmit the username and password credentials. The PingAccess server response contains a `PA_UI` cookie, which is a signed JSON Web Token. Subsequent HTTP requests send this cookie for authentication rather than the less secure HTTP Authorization header. Basic Authentication supports one user – Administrator. To change the Administrator password, click and click Edit to access the **Basic Authentication** page. You will need the existing Administrator password, and the new password must meet the configured password complexity rules defined in *`pa.admin.user.password.regex`* in `run.properties`.

Single Sign-On (SSO) Authentication

There are several configuration steps required within the PingFederate Authorization Server (AS) as well as PingAccess that you must complete to enable SSO. Expand a section to view those configurations. The Administrative SSO option can be configured to require a specific authentication mechanism, leveraging the PingFederate Requested AuthN Context Selector using the PingAccess *Authentication Requirements* options.

Info: When you enable SSO Authentication, administrative timeouts are controlled by the following settings in the run.properties file: `pa.ui.idleExpirationInMinutes`, `pa.ui.maxExpirationInMinutes`, and `pa.ui.expirationWarningInMinutes` (see *Configuration Properties*).

Tip: To define a fall back administrator authentication method should PingFederate be unreachable, enable the *`admin.auth=native`* property in the `run.properties` file. This overrides any configured administrative authentication to *Basic Authentication*.

Prior to configuring Administrator SSO, it is necessary to ensure that the PingFederate server certificate has been imported into PingAccess and assigned to a Trusted Certificate Group, and the Trusted Certificate Group needs to be correctly associated with the *PingFederate Runtime* configuration.

Configure SSO Authentication in PingAccess

Use the Single Sign-On (SSO) Authentication page in PingAccess to enter the Client ID for the OAuth Client you created in the PingFederate AS.

Info: Be sure to complete the configuration for connecting to the PingFederate OAuth AS on the *PingFederate* page as well as completing the steps below.

1. Enter the unique identifier (**Client ID**) assigned when you created the OAuth client for use with SSO (for more information, see *Configuring a Client* in the PingFederate documentation).

   When configuring the client in PingFederate, make sure you have the following options selected:

   - The **Client Authentication** must be set to `None`
   - The **Allowed Grant Types** must be set to `Implicit`
   - The **Redirect URIs** must include `https://<PA_Admin_Host>:<PA_Admin_Port>/*`
   - The OpenID Connect **Policy** should be set to a policy that uses issuance criteria to restrict access based on some additional criteria.

     Warning: If the selected OpenID Connect Policy does not use issuance criteria to limit which users can be granted an access token, *ALL* users in the associated identity store configured in PingFederate will be able to authenticate to the PingAccess Admin console and make changes. See *Identifying Issuance Criteria for Policy Mapping* in the *PingAccess Administrator's Manual*.
2. Select a defined **Authentication Requirements** list, if your environment requires it.
3. Select **Enabled** to activate SSO Authentication.
4. Click **SAVE** when you finish.

Configure API Authentication

Info: For more information on the PingAccess Administrative API, see *Administrative API Endpoints*

1. Enter the unique identifier (**Client ID**) assigned when you created the OAuth client for validating OAuth access tokens (for more information, see *Configuring a Client* in the PingFederate documentation).
2. Enter the secret (**Client Secret**) assigned when you created the OAuth client for validating OAuth access tokens (for more information, see *Configuring a Client* in the PingFederate documentation).
3. Enter the **Scope** required to successfully access the API. For example, admin. For more information, see *Authorization Server Settings* for defining scopes.
4. Select **Enabled** to activate API Authentication.

Configuration Export/Import

The Configuration Export/Import options create and restore a full PingAccess configuration, allowing it to be backed up and restored into a test environment for testing, or to be used for disaster recovery. The configuration backup is stored as a `json` file, and contains the entire PingAccess configuration.

Caution: As the exported `json` file contains your complete PingAccess configuration, ensure the file is stored somewhere with appropriate security controls in place.

Export PingAccess Configuration

To Export the PingAccess Configuration

1. Navigate to **Settings** > **System** > **Configuration Export/Import**
2. Click **EXPORT** to download your PingAccess configuration. The download filename is `pa-data-<timestamp>.json`

   Note: The *<timestamp>* value is formatted `MM-DD-YYYY.hh.mm.ss` - so a date and time of January 31, 2015 1:35 PM would be encoded as `01-31-2015.13.35.00` in the filename.

Import PingAccess Configuration

The **Import Configuration** option is a version-specific tool used to import a previously exported configuration. PingAccess checks the exported `json` file to ensure that the file came from the same version of PingAccess that it is being imported into.

To Import a PingAccess Configuration:

1. Navigate to **Settings** > **System** > **Configuration Export/Import**

2. Click **CHOOSE FILE**
3. Select the `json` export file containing the configuration to import
4. Click **IMPORT** to start the import process
5. When prompted by the configuration dialog, click **OK**

   Important: This operation is destructive, and overwrites your *entire* PingAccess configuration. Passwords in the system will revert to what they were when the backup was created. Unless you perform a backup prior to restoring a different configuration, the configuration prior to clicking **OK** will not be recoverable.
6. **Conditional:** If the Agent or Admin listener key pairs change as a result of the import operation, restart PingAccess.
7. **Conditional:** If the environment is clustered, ensure that the engines are using the proper engine keys. If they are not, re-save the engine to generate a new public key, and reconfigure the engine to use the newly generated key.

Clustering

PingAccess provides clustering features that allow a group of PingAccess servers to appear as a single system. When deployed appropriately, server clustering can facilitate high availability of critical services. Clustering can also increase performance and overall system throughput. It is important to understand, however, that availability and performance are often at opposite ends of the deployment spectrum. Thus, you may need to make some configuration tradeoffs that balance availability with performance to accommodate specific deployment goals.

In a cluster, you can configure each PingAccess engine, or node, as an administrative console, a replica administrative console, or a runtime engine in the *`run.properties`* file. Runtime engines service client requests, while the console server administers policy and configuration for the entire cluster (via the administrative console). The replica administrative console provides a backup copy of the information on the administrative node in the event of a non-recoverable failure of the administrative console node. A cluster may contain one or more runtime nodes, but only one console node and only one replica console node. Server-specific configuration data is stored in the PingAccess administrative console server in the run.properties file. Information needed to bootstrap an engine is stored in the *bootstrap.properties* file on each engine.

At startup, a PingAccess engine node in a cluster checks its local configuration and then makes a call to the administrative console to check for changes. How often each engine in a cluster checks the console for changes is configurable in the engine run.properties file.

Configuration information is replicated to all engine nodes. By default, engines do not share runtime state. For increased performance, you can configure engines to share runtime state by configuring cluster interprocess communication using the run.properties file (see *Cluster Configuration Settings*).

Info: Runtime state clustering consists solely of a shared cache of security tokens acquired from the PingFederate STS for *Token Mediation* use cases using the *Token Mediator Site Authenticator*.

Engine nodes include a status indicator that indicates the health of the node and a **Last Updated** field that indicates the date and time of the last update. The status indicator can be green (good status), yellow (degraded status), or red (failed status).

The status is determined by using the value for `admin.polling.delay` as an interval to measure health:

Green (good status):

The replica administrative node contacted the primary administrative node on the last pull request.

Yellow (degraded status):

The replica administrative node contacted the primary administrative node between 2 and 10 intervals.

Red (failed status):

The replica administrative node has either never contacted the primary administrative node, or it has been more than 10 intervals since the nodes communicated.

Configure Cluster Prerequisites

Before configuring a PingAccess cluster, there are several prerequisite steps that must be taken.

1. Install PingAccess on each cluster node (see *Install PingAccess*)
2. Create a key pair for the PingAccess administrative console that uses the DNS name of the administrative node as the common name. If an administrative replica console is created, this key pair needs to either be configured with the administrative replica node defined in the Subject Alternative Names for the key pair, or the key pair needs to be configured as a wildcard certificate. (See *Key Pairs*)

   Info: Using an IP address as the common name or in the subject alternative names is also acceptable, as long as those values are used in the administrative node fields on the **Settings | Clustering** configuration page.
3. Edit `<PA_HOME>/conf/run.properties` on the clustered console and change the `pa.operational.mode` parameter from `STANDALONE` to `CLUSTERED_CONSOLE`.
4. Go to **Settings** > **System** > **Clustering** and change the **Primary Administrative Node** value from `localhost:9000` to `<dns_name>:9000`, where `<dns_name>` is the common name from the key pair defined in step 2.
5. Restart the administrative node

Define the Primary Administrative Node

Define the PingAccess server you want to use as the administrative node.

1. Enter the host and port for the administrative console. The default is `localhost:9000`.
2. Click **SAVE**.

Configure the Replica Administrative Node

When using a replica administrative node, it is necessary to define a key pair to use for the admin HTTPS Listener that includes both the primary administrative node and the replica administrative node. This can be accomplished either by using a wildcard certificate or by defining subject alternative names in the key pair that include the replica administrative node's DNS name. If a replica administrative node is used in your configuration, configure the replica administrative node before defining the engine nodes, or the `bootstrap.properties` files generated for the engine nodes will not include information about the replica administrative node.

In addition to the configuration below, the Replica Administrative node includes a status indicator that indicates the health of the node and a read-only **Last Updated** field that indicates the date and time of the last update. The status indicator can be green (good status), yellow (degraded status), or red (failed status).

The status is determined by using the value for `admin.polling.delay` as an interval to measure health:

Green (good status):

The replica administrative node contacted the primary administrative node on the last pull request.

Yellow (degraded status):

The replica administrative node contacted the primary administrative node between 2 and 10 intervals.

Red (failed status):

The replica administrative node has either never contacted the primary administrative node, or it has been more than 10 intervals since the nodes communicated.

Note: If a Replica Administrative Node is being configured in the environment, that must be done prior to configuring the engines.

1. Go to **Settings** > **System** > **Clustering** and configure the **Replica Administrative Node** hostname and port. This name must match either a subject alternative name in the key pair created in the previous section, or be considered a match for the wildcard specified if the key pair uses a wildcard in the common name.
2. Click the download icon next to the **SAVE** button to download the bootstrap file for the replica administrative node.
3. Copy the downloaded file to the replica administrative node's `<PA_HOME>` directory and unzip it
4. **Conditional:** If the Replica Administrative Node is running on a Linux host, execute the command `chmod 400 conf/pa.jwk`

5. Edit *<PA_HOME>*`/conf/run.properties` on the replica administrative node and change the `pa.operational.mode` value to `CLUSTERED_CONSOLE_REPLICA`
6. Start the replica node
7. You can verify replication has completed by monitoring the *<PA_HOME>*`/log/pingaccess.log` file and looking for the message "Configuration successfully synchronized with administrative node"

Configure an Engine

For each engine:

1. Click **NEW ENGINE** on the right to configure a new engine.
2. Enter a **Name** for the engine. Special characters and spaces are allowed.
3. Enter a **Description** of the engine.
4. Click **SAVE & DOWNLOAD** to generate and download a public and private key pair into the *<enginename>*`_data.zip` file for the engine. This file is prepended with the name you give the engine. Depending on your browser configuration, you may be prompted to save the file.
5. Copy the zip file to the *<PA_HOME>* directory of the corresponding engine in the cluster and unzip it. The engine uses these files to authenticate and communicate with the administrative console.

   Info: Generate a new key for an engine at any time by clicking **SAVE & DOWNLOAD** and unzipping the *<enginename>*`_data.zip` archive on the engine to replace the files with a new set of configuration files. When that engine starts up and begins using the new files, PingAccess deletes the old key.
6. **Conditional:** On Linux systems running the PingAccess engine, change the permissions on the extracted `pa.jwk` to mode 400 by executing the command `chmod 400 conf/pa.jwk` after extracting the zip file.
7. Start each engine.

   Info: For information on configuring engine to share information with each other in a cluster, see *Configure PingAccess Servers into a Cluster*.

Edit an Engine

1. Navigate to **Settings** > **System** > **Clustering**.
2. Click ≡ by the engine you want to edit, then click **Edit**. The Edit Engine page appears.
3. Make your edits.
4. Click **SAVE**.

Remove an Engine's Access to the Administrative Console

1. Access the Clustering page by selecting *Settings* from the menu bar of the PingAccess administrative console.
2. Click ≡ for the engine you want to edit and click **Edit**. The Edit Engine page appears.
3. Click ⊗ in the Public Keys box to revoke engine access to the administrative console.

   Info: Use the **SAVE & DOWNLOAD** button to create a new key for the engine. See the steps for setting up a PingAccess engine above.
4. Click **SAVE**.

Remove an Engine

1. Access the Clustering page by selecting *Settings* from the menu bar of the PingAccess administrative console.
2. Click ≡ for the engine you want to delete and click **Delete** to permanently remove all references to the engine from the cluster.
3. Click **DELETE** in the confirmation window.

PingFederate

Use this page to configure the connection to the PingFederate Runtime and Administration, and to identify the Resource Server client for validating OAuth access tokens.

The PingFederate Runtime configuration includes advanced options used to configure an optional backchannel communication. Without this configuration, all communication between PingAccess and PingFederate takes place through the host specified in the PingFederate Runtime configuration section.

With a high availability configuration where multiple PingFederate Runtime Engines are in use, it may be desirable to configure PingAccess to use those Runtime Engines for behind-the-scenes communication rather than the front channel interface used for user authentication. When this configuration is used, one or more back channel servers can be configured; a basic availability profile configuration is used, which can be overridden by setting parameters in the PingAccess `run.properties` file. The values are defined in the *Availability Profile Defaults* settings.

Configure PingFederate Runtime

Before configuring a secure connection to the PingFederate Runtime, it is necessary to export the PingFederate certificate and import it into a trusted certificate group in PingAccess. Perform the following steps:

1. In PingFederate, export the certificate active for the Runtime Server. See *SSL Server Certificates* in the *PingFederate Administrator's Manual* for more information.
2. *Import the Certificate* into PingAccess.
3. (Optional) *Create a Trusted Certificate Group* if one does not already exist.
4. *Add the Certificate to a Trusted Certificate Group*.

Info: For information on setting PingFederate up as an OAuth Authorization Server, see *Enabling the OAuth AS* and *Authorization Server Settings* in the PingFederate documentation.

Once the PingFederate Runtime connection is saved, PingAccess will test the connection to PingFederate. If the connection cannot be made, a warning will be displayed in the admin interface.

Configure the connection to the PingFederate Runtime

1. Enter the **Host** name or IP address for the PingFederate Runtime.
2. Enter the **Port** number for PingFederate Runtime.
3. Enter the **Base Path**, if needed, for PingFederate Runtime. This field is optional. It must start with a slash - for example: `/federation`.
4. Select **Audit** to log information about the transaction to the audit store. PingAccess audit logs record a selected subset of transaction log information at runtime and are located in the `/logs` directory of your PingAccess installation (see *Security Audit Log*).
5. Select **Secure** if PingFederate is expecting HTTPS connections.
6. From the **Trusted Certificate Group** list, select the *certificate group* the PingFederate certificate is in. This field is available only if you select **Secure**.
7. **Conditional:** If hostname verification should be disabled for the PingFederate Runtime, open the **Advanced** section and enable the **Skip Hostname Verification** option.
8. **Conditional:** If hostname verification is required for the PingFederate Runtime, open the **Advanced** section and enter the hostname PingAccess should expect in the **Expected Certificate Hostname** field.

   In addition to the above procedure, if your setup involves OpenID Connect flows, SSO, or other configuration options that require PingAccess and PingFederate to communicate without user involvement, PingAccess can be configured to use a separate back channel communication for those interactions.

Configure the PingFederate Back Channel servers

9. Open the **Advanced** subsection of the **PingFederate Runtime** section of the page.
10. Enter one or more *`hostname:port`* pairs in the **Back Channel Servers** list.

11. **Conditional:** If the back channel uses HTTPS, enable the **Back Channel Secure** option. This option becomes available when at least one Back Channel Server is defined.
12. **Conditional:** If the back channel uses an alternate base path, enter the path in the **Back Chanel Base Path** field. This option becomes available when at least one Back Channel Server is defined.
13. **Conditional:** If hostname verification for secure connections is not required for either the Runtime or the Back Channel Servers, enable the **Skip Hostname Verification** option.
14. **Conditional:** If hostname verification is required, enter the hostname PingAccess should expect in the **Expected Certificate Hostname** field.
15. Click **SAVE**.

Info: Once you save this configuration and *Configure the OAuth Resource Server* on page 82, a PingFederate Access Validator is available for selection when you define OAuth-type rules in *Policy Manager*.

Configure PingFederate Administration

For information on the PingFederate Administration API see *PingFederate Administrative API* in the PingFederate documentation.

Once the PingFederate Administration configuration is saved, PingAccess will test the connection to PingFederate. If the connection cannot be made, an error will be displayed in the admin interface, and the configuration will not be saved.

1. Enter the **Host** name or IP address for access to the PingFederate Administrative API.
2. Enter the **Port** number for access to the PingFederate Administrative API.
3. Optional: (Optional) Enter the **Base Path** for the PingFederate Administrative API.

   The **Base Path** must start with a slash (/).

   For example: `/path`
4. Enter the **Admin Username**.

   This username only requires Auditor (read only) permissions in PingFederate.
5. Enter the **Admin Password**.
6. Enable **Audit** to log information about the transaction to the audit store. PingAccess audit logs record a selected subset of transaction log information at runtime and are located in the `/logs` directory of your PingAccess installation (see *Security Audit Log*).
7. Enable **Secure** if the Site is expecting HTTPS connections.
8. From the **Trusted Certificate Group** list, select the *group of certificates* to use when authenticating to PingFederate. PingAccess requires that the certificate in use by PingFederate anchor to a certificate in the associated Trusted Certificate Group. This field is available only if you enable **Secure**.

Configure PingFederate for PingAccess SSO

To enable administrator SSO to PingAccess, configure the following settings within the PingFederate AS. Click the icon ( ) next to each section heading to access additional configuration information. For example, click next to **Roles and Protocols** to open a new window and view the Choosing Roles and Protocols page of the PingFederate documentation.

Note: The information below is an example configuration and does not cover all required steps for each PingFederate OAuth Settings page discussed, only fields necessary for successful SSO to the PingAccess administrative console. Fields not mentioned are not necessary for this configuration (see *Using OAuth Menu Selections* for configuration details of the PingFederate OAuth Settings pages).

Note: You must complete the configuration for connecting to the PingFederate OAuth AS instance you plan to use (see *PingFederate*).

Roles and Protocols

- Enable the OAuth 2.0 AS role and the OpenID Connect protocol.

- Enable the IdP Provider role and a protocol.

Password Credential Validator (PCV)

- Create a PCV for authenticating administrative users.

Adapters

- Create an HTML Form IdP Adapter and specify the PCV you configured.

Authorization Server Settings

- Select **Implicit** in the Reuse Existing Persistent Access Grants for Grant Types section.

Access Token Management

- Select **Internally Managed Reference Tokens** as the Access Token Management Type.
- Extend the contract by adding the Username attribute on the Access Token Attribute Contract page.

OpenID Connect Policy Management

Info: We recommend creating an OpenID Connect Policy to use specifically for PingAccess administrative console authentication.

- Delete all of the attributes that appear in the Extend the Contract section of the Attribute Contract page. The only required attribute is **sub**.
- Select **Access Token** as the Source and **Username** as the Value on the Contract Fulfillment page.

Client Management

Info: We recommend creating a Client to use specifically for PingAccess administrative console authentication.

- Select **None** for Client Authentication.
- Add the location of the PingAccess host as a Redirect URI. For example: `https://localhost:9000/*`
- Select **Implicit** as an Allowed Grant Type.
- Select one of the elliptic curve (**ECDSA**) algorithms as the OpenID Connect ID Token Signing Algorithm and select the OpenID Connect Policy to use for PingAccess administrative console authentication.

IdP Adapter Mapping

- Map the HTML Form IdP Adapter Username value to the USER_KEY and the USER_NAME contract attributes for the persistent grant and the user's display name on the authorization page, respectively.

Access Token Mapping

- Map values into the token attribute contract by selecting **Persistent Grant** as the Source and **USER_KEY** as the value for the Username attribute. These are the attributes included or referenced in the access token.

Configure the OAuth Resource Server

Prior to configuring this option, the steps in *Configure PingFederate Administration* on page 81 must be performed.

When receiving OAuth-protected API calls, PingAccess acts as an OAuth Resource Server, checking with the PingFederate OAuth Authorization Server on the validity of the bearer access token it receives from a client. In order to validate the token, a valid OAuth client must exist within the PingFederate OAuth Authorization Server.

Note: This configuration is optional and needed only if you plan to validate PingFederate OAuth access tokens.

1. Enter the OAuth **Client ID** you defined when creating the PingAccess OAuth client in PingFederate.

➡ **Info:** When you configure an OAuth client in PingFederate, be sure to select *Access Token Validation* as the allowed grant type. For more information, see *Configuring a Client* in the *PingFederate Administrator's Manual*.

2. Enter the **Client Secret** you defined when creating the PingAccess OAuth client within PingFederate.
3. Select **Cache Tokens** to retain token details for subsequent requests. This option reduces the communication between PingAccess and PingFederate.
4. In the **Subject Attribute Name** field, enter the attribute you want to use from the OAuth access token as the subject for auditing purposes. For example, `username`. At runtime, the attribute's value is used as the Subject field in audit log entries for API Resources with policies that validate access tokens. The attribute must align with an attribute in the *OAuth access token attribute contract* defined within PingFederate.
5. If multiple Access Token Managers are configured in PingFederate, select the **Send Audience** option to send the URI the user requested as the `aud` OAuth parameter to select an Access Token Manager.

