



# Authentication and Single Sign-On Guide

/ ForgeRock Access Management 5.1

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## Abstract

Guide to working with authentication and single sign-on support. ForgeRock® Access Management provides authentication, authorization, entitlement and federation software.



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# Preface

This guide covers concepts, implementation procedures, and customization techniques for working with the authentication and single sign-on features of ForgeRock Access Management.

This guide is written for anyone using Access Management to manage authentication, sessions, and implement single sign-on.

## About ForgeRock Identity Platform™ Software

ForgeRock Identity Platform™ serves as the basis for our simple and comprehensive Identity and Access Management solution. We help our customers deepen their relationships with their customers, and improve the productivity and connectivity of their employees and partners. For more information about ForgeRock and about the platform, see <https://www.forgerock.com>.

## Chapter 1

# Introducing Authentication and Single Sign-On

Authentication is the process of verifying login credentials submitted by a user or an entity comparing them to a database of authorized users. This guide covers how to set up, customize, and use the authentication process.

## 1.1. About Access Management and Authentication

Access management is about controlling access to resources using two processes: authentication and authorization.

*Authentication* is how AM verifies the identity of a user or an entity. *Authorization* is how AM determines whether a user has sufficient privileges to access to a protected resource, and if so, access is granted to that user or entity. AM's authorization process is covered in the *Authorization Guide*.

AM plays a role similar to border control at an international airport. Instead of having each and every airline company deal with access to each destination, all airlines redirect passengers to border control. Border control then determines, or authenticates, the identity of each passenger according to passport credentials.

Redirect control also checks whether the identified passenger is authorized to fly to the destination corresponding to the ticket, perhaps based on visa credentials. Then, at the departure gate, an agent enforces the authorization from border control, allowing the passenger to board the plane as long as the passenger has not gotten lost, or tried to board the wrong plane, or swapped tickets with someone else. Thus, border control handles access management at the airport.

AM uses defined mechanisms to validate credentials and complete the authentication process. The authentication methods can vary. For example, AM is most frequently used to protect web application pages.

Consider a user who wants access to a protected web page. You can deploy an agent on the web application server. The agent redirects the user's request to an AM login page, where the user enters their credentials, such as username and password. AM determines who the user is, and whether the user has the right to access the protected page. AM then redirects the user back to the protected page with authorization credentials that can be verified by the agent. The agent allows the user authorized by AM to access the page.

You can use AM to protect physical devices connected on the Internet of things (IoT). For example, a delivery van tracking system could have its proxying gateway authenticate to a brokering system

using an X.509 certificate to allow it to enable an HTTPS protocol and then connect to sensors in its delivery trucks. If the X.509 certificate is valid, the brokering system can monitor a van's fuel consumption, speed, mileage, and overall engine condition to maximize each van's operating efficiency.

## 1.2. Authentication Features

AM supports a number of authentication features and services for use in your deployment:

- **Authentication Modules and Chains.** AM provides a number of authentication modules to handle different modes of authenticating users or entities. The modules also can be *chained* together to provide multiple authentication mechanisms, so that a user's or entity's credentials must be evaluated by one module before control passes to another module. For more information, see "About Authentication Modules and Chains".
- **Authentication Levels.** AM allows each module to be configured with an *authentication level*, which indicates the security level of the user's or entity's credentials. If the user needs to gain access to more sensitive resources, AM may require the user or entity to reauthenticate, providing an additional credential of another type. For more information, see "About Authentication Levels".
- **Social Authentication.** You can configure AM to accept authentication provided by popular third-party identity providers, such as Facebook, Google, and Microsoft. For more information, see "About Social Authentication".
- **Multi-Factor Authentication.** AM supports multi-factor authentication, which requires a user to provide multiple forms of credentials, such as username and password, and a one-time password sent to a user's mobile phone. For more information, see "About Multi-Factor Authentication".
- **Account Lockout.** AM can lock accounts after a pre-configured number of failed authentication attempts. Account lockout works with modules for which users enter a password. For more information, see "About Account Lockout".
- **Sessions.** AM creates a *session* when a user or entity has authenticated to the system to manage the user's or entity's access to resources. AM supports two types of sessions: stateful and stateless. *Stateful sessions* reside in the Core Token Service (CTS) token store. They can be cached in memory on one or more AM servers to improve system performance. *Stateless sessions* do not reside in CTS or in the server's memory, but are sent to the client. For browser-based clients, session state information is encoded within the browser cookie. For more information, see "About Sessions".
- **Single Sign-On.** AM allows a user or an entity to use one set of credentials to access multiple applications within a single domain. This is known as single sign-on (SSO). AM also supports Cross-Domain Single Sign-On (CDSSO). For more information, see "About Single Sign-On".







## 1.3. About Authentication Modules and Chains

AM allows you to configure authentication processes and then customize how they are applied. AM uses *authentication modules* to handle different ways of authenticating. Basically, each authentication module handles one way of obtaining and verifying credentials. You can chain different authentication modules together. In AM, this is called *authentication chaining*. Each authentication module can be configured to specify the continuation and failure semantics with one of the following four criteria: requisite, sufficient, required, or optional.

Authentication modules in a chain can assign a *pass* or *fail* flag to the authorization request. To successfully complete an authentication chain at least one pass flag must have been achieved, and there must be no fail flags.

Flags are assigned when completing a module as shown in the table below:

*Authentication Criteria, Flags, and Continuation Semantics*

Criteria	Fail	Pass	Example
Requisite	Assigns fail flag.  Exits chain.	Assigns pass flag.  Continues chain.	Active Directory, Data Store, and LDAP authentication modules are often set as requisite because of a subsequent requirement in the chain to identify the user.  For example, the Device ID (Match) authentication module needs a user's ID before it can retrieve information about the user's devices.
Sufficient	Assigns no flag. Continues chain.	Assigns pass flag.  Exits chain.	You could set Windows Desktop SSO as sufficient, so authenticated Windows users are let through, whereas web users must traverse another authentication module, such as one requiring a username and password.  One exception is that if you pass a sufficient module after having failed a required module, you will continue through the chain and <i>will not</i> exit at that point. Consider using a requisite module instead of a required module in this situation.
Required	Assigns fail flag.  Continues chain.	Assigns pass flag.  Continues chain.	You could use a required module for login with email and password, so that it can fail through to another module to handle new users who have not yet signed up.
Optional	Assigns no flag. Continues chain.	Assigns pass flag.  Continues chain.	You could use an optional module to assign a higher authentication level if it passes. Consider a chain with a requisite Data Store module and an optional Certificate module. Users who only passed the Data Store module could be assigned a lower authentication level than users who passed both the Data Store and Certificate modules. The



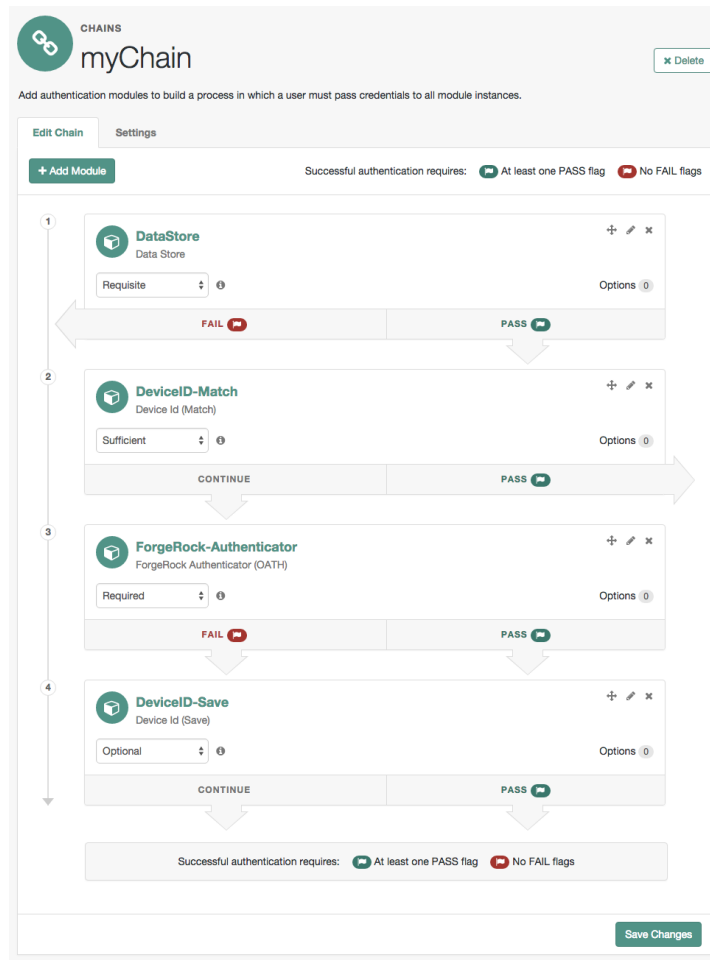
Criteria	Fail	Pass	Example
			users with the higher authentication level could be granted access to more highly-secured resources.

**Tip**

In authentication chains with a single module, requisite and required are equivalent. For authentication chains with multiple modules, use required only when you want the authentication chain to continue evaluating modules even after the required criterion fails.

The AM authentication chain editor displays the flags that could be assigned by each module in the chain, and whether execution of the chain continues downwards through the chain or exits out, as shown below:

## Authentication Chain with Each Criteria



With AM, you can further set *authentication levels* per module, with higher levels being used typically to allow access to more restricted resources. The AM SPIs also let you develop your own authentication modules, and post authentication plugins. Client applications can specify the authentication level, module, user, and authentication service to use among those you have configured. As described later in this guide, you can use *realms* to organize which authentication process applies for different applications or different domains, perhaps managed by different people.

AM leaves the authentication process flexible so that you can adapt how it works to your situation. Although at first the number of choices can seem daunting, now that you understand the basic

process, you begin to see how choosing authentication modules and arranging them in authentication chains lets you use AM to protect access to a wide range of applications used in your organization.

## 1.4. About Authentication Levels

When a user successfully authenticates, AM creates a session, which allows AM to manage the user's access to resources. The session is assigned an *authentication level*, which is calculated to be the highest authentication level of any authentication module that passed. If the user's session does not have the appropriate authentication level, then the user may need to re-authenticate again at a higher authentication level to access the requested resource.

The authentication level sets the level of security associated with a module. The strongest form of authentication is usually assigned the highest authentication level, although if it is your preference, you could assign the strongest form of authentication to the lowest authentication level. Upon successful authentication, a user's session includes information about the authentication level achieved.

If an authentication chain contains `requisite` or `required` modules that were not executed due to the presence of a passing `sufficient` module in front of them, the session's authentication level is calculated to be whichever is greater: the highest authentication level of any authentication module that passed, or the highest authentication level of `requisite` or `required` modules that were not executed.

You can modify AM's default behavior, so that a session's authentication level is *always* the highest authentication level of any authentication module that passed, even if there are `requisite` or `required` modules in the authentication chain that were not executed.

To modify the default behavior, set the `org.forgerock.openam.authLevel.excludeRequiredOrRequisite` property to `true` under Deployment > Servers > *Server Name* > Advanced and restart the AM server.

Authorization policies can require a particular authentication level for access to sensitive resources (or at most or at least a specified authentication level). When a user who is already authenticated in the realm tries to access a sensitive resource with a valid session that does not have the requisite authentication level, AM denies access to the resource. However, AM also returns *advices* with the authorization decision. The advices indicate the need for the required authentication level. The policy agent or policy enforcement point can then send the user back to AM for *session upgrade*.

During session upgrade the user authenticates with a stronger authentication module. The stronger module is typically part of the same authentication chain that handled the original authentication, though not required for access to less sensitive resources. Upon successful stronger authentication, the user session is upgraded to the new authentication level and modified to include any settings related to the stronger authentication.

If unsuccessful, session upgrade leaves the user session as it was before the attempt at stronger authentication. If session upgrade failed because the login page times out, AM redirects the user's browser to the success URL from the last successful authentication.

AM policy agents generally handle session upgrade without additional configuration, as policy agents are built to handle AM's advices. If you build your own policy enforcement point (PEP), however, take advices and session upgrade into consideration. For RESTful PEPs and for indications on how to handle advices, see "Requesting Policy Decisions" in the *Authorization Guide*. For session upgrade see "Authentication and Logout".