Note: Use of this option requires that the Access Token Management instances be configured with appropriate Resource URIs. Matching of the Resource URI is performed on a most-specific match basis. For examples of how this works, please see *Access Token Management Parameters* in the *PingFederate Administrator's Manual*.

PingAccess Deployment Guide

There are many topics to consider when deciding how PingAccess fits into your existing network, from determining the deployment architecture required for your use case and whether high-availability options are required. This section provides information to help you make the right decisions for your environment.

Use Cases and Deployment Architecture

There are many options for deploying PingAccess in your network environment depending on your needs and infrastructure capabilities. For example, you can design a deployment that supports mobile and API access management, Web access management, or auditing and proxying. For each of these environments, you can choose a stand-alone deployment for proof of concept or deploy multiple PingAccess servers in a cluster configuration for high availability, server redundancy, and failover recovery.

You have a choice between using PingAccess as a Gateway or using a PingAccess Agent plugin on the web server. In a gateway deployment, all client requests first go through PingAccess and are checked for authorization before they are forwarded to the target site. In an agent deployment, client requests go directly to the web server serving up the target site, where they are intercepted by the Agent plugin and checked for authorization before they are forwarded to the target resource. The same access control checks are performed by the PingAccess Policy Server in both cases and only properly authorized client request are allowed to reach the target assets. The difference is that in a gateway deployment client requests are rerouted through PingAccess Gateway, while in an agent deployment they continue to be routed directly to the target site, where PingAccess Agent is deployed to intercept them.

PingAccess Agent makes a separate access control request to PingAccess Policy Server using the PingAccess Agent Protocol (PAAP). The *agent request* contains just the relevant parts of the client request so that PingAccess Policy Server can make the access control decision and respond with instructions to the agent regarding any modifications to the original client request that the agent should perform prior to forwarding the request. For example, the agent may add headers and tokens required by the target resource. Under the PingAccess Policy Server's control, the agent may perform a certain amount of caching of information in order to minimize the overhead of contacting the PingAccess Policy Server, thus maximizing response time.

In both gateway and agent deployment the response from the target resource is processed on the way to the original client. In an agent deployment, the amount of processing is more limited than in a gateway deployment. The agent does not make another request to the Policy Server, so response processing is based on the initial agent response. Consequently, the agent is not able to apply the request processing rules available to the gateway.

When designing a deployment architecture, many requirements and components must be identified for a successful implementation. Proper network configuration of routers/firewalls and DNS ensure that all traffic is routed through PingAccess for the Resources it is protecting and that alternative paths (for example, backdoors) are not available.

The following sections provide specific use cases and deployment architecture requirements to assist with designing and implementing your PingAccess environment.

Deploying for Gateway Web Access Management

A PingAccess Web access management (WAM) deployment enables an organization to quickly set up an environment that provides a secure method of managing access rights to Web-based applications while integrating with existing identity management infrastructure. With growing numbers of internal and external users, and more and more enterprise resources available online, it is important to ensure that qualified users can access only those applications to which they have permission. A WAM environment provides authentication and policy-based access management while integrating with existing infrastructure.

Deployed at the perimeter of a protected network between browsers and protected Web-based applications, PingAccess Gateway performs the following actions:

- Receives inbound calls requesting access to Web applications. Web Session protected requests contain a previously-obtained PA token in a cookie derived from the user's profile during an OpenID Connect based login at PingFederate.
- Evaluates application and resource-level policies and validates the tokens in conjunction with an OpenID Connect Policy configured within PingFederate.
- Acquires the appropriate target security token (*Site Authenticators*) from the PingFederate STS or from a cache (including attributes and authorized scopes) should a Web application require identity mediation.
- Makes authorized requests to the sites where the Web applications reside and responses are received and processed.
- Relays the responses on to the browsers.

The following sections describe sample Proof of Concept and Production architectures for a WAM use case deployment.

- *WAM Gateway POC Deployment Architecture*
- *WAM Gateway Production Deployment Architecture*

Deploying for Agent Web Access Management

A PingAccess Web access management (WAM) agent deployment enables an organization to quickly set up an environment that provides a secure method of managing access rights to Web-based applications while integrating with existing identity management infrastructure and minimal network configuration changes. With growing numbers of internal and external users, and more and more enterprise resources available online, it is important to ensure that qualified users can access only those applications to which they have permission. A WAM environment provides authentication and policy-based access management while integrating with existing infrastructure.

The PingAccess Agent plugin is installed on the Web server hosting the protected Web-based applications and configured to communicate with PingAccess Server also deployed on the network. When the agent intercepts a client request to a protected Web application resource it performs the following actions:

- Intercepts inbound requests to Web applications.
- Sends agent requests to the PingAccess Policy Server sending along relevant request information needed by Policy Server.
- Receives agent responses from Policy Server and follows the instructions from Policy Server, modifies the request as specified, and allows the request to proceed to the target resource.
- Intercepts responses from the application and modifies response headers as instructed in the initial agent request to Policy Server.
- Relays responses on to the browsers.

The PingAccess Policy Server listens for agent requests and performs the following actions:

- Evaluates application and resource-level policies and validates the tokens in conjunction with an OpenID Connect Policy configured within PingFederate
- Acquires the appropriate HTTP request header configuration from the associated *Identity Mappings*.
- Sends an agent response with instructions on whether to allow the request and how to modify the client request headers.

The following sections describe sample Proof of Concept and Production architectures for a WAM use case deployment.

- *WAM Agent POC Deployment Architecture*
- *WAM Agent Production Deployment Architecture*

Deploying for Gateway API Access Management

A PingAccess API access management deployment enables an organization to quickly set up an environment that provides a secure method of controlling access to APIs while integrating with existing identity management infrastructure. Pressure from an ever-expanding mobile device and API economy can lead developers to hastily design and expose APIs outside the network perimeter. Standardized API access management leads to a more consistent, centrally-controlled model that ensures existing infrastructure and security policies are followed, thereby safeguarding an organization's assets.

PingAccess Gateway sits at the perimeter of a protected network between mobile, in-browser, or server-based client applications and protected APIs and performs the following actions:

- Receives inbound API calls requesting protected applications. OAuth-protected API calls contain previously-obtained access tokens retrieved from PingFederate acting as an OAuth Authorization Server.
- Evaluates application and resource-level policies and validates access tokens in conjunction with PingFederate.
- Acquires the appropriate target site security token (*Site Authenticators*) from the PingFederate STS or from a cache (including attributes and authorized scopes) should an API require identity mediation.
- Makes authorized requests to the APIs and responses are received and processed.
- Relays the responses on to the clients.

The following sections describe sample Proof of Concept and Production architectures for an API access management use case deployment.

- *API Access Management POC Deployment Architecture*
- *API Access Management Production Deployment Architecture*

Deploying for Auditing and Proxying

A PingAccess deployment for auditing and proxying enables an organization to quickly set up an environment that provides a secure method of controlling access to back-end Sites. With growing numbers of internal and external users, it is important to know which users are accessing applications, from where and when they are accessing them, and ensuring that they are correctly accessing only those applications to which they have permission. A standardized auditing/proxying deployment provides a centrally-controlled model that ensures existing infrastructure and security policies are followed, thereby safeguarding an organization's assets.

Sitting at the perimeter of a protected network between mobile, in-browser, or server-based client applications and back-end Sites, PingAccess performs the following actions:

- Receives inbound calls requesting access to protected back-end Sites.
- Audits the request and then makes authorized requests to the back-end Sites.
- Receives and processes responses and relays them on to the clients.

The following sections describe sample Proof of Concept and Production architectures for an auditing/proxying use case deployment.

- *Audit and Proxy POC Deployment Architecture*
- *Audit and Proxy Production Deployment Architecture*

Configuration by Use Case

Your next configuration steps depend on what type of deployment you are implementing. See the *Deployment Guide* for a detailed discussion of deployment considerations and best practices in designing your architecture. The following sections describe the configuration steps for the most common use cases:

- *API Access Management Gateway Deployment*
- *Web Access Management Agent Deployment*
- *Web Access Management Gateway Deployment*
- *Auditing and Proxying Gateway Deployment*

Next Steps

Once you complete the above configuration settings, your next steps are similar for all use cases:

- Configure *Sites* and *Agents* to define the target applications to be protected. Sites may need *Site Authenticators* to define the credentials the site expects for access control.

- Configure *Applications* and *Resources* to define the assets you wish to allow clients to access.
- Create *Policies* for the defined applications and resources to protect them.

Web Access Management Gateway Deployment

The following section describes the important configuration options for a Web Access Management Gateway deployment. See *Deploying for Gateway Web Access Management* in the *Deployment Guide* for specific use case information.

Step	Description
Configure the connection to the PingFederate.	PingAccess uses PingFederate to manage web session and authentication.
Configure the OpenID Connect Relying Party Client for PingAccess.	The client must be registered with PingFederate and the client credentials configured in PingAccess to identify PingAccess when requesting authentication for users trying to access Web applications.
Configure Web session details to enable protection of Web Resources.	Configures settings for secure Web sessions such as timeout values, cookie parameters, and cryptographic algorithms.
Generate or Import Key Pairs and *configure HTTP Listeners*.	Defines the certificates and keys used to secure access to the PingAccess administrative console and secure incoming HTTPS requests at runtime.
Set up your cluster for high availability.	Facilitates high availability of critical services, and increases performance and overall system throughput.
Add trusted CA certificates.	Defines trust to certificates presented during outbound secure HTTPS connections.
Create a trusted certificate group.	Provides a trusted set of anchor certificates for use when authenticating outbound secure HTTPS connections.
Define virtual servers for protected Resources.	Allows one server to share PingAccess Resources without requiring all Sites on the server to use the same host name. If SNI is available (Java 8), specific key pairs can be *assigned* to virtual hosts.

Web Access Management Agent Deployment

The following section describes the important configuration options for a Web Access Management Agent deployment See *Deploying for Agent Web Access Management* for specific use case information.

First, PingAccess Agent needs to be deployed using the following steps:

1. Install PA Agent on Web Server - following instruction in *PingAccess Agent for Apache Installation* or *PingAccess Agent for IIS Installation* depending on your specific Web server.
2. Define the *Agents* and download agent bootstrap.properties file via the download field in the Shared Secrets field.
3. Deploy the agent bootstrap.properties file to agents following instructions in *PingAccess Agent Configuration* .

The rest of PingAccess deployment is similar to *Web Access Management Gateway Deployment*.

Step	Description
Configure the connection to the PingFederate.	PingAccess uses PingFederate to manage web session and authentication.
Configure the OpenID Connect Relying Party Client for PingAccess.	The client must be registered with PingFederate and the client credentials configured in PingAccess to identify

Step	Description
	PingAccess when requesting authentication for users trying to access Web applications.
Configure Web session details to enable protection of Web Resources.	Configures settings for secure Web sessions such as timeout values, cookie parameters, and cryptographic algorithms.
Generate or Import Key Pairs and *configure HTTP Listeners*.	Defines the certificates and keys used to secure access to the PingAccess administrative console and secure incoming HTTPS requests at runtime.
Set up your cluster for high availability.	Facilitates high availability of critical services, and increases performance and overall system throughput.
Add trusted CA certificates.	Defines trust to certificates presented during outbound secure HTTPS connections.
Create a trusted certificate group.	Provides a trusted set of anchor certificates for use when authenticating outbound secure HTTPS connections.
Define virtual servers for protected Resources.	Allows one server to share PingAccess Resources without requiring all Sites on the server to use the same host name. If SNI is available (Java 8), specific key pairs can be *assigned* to virtual hosts.

API Access Management Gateway Deployment

The following section describes the important configuration options for deploying an API Gateway. See *Deploying for Gateway API Access Management* in the *Deployment Guide* for specific use case information.

Step	Description
Configure the connection to the PingFederate OAuth Authorization Server.	PingAccess uses this connection and credentials to validate incoming Access Tokens for securing API calls.
Configure the Resource Server OAuth Client.	The client must be registered with PingFederate and the client credentials configured in PingAccess to authenticate PingAccess when validating incoming Access Tokens.
Generate or Import Key Pairs and *configure HTTP Listeners*.	Defines the certificates and keys used to secure access to the PingAccess administrative console and secure incoming HTTPS requests at runtime.
Set up your cluster for high availability.	Facilitates high availability of critical services, and increases performance and overall system throughput.
Add trusted CA certificates.	Defines trust to certificates presented during outbound secure HTTPS connections.
Create a trusted certificate group.	Provides a trusted set of anchor certificates for use when authenticating outbound secure HTTPS connections.
Define virtual servers for protected applications.	Allows one server to share PingAccess Resources without requiring all Sites on the server to use the same host name. If SNI is available (Java 8), specific key pairs can be *assigned* to virtual hosts

Auditing and Proxying Gateway Deployment

The following section describes the important configuration options for an auditing or proxying deployment (see *Deploying for Auditing and Proxying* for specific use case information).

Step	**Description**
Generate or Import Key Pairs and *configure HTTP Listeners*.	Defines the certificates and keys used to secure access to the PingAccess administrative console and secure incoming HTTPS requests at runtime.
Set up your cluster for high availability.	Facilitates high availability of critical services, and increases performance and overall system throughput.
Add trusted CA certificates.	Defines trust to certificates presented during outbound secure HTTPS connections.
Create a trusted certificate group.	Provides a trusted set of anchor certificates for use when authenticating outbound secure HTTPS connections.
Define virtual servers for protected Resources.	Allows one server to share PingAccess Resources without requiring all Sites on the server to use the same host name.

Web Access Management

With growing numbers of internal and external users, and more and more enterprise resources available online, it is important to ensure that qualified users can access only those resources to which they have permission. PingAccess uses Web Access Management (WAM) capabilities to allow organizations to manage access rights to Web-based resources. WAM is a form of identity management that controls access to Web resources, providing authentication and policy-based access management. Once a user is authenticated, PingAccess applies application and resource-level policies to the request. Once policy evaluation is passed, any required identity mediation between the back-end site and the authenticated user is performed. The user is then granted access to the requested resource.

PingAccess provides two deployment architectures for Web Access Management - gateway and agent. In a gateway deployment client requests are routed to PingAccess which then forwards authorized requests to the target application. In an agent deployment, client requests are intercepted at the web server hosting the application via the PingAccess agent plugin. The agent then communicates with PingAccess Policy Server to validate access before allowing the request to proceed to the target application resource.

Choosing Between an Agent or Gateway Deployment

PingAccess can be deployed using Agents, as a Gateway (or reverse proxy), or using a combination of both. Before deciding on a deployment, it is important to understand the pros and cons of each deployment scenario and determine how they impact your strategy.

Gateway

Pros:

- Fewer number of deployed components that require maintenance
- Independent of target application platform
- No impact on web/app server processing and performance
- Able to work with existing security token types (such as creating 3rd party WAM tokens)

Cons:

- Requires networking changes
- Requires strategy for securing direct access to backend web/app servers (network routing or service level authentication)

- Depending on the application, may require content / request/response rewriting
- Another layer that requires HA/DR planning

Agents

Pros:

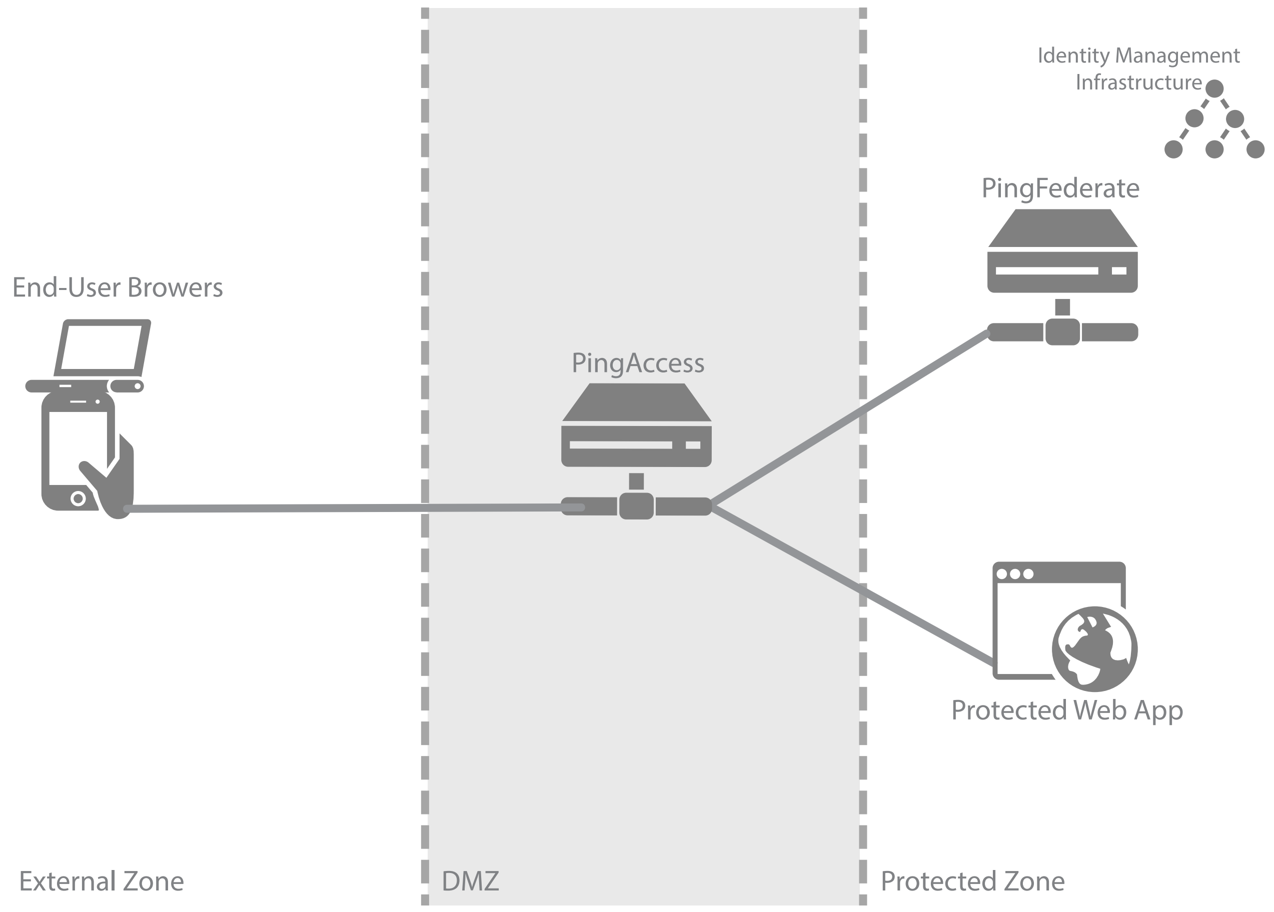
- No networking or server level authentication changes required
- Tight integration with web server handling requests
- Scales with application

Cons:

- High cost of ownership when many agent instances deployed, although should be upgradable/patchable independently of PingAccess (policy) server
- Policy evaluation is cached; although it is periodically flushed/re-evaluated (for new sessions, updates to session token, etc.) it isn't quite is "real time" as proxy
- Tight dependency on web server version & platform

Web Access Management Gateway Proof Of Concept Deployment Architecture

This environment is used to emulate the Production environment for testing purposes. In the test environment, PingAccess can be set up with the minimum hardware requirements. This environment example does not provide high availability and is not recommended for a Production environment.