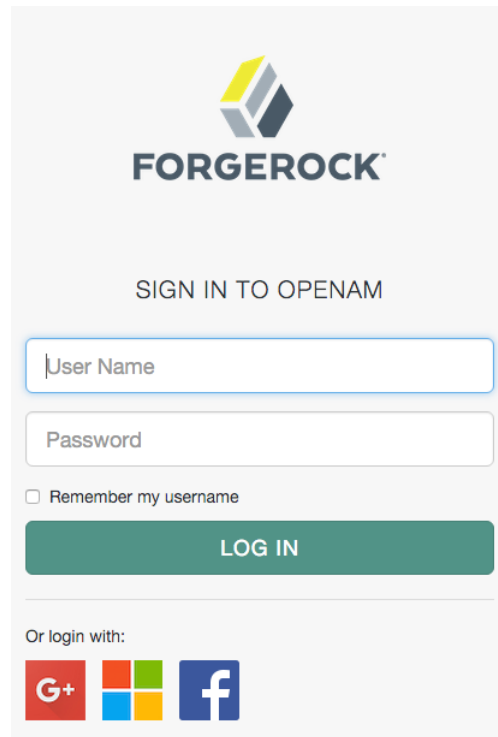
AM's support for session upgrades requires stateful sessions. Be sure that AM is configured for stateful sessions—the default configuration—before attempting to upgrade AM sessions.

## 1.5. About Social Authentication

AM supports delegated authentication through third-party identity providers, such as Facebook, Google, and Microsoft. The AM console provides setup wizards to configure authentication with each identity provider. An additional wizard provides the ability to configure other third-party authenticators.

Each AM wizard creates an authentication module and an authentication chain containing the correct configuration needed to authenticate with the third party. The wizard also adds configuration data to the realm's *Social Authentication Implementations Service* and provisions the service to enable the display of logos of the configured third-party authentication providers on the AM login screen, as shown below.

## Login Screen With Social Authentication Logos



The screenshot displays the ForgeRock login interface. At the top center is the ForgeRock logo, consisting of a stylized 'F' made of three overlapping geometric shapes in yellow, grey, and blue, with the word 'FORGEROCK' in a bold, sans-serif font below it. Underneath the logo is the text 'SIGN IN TO OPENAM'. Below this are two input fields: 'User Name' and 'Password'. A checkbox labeled 'Remember my username' is positioned below the password field. A prominent green button with the text 'LOG IN' is centered below the form. At the bottom of the form, the text 'Or login with:' is followed by three social media icons: Google+, Microsoft, and Facebook.

"*Implementing Social Authentication*" describes how to set up social authentication in AM.

## 1.6. About Multi-Factor Authentication

*Multi-factor authentication* is an authentication technique that requires users to provide multiple forms of identification when logging in to AM.

This section describes multi-factor authentication features in AM. See "*Implementing Multi-Factor Authentication*" for information about how to set up multi-factor authentication in AM.

Multi-factor authentication provides a more secure method for users to access their accounts with the help of a *device*. Note that the word *device* is used in this section to mean a piece of equipment that can display a one-time password or that supports push notifications using protocols supported by AM multi-factor authentication. Devices are most commonly mobile phones with authenticator apps that support the OATH protocol or push notifications, but could also include other equipment.

The following is an example scenario of multi-factor authentication in AM:

1. An AM administrator configures an authentication chain with the Data Store and ForgeRock Authenticator (OATH) authentication modules.
2. An end user authenticates to AM using that authentication chain.
3. AM prompts the user to enter the user ID and password as required by the Data Store authentication module—the first factor in multi-factor authentication.
4. If the user ID and password were correct, AM prompts the user to obtain a one-time password.
5. The user runs an authenticator app on a mobile phone that generates and displays a one-time password.
6. The user provides the one-time password to AM to successfully complete authentication—the second factor in multi-factor authentication.

Administrators set up multi-factor authentication by creating authentication chains with two or more authentication modules. The initial module in the chain defines the first authentication module for multi-factor authentication. In the preceding scenario, the first authentication module is the Data Store authentication module. Subsequent modules in the chain define the additional factors required to log in, for example the ForgeRock Authenticator (OATH) or ForgeRock Authenticator (Push) authentication modules.

AM supports the Open AuTHentication (OATH) protocols, and also push notification for multi-factor authentication.

### 1.6.1. About Open AuTHentication (OATH)

The ForgeRock Authenticator (OATH) module supports HMAC one-time password (HOTP) and time-based one-time password (TOTP) authentication as defined in the OATH standard protocols for HOTP (RFC 4226) and TOTP (RFC 6238). Both HOTP and TOTP authentication require an OATH-compliant device that can provide the password.

HOTP authentication generates the one-time password every time the user requests a new password on their device. The device tracks the number of times the user requests a new one-time password with a counter. The one-time password displays for a period of time you designate in the setup, so the user may be further in the counter on their device than on their account.

AM will resynchronize the counter when the user finally logs in. To accommodate this, you set the number of passwords a user can generate before their device cannot be resynchronized. For example, if you set the number of HOTP Window Size to 50 and someone presses the button 30 times on the user's device to generate a new password, the counter in AM will review the passwords until it reaches the one-time password entered by the user. If someone presses the button 51 times, you will need to reset the counter to match the number on the device's counter before the user can login to AM. HOTP authentication does not check earlier passwords, so if the user attempts to reset the counter on their device, they will not be able to login until you reset the counter in AM to match their device. For more information, see "[Resetting Registered Devices by using REST](#)".

TOTP authentication constantly generates a new one-time password based on a time interval you specify. The device tracks the last several passwords generated and the current password. The

TOTP Time Steps setting configures the number of passwords tracked. The Last Login Time setting monitors the time when a user logs in to make sure that user is not logged in several times within the present time period. The TOTP Time-Step Interval should not be so long as to lock users out, with a recommended time of 30 seconds.

### 1.6.2. Differences Among Authentication Modules That Support HOTP

The ForgeRock Authenticator (OATH), OATH, and HOTP authentication modules let you configure authentication that prompts users to enter HMAC one-time passwords. It is important that administrators understand the differences among these authentication modules:

- The ForgeRock Authenticator (OATH) and OATH authentication modules accept one-time passwords generated by the end user's device, while the HOTP authentication module generates passwords and sends them to users by e-mail or SMS.
- All three of the authentication modules support HOTP passwords. The ForgeRock Authenticator (OATH) and OATH authentication modules also support TOTP passwords.
- The ForgeRock Authenticator (OATH) and OATH authentication modules require users to register their devices, and store the device registration details in the user profile. The HOTP authentication module requires the presence of mobile phone numbers and/or e-mail addresses in user profiles.
- The ForgeRock Authenticator (OATH) authentication module can encrypt stored device registration details.

Before deciding on an implementation strategy, assess your requirements against the following capabilities in AM:

#### *Comparing the ForgeRock Authenticator (OATH) to the HOTP Authentication Module*

<b>Requirement</b>	<b>Available With the ForgeRock Authenticator (OATH) Authentication Module?</b>	<b>Available With the HOTP Authentication Module?</b>
End users can authenticate using a HOTP password	Yes	Yes
AM can generate a HOTP password and send it to end users in a text message or an e-mail	No	Yes
End users can register a mobile phone with AM, and an authenticator app on the phone can generate a HOTP or TOTP password that AM accepts as proof of authentication	Yes	No
End users can authenticate with a TOTP password	Yes	No
End users can opt out of providing a one-time password	Yes	No
End users can authenticate using XUI	Yes	Yes

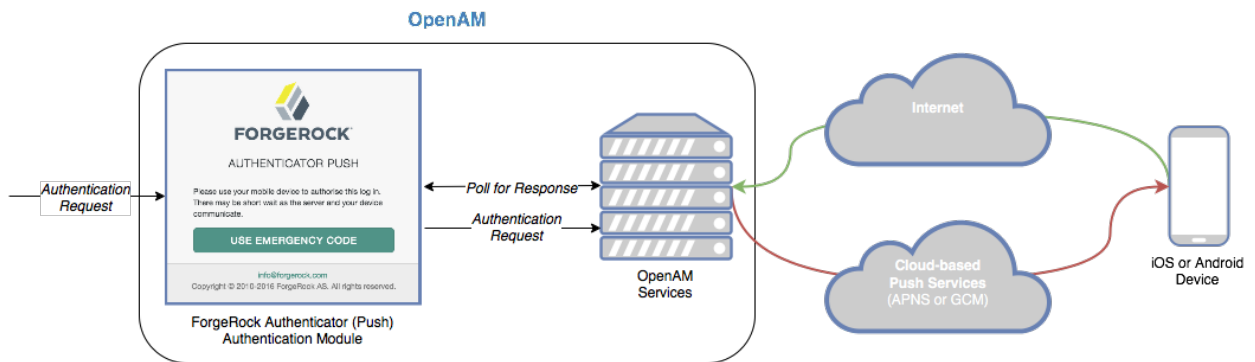
Requirement	Available With the ForgeRock Authenticator (OATH) Authentication Module?	Available With the HOTP Authentication Module?
End users can authenticate using the legacy UI	No	Yes

### 1.6.3. About Push Authentication

You can use push notifications as part of the authentication process in AM.

To receive push notifications when authenticating, end users must register an Android or iOS device with AM. The registered device can then be used as an additional factor when authenticating to AM. AM can send the device a push notification, which can be accepted by the ForgeRock Authenticator app. In the app, the user can allow or deny the request that generated the push notification and return the response to AM.

#### Overview of Push Authentication



The following steps occur when AM receives an authentication request and is configured for multi-factor authentication using push notifications:

1. The user must provide credentials to enable AM to locate the user in the identity store and determine if they have a registered mobile device.
2. AM prompts the user to register a mobile device if they have not done so already. Registering a device associates metadata about the device essential for enabling push notifications with the user's profile in the identity store.

For more information, see "[Managing Devices for Multi-Factor Authentication](#)".

3. Once the details of the registered device are obtained, AM creates a push message specific to the registered device. The message has a unique ID, which AM stores in anticipation of a response from the registered device.



A pending record using the same message ID is also written to the CTS store, providing redundancy should an individual server go offline during the authentication process.

4. AM sends the push message to the registered device.

AM uses cloud-based push notification services to deliver the messages to the devices. Depending on the registered device, AM uses either Apple Push Notification Services (APNS) or Google Cloud Messaging (GCM) to deliver the push notification.

The ForgeRock Authenticator (Push) authentication module begins to poll AM and the CTS for an accepted response from the registered device.

5. The user responds to the notification on the registered device, which will open the ForgeRock Authenticator app. In the ForgeRock Authenticator app, the user approves the authentication request with either a swipe, or by using a fingerprint on supported hardware.

For more information, see "To Perform Authentication using Push Notifications".

The app returns the response to the AM cluster.

6. AM verifies the message is from the correct registered phone and has not been tampered with, and marks the pending record as accepted if valid.

The ForgeRock Authenticator (Push) module detects the accepted record and redirects the user to their profile page, completing the authentication.

#### 1.6.4. Limitations When Using Passwordless Push Authentication

The ForgeRock Authenticator (Push) authentication module operates in passwordless mode if not preceded by a Data Store module in an authentication chain. When authenticating using such a chain, the user will be asked to enter their user ID, but not their password. A push notification is then sent to their registered device to complete the authentication by using the ForgeRock Authenticator app.

You should be aware of the following potential limitations before deciding to implement passwordless push authentication:

- Unsolicited push messages could be sent to a user's registered device by anyone who knew or was able to guess their user ID.
- If a malicious user attempted to authenticate by using push at the same time as a legitimate user, the legitimate user might unintentionally approve the malicious attempt. This is because push notifications only contain the username and issuer in the text, and it is not easy to determine which notification relates to which authentication attempt.

Consider using push notifications as part of a multi-factor authentication chain. For an example, see "Creating Authentication Chains for Push Authentication".

## 1.7. About Account Lockout

AM can lock accounts after repeated authentication failures. Account lockout works with modules for which users can enter a password incorrectly.

"*Implementing Account Lockout*" describes how to set up account lockout in AM.

## 1.8. About Sessions

When a user successfully authenticates, AM creates a session to manage the user's access to resources. AM uses information stored in the session to determine if a user's login is still valid, or if a user needs to reauthenticate.

### Important

In a multi-AM server with load balancer deployment, sticky load balancing is required during authentication regardless if you are using stateful or stateless sessions. For example, whether you use a single authentication module or multiple authentication modules in a chain, you must implement sticky load balancing using the `amlbcookie`, so that the load balancer can route the appropriate authentication requests to a target server. For more information, see "Configuring Site Sticky Load Balancing" in the *Installation Guide*.

### 1.8.1. Session State

AM sessions are "stateful" or "stateless," and are described in detail in the following sections.

#### 1.8.1.1. Stateful Sessions

Stateful sessions are sessions that reside on the server in the CTS token store and that can be cached in memory on one or more AM servers to improve system performance. AM sends clients a reference to the session, but the reference does not contain any of the session state information. The session reference is also known as an *SSO token*. For browser clients, AM sets a cookie in the browser that contains the session reference. For REST clients, AM returns the session reference in response to calls to the `authentication` endpoint.

Stateful sessions are malleable. The AM server can modify various aspects of users' sessions during the sessions' lifetime.

#### 1.8.1.2. Stateless Sessions

Stateless sessions are those where AM returns session state to the client after each request, and require it to be passed in with the subsequent request.