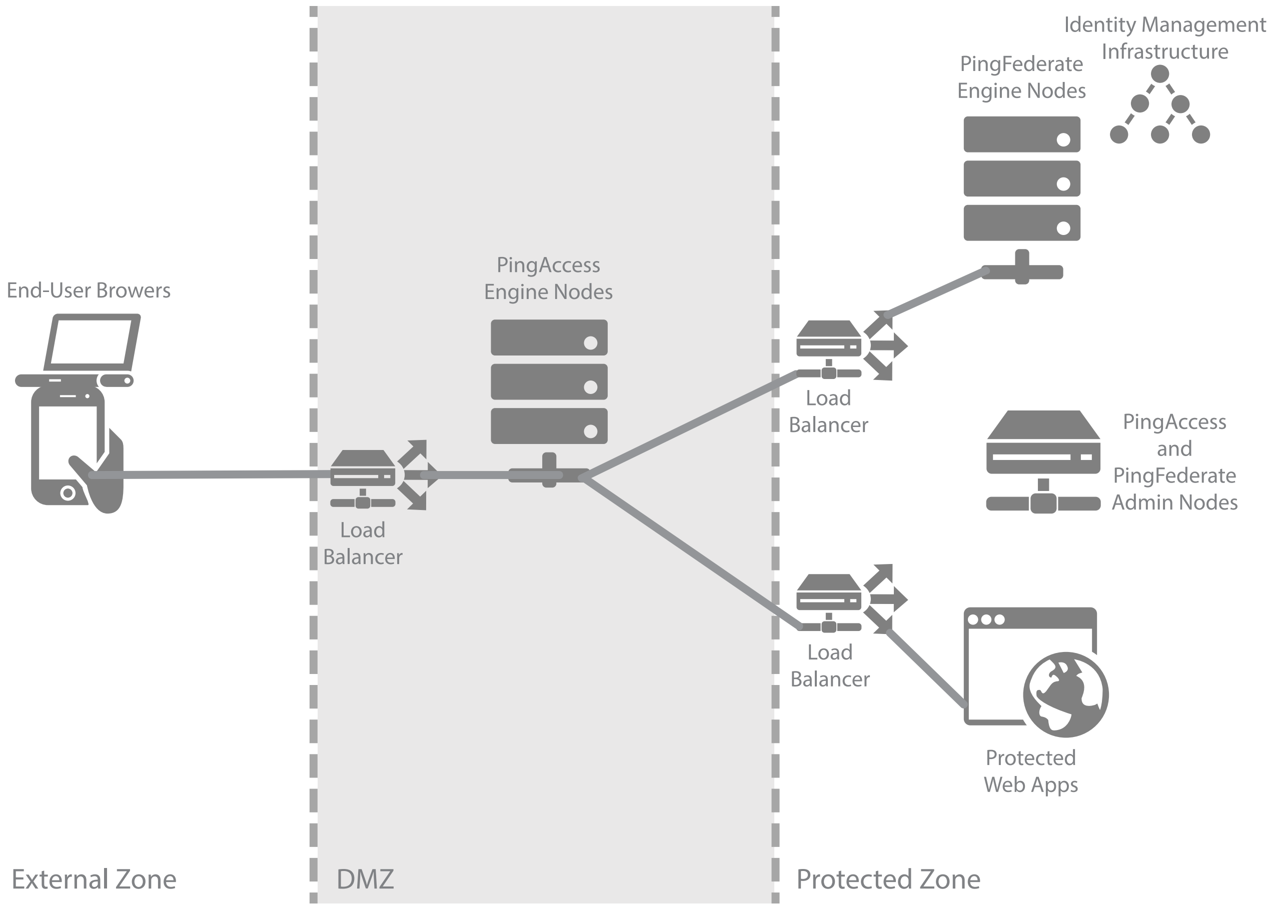
The following table describes the three zones within this proposed architecture.

Zone	**Description**
External Zone	External network where incoming requests for Web applications originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to Web browsers. PingAccess is a standalone instance in this environment, serving as both a runtime and an administrative port.
Protected Zone	Back-end controlled zone in which Sites hosting the protected Web applications are located. All requests to these Web applications must be designed to pass through PingAccess. PingFederate is accessible to Web browsers in this zone and is a standalone instance in this environment, serving as both a runtime and an administrative port. PingFederate requires access to identity management infrastructure in order to authenticate users (depicted by the icon in the diagram).

Web Access Management Gateway Production Deployment Architecture

There are many considerations when deploying a Production environment. For high availability and redundancy, the environment requires clustering and load-balancing. Load balancers are required as part of the networking infrastructure to achieve high availability by ensuring that requests are sent to available servers they are front-ending. Best practices in network design and security also include firewalls to ensure that only required ports and protocols are permitted across zones.

➡ **Info:** PingAccess can provide high availability and basic load balancing for the protected web apps in the protected zone. See the *Availability Profiles* and *Load Balancing Strategies* documentation for more information.

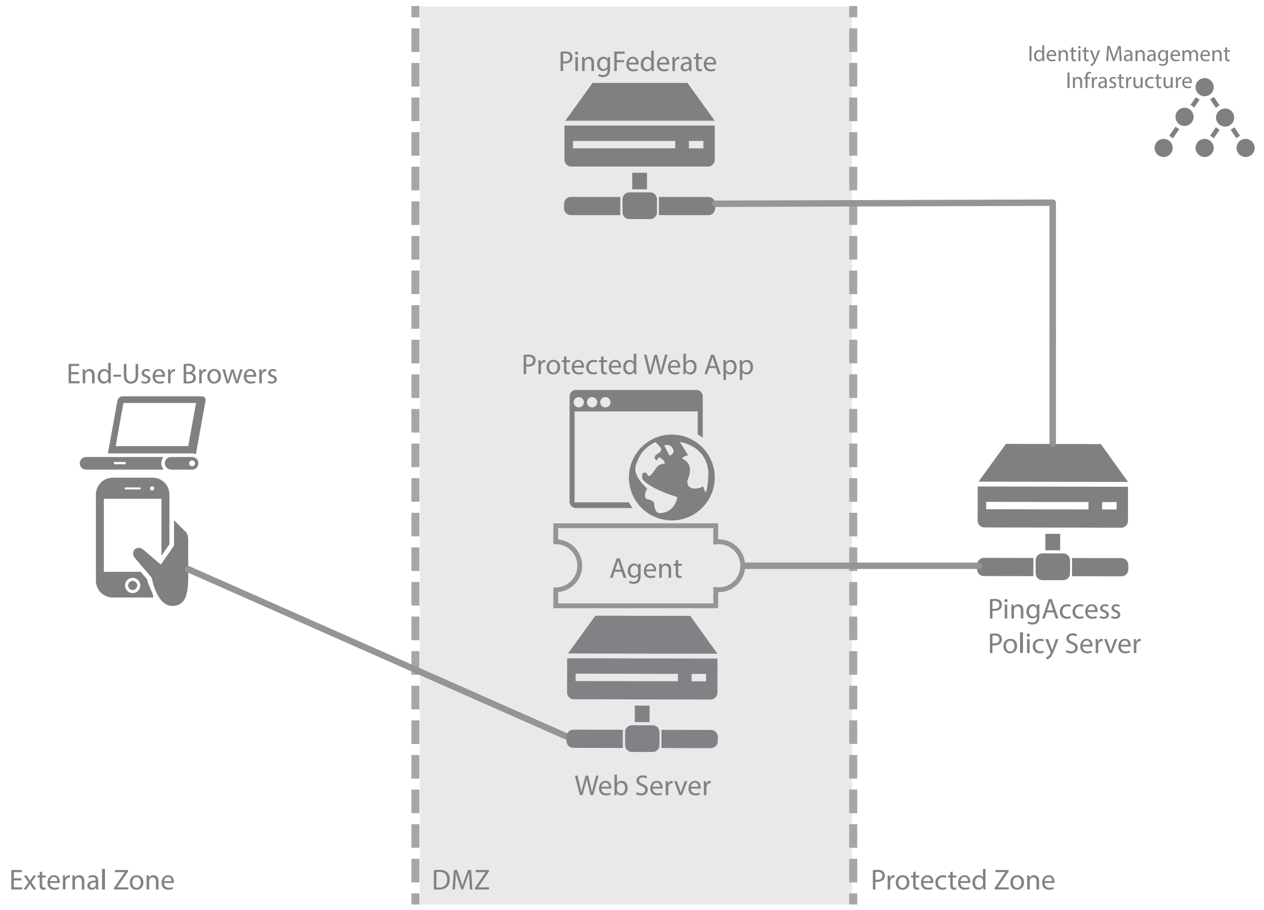


The following table describes the three zones within this proposed architecture.

Zone	Description
External Zone	External network where incoming requests for Web applications originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to Web browsers. A minimum of two PingAccess engine nodes will be deployed in the DMZ to achieve high availability. Depending on your scalability requirements, more nodes may be required.
Protected Zone	Back-end controlled zone in which Sites hosting the protected Web applications are located. All requests to these Web applications must be designed to pass through PingAccess. PingFederate is accessible to Web browsers in this zone and requires access to identity management infrastructure in order to authenticate users (depicted by the icon in the diagram). A minimum of two PingFederate engine nodes will be deployed in the protected zone. Administrative nodes for both PingAccess and PingFederate may be co-located on a single machine to reduce hardware requirements.

Web Access Management Agent Proof Of Concept Deployment Architecture

This environment is used to emulate the Production environment for testing purposes. In the test environment, PingAccess can be set up with the minimum hardware requirements. This environment example does not provide high availability and is not recommended for a Production environment.

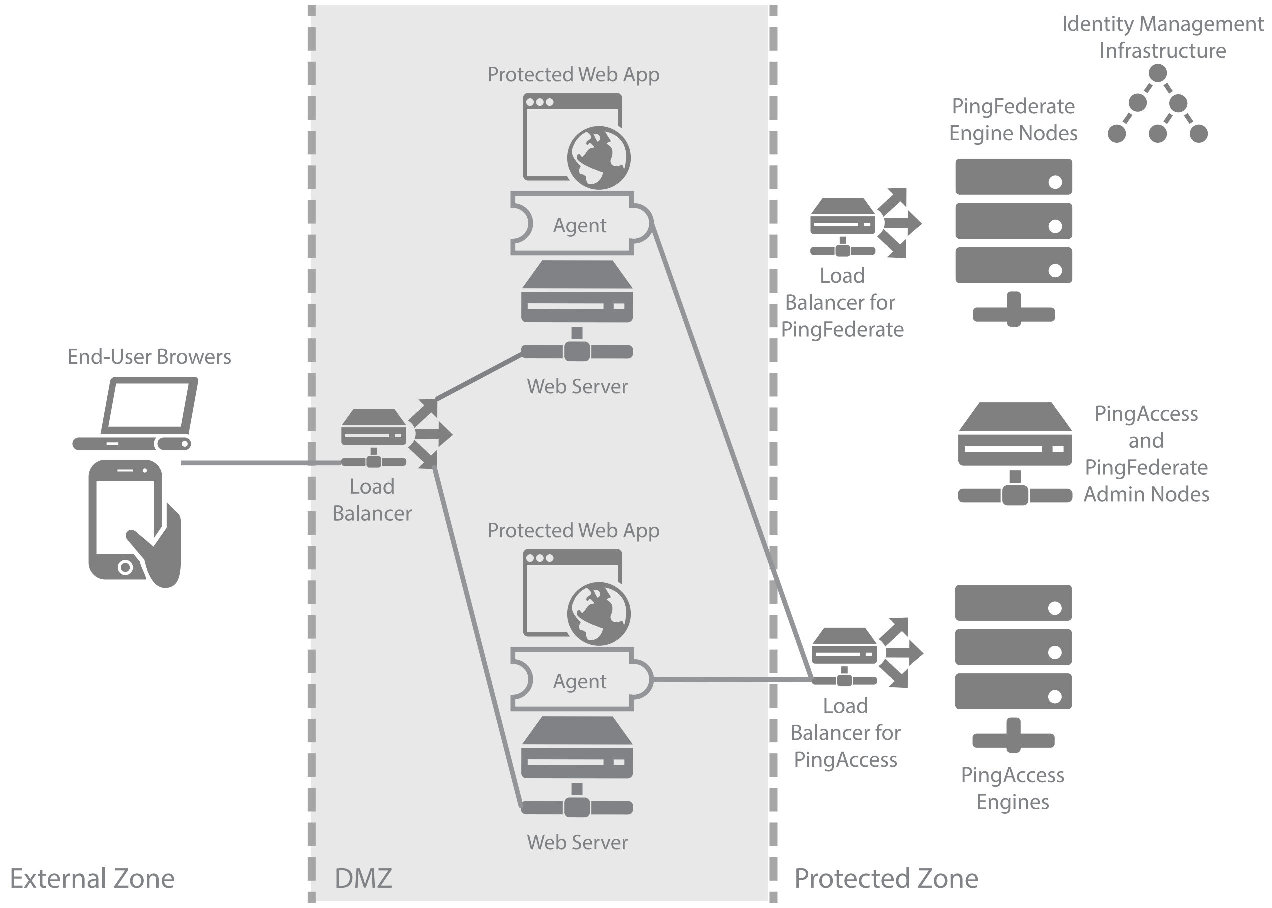


The following table describes the three zones within this proposed architecture.

Zone	Description
External Zone	External network where incoming requests for Web applications originate.
DMZ Zone	Externally exposed segment where application Web server is accessible to Web clients. PingAccess Agent is deployed as a plugin on this Web server. The agent interacts with PingAccess Policy Server in the Protected Zone. PingFederate is deployed as a standalone instance in this environment because during user authentication clients interact with PingFederate. PingFederate requires access to Identity Management Infrastructure in order to authenticate users.
Protected Zone	Back-end controlled zone with no direct access by Web clients. PingAccess Policy Server is deployed in this zone. PingAccess interacts with PingFederate in the DMZ Zone. Identity Management Infrastructure is deployed in this zone.

Web Access Management Agent Production Deployment Architecture

There are many considerations when deploying a Production environment. For high availability and redundancy, the environment requires clustering and load-balancing. Load balancers are required as part of the networking infrastructure to achieve high availability by ensuring that requests are sent to available servers they are front-ending. Best practices in network design and security also include firewalls to ensure that only required ports and protocols are permitted across zones.


Identity Management Infrastructure
Protected Web App
PingFederate Engine Nodes
Agent
Load Balancer for PingFederate
End-User Browers
Web Server
PingAccess and PingFederate Admin Nodes
Load Balancer
Protected Web App
Agent
Load Balancer for PingAccess
PingAccess Engines
Web Server
External Zone
DMZ
Protected Zone

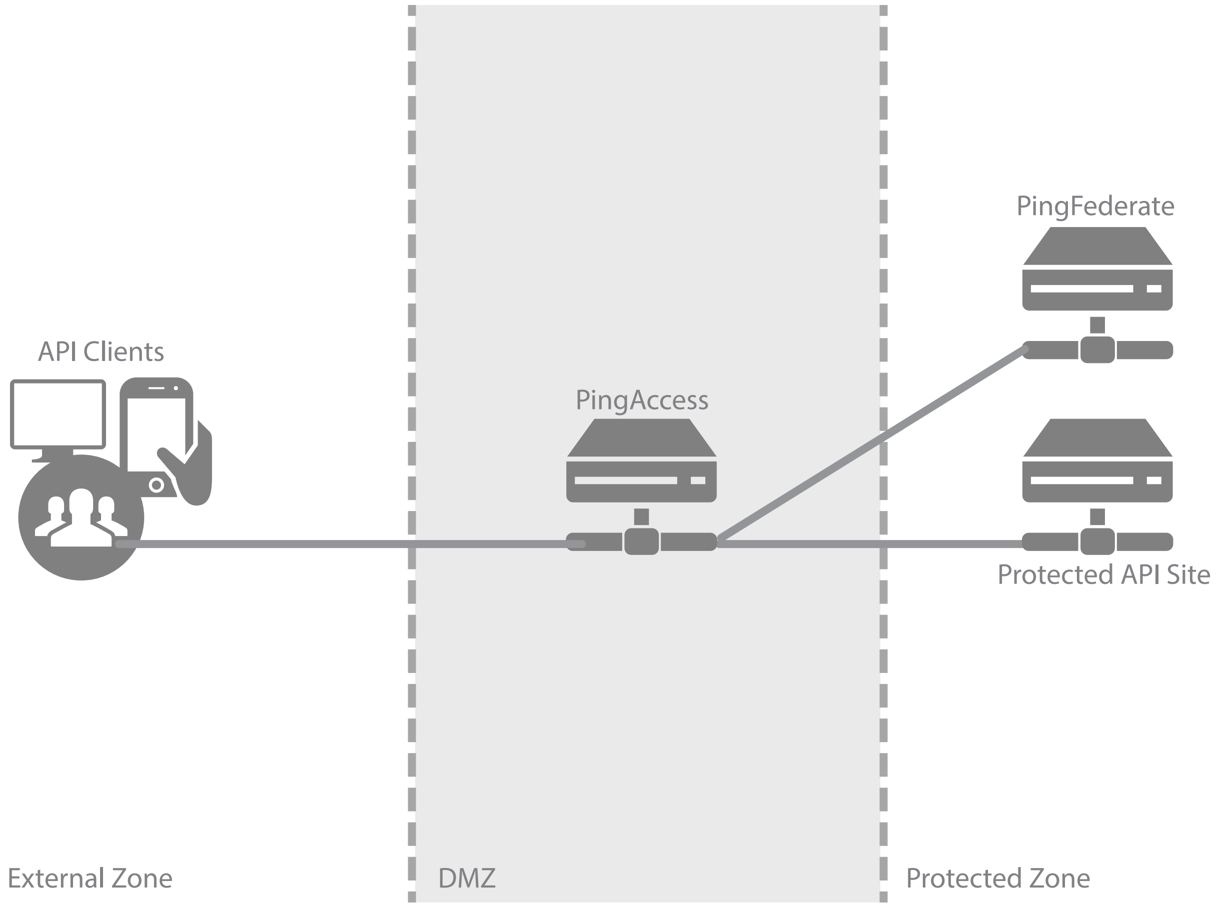
The following table describes the three zones within this proposed architecture.

Zone	Description
External Zone	External network where incoming requests for Web applications originate.
DMZ Zone	Externally exposed segment where (possibly multiple) application Web servers are accessible to Web clients. PingAccess Agent is deployed as a plugin on these Web servers. Agents interact with PingAccess Policy Server in the Protected Zone.
Protected Zone	Back-end controlled zone with no direct access by Web clients. PingAccess Policy Server is deployed in a cluster in this zone with a separate administrative engine. PingFederate is also deployed in this zone in a cluster with its own separate administrative engine. PingFederate needs access to the Identity Management Infrastructure in order to authenticate users. Since during user authentication Web clients need to interact with PingFederate directly, a reverse proxy such as

Zone	Description
	PingAccess Gateway is required to forward client requests through the DMZ. This aspect is not shown in the diagram.

API Access Management Proof of Concept Deployment Architecture

This environment is used to emulate a production environment for development and testing purposes. In the test environment, PingAccess can be set up with the minimum hardware requirements. Given these conditions, we do not recommend using this proposed architecture in a production deployment as it does not provide high availability.



The following table describes the three zones within this proposed architecture.

Zone	Description
External Zone	External network where incoming API requests originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to API clients. PingAccess is a standalone instance in this environment, serving as both a runtime and an administrative port.
Protected Zone	Back-end controlled zone in which Sites hosting the protected APIs are located. All requests to these APIs must be designed to pass through PingAccess. PingFederate is accessible to API clients in this zone and

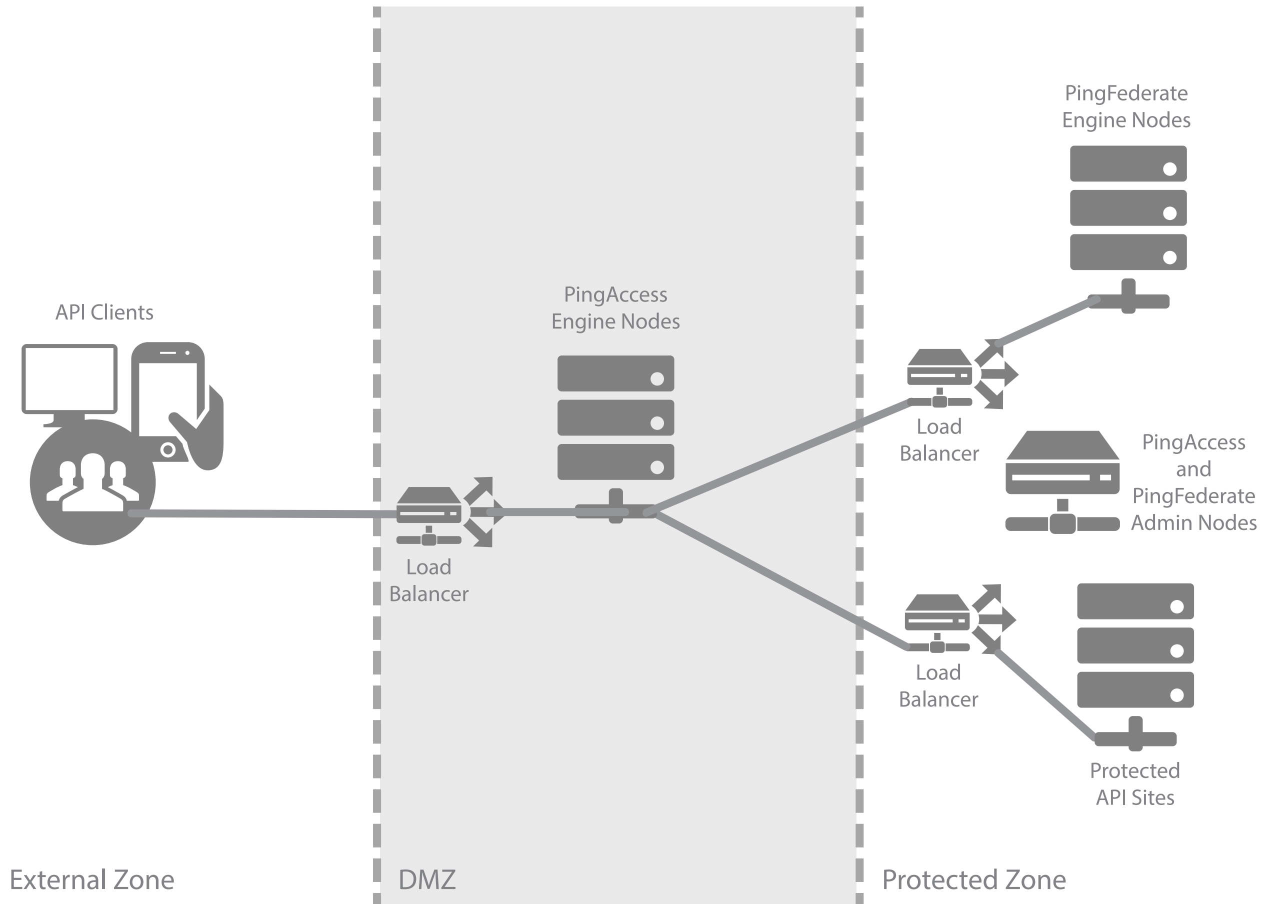
Zone	Description
	is a standalone instance, serving as both a runtime and an administrative port.