**Note**

You should configure AM to sign and/or encrypt stateless sessions for security purposes. Because decrypting and verifying the session can be an expensive operation on each request, AM caches the decrypt sequence in memory to improve performance.

For more information about configuring stateless session security, see "Configuring Stateless Session Cookie Security".

### 1.8.1.3. Configuration By Realm

Session statefulness and statelessness are configured at the realm level. AM realms use stateful sessions by default. Sessions for all users authenticating to a given realm are either stateful or stateless, depending on the individual realm's configuration. AM can be deployed with some realms using stateless sessions and so forth using stateful sessions.

There is, however, one exception to the per-realm session state configuration. When the top-level administrator (by default, the `amadmin` user) authenticates to AM, the session is always stateful, even if the Top Level Realm is configured for stateless sessions.

### 1.8.1.4. Session State During Authentication

During authentication, AM maintains the authenticating user's session in its memory regardless of whether you have configured the realm to which the user is authenticating for stateful or stateless sessions.

After authentication has completed, AM deletes in-memory sessions for users authenticating to realms configured for stateless sessions. Sessions for users authenticating to realms configured for stateful sessions are written to the CTS token store.

### 1.8.1.5. Session Customization

You can store custom information in both stateful and stateless sessions with post authentication plugins. For more information about post authentication plugins, see "Creating a Post Authentication Plugin".

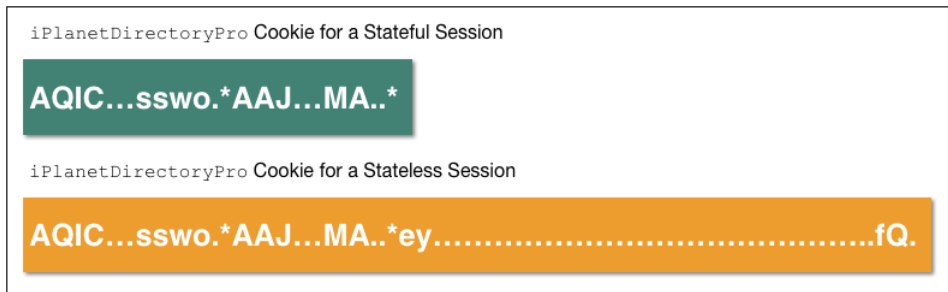
### 1.8.1.6. Session Cookies

AM writes a cookie in the authenticated user's browser for both stateful and stateless sessions. By default, the cookie's name is `iPlanetDirectoryPro`. For stateful sessions, the cookie contains a reference to the stateful session in the CTS token store and several other pieces of information. For stateless sessions, the cookie is larger and contains all the information that would be held in the CTS token store if the session were stateful.

Stateless session cookies are comprised of two parts. The first part of the cookie is identical to the cookie for stateful sessions, which ensures the compatibility of the cookies regardless of the

session type. The second part is a base 64-encoded JSON Web Token (JWT), and it contains session information, as illustrated in the figure below.

### *Stateful and Stateless Session Cookies*



Note that the diagram is not to scale. The size of the stateless session cookie increases when you customize AM to store additional attributes in users' sessions. You are responsible for ensuring that the size of the cookie does not exceed the maximum cookie size allowed by your end users' browsers.

#### 1.8.1.6.1. Stateless Session Cookie Security

When using stateless session cookies, you should configure AM to sign and encrypt the JWT inserted in the `iPlanetDirectoryPro` cookie.

Configuring stateless session cookies for JWT signing and encryption is discussed in "Configuring Stateless Session Cookie Security".

##### 1.8.1.6.1.1. JWT Signing

AM sets the `iPlanetDirectoryPro` cookie in the user's browser as proof of previous authentication whenever single sign-on is desired. AM verifies that the cookie is authentic by validating a signature configured in the Session Service. AM thwarts attackers who might attempt to tamper with the contents of the cookie or its signature, or who might attempt to sign the cookie with an incorrect signature.

##### 1.8.1.6.1.2. JWT Encryption

Knowledgeable users can easily decode base 64-encoded JWTs. Because an AM session contains information that might be considered sensitive, encrypting the JWT that contains the session protects its contents by ensuring opaqueness.

Encrypting the JWT prevents man-in-the-middle attacks that could log the state of every AM session. Encryption also ensures that end users are unable to access the information in their AM session.

### 1.8.1.7. Core Token Service Usage

AM uses the Core Token Service differently for stateful and stateless sessions.

For stateful sessions, AM uses the Core Token Service's token store to save user sessions. Any AM server in a site can retrieve sessions from the CTS token store.

With stateless sessions, AM does not store user sessions in the Core Token Service's token store. Instead, AM stores sessions in the `iPlanetDirectoryPro` cookie on the user's browser. Any AM server in a site can read the stateless session from the `iPlanetDirectoryPro` cookie.

Session blacklisting is an optional feature that maintains a list of logged out stateless sessions in the CTS token store. The next section describes session logout, including session blacklisting for stateless sessions.

### 1.8.1.8. Session Termination

AM manages active sessions, allowing single sign-on when authenticated users attempt to access system resources in AM's control.

AM ensures that user sessions are terminated when a configured timeout is reached, or when AM users perform actions that cause session termination. Session termination effectively logs the user out of all systems protected by AM.

With stateful sessions, AM terminates sessions in four situations:

- When a user explicitly logs out
- When an administrator monitoring sessions explicitly terminates a session
- When a session exceeds the maximum time-to-live
- When a user is idle for longer than the maximum session idle time

Under these circumstances, AM responds by removing stateful sessions from the CTS token store and from AM server memory caches. With the user's stateful session no longer present in CTS, AM forces the user to reauthenticate during subsequent attempts to access resources protected by AM.

When a user explicitly logs out of AM, AM also attempts to invalidate the `iPlanetDirectoryPro` cookie in users' browsers by sending a `Set-Cookie` header with an invalid session ID and a cookie expiration time that is in the past. In the case of administrator session termination and session timeout, AM cannot invalidate the `iPlanetDirectoryPro` cookie until the next time the user accesses AM.

Session termination differs for stateless sessions. Since stateless sessions are not maintained in the CTS token store, administrators cannot monitor or terminate stateless sessions. Because AM does not modify the `iPlanetDirectoryPro` cookie for stateless sessions after authentication, the session idle time is not maintained in the cookie. Therefore, AM does not automatically terminate stateless sessions that have exceeded the idle timeout.

As with stateful sessions, AM attempts to invalidate the `iPlanetDirectoryPro` cookie from a user's browser when the user logs out. When the maximum session time is exceeded, AM also attempts to invalidate the `iPlanetDirectoryPro` cookie in the user's browser the next time the user accesses AM.