API Access Management Production Deployment Architecture

There are many considerations when deploying a Production environment. For high availability and redundancy, the environment requires clustering and load-balancing. Load balancers are required as part of the networking infrastructure to achieve high availability by ensuring that requests are sent to available servers they are front-ending. Best practices in network design and security also include firewalls to ensure that only required ports and protocols are permitted across zones.

➡ **Info:** PingAccess can provide high availability and basic load balancing for the protected web apps in the protected zone. See the *Load Balancing Strategies* documentation for more information.

The following environment example is a recommended production quality deployment architecture for an API access management use case.



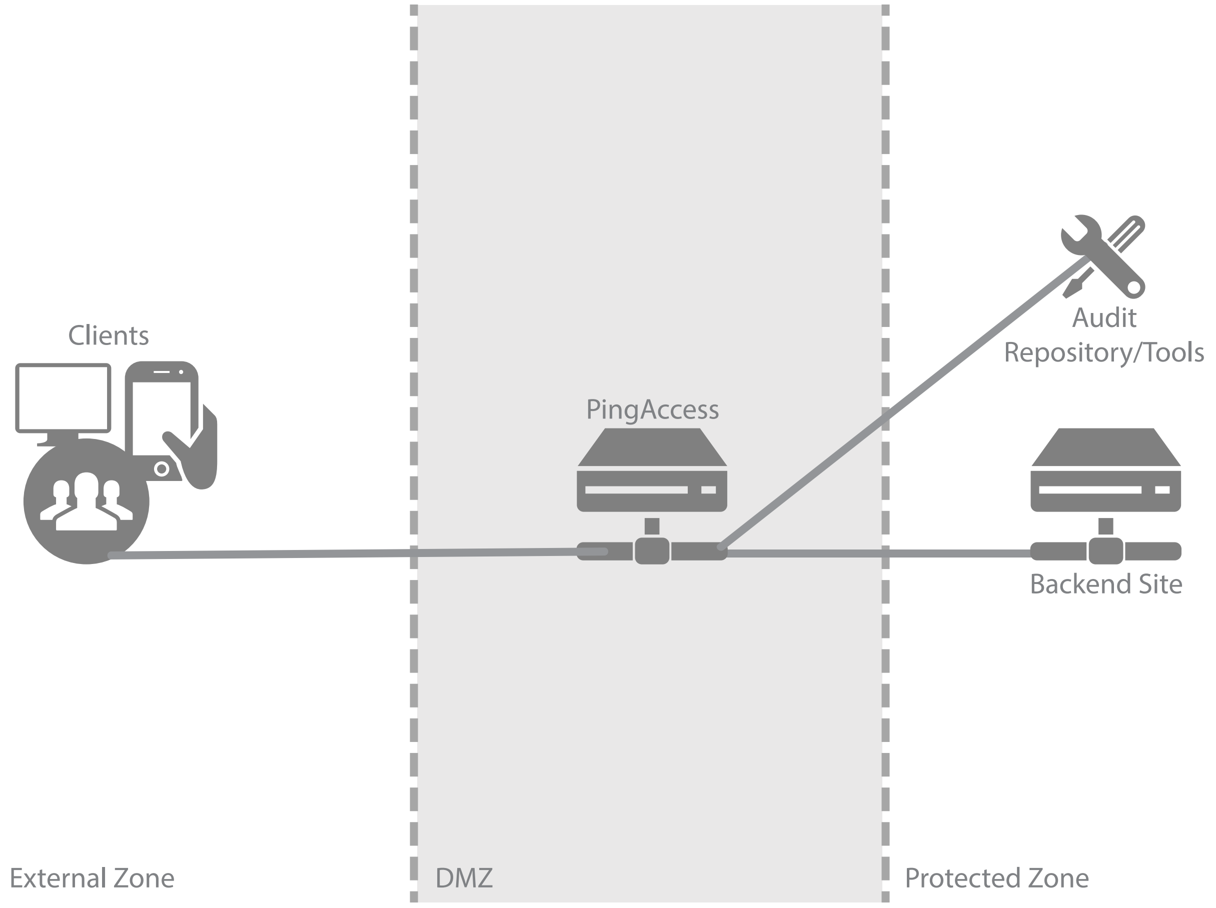
The following table describes the three zones within this proposed architecture.

External Zone	External network where incoming API requests originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to API clients. A minimum of two PingAccess engine nodes will be deployed in the DMZ to achieve

	high availability. Depending on your scalability requirements, more nodes may be required.
Protected Zone	Back-end controlled zone in which Sites hosting the protected APIs are located. All requests to these APIs must be designed to pass through PingAccess. PingFederate is accessible to API clients in this zone. A minimum of two PingFederate engine nodes will be deployed in the protected zone. Administrative nodes for both PingAccess and PingFederate may be co-located on a single machine to reduce hardware requirements

Auditing and Proxying Proof of Concept Deployment Architecture

This environment is used to emulate a production environment for development and testing purposes. In the test environment, PingAccess can be set up with the minimum hardware requirements. Given these conditions, we do not recommend using this proposed architecture in a production deployment as it does not provide high availability.



The following table describes the three zones within this proposed architecture.

Zone	Description
External Zone	External network where incoming requests originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to clients. PingFederate and PingAccess are standalone instances in this environment, serving as both runtime and administrative ports.

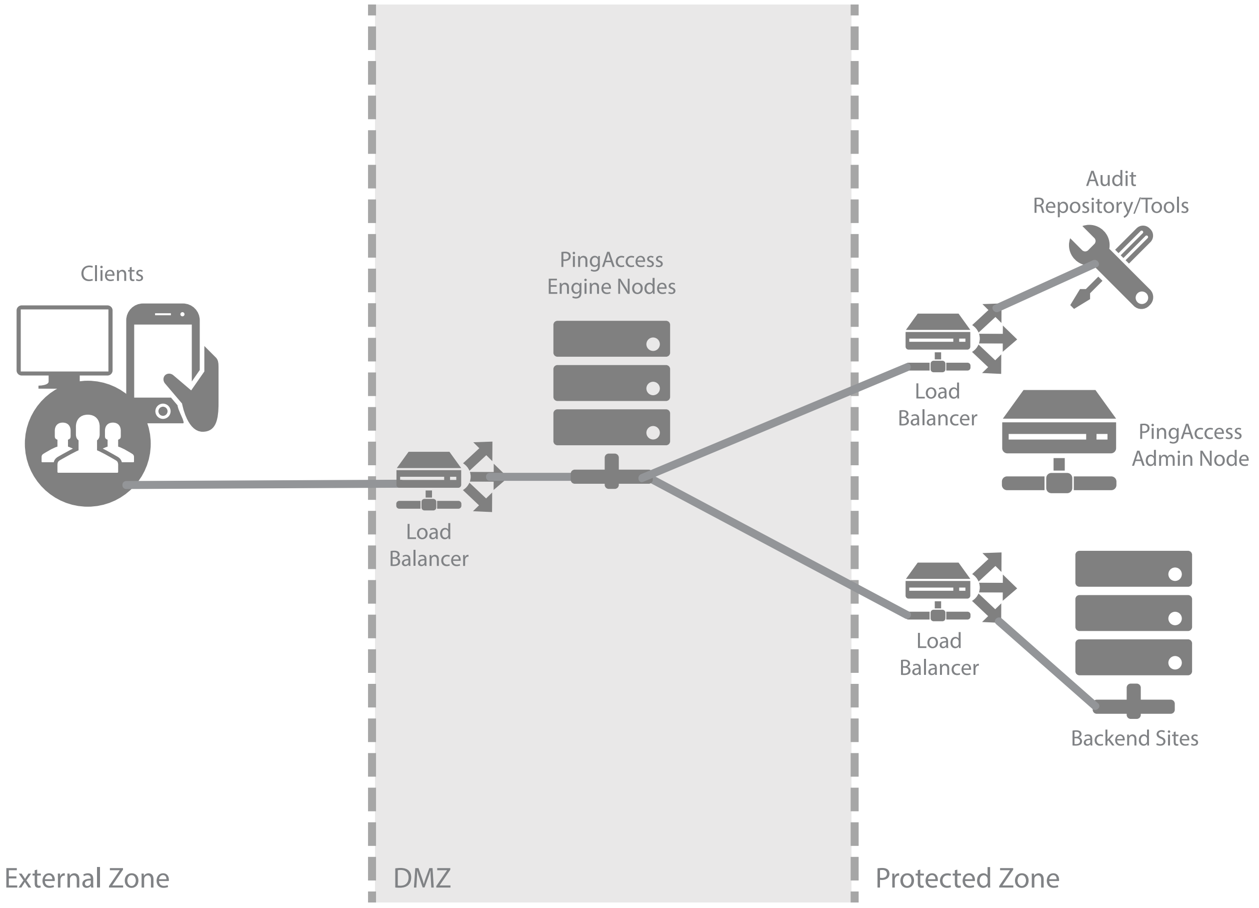
Zone	Description
Protected Zone	Contains back-end Sites audited and proxied through PingAccess. Audit results are sent to an audit repository or digested by reporting tools. Many types of audit repository/tools are supported such as SIEM/GRC, Splunk, database, and flat files.

Auditing and Proxying Production Deployment Architecture

There are many considerations when deploying a Production environment. For high availability and redundancy, the environment requires clustering and load-balancing. Load balancers are required as part of the networking infrastructure to achieve high availability by ensuring that requests are sent to available servers they are front-ending. Best practices in network design and security also include firewalls to ensure that only required ports and protocols are permitted across zones.

Info: PingAccess can provide high availability and basic load balancing for the protected web apps in the protected zone. See the *Load Balancing Strategies* documentation for more information.

The following environment example is a recommended production quality deployment architecture for an auditing/ proxying use case.



The following table describes the three zones within this proposed architecture.

External Zone	External network where incoming requests originate.
DMZ Zone	Externally exposing segment where PingAccess is accessible to clients. A minimum of two PingAccess

	engine nodes will be deployed in the DMZ. Depending on your scalability requirements, more nodes may be required.
Protected Zone	Contains back-end Sites audited and proxied through PingAccess. Audit results are sent to an audit repository or digested by reporting tools. Many types of audit repository tools are supported such as SIEM/GRC, Splunk, database, and flat files.

Customization and Development

Customize User-Facing Pages

PingAccess supplies templates to provide information to the end user. These template pages use the Velocity template engine, an open-source Apache project, and are located in the `<PA_HOME>/conf/template` directory.

You can modify most of these pages in a text editor to suit the particular branding and informational needs of your PingAccess installation. (Cascading style sheets and images for these pages are included in the `<PA_HOME>/conf/static/pa/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 PingAccess server supplies values for the Velocity variables used in the template.

For information about Velocity, refer to the *Velocity project documentation* on the Apache Web site. Changing Velocity or JavaScript code is not recommended. The following variables are the only variables that can be used for rendering the associated Web-browser page.

Variable	Description
`title`	The browser tab title for the message. For example, Not Found.
`header`	The header for the message. For example, Not Found.
`info`	The information for the message. For example, No Resource configured for request.
`exchangeId`	A value that identifies the request/response pair. This can be used to locate messages in the PingAccess logs.
`trackingId`	A value that identifies either the tracking ID (identified with a `tid:` prefix) or an Access Token ID (identified with a `atid:` prefix). This can be used to identify the session in the PingAccess and PingFederate logs.

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 the table below). For example, if Rule evaluation fails, the user's browser is directed to the Policy error-handling page. The following table describes each template.

Template File Name	Purpose	Type	Action
`admin.error.page.template.html`	Indicates an error occurred while the admin console was processing a request	Error	Consult `<PA_HOME>/log/pingaccess.log` to determine the underlying cause of the issue.
`general.error.page.template.html`	Indicates that an unknown error has occurred and provides an error message.	Error	Consult `<PA_HOME>/log/pingaccess.log` to determine the underlying cause of the issue.
`general.loggedout.page.template.html`	Displayed when a user logs out of PingAccess.	Normal	User should close the browser.
`oauth.error.json`	Indicates that Rule evaluation has failed and provides an optional error message. To customize this	Normal	If necessary, consult the audit logs in `<PA_HOME>/log` for details about

Template File Name	Purpose	Type	Action
	information, see *Error-Handling Fields for OAuth Rules*.		why the policy denied the request.
`policy.error.page.template.html`	Indicates that Rule evaluation has failed and provides an optional error message. To customize this information, see *Error-Handling Fields for Rules*.	Normal	If necessary, consult the audit logs in *<PA_HOME>*/`log` for details about why the policy denied the request.

Note: The templates stored in *<PA_HOME>*`/conf/template/system` are system templates, and should not be modified.

PingAccess Endpoints

The following endpoints provide a means by which external applications can communicate with the PingAccess server and provide complete administrative capabilities of the product.

Heartbeat Endpoint

A maintenance endpoint is provided for administrators to verify that the server is running.

OpenID Connect Endpoints

Endpoints needed for PingFederate to interface with PingAccess using the OpenID Connect (OIDC) protocol are also included.

Administrative API Endpoints

The Administrative API endpoints are used by the PingAccess administrative console. These are REST APIs that can be called from custom applications or using command line tools such as curl.

Heartbeat Endpoint

You can use an HTTPS call at any time to verify that the PingAccess server is running. This call can be made to any active PingAccess listener and on any node in a PingAccess cluster. For example, with default port configurations, a CLUSTERED_CONSOLE_REPLICA will respond to this endpoint on port 9000, and a CLUSTERED_ENGINE will respond to it on port 3000.

/pa/heartbeat.ping

This endpoint is configured using the enable.detailed.heartbeat.response parameter in run.properties. If this option is set to false, then an HTTP 200 status and the text OK is returned.

If the enable.detailed.heartbeat.response parameter is set to true (the default setting), then a configurable status with more detail is returned. PingAccess must be restarted if this value is changed.

If an error is returned, then the PingAccess instance associated with the endpoint is down. Load balancers can use this endpoint to determine the status of PingAccess, independent of any other system status checks.

Info: Begin the URL with the server name and the PingAccess runtime port number. For example: https://*hostname*:3000/pa/heartbeat.ping.

The detailed response output format is an Apache Velocity template defined in <*PA_HOME*>/conf/template/heartbeat.page.json. The following values are available:

Value	Description
$monitor.getTotalJvmMemory('bytes'|'KB'|'MB'|'GB')	Returns the total memory in the JVM. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getUsedJvmMemory('bytes'|'KB'|'MB'|'GB')	Returns the used memory in the JVM. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getFreeJvmMemory('bytes'|'KB'|'MB'|'GB')	Returns the free memory in the JVM. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getTotalPhysicalSystemMemory('bytes'|'KB'|'MB'|'GB')	Returns the total system memory. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getTotalUsedPhysicalSystemMemory('bytes'|'KB'|'MB'|'GB')	Returns the used system memory. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getTotalFreePhysicalSystemMemory('bytes'|'KB'|'MB'|'GB')	Returns the free system memory. Specify 'bytes', 'KB', "MB', or 'GB' to specify the units. 'bytes' is the default if not specified.
$monitor.getHostname()	Returns the hostname for the system running PingAccess.
$monitor.getNumberOfCpus()	Returns the number of CPU cores in the system.
$monitor.getCpuLoad('###.##')	Returns the current CPU utilization. The parameter contains an optional format value. If the format is specified, the value returned is returned as a percentage value from 0%-100%, formatted using the *Java DecimalFormat* specification. If no format value is specified, then the value returned is a real number from 0 to 1 which represents the CPU utilization percentage. For example, a format value of "###.##" will return a value similar to "56.12", but no specified format would result in the value being returned as "0.5612".
$monitor.getOpenClientConnections()	Returns the current number of clients connected to PingAccess.
$monitor.getNumberOfVirtualHosts()	Returns the current number of configured virtual hosts in PingAccess.
$monitor.getNumberOfApplications()	Returns the current number of configured applications in PingAccess.
$monitor.getNumberOfSites()	Returns the current number of configured sites in the PingAccess configuration database. In a clustered environment, on the engine nodes, this number will reflect the number of sites associated with applications rather than the number of configured sites that show on the admin node. For more information, see the note in the *Server Clustering* section. This value is not included in the default template, but can be added by the system administrator if desired.
$monitor.getLastRefreshTime('yyyy/MM/dd HH:mm:ss')	Returns the time the PingAccess configuration was last refreshed. The parameter specifies the date format to use;

Value	Description
	if no value is specified, the ISO 8601 date format is used. If the parameter is specified, the format used comes from the *Joda DateTimeFormat* specification.

The template can be modified in any way to suit your needs.

The default content type is application/json, however this can be overridden by modifying the $monitor.setContentType() line in the template to specify the desired content-type header.

OpenID Connect Endpoints

This page describes the endpoints needed for PingFederate to interface with PingAccess using the OpenID Connect (OIDC) protocol. These endpoints are available on the `engine.http.port` and `agent.http.port` ports defined in `<PA_HOME>/conf/run.properties`.

/pa/oidc/logout

Clears the cookie containing the PA Token. This endpoint enables end users to trigger the removal of their own PA Cookie from the browser they are using. The Logged Out page is a template that can be modified (see *Customize User-Facing Pages*).

Info: This endpoint simply clears the PA Token from the browser cookie. It does not retain any server-side state to denote log off. Additionally, this endpoint clears the cookie only from the requested host/domain and may still exist in requests bound for other hosts/domains.

Note: If logout is being performed across multiple domains, use the PingFederate `/idp/startSLO.ping` endpoint instead. See *IdP Endpoints* in the *PingFederate Administrator's Manual* for more information about this endpoint.

/pa/oidc/cb

The OIDC callback endpoint that receives the ID Token from PingFederate.

/pa/oidc/JWKS

The JSON Web Key endpoint used by the PingFederate JWT Token Processor for signature verification. This endpoint must is used in conjunction with the configuration of a JWT token processor instance in PingFederate. For more information, see *Configuring a JSON Web Token (JWT) Processor Instance* in the PingFederate Administrator's Manual.

/pa/oidc/logout.png

Used by PingFederate to initiate a logout from PingAccess in conjunction with the single logout functionality. This endpoint terminates the PA tokens across domains.

Administrative API Endpoints

PingAccess ships with interactive documentation for both developers and non-developers to explore the PingAccess API endpoints, view a reference of the metadata for each API, and experiment with API calls. PingAccess APIs are REST APIs that provide complete administrative capabilities of the product. They can be called from custom applications or from command line tools such as cURL. This endpoint is only available on the `admin.port` defined in `<PA_HOME>/conf/run.properties`.

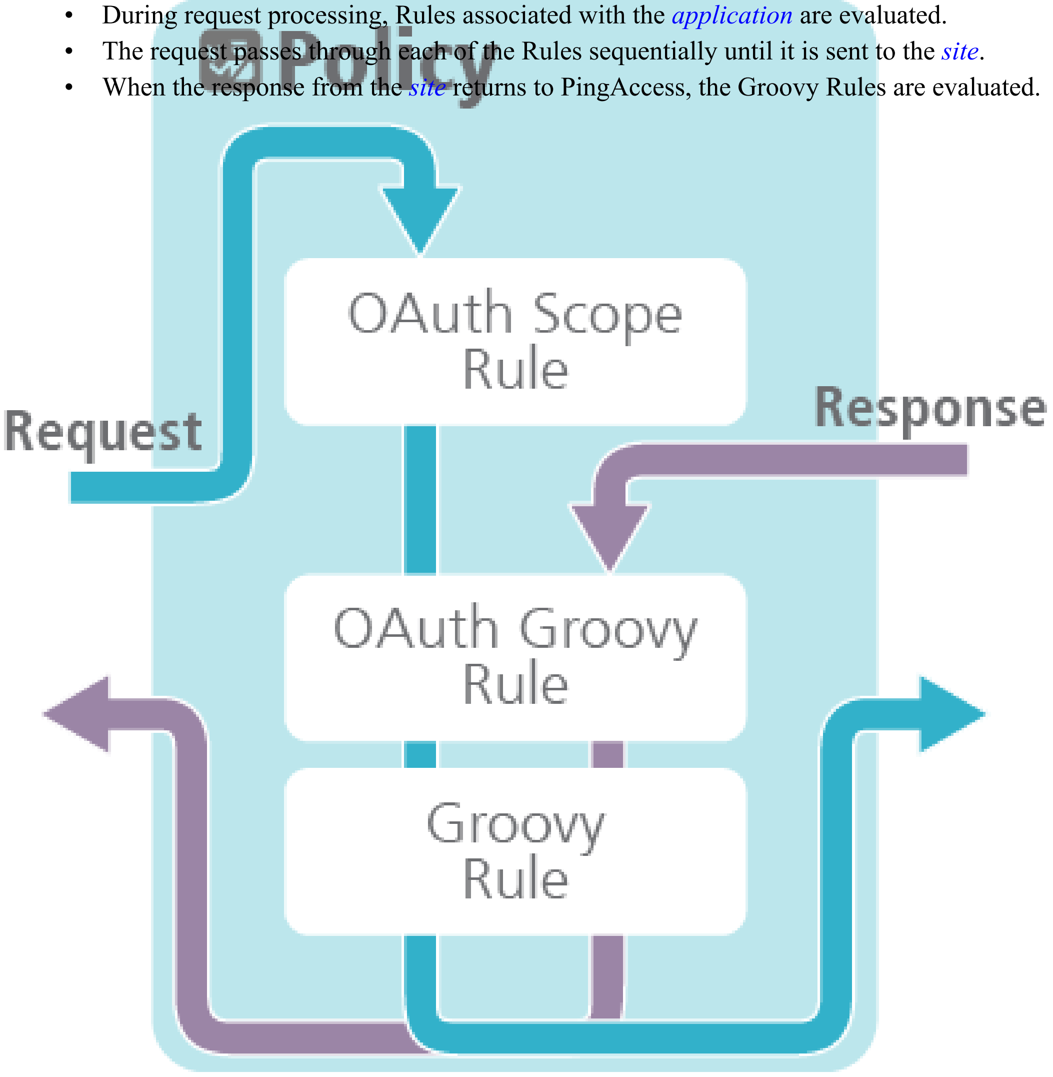
Note: For enhanced API security, you must include `X-XSRF-Header: PingAccess` in all requests and use the `application/json` content type for PUT/POST requests.

Groovy

Groovy

PingAccess provides the *Groovy Script* and *OAuth Groovy Script* Rule types that enable the use of Groovy, a dynamic programming language for the Java Virtual Machine (see the *Groovy documentation*). Groovy scripts provide advanced rule logic that extends PingAccess rule development beyond the capabilities of the packaged rules. Groovy scripts have access to important PingAccess runtime objects such as the *Exchange* and *PolicyContext* objects, which the scripts can interrogate and modify. Groovy Script Rules are invoked during the request processing phase of an exchange, allowing the script to modify the request before it is sent to the server. Groovy Script Rules are also invoked during the response, allowing the script to modify the response before it is returned to the client. The diagram below highlights the flow of Rule processing.

- During request processing, Rules associated with the *application* are evaluated.
- The request passes through each of the Rules sequentially until it is sent to the *site*.
- When the response from the *site* returns to PingAccess, the Groovy Rules are evaluated.



Groovy Scripts

Groovy scripts provide advanced Rule logic that extends PingAccess Rule development beyond the capabilities of the packaged *rules*. Groovy scripts have access to important PingAccess runtime objects such as the *Exchange* and *PolicyContext* objects, which the scripts can interrogate and modify. Groovy Script Rules are invoked during the request processing phase of an exchange, allowing the script to modify the request before it is sent to the server.

Groovy Script Rules are also invoked during the response, allowing the script to modify the response before it is returned to the client. See *Groovy* for more info about Groovy.

Note: Through Groovy scripts, PingAccess administrators can perform sensitive operations that could affect system behavior and security.

Matchers

Groovy scripts must end execution with a Matcher instance. Matchers provide a framework for establishing declarative Rule matching objects. You can use a Matcher from the list of *PingAccess matchers* or from the *Hamcrest library*.

The following are Hamcrest method examples for constructing access control policies with the *Web Session Attribute Rule* using evaluations such as an OR group membership evaluation.

allOf - Matches if the examined object matches ALL of the specified matchers. In this example, the user needs to be in both the sales and managers groups for this rule to pass.

```
allOf(containsWebSessionAttribute("group","sales"),
 containsWebSessionAttribute("group","managers"))
```

anyOf - Matches any of the specified matchers. In this example, the rule passes if the user is in any of the specified groups.

```
anyOf(containsWebSessionAttribute("group","sales"),
 containsWebSessionAttribute("group","managers"),
 containsWebSessionAttribute("group","execs"))
```

not - Inverts the logic of a matcher to not match. In this example, the rule fails if the user is in both the sales and the managers groups.

```
not(allOf(containsWebSessionAttribute("group", "sales"),
 containsWebSessionAttribute("group", "managers")))
```

See *Matchers* for more information.

Objects

The following objects are available in Groovy. Click a link for more information on that object.

Exchange Object

Contains the HTTP request and the HTTP response for the transaction processed by PingAccess.

PolicyContext Object

Contains a map of objects needed to perform policy decisions. The contents of the map vary based on the context of the current user flow.

Request Object

Contains all information related to the HTTP request made to a *Application*.

Response Object

Contains all information related to the *site* HTTP response.

Method Object

Contains the HTTP method name from the request made to a *Application*.

Header Object

Contains the HTTP header information from the request made to a *Application* or the HTTP header from a Site response.

Body Object

Contains the HTTP body from the *Application* request or the HTTP body from the Site response.

OAuthToken Object

Contains the OAuth access token and related identity attributes.

Debugging/Troubleshooting

Groovy Script Rules are evaluated when saved to ensure that they are syntactically valid. If a Groovy Script Rule fails to save, check the log for output with the exception `javax.script.ScriptException`. For example, if you are trying to save a Groovy Script Rule that references the missing method `foo()`, the following output would be logged:

```
DEBUG com.pingidentity.synapse.adminui.AdminAPIInterceptor:1585 -
 javax.script.ScriptException:
javax.script.ScriptException: groovy.lang.MissingMethodException: No
 signature of method:
org.codehaus.groovy.jsr223.GroovyScriptEngineImpl.foo() is applicable for
 argument types: () values: []
Possible solutions: find(), any(), get(java.lang.String),
 use([Ljava.lang.Object;), is(java.lang.Object), find(groovy.lang.Closure)
DEBUG com.pingidentity.synapse.adminui.AdminAPIInterceptor:1399 - Returning
 error to UI: [[Error occurred validating policy.], {}]
```

Info: These error messages are only logged if the DEBUG level output is enabled for the `com.pingidentity` logger.

Body Object

Purpose

Accesses the Body object in Groovy exc?.request?.body or exc?.response?.body

The Body object contains the HTTP body from the application request or the HTTP body from the site response. The request HTTP body is sent on to the site after the rules are evaluated. The response HTTP body is sent on to the User-Agent after the response rules are evaluated.

Groovy Sample

```
//Checks the actual length of the body content and set the Content-Length
 response header
def body = exc?.response?.body;
def header = exc?.response?.header;
header?.setContentLength(body.getLength());
anything("Content-Length header set");
```

Method Summary

Method	Description
byte[] getContent()	Returns the body content of the request or response.
int getLength()	Returns the length of the body content.

Exchange Object

Purpose

Accesses the Exchange object in Groovy - `exc`

The Exchange object is available to both the *OAuth Groovy Script Rule* and the regular *Groovy Script Rule*. PingAccess makes the Exchange object available to Groovy Script developers to provide request and response information for custom Groovy Rules.

The Exchange object contains both the HTTP request and the HTTP response for the transaction processed by PingAccess. You can use this object to manipulate the request prior to it being sent to the *site*. You can also use this object to manipulate the response from the site before it is sent to the client.

An instance of the Exchange object lasts for the lifetime of a single *Application* request. The Exchange object can be used to store additional information determined by the developer.

Some fields and methods for the Response Object are not available in scripts used with an Agent. See the Field Summary and Method Summary tables below for more information.

Groovy Sample

```
//Evaluate if the content length of the request is empty
if (exc?.request?.header?.contentLength > -1 )

{
    //Set a custom header in the request object
    exc?.request?.header?.add("X-PINGACCESS-SAMPLE", "SUCCESS")
    anything("Custom header added to request")
}
else
{
    println("Request content is empty") //Debugging statement
    not(anything("Request has no content"))
}
```

Field Summary

Field	Description
Request request	Obtains the PingAccess representation of the request. This request is sent to the *site* with any changes that might be made in a Groovy script.
Response response	Obtains the PingAccess representation of the response. If the *site* has not been called, the response is null. This field is not available in scripts used with an Agent.
long timeReqSent	Obtains the time, in milliseconds, when the request was sent to the *site*. This field is not available in scripts used with an Agent.
long timeResReceived	Obtains the time, in milliseconds, when the response was received from the *site*. This field is not available in scripts used with an Agent.

Method Summary

Method	Description
String getRequestURI()	Returns the PingAccess URI that received the request.
MediaType getRequestContentType()	Convenience method that returns the request Content-Type. This method works the same as exc?.request?.contentType.

Method	Description
int getRequestContentLength()	Convenience method that returns the request Content-Length. This method works the same as exc?.request?.contentLength.
MediaType getResponseContentType()	Convenience method that returns the response Content-Type. This method works the same as exc?.response?.contentType. This method is not available in scripts used with an Agent.
int getResponseContentLength()	Convenience method that returns the response Content-Length. This method works the same as exc?.response?.contentLength. This Method is not available in scripts used with an Agent.
Object getProperty(String key)	Returns the value of a custom property.
void setProperty(String key, Object value)	Sets a custom property.

Header Object

Purpose

Accesses the Header object in Groovy exc?.request?.header or exc?.response?.header

The Header object contains the HTTP Header information from the request made to an *application* or the HTTP Header from a *site* response. The *Request* HTTP Header is sent on to the *site* after the Rules are evaluated. The *Response* HTTP Header is returned to the client after the response Rules are evaluated.

Use the Header object to add custom HTTP headers for site.

Groovy Sample

```
//Set a custom header for the Service request
def header = exc?.request?.header;
header?.add("X-PINGACCESS-SAMPLE", "SUCCESS");
anything("Custom header set into request");
```

Method Summary

Method	Description
void add(String key, String val)	Adds HTTP header fields for the request. **Info:** Note that if Groovy Rules are used to inject HTTP headers for the backend protected application, the script must sanitize the same headers from the original client request.
String getAccept()	Returns the acceptable response Content-Types expected by the User-Agent.
void setAccept(String value)	Sets the acceptable response Content-Types expected by the User-Agent.
String getAuthorization()	Returns the authentication credentials for HTTP Authentication.
void setAuthorization(String user, String password)	Sets authentication credentials for HTTP Authentication.
String getConnection()	Returns the connection type preferred by the User-Agent.

Method	Description
void setConnection(String connection)	Sets the connection type preferred by the User-Agent.
int getContentLength()	Returns the request body content length.
void setContentLength(int length)	Sets the request body content length.
boolean hasContentLength()	Returns true of the Content-Length header is set.
void setContentType(String value)	Sets the request body MIME type.
Map getCookies()	Returns all cookies sent with the request.
void setCookie(String value)	Sets a cookie.
String getFirstCookieValue()	Returns the first cookie in the Cookie header.
String getFirstValue(String value)	Returns the first value of the HTTP header specified by the value.
void setDate(Date date)	Sets the date of the message in the Date HTTP header.
String getHost()	Returns the hostname specified in the request.
void setHost(String value)	Sets the hostname for the request to the *Site*.
String getLocation()	Gets the redirect location URL for the response.
void setLocation(String value)	Sets the redirect location URL for the response.
String getProxyAuthorization()	Returns the proxy credentials.
void setProxyAuthorization(String value)	Sets the request proxy credentials.
void setServer(String value)	Sets the server name for the response.
String getXForwardedFor()	Returns the originating IP address of the client and the proxies, if set.
void setXForwardedFor(String value)	Sets the IP Address for the client and the proxies.
boolean removeContentEncoding()	Removes the Content-Encoding header value. Returns true if the value has been removed.
boolean removeContentLength()	Removes the Content-Length header value. Returns true if the value has been removed.
boolean removeContentType()	Removes the Content-Type header value. Returns true if the value has been removed.
boolean removeExpect()	Removes the Expect header value. Returns true if the value has been removed.
boolean removeFields(String name)	Removes the header value specified by the name parameter. Returns true if the value has been removed.
boolean removeTransferEncoding()	Removes the Transfer-Encoding header value. Returns true if the value has been removed.

Method Object

Purpose

Accesses the Method object in Groovy exc?.request?.method

The Method object contains the HTTP Method name from the request made to an *application*. The HTTP Method is sent on to the Site after the Rules are evaluated.

Groovy Sample

```
//Retrieve the HTTP Method name and make different decisions based on the
 method name
def method = exc?.request?.method?.methodName
switch (method) {
     case "GET":
         println("GET")
         break;
     case "POST":
         println("POST")
         break;
     case "PUT":
         println("PUT")
         break;
     case "DELETE":
         println("DELETE")
         break;
default:
     println("DEFAULT")
     pass()
}
```

Field Summary

Field	Description
String methodName	Returns the name of the HTTP Method (GET, PUT, POST, DELETE, HEAD).

OAuth Token Object

Purpose

Accesses the OAuth Token object in Groovy
`exc?.user?.policyContext?.context?.get("oauth_token")`

The OAuthToken object contains the OAuth access token and related identity attributes. The OAuthToken instance is available only for *OAuth Groovy Script* Rules.

Groovy Sample

```
def scopes = exc?.user?.policyContext?.context?.get("oauth_token")?.scopes
def attr = exc?.user?.policyContext?.context?.get("oauth_token")?.attributes
def username =
 exc?.user?.policyContext?.context?.get("oauth_token")?.attributes?.get("username")?.get
exc?.request?.header?.add("x-scopes", "$scopes")
exc?.request?.header?.add("x-attributes", "$attr")
exc?.request?.header?.add("x-username", "$username")
anything()
```

Field Summary

Field	Description
Date expiresAt	Contains the expiration date of the OAuth access token.
Date retrievedAt	Contains the date that the OAuth access token was retrieved from PingFederate.

Field	Description
String tokenType	Contains the type of OAuth access token. (Bearer, JWT).
String clientId	Contains the client ID associated with the OAuth access token.
Set scopes	Contains the set of scopes associated with the OAuth access token.
Map<String, List> attributes	Contains a map of identity attributes specific to the user.

PolicyContext Object

Purpose

Accesses the Policy Context object in Groovy policyCtx

The PolicyContext object is a map of objects needed to perform policy decisions. The contents of the map vary based on the context of the current user flow. A common example is OAuth token information stored in an OAuthToken object contained within the context map. In this example, an OAuthToken object is retrieved from the policy context by using the oauth_token key. The OAuthToken object is available only for the *OAuth Groovy Script Rule*.

Groovy Sample

```
def oauthToken = policyCtx?.context.get("oauth_token")
```

Field Summary

Field	Description
java.util.Map context	Container for the *OAuthToken object*.

Request Object

Purpose

Accesses the Request object in Groovy exc?.request

The Request object contains all information related to the HTTP request made to an *application*. The request instance is sent on to the *site* after the Rules are evaluated.

Some fields and methods for the Response Object are not available in scripts used with an Agent. See the Field Summary and Method Summary tables below for more information.

Groovy Sample

```
//Retrieve the request object from the exchange object
def request = exc?.request?.isJSON()

//Check to make sure the request body contains JSON
if (!request) {
not(anything("The request requires a JSON body"))
} else {
    anything("The request contains JSON")
}
```

Field Summary

Field	Description
String uri	Returns the PingAccess URI that received the request.
Method method	Contains the HTTP method information from the request sent to the *application*.
Header header	Contains the HTTP header information from the request sent to the *application*. **Warning: Warning**: Previously executed custom Rules can modify these values.
Body body	Contains the HTTP body information from the request sent to the *application*. This field is not available in scripts used with an Agent. **Warning: Warning**: Previously executed custom Rules can modify these values.

Method Summary

Method	Description
boolean isXML()	Returns true if the Content-Type header is set to xml.
boolean isJSON()	Returns true if the Content-Type header is set to application/json.
boolean isHTML()	Returns true if the Content-Type header is set to text/html.
boolean isBodyEmpty()	Returns true if the Content-Length header is set to zero or the HTTP body has zero length.

Response Object

Purpose

Accesses the Response object in Groovy exc?.response

The Response object contains all information related to the Service HTTP response. The response instance is sent on to the User-Agent after the Rules are evaluated.

The fields and methods for the Response Object are not available in scripts used with an Agent.

Groovy Sample

```
// Intercept a server error (status code = 500) return a failure
def response = exc?.response

if (response?.isServerError()) {
 not(anything("A server error occurred"))
}
```

Field Summary

Field	Description
int statusCode	Contains the HTTP response status code.
String statusMessage	Contains the HTTP response status message.
Header header	Contains the HTTP header information from the request sent to the *application*. **Warning:** Previously executed custom Rules can modify these values.
Body body	Contains the HTTP body information from the request sent to the *application*. **Warning:** Previously executed custom Rules can modify these values.

Method Summary

Method	Description
boolean isRedirect()	Returns true if the status code is in the 300's.
boolean isUserError()	Returns true if the status code is in the 400's.
boolean isServerError()	Returns true if the status code is in the 500's.
boolean isBodyEmpty()	Returns true if the Content-Length header is set to zero or the HTTP body has zero length.

Groovy Script Examples

OAuth Policy Context Example

In some instances, it may be necessary to transmit identity information to Sites to provide details of the user attempting to access a Site. In such instances, Groovy scripts can be used to inject identity information into various portions of the HTTP request to the target. In this example, the Site is expecting the identity of the user to be conveyed via the User HTTP header. This can be accomplished using the OAuth Groovy Script Rule and the following Groovy script:

```
user=policyCtx?.context.get("oauth_token")?.attributes?.get("user")?.get(0)
exc?.request?.header?.add("User", "$user")
anything()
```

More complex Groovy script logic:

```
test = exc?.request?.header?.getFirstValue("test");
if(test != null && test.equals("foo"))
{
  //rule will fail evaluation if Test header has value 'foo'
  not(anything("Test header is foo"))
}
else
{
  //rule will pass evaluation is Test header has value of anything else
  //or isn't present
  anything("Test header is something else")
}
```

Matchers

The *Groovy Script Rule* and the *OAuth Groovy Script Rule* must end execution with a Matcher instance. This could either be a Matcher from the list of PingAccess matchers or from the *Hamcrest library* (for more information on Hamcrest, see the *Hamcrest Tutorial*).

Example 1 - Simple Groovy Rule Inserts a Custom HTTP Header

```
test = "let's get Groovy!"
exc?.response?.header?.add("X-Groovy", "$test")
anything()
```

In the sample rule above, the script ends with a call to the Matcher `anything()`. The `anything()` Matcher signals that the rule has passed.

Example 2 - OAuth Groovy Rule Checks the HTTP Method and Confirms the OAuth Scope

```
//Get the HTTP method name
def methodName = exc?.request?.method?.methodName()
if (methodName == "POST") {
    hasScope("WRITE")
} else {
    not(anything())
}
```

In the sample rule above, a Matcher is evaluated at the end of each line of execution. The first Matcher used is the `hasScope()` Matcher that confirms if the OAuth Access token has the `WRITE` scope. If this is true, the rule passes.

The `not(anything())` Matcher combination is evaluated when the `methodName` does not equal `POST`. This Matcher combination evaluates to false.

PingAccess Matchers

The following table lists the Matchers available for the Groovy Script Rule and the OAuth Groovy Script Rule.

Matcher	Description
`inIpRange(String cidr)`	Validates the source IP address of the request against the `cidr`String parameter in CIDR notation. When Source IP headers defined in the *HTTP Requests* page are found, the source IP address determined from those headers is used as the source address. For agents, this value is also potentially controlled by the override options on the *Agent* settings. **Example**: `inIpRange("127.0.0.1/8")`
`inIpRange(java.net.InetAddress ipAddress, int prefixSize)`	Validates the source IP address against the `ipAddress` and the prefixSize parameters specified individually. When Source IP headers defined in the *HTTP Requests* page are found, the source IP address determined from those headers is used as the source address. For agents, this value is also potentially controlled by the override options on the *Agent* settings. **Example**: `inIpRange(InetAddress.getByName("127.0.0.1"),8)` is equivalent to `inIpRange("127.0.0.1/8")`

Matcher	Description
`inIpRange(String cidr, String listValueLocation, boolean fallBackToLastHopIp, String... headerNames)`	Validates the source IP address in the first of the specified `headerNames` using the `cidr` value. This behaves similar to the *HTTP Requests* on page 69 configuration option, but can be specified as part of a Groovy Script as a means of overriding the configuration stored in PingAccess for a specific Groovy Script rule. Valid values for the `listValueLocation` parameter are `FIRST`, `LAST`, and `ANY`. This parameter controls where, in a multivalued list of source IP addresses, the last source should be taken from. If `ANY` is used, if any of the source IP addresses in a matching header match the `CIDR` value, the matcher evaluates to `true`. **Example**: `inIpRange("127.0.0.1/8", "LAST", true, "X-Forwarded-For", "Custom-Source-IP")`
`inIpRange(java.net.InetAddress address, int prefixSize, String listValueLocation, boolean fallBackToLastHopIp, String... headerName)`	Validates the source IP address in the first of the specified `headerNames` using the `address` and `prefixSize` values. In all other respects, this matcher behaves the same as the version that uses a `cidr` value for comparison. **Example**: `inIpRange(InetAddress.getByName("127.0.0.1"), 8, "LAST", true, "X-Forwarded-For", "Custom-Source-IP")`
`requestXPathMatches(String xPathString, String xPathValue)`	Validates that the value returned by the `xPathString` parameter is equal to the `xPathValue` parameter. **Example:** `requestXPathMatches("//header[@name='Host']/text()","localhost:3000")`
`inTimeRange(String startTime, String endTime)`	Validates that the current server time is between the `startTime` and endTime parameters. **Example:** `inTimeRange("9:00 am","5:00 pm")`
`inTimeRange24(String startTime, String endTime)`	Validates that the current server time is between the specified 24-hour formatted time range between the `startTime` and `endTime` parameters. **Example:** `inTimeRange24("09:00","17:00")`
`requestHeaderContains(String field, String value)`	Validates that the HTTP header field value is equal to the value parameter. **Example:** `requestHeaderContains("User-Agent", "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/27.0.1453.93 Safari/537.36")`

Matcher	Description
`requestHeaderContains(Map<String, String> fieldValuesMap, boolean caseSensitive)`	Validates that at all of the HTTP header fields maps to the associated value. The first `fieldValuesMap` string contains the HTTP header name, and the second string contains the value to compare the incoming request header value with. The `caseSensitive` parameter determines whether a case-sensitive comparison is performed on the value. The second string in the `fieldValuesMap` supports Java Regular Expressions. If multiple pairs of strings are present in the `fieldValuesMap` parameter, then all conditions must be met in order for the matcher to pass. **Example:** `requestHeaderContains(['User-Agent':'Mozilla/5.0', 'Cookie':'JSESSIONID'], false)`
`requestPostFormContains(Map<String, String> fieldValuesMap, boolean caseSensitive)`	Validates that all of the HTTP form fields maps to the associated value. The first `fieldValuesMap` string contains the form header name, and the second string contains the value to compare the incoming request header value with. The `caseSensitive` parameter determines whether a case-sensitive comparison is performed on the value. **Note:** This matcher determines whether to use fields passed in the URL or forms with a `content-type` header of `application/x-www-form-urlencoded`. The second string in the `fieldValuesMap` supports Java Regular Expressions. If multiple pairs of strings are present in the `fieldValuesMap` parameter, then all conditions must be met in order for the matcher to pass. **Example:** `requestPostFormContains(['email':'@example.com', 'phonenumber':'720'], false)`
`requestHeaderDoesntContain(String field, String value)`	Validates that the HTTP header field value is not equal to the value parameter. **Example:** `requestHeaderDoesntContain("User-Agent", "InternetExplorer")`
`requestBodyContains(String value)`	Validates that the HTTP body contains the value parameter. **Example:** `requestBodyContains("production")`
`requestBodyDoesntContain(String value)`	Validates that the HTTP body does not contain the value parameter.