It is important to understand that AM cannot guarantee cookie invalidation. For example, the HTTP response containing the `Set-Cookie` header might be lost. This is not an issue for stateful sessions, because a logged out stateful session no longer exists in the CTS token store, and a user who attempts to reaccess AM after previously logging out will be forced to reauthenticate.

However, the lack of a guarantee of cookie invalidation is an issue for deployments with stateless sessions. It could be possible for a logged out user to have an `iPlanetDirectoryPro` cookie. AM could not determine that the user previously logged out. Therefore, AM supports a feature that takes additional action when users log out of stateless sessions. AM can maintain a list of logged out stateless sessions in a session blacklist in the CTS token store. Whenever users attempt to access AM with stateless sessions, AM checks the session blacklist to validate that the user has not, in fact, logged out.

For more information about session blacklist options, see "Configuring Session Blacklisting".

### 1.8.1.9. Choosing Between Stateful and Stateless Sessions

AM stores stateful sessions in the CTS token store and caches sessions in server memory. If a server with cached sessions fails, or if the load balancer in front of AM servers directs a request to a server that does not have the user's session cached, the AM server retrieves the session from the CTS token store, incurring performance overhead.

Stateless sessions provide the following advantage:

#### **Simpler load balancing configuration**

Stateless sessions do not require the use of a load balancer with session stickiness to achieve optimal performance, making deployment of AM on multiple servers simpler.

Stateful sessions provide the following advantages:

#### **Full feature support**

Stateful sessions support all AM features. Stateless sessions do not. For information about restrictions on AM usage with stateless sessions, see "Limitations When Using Stateless Sessions".

#### **Session information is not resident in browser cookies**

With stateful sessions, all the information about the session resides in CTS and might be cached on one or more AM servers. With stateless sessions, session information is held in browser cookies. This information could be very long-lived.

The following table contrasts the impact of using stateful and stateless sessions in an AM deployment:

### Impact of Deploying Using Stateful and Stateless Sessions

Deployment Area	Stateful Session Deployment	Stateless Session Deployment
Hardware	Higher I/O and memory consumption	Higher CPU consumption
Logical Hosts	Variable or large number of hosts	Variable or large number of hosts
Session Monitoring	Available	Not available
Session Location	Authoritative source: CTS token store. Sessions might also be cached in AM's server memory heap for improved performance.	In a cookie in the user's browser
Uninterrupted Session Availability	No special configuration required	No special configuration required
Load Balancer Requirements	Session stickiness required while authenticating users. After authentication, recommended for performance.	Session stickiness required while authenticating users. After authentication, recommended for performance.
Core Token Service Usage	Authoritative source for user sessions	Provides session blacklisting for logged out sessions
Core Token Service Demand	Heavier	Lighter
Session Security	Sessions reside in the CTS token store, and are not accessible to users.	Sessions should be signed and encrypted.
Policy Agents	Sessions cached in the Policy Agent can receive change notification.	Sessions cached in the Policy Agent cannot receive change notification.

## 1.8.2. Session Upgrade

As shown in "About Authentication Levels", authentication modules are configured with an authentication level. This configuration sets the level of security associated with the module, Stronger forms of authentication are assigned higher authentication levels. (Or lower authentication level numbers if the deployment defines stronger authentication with lower authentication level numbers.) Upon successful authentication, a user's session includes information about the authentication level achieved.

Authorization policies can require a particular authentication level for access to sensitive resources (or at most or at least a specified authentication level). When a user who is already authenticated in the realm tries to access a sensitive resource with a valid session that does not have the requisite authentication level, AM denies access to the resource. However, AM also returns *advices* with the authorization decision. The advices indicate the need for the required authentication level. The policy agent or policy enforcement point can then send the user back to AM for *session upgrade*.

During session upgrade the user authenticates with a stronger authentication module. The stronger module is typically part of the same authentication chain that handled the original authentication, though not required for access to less sensitive resources. Upon successful stronger authentication, the user session is upgraded to the new authentication level and modified to include any settings related to the stronger authentication.

If unsuccessful, session upgrade leaves the user session as it was before the attempt at stronger authentication. If session upgrade failed because the login page times out, AM redirects the user's browser to the success URL from the last successful authentication.

AM policy agents generally handle session upgrade without additional configuration, as policy agents are built to handle AM's advices. If you build your own policy enforcement point (PEP), however, take advices and session upgrade into consideration. For RESTful PEPs and for indications on how to handle advices, see "Requesting Policy Decisions" in the *Authorization Guide*. For session upgrade see "Authentication and Logout".

AM's support for session upgrades requires stateful sessions. Be sure that AM is configured for stateful sessions—the default configuration—before attempting to upgrade AM sessions.

### 1.8.3. Session Quotas

In some deployments, you need to limit how many active sessions a user can have at a given time. For example, you might want to prevent a user from using more than two devices at once.

AM lets you limit the number of active sessions for a user by setting session quotas. You also configure session quota exhaustion actions so that when a user goes beyond the session quota, AM takes the appropriate action.

See "Implementing Session Quotas" for instructions.

AM's support for session quotas requires stateful sessions. Be sure that AM is configured for stateful sessions—the default configuration—before attempting to configure session quotas.

## 1.9. About Single Sign-On

With single sign-on (SSO), a user can access multiple independent services from a single login session.

AM supports SSO within a single domain or across domains.

### 1.9.1. Single Domain SSO

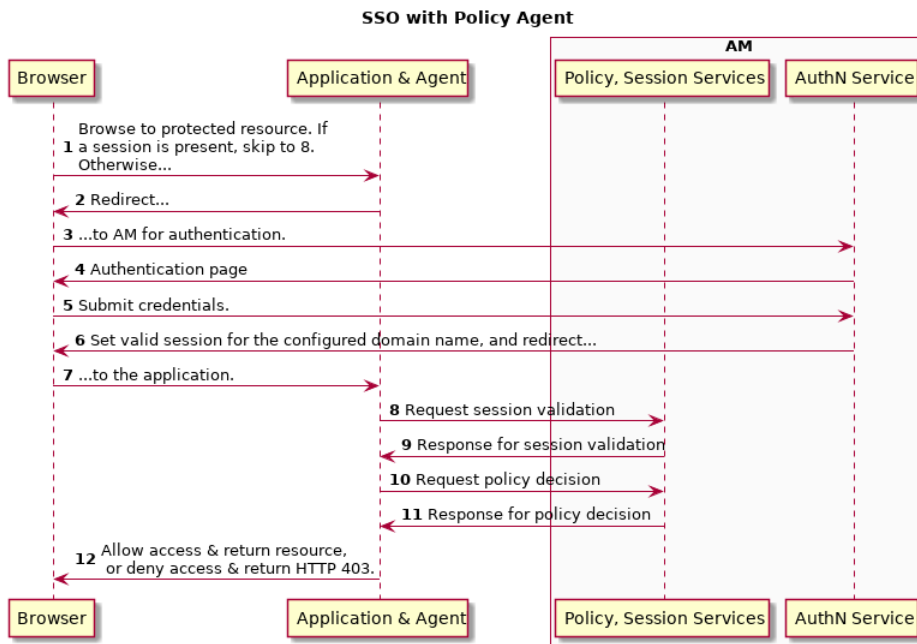
AM uses HTTP cookies to track user sessions. If you are unfamiliar with HTTP cookies, see "About HTTP Cookies" for more information.