Matcher	Description
	Example: `requestBodyDoesntContain("test")`
`containsWebSessionAttribute(String attributeName, String attributeValue)`	Validates that the PA Token contains the attribute name and value. **Example:** `containsWebSessionAttribute("sub", "sarah")`

The following table lists the matchers available to only the OAuth Groovy Rule.

Matcher	Description
`hasScope(String scope)`	Validates that the OAuth access token contains the scope parameter. **Example:** `hasScope("access")`
`hasScopes(String... scopes)`	Validates that the OAuth access token contains the list of scopes. **Example:** `hasScopes("access","portfolio")`
`hasAttribute(String attributeName, String attributeValue)`	Checks for an attribute value within the current OAuth2 policy context. **Example:** `hasAttribute("account","joe")`

PingAccess Addon SDK for Java

Preface

This document provides technical guidance for using the PingAccess Add-on SDK. Developers can use this guide, in conjunction with the installed Javadocs, to extend the functionality of the PingAccess server.

Intended Audience

This guide is intended for application developers and system administrators responsible for extending PingAccess. The reader should be familiar with Java software-development principles and practices. It describes the development of:

- SiteAuthenticators
- Rules

Additional Documentation

- The PingAccess Javadocs provide detailed reference information for developers. The Javadocs can be accessed with a web browser by viewing the file `<PA_HOME>/sdk/apidocs/index.html`.

Introduction

The PingAccess Add-on SDK provides the following extension points:

RuleInterceptor

An interface for developing custom Rule implementations to control authorization logic in policies.

SiteAuthenticatorInterceptor

An interface for developing custom Site Authenticators to control how PingAccess (operating as a proxy) is able to integrate with web servers or services it is protecting.

These extension points allow users to customize certain behaviors of PingAccess to suit an organization's needs. This SDK provides the means to develop, compile, and deploy custom extensions to PingAccess.

If you need assistance using the SDK, visit the Ping Identity *Support Center* (ping.force.com/Support) to see how we can help you with your application. You may also engage the Ping Identity Global Client Services team for assistance with developing customizations.

Getting Started With the SDK

This section describes the directories and build components that comprise the SDK and provides instructions for setting up a development environment.

SDK Directory Structure

The PingAccess SDK directory (`<PA_HOME>/sdk`) contains the following:

- `README.md` – Contains an overview of the SDK contents.
- `/samples/README.md` – Contains an overview of the steps necessary to build and use the samples.
- `/samples/Rules` – Contains a maven project with example plug-in implementations for Rules showing a wide range of functionality. You may use these examples for developing your own implementations.
- `/samples/Rules/README.md` – Contains the details of the Rules samples.
- `/samples/SiteAuthenticator` – Contains a maven project with example plug-in implementations for Site Authenticators. You may use these examples for developing your own implementations.
- `/samples/SiteAuthenticator/README.md` – Contains the details of the Site Authenticator samples.
- `/apidocs/` – Contains the SDK Javadocs. Open `index.html` to get started.

SDK Prerequisites

Before you start, ensure you have the Java SDK and *Apache Maven* installed. The samples use Apache Maven and assume that the PingAccess SDK can be referenced as a dependency. They reference Ping Identity's public maven repository, located at:

```
http://maven.pingidentity.com/release
```

If Internet access is unavailable, update the `pingaccess-sdk` dependency in your `pom.xml` to point to the local installation.

```
<dependency>
        <groupId>com.pingidentity.pingaccess</groupId>
        <artifactId>pingaccess-sdk</artifactId>
        <version>3.2.6.0</version>
        <scope>system</scope>
        <systemPath><PA_HOME>/lib/pingaccess-sdk-3.2.6.0.jar</systemPath>
</dependency>

<dependency>
        <groupId>javax.validation</groupId>
        <artifactId>validation-api</artifactId>
        <version>1.0.0.GA</version>
  <scope>system</scope>
        <systemPath><PA_HOME>/lib/validation-api-1.0.0.GA.jar</systemPath>
</dependency>

<dependency>
        <groupId>org.slf4j</groupId>
        <artifactId>slf4j-api</artifactId>
        <version>1.7.4</version>
  <scope>system</scope>
        <systemPath><PA_HOME>/lib/slf4j-api-1.7.4.jar</systemPath>
</dependency>

<dependency>
        <groupId>org.slf4j</groupId>
        <artifactId>slf4j-log4j12</artifactId>
        <version>1.7.4</version>
  <scope>system</scope>
        <systemPath><PA_HOME>/lib/slf4j-log4j12-1.7.4.jar</systemPath>
</dependency>
```

Replace *<PA_HOME>* with the path to the PingAccess installation.

How to Install the SDK Samples

- Before you begin, ensure you have the Java SDK and Apache Maven installed.
- Each sample type is installed separately:
  - For the Rules samples, navigate to `<PA_HOME>/sdk/samples/Rules`
  - For the Site Authenticators samples, navigate to `<PA_HOME>/sdk/samples/SiteAuthenticator`
- From the sample's directory, run the command: `$ mvn install`
  - This builds the samples, runs their tests, and copies the resulting jar file from the target directory to the `<PA_HOME>/lib` directory.

```
jsmith-MBP-2:Rules jsmith$ mvn install
[INFO] Scanning for projects...
[INFO]
[INFO] Using the builder
 org.apache.maven.lifecycle.internal.builder.singlethreaded.SingleThreadedBuilder
 with a thread count of 1
[INFO]
[INFO]
 ------------------------------------------------------------------------
[INFO] Building PingAccess :: Sample Rules 3.2.6
[INFO]
 ------------------------------------------------------------------------
Downloading: http://...
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @
 sample-rules ---
[INFO] Using 'ISO-8859-1' encoding to copy filtered resources.
[INFO] Copying 1 resource
[INFO]
[INFO] --- maven-compiler-plugin:2.5.1:compile (default-compile) @ sample-
rules ---
[INFO] Compiling 7 source files to /Users/jsmith/Downloads/pingaccess-3.2.6/
sdk/samples/Rules/target/classes
[INFO]
[INFO] --- maven-resources-plugin:2.6:testResources (default-testResources)
 @ sample-rules ---
[INFO] Using 'ISO-8859-1' encoding to copy filtered resources.
[INFO] Copying 4 resources
[INFO]
[INFO] --- maven-compiler-plugin:2.5.1:testCompile (default-testCompile) @
 sample-rules ---
[INFO] Compiling 4 source files to /Users/jsmith/Downloads/pingaccess-3.2.6/
sdk/samples/Rules/target/test-classes
[INFO]
[INFO] --- maven-surefire-plugin:2.12.4:test (default-test) @ sample-rules
 ---
```

```
[INFO] Surefire report directory: /Users/jsmith/Downloads/pingaccess-3.2.6/
sdk/samples/Rules/target/surefire-reports

-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running com.pingidentity.pa.sample.TestAllUITypesAnnotationRule
Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.912 sec
Running com.pingidentity.pa.sample.TestIllustrateManyUITypesRule
Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.029 sec
Running com.pingidentity.pa.sample.TestValidateRulesAreAvailable
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.002 sec

Results :

Tests run: 5, Failures: 0, Errors: 0, Skipped: 0

[INFO]
[INFO] --- maven-jar-plugin:2.4:jar (default-jar) @ sample-rules ---
[INFO] Building jar: /Users/jsmith/Downloads/pingaccess-3.2.6/sdk/samples/
Rules/target/sample-rules-3.2.6.jar
[INFO]
[INFO] --- maven-install-plugin:2.4:install (default-install) @ sample-rules
 ---
[INFO] Installing /Users/jsmith/Downloads/pingaccess-3.2.6/sdk/samples/
Rules/target/sample-rules-3.2.6.jar to /Users/jsmith/.m2/repository/com/
pingidentity/pingaccess/sample-rules/3.2.6/sample-rules-3.2.6.jar
[INFO] Installing /Users/jsmith/Downloads/pingaccess-3.2.6/sdk/samples/
Rules/pom.xml to /Users/jsmith/.m2/repository/com/pingidentity/pingaccess/
sample-rules/3.2.6/sample-rules-3.2.6.pom
[INFO]
[INFO] --- maven-antrun-plugin:1.7:run (default) @ sample-rules ---
[INFO] Executing tasks

main:
     [copy] Copying 1 file to /Users/jsmith/Downloads/pingaccess-3.2.6/lib
[INFO] Executed tasks
[INFO]
 ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO]
 ------------------------------------------------------------------------
[INFO] Total time: 6.418 s
[INFO] Finished at: 2014-07-08T16:38:30-07:00
[INFO] Final Memory: 16M/38M
[INFO]
 ------------------------------------------------------------------------
```

Creating your own Plugins

This section describes using the samples as a template for creating your own plugins.

Creating a Rule

- For details on how to create a Rule, reference the javadoc at: `<PA_HOME>/sdk/apidocs/com/pingidentity/pa/sdk/policy/RuleInterceptor.html`
- Add a Java class to `/sdk/samples/Rules/src` that implements `com.pingidentity.pa.sdk.policy.RuleInterceptor` and is annotated by `com.pingidentity.pa.sdk.policy.Rule`. A base class `com.pingidentity.pa.sdk.policy.RuleInterceptorBase` is available to simplify implementing a Rule.

- Add the class name of the new class to `/sdk/samples/Rules/src/main/resources/META-INF/services/com.pingidentity.pa.sdk.policy.RuleInterceptor`. Execute `maven install` on the Rules sample pom.

Creating a Site Authenticator

- For details on how to create a Site Authenticator, reference the javadoc at: `<PA_HOME>/sdk/apidocs/com/pingidentity/pa/sdk/siteauthenticator/SiteAuthenticator.html`
- Add a Java class to `/sdk/samples/SiteAuthenticator/src` that extends `com.pingidentity.pa.sdk.siteauthenticator.SiteAuthenticatorInterceptor`and is annotated by `com.pingidentity.pa.sdk.siteauthenticator.SiteAuthenticator`. A base class `com.pingidentity.pa.sdk.siteauthenticator.SiteAuthenticatorInterceptorBase` is available to simplify implementing a SiteAuthenticator.
- Add the class name of the new class to `/sdk/samples/Rules/src/main/resources/META-INF/services/com.pingidentity.pa.sdk.siteauthenticator.SiteAuthenticator`. Execute `maven install` on the SiteAuthenticator sample pom.

Implementation Guidelines

The following sections provide specific programming guidance for developing custom interfaces. Note that the information is not exhaustive – consult the Javadocs to find more details about interfaces discussed here as well as additional functionality.

Logging

Use the SLF4j API for logging activities in your module. Documentation on using SLF4j is available on the *SLF4j website*.

Lifecycle

The plugins and the implementation of a PluginConfiguration can be instantiated for a number of reasons and at many times. For example, with a RuleInterceptor here is what happens before the RuleInterceptor is available to process user requests:

- The Rule annotation on the implementation class of the RuleInterceptor is interrogated to determine which PluginConfiguration instance will be instantiated.
- The following is performed on RuleInterceptor and PluginConfiguration. Which of these is handled first is not defined.
  - The bean will be provided to Spring for Autowiring.
  - The bean will be provided to Spring for post construction initialization. (See PostConstruct)
- PluginConfiguration.setName(String) is called.
- PA attempts to map the incoming JSON configuration to the PluginConfiguration instance.
- ConfigurablePlugin.configure(PluginConfiguration) is called.
- Validator.validate(Object, Class[]) method is invoked and provided to the RuleInterceptor.
- The instance is then made available to service end user requests, such as RequestInterceptor.handleRequest(com.pingidentity.pa.sdk.http.Exchange) and ResponseInterceptor.handleResponse(com.pingidentity.pa.sdk.http.Exchange)

Injection

Before they are put into use, Rules, SiteAuthenticators, and their defined PluginConfigurations are passed through Spring's Autowiring and initialization. To future-proof any code against changes in PingAccess, we recommend that Spring not be used as a dependency. Use the annotation javax.inject.Inject for any injection.

Classes Available for Injection

Currently, injection is available for the following classes:

- com.pingidentity.pa.sdk.util.TemplateRenderer

Differences Between Rules for Agents and Sites

Rules may be applied to applications associated with Agents or Sites. Some features of the SDK are not available to rules that are applied to agents. Rules that use features only available to sites should be marked as only applying to sites. This is done by setting the destination element of the rule annotation to the value {RuleInterceptorSupportedDestination.Site}

Rules that apply only to agents are limited in the following ways:

- The handleResponse method is not called.
- The request body is not present.
- The Exchange.getDestinations list is empty and modifying the destination list has no effect.

As with rules that use features only available to sites, rules that only apply to agents should be marked as only applying to agents. To do this, set the destination element of the rule annotation to the value {RuleInterceptorSupportedDestination.Agent}.

PingAccess Agent SDK for Java

Preface

This document provides technical guidance for using the PingAccess Agent SDK for Java. Developers can use this guide along with the Javadocs for the Java Agent API and sample source code to implement the PingAccess Agent Protocol in custom agents.

Intended Audience

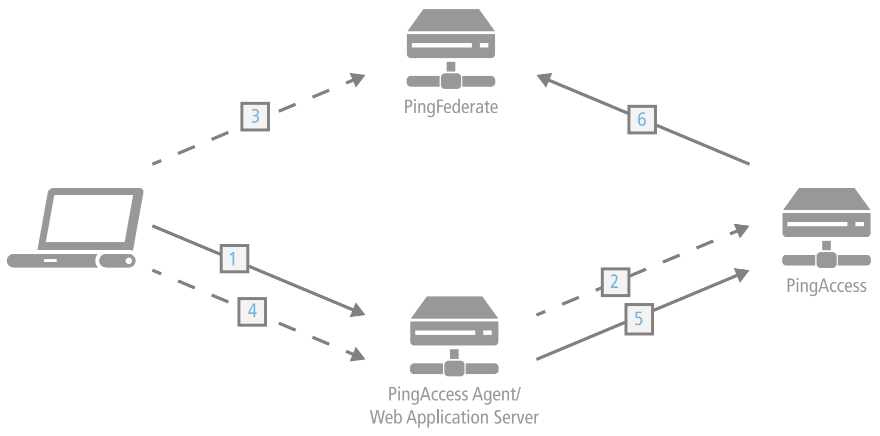
This guide is intended for application developers and system administrators responsible for implementing a Java PingAccess Agent. The reader should be familiar with Java software-development principles and practices. It describes the use of the SDK within a sample Java Servlet Filter.

Additional Documentation

The Java Agent API Javadocs provide detailed reference information for developers. After unzipping the `pingaccess-agent-java-sdk-1.0.0.zip` package, the Javadocs can be accessed with a web browser by viewing the file *<AGENT_SDK_JAVA_HOME>*`/apidocs/index.html`.

Introduction

The PingAccess Agent SDK for Java provides an API and sample code to enable developers to build agents for Java-based application and web servers. Agents provide access management features to their containing server by relying on central PingAccess servers over the PingAccess Agent Protocol. The *PingAccess Agent Protocol Specification* is available from the Ping Identity support portal.



The process used when a PingAccess Agent is added to the policy decision process is as follows:

1. The client accesses a resource. If the user is already authenticated, this process continues with step 5.
2. The agent asks PingAccess for instructions. PingAccess checks the URL policy and determines that it is a protected resource. PingAccess then redirects the client to PingFederate to establish a session.
3. The user logs in, and PingFederate creates the session.
4. The client is then redirected back to the resource.
5. The agent asks PingAccess for instructions. PingAccess checks the URL policy and determines that it is a protected resource. PingAccess then checks the session token and determines that it is valid.
6. If session revocation is enabled, PingAccess checks and updates the central session revocation list. If the session is valid, the agent is instructed to set identity HTTP headers.

The PingAccess Agent SDK for Java consists of the following components:

Java Agent API (Java Agent)

`pingaccess-agent-java-api-1.0.0.2.jar` : The Java Agent API is a set of classes that implement the PingAccess Agent Protocol.

PingAccess Agent SDK for Java

`agent-java-sdk-1.0.0.zip` : The PingAccess Agent SDK for Java package.

Servlet Filter Sample

`<AGENT_SDK_FOR_JAVA_HOME>``/sample` : The Servlet Filter Sample demonstrates how the Java Agent API integrates into a Java Servlet container. The provided source code, logging configuration and deployment descriptor provide a functional example for how to integrate the Java Agent API into an existing web application. The sample can be modified in place and recompiled using Maven to test customizations to the Servlet Filter Sample code for your environment.

Note: This sample code demonstrates how to implement a servlet filter and has been qualified on Apache Tomcat 7. The filter itself is production quality and can be used either as-is or as a starting point for further development. Application configuration within the sample demonstrates how to associate the filter with a servlet (namely, in `web.xml`). Further hardening of this file or the application server configuration may be required.

If you need assistance using the PingAccess Agent SDK for Java, visit the Ping Identity *Support Center* (ping.force.com/Support) to see how we can help you with your application. You may also engage the Ping Identity Global Client Services team for assistance with developing customizations.

Getting Started with the PingAccess Agent SDK for Java

Agent SDK Directory Structure

The PingAccess Agent SDK for Java directory (pingaccess-agent-java-sdk-1.0.0) contains the following:

/apidocs

The Javadocs for the Java Agent API. Open `index.html` in this directory to access the Javadocs content.

/dist

The directory containing `pingaccess-agent-java-api-1.0.0.2.jar`

/sample

A directory containing `src` and `target` directories for building a Java Servlet Filter. This filter uses the Java Agent API, an `agent.properties` configuration exported from PingAccess, and the `init-params` from the web application `web.xml` file to enforce resource policy decisions configured in PingAccess.

Agent SDK Prerequisites

Before you start, ensure you have the Java SDK, *Apache Maven* (maven.apache.org) and an application server (e.g. Apache Tomcat) installed. The sample uses Apache Maven and assumes that the Java Agent API can be referenced as a dependency. It references Ping Identity's public Maven repository, located at:

```
http://maven.pingidentity.com/release
```

If Internet access is unavailable, there are two other ways to reference the Java Agent API. First, once Apache Maven is installed, install the Java Agent API into your local dependency repository by executing the following command:

```
mvn install:install-file -Dfile=<AGENT_SDK_JAVA_HOME>/dist/pingaccess-agent-
java-api-1.0.0.2.jar -DgroupId=com.pingidentity -DartifactId=pingaccess-
agent-java-api -Dversion=1.0.0.2 -Dpackaging=jar
```

Alternatively, update the dependency in your `pom.xml` to point to the local installation:

```
<dependency>
        <groupId>com.pingidentity</groupId>
        <artifactId>pingaccess-agent-java-api</artifactId>
        <version>1.0.0.2</version>
        <scope>system</scope>
        <systemPath><AGENT_SDK_JAVA_HOME>/dist/pingaccess-agent-java-
api-1.0.0.2.jar</systemPath>
</dependency>
```

With either of these options, replace *<AGENT_SDK_JAVA_HOME>* with the absolute path to the unzipped `pingaccess-agent-java-sdk-1.0.0.2` directory.

How to Install the servlet filter sample

Ensure you have the PingAccess Agent SDK for Java, Apache Maven, and Apache Tomcat. These instructions assume that you are using Apache Tomcat.

- The servlet filter sample is installed under `<AGENT_SDK_JAVA_HOME>/sample`.
- A deployed version of the servlet filter is under `<AGENT_SDK_JAVA_HOME>/sample/target/agent-sample`.

For the initial setup of the web application, we assume you already have Tomcat or another application server set up on the same machine hosting PingAccess. Out of the box, PingAccess generates self-signed server certificates for listeners servicing runtime ports with the hostname `localhost`. By default, the servlet filter sample configures the Java Agent (Java Agent API) to use "strict" certificate checking for communications with PingAccess. The Java Agent will not be able to communicate with PingAccess over HTTPS if it is not also on `localhost` because of strict hostname checking. If PingAccess already has a server certificate configured with a valid hostname other than `localhost`, then you can deploy the Java Agent into a container on another system.

If you cannot setup the application server on the same system as an existing PingAccess service, and that PingAccess deployment still uses the default `localhost` server certificate for the Agent port, there is another option. You can change the default `strict` certificate checking in `agent-sample/WEB-INF/web.xml` to `test`. Please see the comments in `agent-sample/WEB-INF/web.xml` for more detail.

The agent-sample (servlet filter sample) web application is meant to demonstrate the features of the Java Agent within the context of a functional, standalone sample application. The servlet filter sample uses the Java Agent to intercept requests bound for sample servlet and will accept or reject them based on the configured PingAccess policy. The sample servlet only prints out headers, cookies, and other parameters it receives in the request.

1. In the Tomcat `webapps` directory, create a directory called `ROOT`.
2. Copy the `WEB-INF`, `META-INF`, and `assets` contents from `/sample/target/agent-sample/` into `webapps/ROOT`.

   This sample servlet filter must run as `/` to properly carry out the OpenID Connect workflow.
3. In the Tomcat `bin` directory, create a script called `setenv.sh` (Linux) or `setenv.bat` (Windows) with the following contents:

   - For Linux:

     ```
     export CATALINA_OPTS="-Dlog4j.configurationFile=<PATH_TO_TOMCAT_ROOT>/
     webapps/ROOT/WEB-INF/logs/log4j2.xml -
     Dserver.log.file=<PATH_TO_TOMCAT_ROOT>/webapps/ROOT/WEB-INF/logs/
     server.log"
     ```
   - For Windows:

     ```
     set CATALINA_OPTS=="-Dlog4j.configurationFile=<PATH_TO_TOMCAT_ROOT>/
     webapps/ROOT/WEB-INF/logs/log4j2.xml -
     Dserver.log.file=<PATH_TO_TOMCAT_ROOT>/webapps/ROOT/WEB-INF/logs/
     server.log"
     ```

   The Agent servlet filter logging is configured in `webapps/ROOT/WEB-INF/logs/log4j2.xml`, and outputs to `webapps/ROOT/WEB-INF/logs/server.log`
4. **Conditional:** If running Tomcat on Linux, execute the command `chmod a+x setenv.sh` to make this script executable.
5. *Configure a PingAccess Agent*.
6. *Configure an Application* and associate the new Agent with it.
7. When configuring an Agent through the PingAccess administration console, it automatically exports the agent properties file. Copy the downloaded properties file to `webapps/ROOT/WEB-INF/agent-config/agent.properties`.
8. Start Tomcat
9. Start a browser and navigate to `http://<HOST>:<PORT>/sample`

   The values for *<HOST>* and *<PORT>* here need to match the Tomcat configuration in use.

   Note: If your Tomcat server is not set up to use HTTPS, ensure that any related Web Sessions do not have the **Secure** option enabled.

PingAccess Agent SDK for Java Release History

Version 1.0 - June 2015

Initial Release

Reference Information

This section includes reference information for various configuration files and property settings used by PingAccess.

The default PingAccess administrative console and some runtime behavior is controlled in part by configuration properties located in `<PA_HOME>/conf/run.properties`. The majority of runtime configuration data (such as Applications, Rules, and Sites) is stored in the data store.

Note: You must restart PingAccess for the changes to `run.properties` to take effect.

Tip: When storing passwords in `run.properties`, we strongly recommend you obfuscate them using the `obfuscate.bat or obfuscate.sh` utility to mask the password value. This utility is located in the `<PA_HOME>/bin` folder.

Admin Properties

Property	**Description**
`admin.port`	Defines the TCP port on which the PingAccess administrative console runs. Default is `9000`.
`admin.bindAddress`	Defines the IP address that `admin.port` will bind to. This is typically required on multihomed servers having multiple IP addresses. The default value of `0.0.0.0` means that the port will bind to all of the server's IP addresses.
`admin.ssl.ciphers`	Defines the type of cryptographic ciphers available for use with administrative HTTPS ports.
`admin.auth`	Overrides the *administrator authentication method*. For example, if *SSO Authentication* is enabled and is somehow misconfigured, this property can be used to bypass the database configuration and force the use of Basic Authentication. Commented out by default with value `native`.

Admin and Engine Cluster Settings

Property	**Description**
`pa.operational.mode`	Controls the operational mode of the PingAccess server in a cluster. Valid values are: • STANDALONE - Use this value for a standalone (unclustered) PingAccess instance that runs both the administrative console and the engine. This is the default. • CLUSTERED_CONSOLE - Use this value for the server instance you want to use as the administrative console server. **Info:** Only one engine in a cluster can run the administrative console.

Property	Description
	• CLUSTERED_CONSOLE_REPLICA - Use this value for the server instance you want to use as the backup administrative console server. • CLUSTERED_ENGINE - Use this value to indicate a server engine.

Define the following Engine and Admin properties depending on what operational mode an engine is using.

- Define all of the following Engine and Admin properties when `pa.operational.mode` is set to `STANDALONE`.
- Define only the Admin properties when using `CLUSTERED_CONSOLE` or `CLUSTERED_CONSOLE_REPLICA` mode.
- Define only the Engine properties when using `CLUSTERED_ENGINE` mode.

Administrative Console Settings

These properties control the behavior of the Administrative Console. Some are commented out by default and need to be uncommented to apply.

Property	Description
`pa.ui.idleExpirationInMinutes`	Defines, in minutes, the length of time until an inactive administrative console times out. The default is `30` minutes.
`pa.ui.maxExpirationInMinutes`	Defines, in minutes, the length of time until the administrative console (active or inactive) times out. The default is `240` minutes. This session expiration may be disabled by setting this parameter to `-1`.
`pa.ui.expirationWarningInMinutes`	Defines, in minutes, the length of time a warning message displays prior to timing out the administrative console session. The default is `1` minute. **Note:** This parameter must be set to a value that is less than the value set for `pa.ui.idleExpirationInMinutes`.
`pa.ui.legacyBrowserMode`	Adjusts Administrative console HTTP header requirements to be interoperable with older web browsers (Internet Explorer 9, etc).
`pa.admin.user.password.regex`	Defines the regex that controls password complexity for the Administration Console. The default value is `((?=.*\\d)(?=.*[a-z])(?=.*[A-Z]).{8,20})`
`pa.admin.user.password.error.message`	Defines the message returned when password complexity is not satisfied. The default value is `Password must be at least 8 characters in length, contain one upper-case letter, one lower-case letter and one digit.`.

Property	Description
`pa.backup.filesToKeep`	Defines the number of backup files to preserve when the Administrator authenticates to PingAccess. The default value is `25`.

Agent Properties

Property	Description
`agent.http.enabled`	Defines whether a STANDALONE or CLUSTERED_ENGINE node listens for agent requests on the port defined by the `agent.http.port` setting. Default is `true`.
`agent.http.port`	Defines the TCP port on which the engine listens for agent requests. Default is `3030`.
`agent.http.secure`	Defines whether the engine is using HTTPS for agent requests. Default is `true`.
`agent.ssl.ciphers`	Defines the type of cryptographic ciphers available for use with agent HTTPS ports.
`agent.authz.header.required`	Defines whether PingAccess server should authenticate agent requests using agent name and shared secret in the vnd-pi-authz header. Default value is `true`. Setting this to `false` is useful for POCs and/or debugging.
`agent.cache.invalidated.response.duration`	Defines the duration in seconds that application configuration changes are sent by PingAccess server to agents using the vnd-pi-cache-invalidated header in agent responses for the changed application. Default value is `900`.

Auditing Settings

Property	Description
`pa.auditing.unknown.resource`	When set to `true`, this setting causes PingAccess to audit requests for resources that are requested but not mapped to an Application or Resource. This setting can be used to help troubleshoot resource definition issues. The default is `false`.

Availability Profile Defaults

Use the following properties to manage the default settings used for availability profiles. These values are also used to provide high availability for PingFederate Back Channel Server configurations.

Property	Description
`pa.default.availability.ondemand.maxRetries`	Defines the maximum number of retries before marking the target system down. The default is `2`.

Property	Description
`pa.default.availability.ondemand.connectTimeout`	Defines, in milliseconds, the amount of time to wait before trying to connect to the remote host. The default is `10000`.
`pa.default.availability.ondemand.retryDelay`	Defines, in milliseconds, the amount of time to wait after a timeout before retrying the host. The default is `250`.
`pa.default.availability.ondemand.failedRetryTimeout`	Defines, in seconds, the amount of time to wait before retrying a failed host. The default is `60`.

In addition, the following properties control the default configuration for client connection timeouts and the maximum connections per site:

Property	Description
`pa.default.httpClientKeepAliveTimeout`	Defines, in milliseconds, the amount of time a client connection is kept open to the PingAccess Engine. The default is `30000`. **Important:** Ensure this value is not larger than the idle timeout values defined in the PingFederate configuration. Use the following table to identify which configuration file (located in *`<PF_HOME>`*`/pingfederate/etc/`) and value is relevant to your configuration: (see table below) In a clustered environment, the idle timeouts can be controlled using the `pa.default.httpClientKeepAliveTimeout` setting for the particular node type (Administrative/Replica Administrative or Engine).
`pa.default.maxConnectionsPerSite`	Defines the maximum number of connections PingAccess will open to the PingFederate Admin or Engine. A value of `-1` means there is no limit. The default is `-1`.

Communicatio Type	PingFederate 7.3	PingFederate 8.0
Administrative	`jetty-admin.xml` `MaxIdleTime`	`jetty-admin.xml` `IdleTimeout`
Runtime	`jetty-runtime.xml` `MaxIdleTime`	`jetty-runtime.xml` `IdleTimeout`

Cluster Configuration Settings

Use the following properties when *clustered* engines are sharing information:

Property	**Description**
`admin.polling.initialdelay`	Defines, in milliseconds, how long after the replica administrative node starts up before it begins to poll the administrative console for configuration information. The default is `500`.
`admin.polling.delay`	Defines, in milliseconds, how long after the initial query to the administrative console that the replica administrative node begins querying for configuration information. The default is every `2000` milliseconds.
`pa.cluster.interprocess.communication`	Defines how the JGroups cluster communicates. `none` (the default): Indicates that no communication is configured between servers in the cluster. `udp`: Indicates that the cluster uses Multicast communications to send and receive information to and from multiple servers at once. `tcp`: Indicates that the cluster uses Unicast communications to send and receive information to and from individual servers one at a time.
`pa.cluster.auth.pwd`	Sets the password that each engine in the cluster must use to authenticate when joining the group. This prevents unauthorized engines from joining a cluster. (Values: any string or blank)
`pa.cluster.encrypt`	Indicates whether to encrypt network traffic sent between engines in a cluster. (Values:`true` or `false` [default])
`pa.cluster.bind.address`	Defines the IP address to which you bind the TCP or UDP listener. The default is `127.0.0.1`.
`pa.cluster.bind.port`	The port associated with the bind-address property above. The default is `7610`. Whether this is a TCP or UPD port depends on the value configured for the `pa.cluster.interprocess.communication` property (see above).
`pa.cluster.failure.detection.bind.port`	Indicates the bind port of a server socket that is opened on the given engine and used by other engines as part of one of the cluster's failure-detection mechanisms. This port is bound to the address determined by `pa.cluster.bind.address`. The default is `7710`. Whether this is a TCP or UDP port depends on the value configured for the `pa.cluster.interprocess.communication` property (see above).
`pa.cluster.mcast.group.address`	Defines the IP address shared among engines in the same cluster for UDP multicast communication; required when the interprocess communication mode is set to `udp`. (Range: `224.0.0.0` to `239.255.255.255`; note that some addresses in this range are reserved for other purposes.) This property is not used for TCP. All engines in a cluster must use the same address for this property and the port property below. The default value is `239.16.96.69`.

Property	Description
`pa.cluster.mcast.group.port`	Defines the UDP port associated with the `pa.cluster.mcast.group.address` property above. The default value is `7611`
`pa.cluster.serverstate.timeToIdleSeconds`	Defines, in seconds, how long metadata for the Rate Limiting rule is maintained by a PingAccess Engine after its last use. The default value is `86400`.
`pa.cluster.serverstate.staleEntryEvictionIntervalSeconds`	Defines, in seconds, how often a PingAccess engine scans the Rate Limiting metadata to evaluate metadata to be removed from the cache, based on the `pa.cluster.serverstate.timeToIdleSeconds` value. The default value is `60`.
`pa.cluster.serverstate.replicationIntervalMillis`	Defines, in milliseconds, how often Rate Limiting metadata is replicated within a subcluster. The default value is `1000`.
`pa.cluster.tcp.discovery.initial.hosts`	Designates the initial hosts to be contacted for group membership information when discovering and joining the group; required when the interprocess communication mode is set to `tcp`. The value is a comma-separated list of host names (or IP addresses) and ports. For example, `127.0.0.1[7602]`.
`engine.polling.initialdelay`	Defines, in milliseconds, how long after the engine starts up before it begins to poll the administrative console for configuration information. The default is `500`.
`engine.polling.delay`	Defines, in milliseconds, how long after the initial query to the administrative console that the engine begins querying for configuration information. The default is every `2000` milliseconds.

Configuration Database and Keystore Settings

Define the username and passwords for the PingAccess *configuration database* and the password for the `cacerts` keystore.

Property	Description
`pa.jdbc.username`	Defines the username for accessing the PingAccess configuration database. Default is `sa`.
`pa.jdbc.password`	Defines the password for the database user of the PingAccess configuration database. Default is `2Access`.
`pa.jdbc.filepassword`	Defines the password used to encrypt the PingAccess configuration database. Default is `2Access`.
`pa.keystore.pw`	Defines the password for the `$JAVA_HOME/lib/security/cacerts` keystore.

EHCache Configuration Properties

Use the following properties to manage the EHCache configuration:

Property	Description
`pa.ehcache.PingFederateReferenceTokenCache.maxEntriesLocalHeap`	Defines the maximum number of entries in the local heap for OAuth tokens. The default is `10000`.
`pa.ehcache.ServiceTokenCache.maxEntriesLocalHeap`	Defines the maximum number of entries in the local heap for token mediation. The default is `10000`.
`pa.ehcache.ServiceTokenCache.timeToIdleSeconds`	Defines, in seconds, the time an entry in the token mediation cache can be idle before it is expired. The default is `1800` seconds.
`pa.ehcache.ServiceTokenCache.timeToLiveSeconds`	Defines, in seconds, the maximum time an entry can be in the token mediation cache. The default is `14400` seconds.
`pa.ehcache.PATokenValidationCache.maxEntriesLocalHeap`	Defines the maximum number of entries in the local heap for decryption of signed or encrypted PingAccess tokens. The default is `10000`.
`pa.ehcache.PATokenValidationCache.timeToIdleSeconds`	Defines, in seconds, the time an entry in the token validation cache can be idle before it is expired. The default is `120` seconds.
`pa.ehcache.PATokenValidationCache.timeToLiveSeconds`	Defines, in seconds, the maximum time an entry can be in the token validation cache. The default is `300` seconds.
`pa.ehcache.PFSessionValidationCache.maxEntriesLocalHeap`	Defines the maximum number of entries in the local heap for the session validation cache. The default is `10000`.
`pa.ehcache.PFSessionValidationCache.timeToIdleSeconds`	Defines, in seconds, the time an entry in the session validation cache can be idle before it is expired. The default is `120` seconds.
`pa.ehcache.PFSessionValidationCache.timeToLiveSeconds`	Defines, in seconds, the maximum time an entry can be in the session validation cache. The default is `300` seconds.

EHCache is used for the cached information shared by nodes in PingAccess *Subclusters*.

Engine Properties

Property	Description
`engine.http.enabled`	Defines whether a STANDALONE or CLUSTERED_ENGINE node listens for requests on the ports defined by the Engine Listeners. Default is `true`.
`engine.ssl.ciphers`	Defines the type of cryptographic ciphers available for use with engine HTTPS ports.

Engine Properties File

An administrator uses PingAccess to generate and download the bootstrap.properties file when adding an engine to a cluster (see *Clustering*). This file is specific to that engine and is stored with the engine in the /conf directory. The engine uses this file to gain access to and communicate with the administrative console for configuration updates.

The following configuration properties are found in the bootstrap.properties file.

Property	Description
engine.admin.configuration.host	Defines the host where the administrative console is available. The default is localhost
engine.admin.configuration.port	Defines the port where the administrative console is running. The default is 9000
engine.admin.configuration.userid	Defines the name of the engine.
engine.admin.configuration.keypair	Defines an elliptic curve key pair that is in the JSON Web Key (JWK) format.
engine.admin.configuration.bootstrap.truststore	Defines the truststore, in JWK format, that is used for communication with the administrative console.

POST Preservation Properties

The PingAccess POST Preservation feature preserves submitted POST form data that would otherwise be lost when the user is forced to re-authenticate to an application as a result of a session timeout.

The form data is stored in local browser storage, and is then resubmitted after the re-authentication process completes. This preserved form data can optionally be encrypted during the re-authentication process if desired.

Property	Description
`pa.oidc.post.preservation.enabled`	Enables functionality to preserve POST data if the client is redirected to PingFederate for authentication. The default value is `true`.
`pa.oidc.post.preservation.encrypt`	When enabled, POST data preserved through a redirection to PingFederate for authentication is encrypted on the client to be used after the authentication is successful. The default value is `false`.

Security Headers Properties

PingAccess can return response headers with every request that results in a response directly from PingAccess - the Administrator Console, the engine, the agent, policy rule results, and when PingAccess replies to a request to a protected resource that requires redirection to PingFederate for authentication.

Note: While intended primarily for security-related headers, this feature can also be used for arbitrary header injection in these specific instances.

The following options are used to control which headers are returned in each of these scenarios:

Property	Description
`admin.headers`	Additional headers added to responses from the PingAccess Administrator Console and the Administrator API interface. Header values are defined using the `admin.header` prefix.
`agent.assets.headers`	Additional headers added to responses from PingAccess Agents. Header values are defined using the `agent.assets.header` prefix.

Property	Description
`agent.error.headers`	Additional headers added to error responses from PingAccess Agents. Header values are defined using the `agent.error.header` prefix.
`engine.assets.headers`	Additional headers added to responses from the PingAccess Engine. Header values are defined using the `engine.assets.header` prefix.
`engine.error.headers`	Additional headers added to error responses from the PingAccess Engine. Header values are defined using the `engine.error.header` prefix.
`rule.error.headers`	Additional headers added to responses that result from policy rule results. Header values are defined using the `rule.error.header` prefix.
`pf.redirect.headers`	Additional headers added to the redirection response that sends the client to PingFederate for authentication. Header values are defined using the `pf.redirect.header` prefix.

The value for each of these options is a comma-delimited list of headers to add to the response to the client.

The value to send with the header is defined using a property that follows the naming convention *<prefix>*.*<headername>*. For example, in a default `run.properties` configuration, the following values are defined as `admin.headers`:

```
admin.headers=X-Frame-Options,X-XSS-Protection,X-Content-Type-
Options,Strict-Transport-Security
```

The values for these headers are defined using the following configuration properties:

```
admin.header.X-Frame-Options=DENY
admin.header.X-XSS-Protection=1; mode=block
admin.header.X-Content-Type-Options=nosniff
#Enable only if the admin and engine use different host names
#admin.header.Strict-Transport-Security=max-age=31536000; includeSubDomains
```

These settings result in the following headers being set with every access to the PingAccess Administrator Console:

```
X-Frame-Options: DENY
X-XSS-Protection: 1; mode=block
X-Content-Type-Options: nosniff
```

Specific headers can be disabled by removing them from the `admin.headers` list or by commenting them out. For example, while defined in the `admin.headers` property, the `Strict-Transport-Security` header is commented out in the default configuration, so that header is not included in the response.

As noted in the comment, if the PingAccess Administrator Console and the PingAccess Engine use different external host names, then the `Strict-Transport-Security` header should be enabled. When the same host name is used for both of these, then the header should be disabled.

This header is only effective when a signed or trusted certificate is used for the Administrator Console. The generated self-signed certificate cannot be used with this header.

Important: If the `Strict-Transport-Security` setting is enabled and a the host names are the same, a user accessing both the Administrator Console and a protected application with the same host name will not be able to access the protected application after accessing the Administrator Console.

Server-Side Session Management Configuration Settings

Use the following properties to configure session management:

Property	Description
`pa.websession.updateTokenWindowInSeconds`	Defines, in seconds, how long before an active Web Session token is updated. The default is every `60` seconds.
`pa.websession.cachePFSessionStateInSeconds`	Defines, in seconds, how long PingAccess may cache session state before re-validating it again with PingFederate. The default is `60` seconds.
`pa.websession.refreshSessionInterval`	Defines, in seconds, how frequently PingAccess contacts PingFederate to update user data used in making policy decisions.