The following diagram illustrates how AM assigns and tracks cookies:

- The domain shown in the description is `example.net`.
- The protected resource application can be found on `app.example.net`.
- The AM server is located on `sso.example.net`.

### SSO With Policy Agent



A client points their browser to a protected resource application. An agent on the application checks the client browser cookies for the presence of a session. If a session cookie exists and is valid, the agent requests validation (see arrow 8).

If no valid session cookie exists, the agent redirects the client to AM for authentication (AuthN). The client is then sent to AM for AuthN. If the client submits valid credentials, the AuthN service creates a session cookie for the configured domain. The contents of the session cookie varies, depending on the configuration of the realm to which the user authenticates:

- If the realm is configured for stateful sessions, an SSO token is embedded in the cookie.
- If the realm is configured for stateless sessions, the session itself is embedded in the cookie.

### 1.9.1.1. Classic Cross-Domain SSO

Classic cross-domain single sign-on (CDSSO) provides a mechanism for policy agents earlier than version 5 to manage access across multiple domains in a single organization. For example, CDSSO allows your AM servers in the DNS domain `.internal.net` to provide authentication and authorization to policy agents from other DNS domains, such as `.example.net`.

For information about how to configure SSO in a single domain, see "Implementing Single Sign-On Within One Domain".

### 1.9.1.2. Cross-Domain SSO

When you have multiple domains in a single organization, CDSSO lets your AM servers in one domain work with policy agents from other domains.

*Cross-domain single sign-on* provides a safe mechanism for managing access across multiple, different domains that you control. CDSSO lets AM authenticate users redirected by policy agents in other DNS domains.

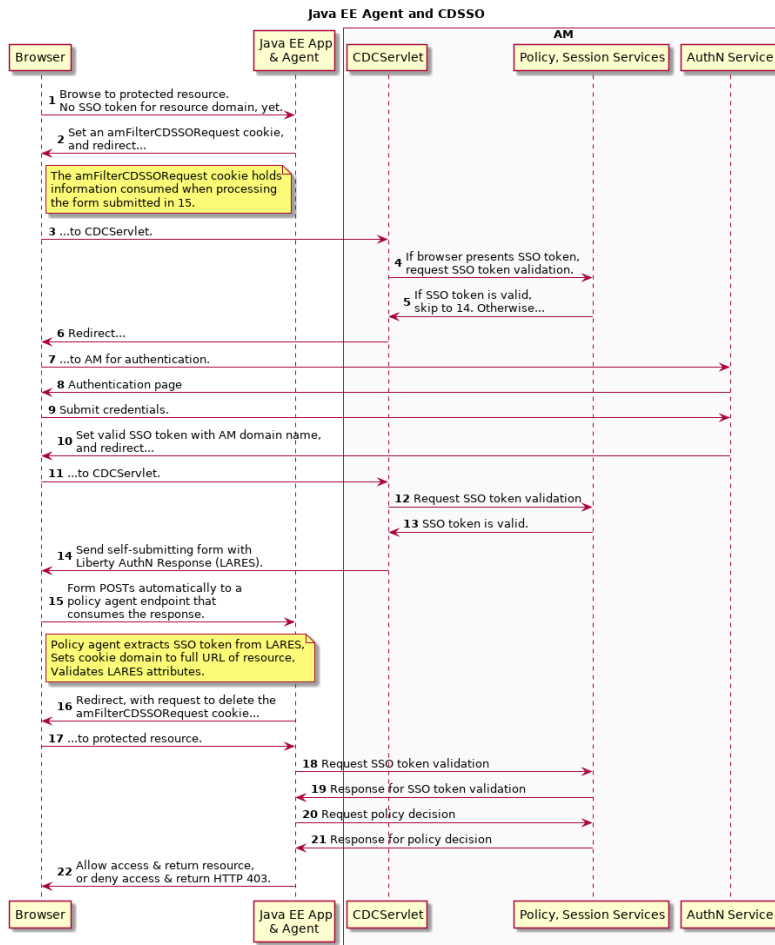
CDSSO is an AM-specific capability. For single sign-on across multiple organizations or when integrating with other access management software, use AM's federation capabilities.

CDSSO requires stateful AM sessions. Be sure that AM is configured for stateful sessions—the default configuration—before attempting to use CDSSO.

Single sign-on depends on cookies to store session information. Yet for security reasons, browsers do not let a web site in one domain to get access to a cookie from another domain. With CDSSO, the policy agents work around this by negotiating with AM to allow access.

The Java EE policy agent allows CDSSO by using a mechanism to write the SSO token from AM authentication to a cookie with the domain of the host where the agent runs. The following sequence diagram illustrates this mechanism.