Info: Changes to `pa.websession.refreshSessionInterval` and `pa.websession.cachePFSessionStateInSeconds` apply to new web sessions as the default value. Changes for existing sessions can be made using the Administrative API.

URL Filtering Settings

The following properties are available to control URL filtering of incoming requests:

Property	Description
`pa.interceptors.relativepath.decode.count`	Number of times the URL is decoded to check for path traversal characters. The default is `3`.
`pa.interceptors.relativepath.strict`	When this property is set to `true`, the incoming URL is matched with the whitelist pattern defined in `pa.interceptors.relativepath.decode.regex`. All other request URLs are rejected. The default value is `false`.
`pa.interceptors.relativepath.decode.regex`	Defines the accepted URL regex pattern that administrators can customize based on their needs. The default value is: `[\p{Po}\p{N}\p{Z}\p{L}\p{M}\p{Zs}\./_\-\\~()\{\}\[\]]*` See *http://www.regular-expressions.info/unicode.html* for more details. This setting is only used when `pa.interceptors.relativepath.strict` is set to `true`.

Release Notes

PingAccess is a centralized point of security and access control for Web applications and APIs, serving applications and other resources to clients outside an organization while still protecting internal interfaces from unauthorized access. PingAccess sits in front of applications to protect them, enabling access control and identity-based auditing on incoming requests. Featuring a lightweight, highly scalable architecture, PingAccess complements PingFederate with centralized session management and URL-level authorization.

These release notes summarize the changes in current and previous product updates.

Enhancements for the 3.2 Release

PingAccess 3.2 includes the following enhancements and new functionality:

Access Control Enhancements

Rate Limiting

The **Rate Limiting** rule enables administrators to control the allowed request rate to a protected API or Web Application based on the identity, source IP address, OAuth client, or resource being accessed.

New HTTP Request Rules

The **HTTP Request Rule** has been refactored into two rules: The **HTTP Request Header** and **HTTP Request Parameter** rules. These rules provide additional flexibility for making policy decisions based on values passed either in HTTP headers sent by a client, or based on form data submitted by a client. Both of these new rule types can be configured to require multiple value matches.

Cross-Origin Resource Sharing (CORS)

Cross-Origin Resource Sharing is a method for allowing restricted resources on a web page to be requested from a domain that is different from the domain that hosts the requested web page. This release of PingAccess adds an access control rule that can be used to control this type of access request.

Engine Enhancements

HTTP and HTTPS Engine Listeners

When multiple engine listeners are defined, PingAccess now allows the administrator to define, on a per-engine listener basis, whether the listener uses HTTP or HTTPS.

Multiple Access Token Manager Support

In instances where multiple Access Token Managers are configured in PingFederate to provide OAuth access tokens for API applications, the `aud` OAuth parameter is populated with the user-requested URI to enable PingFederate to select the proper Access Token Manager when PingAccess makes a validation request to PingFederate.

POST Preservation

When a user submits a POST form and the authentication session has timed out, the user is redirected to PingFederate in order to re-authenticate. The POST form data is now preserved through this redirection, and the submitted form is automatically resubmitted after successful authentication. The preserved POST form data can optionally be encrypted in the user's browser with this feature.

HTTP Header-Based Load Balancing

In addition to the Round Robin load balancing strategy, PingAccess now includes a header-based load balancing strategy. This feature allows an external load balancer in the infrastructure to inject a header (such as `X-Target-Host`) with a value for a hostname or IP address (defined as a target in the Site configuration) where the request should be routed after PingAccess processes it.

Improvements to HTTP Security Headers Set for PingAccess Admin/Engine/Agent Listeners

PingAccess now includes a number of HTTP Security Headers for connections to the Administrative User Interface, Engine, and Agents. These headers are defined using options in `run.properties`, and additional headers can be added if desired.

Auditing Enhancements

Auditing of Unknown Resource Requests

When a client requests a resource that is not known, PingAccess does not record the request in the audit log for performance reasons. In PingAccess 3.2, the optional configuration property `pa.auditing.unknown.resource` can be enabled in order to help troubleshoot resource definition issues.

Request Tracking

Audit logging now includes a default option to include either a Tracking ID or an Access Token ID along with an Exchange ID to make it easier to follow the audit information for a particular session and exchange in the log files.

Administrative Enhancements

JSON-Based Export/Import of PingAccess Configuration

The existing **Backup** section for the administrative user interface has been replaced with a JSON-based export/import capability, making it simpler to duplicate an environment for development purposes. The JSON-based import functionality also simplifies the procedure to restore an environment's backup by allowing the administrator to use the administrative user interface.

Support for Wildcards in Virtual Hosts

Earlier releases of PingAccess permitted the use of a wildcard virtual host that would match any host (for example, `*:443`), but wildcards used in conjunction with an existing domain name were not supported. This feature adds the ability to specify a wildcard host with a domain (for example, `*.example.com:443`).

Usability Enhancements

Several administrative interface usability enhancements are in this release, including:

- Moved Options to Advanced Sections on Some Configuration Pages
- Restructured the Settings Page
- Added Pagination, List View, and Filtering Options to Improve Administrative UI Scalability
- Test Connections to Sites and PingFederate When Saving Related Configuration
- Added Cluster Status Display Information to Clustering Configuration Page

Administrative API Name-Based Search

When using the Administrative API at `/pa-admin-api/v1/` to retrieve information about named objects (for example, Agents or Engines), a `name` parameter can be specified to retrieve the object with the exact name specified.

Known Issues

- Internet Explorer and Firefox do not correctly support the HTML5 time tag. When using the Time Range rule, enter time in 24-hour format.
- PingFederate does not appear as an Authorization Server in Applications unless it is configured as an OAuth Resource server to validate OAuth access tokens. See the *PingFederate Settings*.
- When installing PingAccess as a Windows service using Windows PowerShell and Java 8, the error message "Could not find or load main class" can be safely ignored.
- When upgrading from PingAccess 3.0.3, the PingAccess Upgrade Utility may throw a `JdbcSQLException`. This can be worked around by restarting the PingAccess Administrative Console for the 3.0.3 installation and re-running the upgrade utility.
- POST Preservation is not supported with Safari Private Browsing.

Upgrading from an earlier PingAccess 3.2 release

If you have disabled Basic Authentication, navigate to **Settings** > **System** > **Admin Authentication**, then slide the **Basic Authentication** slider to `ON` to enable basic authentication for the PingAccess Administrative API interface.

Note: For upgrades from releases earlier than 3.2, see *Upgrading from PingAccess 2.1 and Later* on page 32.

To upgrade from PingAccess 3.2 through 3.2.5 to PingAccess 3.2.6, perform the following steps:

1. Download a configuration archive by using your browser to open `https://<PA_HOST>:<ADMIN_PORT>/pa-admin-api/v1/backup`. When prompted, enter your basic authentication credentials.
   A configuration backup named `pa-data-<date>.<time>.zip downloads.`
2. Copy the downloaded configuration archive and the PingAccess 3.2.6 distribution zip file to the server being upgraded.
3. Unzip the PingAccess 3.2.6 distribution zip file to a new installation folder.
4. In the new *<PA_HOME>* directory, unzip the zip file you copied in step 2.
5. Copy `pingaccess.lic` from the earlier PingAccess 3.2.x installation to the `conf` folder in the new 3.2.6 installation.
6. Optional: For each cluster engine node that is being upgraded, perform the following steps:
   a) Copy the PingAccess 3.2.6 distribution zip file to the cluster engine node.
   b) Unzip the PingAccess 3.2.6 distribution zip file to a new directory.
   c) Copy the configuration files from the PingAccess 3.2 `conf` directory to the new PingAccess 3.2.6 `conf` directory.
7. Shut down the older running PingAccess instance.
8. **Conditional:** If PingAccess is clustered, shut down the clustered engine nodes.
9. Start the new PingAccess environment.

Complete Change List by Released Version

PingAccess 3.2.6 addresses the following issues:

POST Preservation

PingAccess no longer throws an exception when POST preservation data cannot be retrieved.

PUT requests with On-Demand availability profiles

PUT requests where the request body is no longer available after an initial failure are no longer retried.

Server Name Indication

Corrected a `server_name` and `host` data/header mismatch when using SNI.

Non-string Subject Alternative Name values in imported keypairs

Enhanced handling of values in imported keypairs to handle non-string SANs.

Admin console not accessible after upgrade

Corrected an issue where an upgrade could result in the administrative console not being accessible.

Security fix

Fixed a security vulnerability (SECADV012).

PingAccess 3.2.6 - February, 2016

PingAccess 3.2.6 addresses the following issues:

POST Preservation

PingAccess no longer throws an exception when POST preservation data cannot be retrieved.

PUT requests with On-Demand availability profiles

PUT requests where the request body is no longer available after an initial failure are no longer retried.

Server Name Indication

Corrected a `server_name` and `host` data/header mismatch when using SNI.

Non-string Subject Alternative Name values in imported keypairs

Enhanced handling of values in imported keypairs to handle non-string SANs.

Admin console not accessible after upgrade

Corrected an issue where an upgrade could result in the administrative console not being accessible.

Security fix

Fixed a security vulnerability (SECADV012).

PingAccess 3.2.5 - December, 2015

PingAccess 3.2.5 addresses the following issue:

Issues resolved:

Corrected a resource allocation issue when using PingAccess agents configured with caching enabled in the agent.

PingAccess 3.2.4 - December, 2015

PingAccess 3.2.4 addresses the following issues:

Authentication loop with cached user attributes

Resolved an issue where a misconfiguration in the web session user attribute caching settings could cause an authentication loop.

Security updates

Fixed a few minor potential security issues.

Improved expiration handling for AccessToken validation during API flow

When validating an access token in the API flow which did not contain an `expires_in` value, a null pointer exception would be thrown.

PingAccess 3.2.3 - October, 2015

PingAccess 3.2.3 addresses the following issues:

Security issues

Two minor potential security issues are addressed in this release.

Fixed upgrade utility `SSLHandShakeException` failures with Java 8 update 51 or later

When updating from versions of PingAccess that use deprecated RC4 ciphers, the PingAccess Upgrade Utility would fail.

Fixed potential issues with POST preservation in certain configuration scenarios

In certain rare cases, POST preservation would fail as a result of a configuration error. Additional checks have been added to prevent these configuration errors from occurring.

Fixed issue that could lead to unexpected request failures when using token mediation

If a protected application relies on cookies being sent with the mediated token, if the token mediation flow needed to retry, the additional cookies delivered with the token would be removed, resulting in unexpected application failures.

Fixed issue where the Subject Alternative Name is missing from the CSR for key pairs created in PingAccess

When a key pair was generated in PingAccess and a Certificate Signing Request was issued, the CSR was missing the Subject Alternative Names.

Improvements to the `install-service.bat` script

When executed from a directory with a space in the path, the `install-service.bat` script would fail. This script has been updated to correct the issue.

Made the `dbfilepasswd` and `dbuserpasswd` scripts more robust

These scripts now run from paths containing spaces, and use the Java executable identified by `JAVA_HOME`.

Added validation to prevent a potential redirect loop

When a web session cookie domain is configured incorrectly, a user's browser could end up in an endless redirection loop. PingAccess now includes additional validation to prevent this misconfiguration.

PingAccess 3.2.2 - August, 2015

PingAccess 3.2.2 addresses the following issues:

The Admin API should require authnReqListId be set to 0 for an anonymous user

Authentication requirements should not be allowed to be added to an anonymous resource. The PingAccess UI enforces this constraint, but previously the Admin API did not.

Configuration backup archive not created when using Admin SSO

When an administrator user logs into the administrative console using SSO authentication, PingAccess does not create a configuration archive. The archive is created successfully when the administrator logs in using basic authentication.

Unable to reorder PingAccess rules inside Rule Sets in UI

Making a change in the order of rules within a Rule Set produces a success message, but after navigating to another page and returning to the Policy page, the rules are displayed in the previous order, as it was before the change.

JWT signature error produced when integrating with PingFederate 7.2

When using unsigned access tokens with PingAccess 3.2, authentication using the OpenID Connect authentication flow may fail, logging the following message in `<PA_HOME>/log/pingaccess.log` when logging is set to `DEBUG`:

```
The JWT has no signature but the JWT Consumer is configured to require one
```

After Admin Console cookie expiration, the administrator is prompted for basic authentication instead of SSO

The problem occurs when Admin SSO is enabled and the administrator is logged into the Admin Console, but the access cookie has expired, for example, due to no user activity for a certain time period. In this case, the Admin Console directs the user to the basic login prompt instead of to PingFederate for reauthentication using SSO.

Concealed plugin fields are not handled correctly in the PingAccess UI

When entering values in the Basic Authentication Site Authenticator form, if username and password values are filled and then the username is edited again, the password value is saved as null rather than the password value entered. This issue affects any plugin with a concealed field such as a password field.

New login required after change to the Admin SSO page even though SSO is disabled

If the administrator changes the **Client ID** value in the Admin SSO page, but does not select the **Enabled** checkbox, the administrator is required to authenticate again. A new login should be required only if Admin SSO is enabled.

Admin SSO authentication fails when PingAccess 3.2 is installed with PingFederate 7.2

When PingAccess 3.2 is used with PingFederate 7.2, Admin SSO does not work.

PingAccess load balancing not enforcing stickiness

In some cases, PingAccess sticky sessions do not work with PingAccess load balancing.

Corrected a potential security vulnerability

Refer to the Security Advisory SECADV010 on the *Customer Portal* for more information.

PingAccess 3.2.1 - July, 2015

PingAccess 3.2.1 includes the following fixes:

Stale `postprsv` Cookie Causes PingAccess Internal Server Error Response

In certain circumstances when using POST Preservation, the `postprsv` cookie was not properly maintained, resulting in the cookie not containing the expected information.

Intermittent `403 Forbidden` Responses when Browser Pre-fetches `favicon.ico`

In some instances, a browser might attempt to retrieve `favicon.ico` before a session cookie was issued, resulting in access being denied to the resource.

PingAccess 3.2 - June, 2015

PingAccess 3.2 includes the following enhancements and new functionality:

Access Control Enhancements

Rate Limiting

The **Rate Limiting** rule enables administrators to control the allowed request rate to a protected API or Web Application based on the identity, source IP address, OAuth client, or resource being accessed.

New HTTP Request Rules

The **HTTP Request Rule** has been refactored into two rules: The **HTTP Request Header** and **HTTP Request Parameter** rules. These rules provide additional flexibility for making policy decisions based on values passed either in HTTP headers sent by a client, or based on form data submitted by a client. Both of these new rule types can be configured to require multiple value matches.

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Usability Enhancements

Several administrative interface usability enhancements are in this release, including:

- Moved Options to Advanced Sections on Some Configuration Pages
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Administrative API Name-Based Search

When using the Administrative API at `/pa-admin-api/v1/` to retrieve information about named objects (for example, Agents or Engines), a `name` parameter can be specified to retrieve the object with the exact name specified.

PingAccess 3.1 - February, 2015

PingAccess 3.1 includes enhancements and new functionality for the Session Management capabilities, the PingAccess Engine, and the Administrative interface.

Session Management

Session Attribute Updates and Revocation

Administrators can now configure PingAccess to periodically query PingFederate to update attributes associated with the session, and to terminate the session based on a determination by PingFederate that the user no longer meets the criteria used to issue a token. For example, if PingFederate is configured to return the user's attributes only if the user account is enabled, disabling the user account can now trigger a session revocation. Additionally, if a user is removed from a group that grants them access to an application, access can be denied for a current session.

Support for Large Attribute Data

PingAccess now has the ability to cache user attribute data that previously was limited to the browser maximum cookie size. When this feature is enabled, potentially large attribute values - such as group memberships - can be used in policy decisions.

OpenID Connect / OAuth 2.0 Form Post Response Mode

Support has been added for the emerging *OAuth V2 Form Post Response Mode* standard. If you are upgrading from an earlier release of PingAccess, web sessions using the existing `POST` method will be migrated to `x_post`.

Engine

HTTP Request Configuration Source Handling

To better integrate PingAccess with configurations using reverse proxies and external load balancers, support has been added to support arbitrary IP Source, Host Source, and Protocol Source headers. This allows headers such as the **X-Forwarded-For** header to be injected by those reverse proxies in order to preserve information about the originating host IP address, hostname, and protocol source, in order to be able to use that information to make policy decisions. In addition, the originating host IP address is recorded in the audit logs.

HTTP Response Body Content Rewriting

The new *Rewrite Content Rule* on page 49 allows arbitrary content rewriting to be performed on outbound content. The content rewriting functionality can be used, for example, to rewrite URL text in HTTP responses so links a user might click on will use the external hostname for the Application rather than an internal name. This feature can also be constrained to particular content-types, allowing different rules to be tailored to the response `Content-Type` header.

Multiple Engine Ports

The PingAccess Engine listener can now listen on multiple ports, providing greater configuration flexibility.

Specify Different PingFederate Runtime Engines for Backchannel Calls

PingAccess can now use separate hostnames and ports to perform behind-the-scenes communication with PingFederate, providing greater flexibility in managing traffic between the two products. If more than one backchannel communication is set up, a built-in availability profile is used to provide failover.

Administration

Configurable Signature Algorithm Generated Key Pairs

When generating a key pair, the **Signature Algorithm** can now be selected, and the options available are based on the chosen **Key Algorithm**.

Remove Resource Ordering

The determination of the "most specific" match of an application resource path has been simplified, removing the need for manual ordering of resources within an application. PingAccess now evaluates this based on the length of the path requested and matching that to the Path Prefixes defined in the Application. This change also removes the `PATCH` method from the `/applications/{id}/resources` Administrative API endpoint, since that method was used to update the order of Resources in an Application.

Authentication Requirements for Admin SSO

Authentication Requirements can now be specified for administrator Single Sign-On. This can be used to ensure administrative users log in with stronger forms of authentication than just a username and password.

PingAccess 3.0 R2 - October, 2014

This release introduces the following new features:

Backup Admin Console Nodes

Provides the ability, in a clustered environment, to create a backup administrative node that the administrator can manually fail over to in the event of a catastrophic failure of the primary administrative node.

Failover and Load Balancing for Sites

Adds new functionality to provide failover and load balancing to multiple backend target servers without requiring a load balancer.

Ability to Ignore HTTPS Certificate Errors

Reduces certificate management burden for internal servers in a controlled environment by allowing the administrator to ignore certificate errors for backend connections, such as connections to Site targets.

Heartbeat Endpoint Enhancements

Enhances the monitoring capabilities by adding functionality to the heartbeat to return a configurable list of performance metrics as a JSON payload for consumption by third party monitoring tools.

Logging Enhancements

Adds logging options for rewritten cookies as well as cookies passed or proxied, and realign logged information with appropriate log levels.

PingAccess 3.0.3 - November, 2014

This release addresses the following issue:

- Corrected a potential security issue in Identity Mappings (SECBL006)

PingAccess 3.0.2 - September, 2014

This release addresses the following issue:

- Resolved an issue with Session Validation causing the token mediator to stop working.

PingAccess 3.0.1 - August, 2014

This release addresses the following issues:

- Resolved an issue with token validation when using OAuth Admin API Authentication
- Corrected handling of PingFederate Runtime Base Path setting
- OIDC callback endpoint improvements to support front-end load balancers listening on a different port than the PingAccess Engine

PingAccess 3.0 - July, 2014

PingAccess Agents

Added PingAccess Agents to provide additional architectural flexibility with an agent based deployment model.

Session Management enhancements

Web session management has been enhanced to offer additional security for end user-driven logout use cases.

Add-on Java SDK

New PingAccess add-on Java SDK has been introduced.

TLS Server Name Indication support

HTTPS listener configuration has been extended to support the TLS Server Name Indication (SNI) extension.

Request/Response Time Auditing

Additional fields have been added to the engine audit logs for performance monitoring and capacity planning purposes - total request processing time and back-end proxy response time.

Administration enhancements

Many enhancements have been made to improve the administration and modeling of configuration in PingAccess.

PingAccess 2.1.4 – June 2014

- Resolved an issue with Resource Ordering in the Administrative Console.
- improved interoperability with backend applications introduced by URL filtering in PingAccess 2.1.3.

PingAccess 2.1.3 - May 2014

- Fix a potential security issue that affects deployments that have varying policy applied across a single virtual server.

PingAccess 2.1.2 – April 2014

- Allow for specifying the base path for PingFederate. Useful when PingFederate is behind a reverse proxy.

PingAccess 2.1.1 – March 2014

- Fix Identity Mediation back channel communication issue.
- Fix Web Session cookie attribute handling.

PingAccess 2.1 - December 2013

- Ability to encrypt the PA session token.
- Sites can have multiple Site Authenticators configured.
- Added Authentication Requirements policy to allow step-up authentication to a Resource.
- Ability to specify “Any” or “All” processing to policy rules within a rule set.
- Multiple Web Sessions can be configured to scope a PingAccess session for a specific set of Resources.
- Added OpenID Connect Basic Profile flow for obtaining claims from PingFederate.
- Enhanced Audit log options to database and Splunk.

PingAccess 2.0.1 - October 2013

- Fixed well-known HTTP/S port issue
- Fixed a potential security issue with the Web Session Header Site Authenticator

PingAccess 2.0 - September 2013

- Initial General Availability (GA) release

PingAccess 1.0 - April 2013

- Limited release