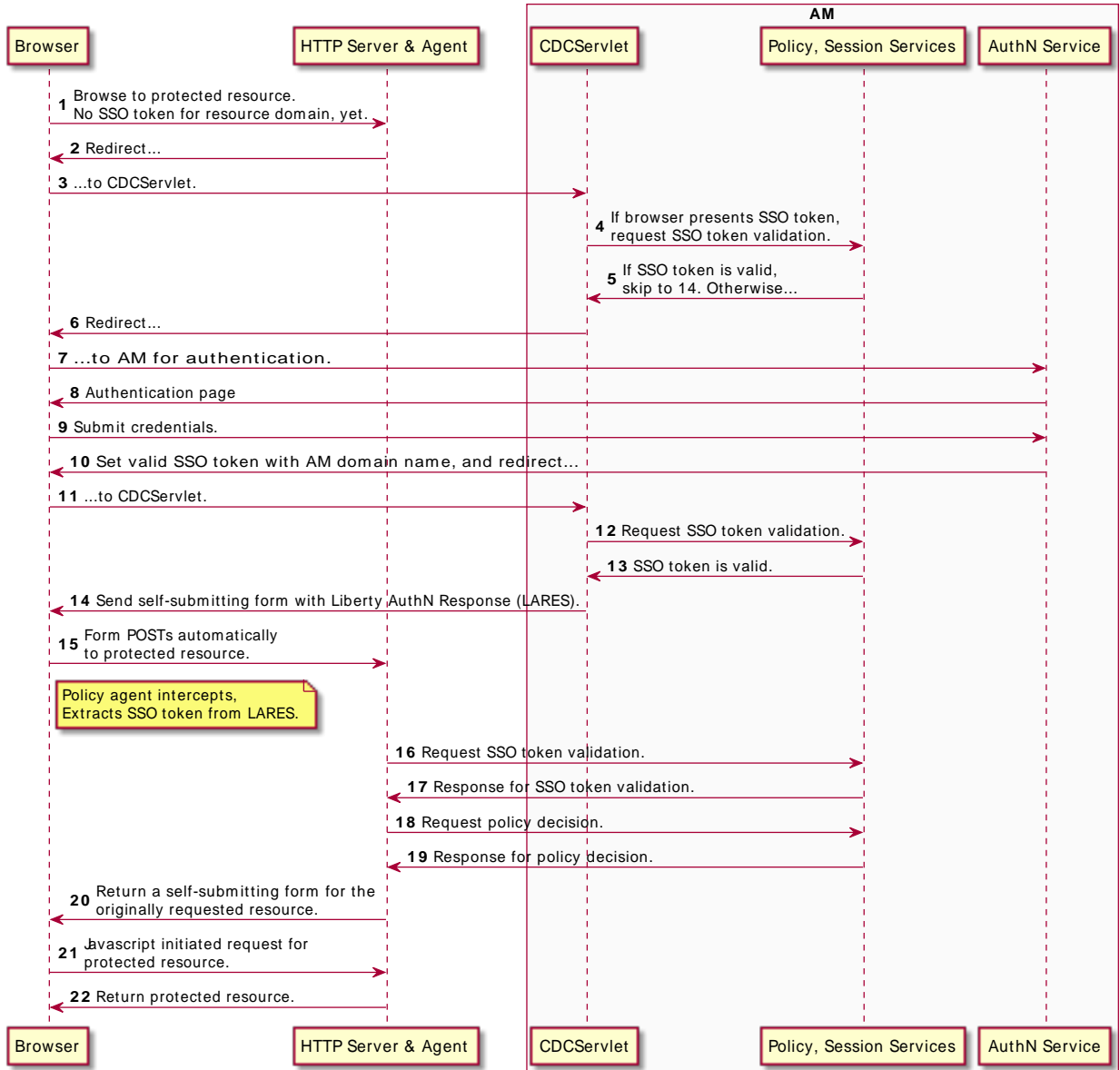
## Java EE Policy Agent Mechanism for CDSSO



Whereas the Java EE policy agent has an endpoint specifically to handle the cookie domain translation, the web policy agent handles the request directly as shown in the following sequence diagram.

## Web Policy Agent Mechanism for CDSSO

### Web Agent and CDSSO



For information about how to configure cross-domain SSO, see "Implementing Cross-Domain Single Sign-On".

## Chapter 2

# Implementing Authentication

AM supports a wide range of authentication modules that can be configured together using authentication chains. AM also supports post-authentication plugins to customize any process after the user or the entity has been authenticated.

After you configure AM authentication, users can authenticate to AM using a browser or a REST API call as described in "*Using Authentication*".

This chapter presents the available authentication modules and procedures to configure chains and post-authentication plugins:

- "Setting up a Realm for Authentication"
- "Configuring Authentication Modules"
- "Configuring Authentication Chains"
- "Implementing Post-Authentication Plugins"

## 2.1. Setting up a Realm for Authentication

In AM, users always authenticate to a realm. Every AM realm has a set of authentication properties that applies to all authentication performed to that realm. The settings are referred to as *core authentication attributes*.

To configure core authentication attributes for an entire AM deployment, navigate to Configure > Authentication in the AM console, and then click Core Attributes.

## The Core Authentication Attributes Page

The screenshot shows the 'Core' configuration page in the AM console. The 'Global Attributes' tab is selected, and the 'Core' sub-tab is active. The page displays several configuration options:

- Pluggable Authentication Module Classes:** A text area containing a list of module classes: `com.sun.identity.authentication.modules.ad.AD`, `org.forgerock.openam.authentication.modules.saml2.SAML2`, `org.forgerock.openam.authentication.modules.oath.OATH`, and `org.forgerock.openam.authentication.modules.social.SocialAuthInstagram`. A search icon is visible to the right.
- LDAP Connection Pool Size:** An empty text input field with an information icon.
- Default LDAP Connection Pool Size:** A text input field containing the value '1:10' with an information icon.
- Remote Auth Security:** A toggle switch that is currently turned off, with an information icon.
- Keep Post Process Objects for Logout Processing:** A toggle switch that is currently turned off, with an information icon.

A 'Save Changes' button is located at the bottom right of the configuration area.

To override the global core authentication configuration in a realm, navigate to Realms > *Realm Name* > Authentication > Settings in the AM console. Note that when you configure core authentication attributes in a realm, the Global tab does not appear.

Use core authentication attributes to configure:

- The list of available authentication modules
- Which types of clients can authenticate with which modules
- Connection pools for access to directory servers
- Whether to retain objects used during authentication so they can be used at logout
- Defaults for configuring authentication in a particular realm

For detailed information about the core configuration attributes, see "Core Authentication Attributes".

## 2.2. Configuring Authentication Modules

The AM console provides two places where you can configure authentication modules:

1. Under Configure > Authentication, you configure default properties for global authentication modules.
2. Under Realms > *Realm Name* > Authentication > Modules, you configure modules for your realm.

The configuration of individual modules depend on its function. The configuration of an Active Directory instead of the LDAP authentication module requires connection information and details about where to search for users. In contrast, the configuration of the HOTP module for OTP authentication requires data about the password length and the mail server or SMS gateway to send the password during authentication.

### 2.2.1. Active Directory Authentication Module

AM connects to Active Directory over Lightweight Directory Access Protocol (LDAP). AM provides separate Active Directory and LDAP modules to support the use of both Active Directory and another directory service in an authentication chain.

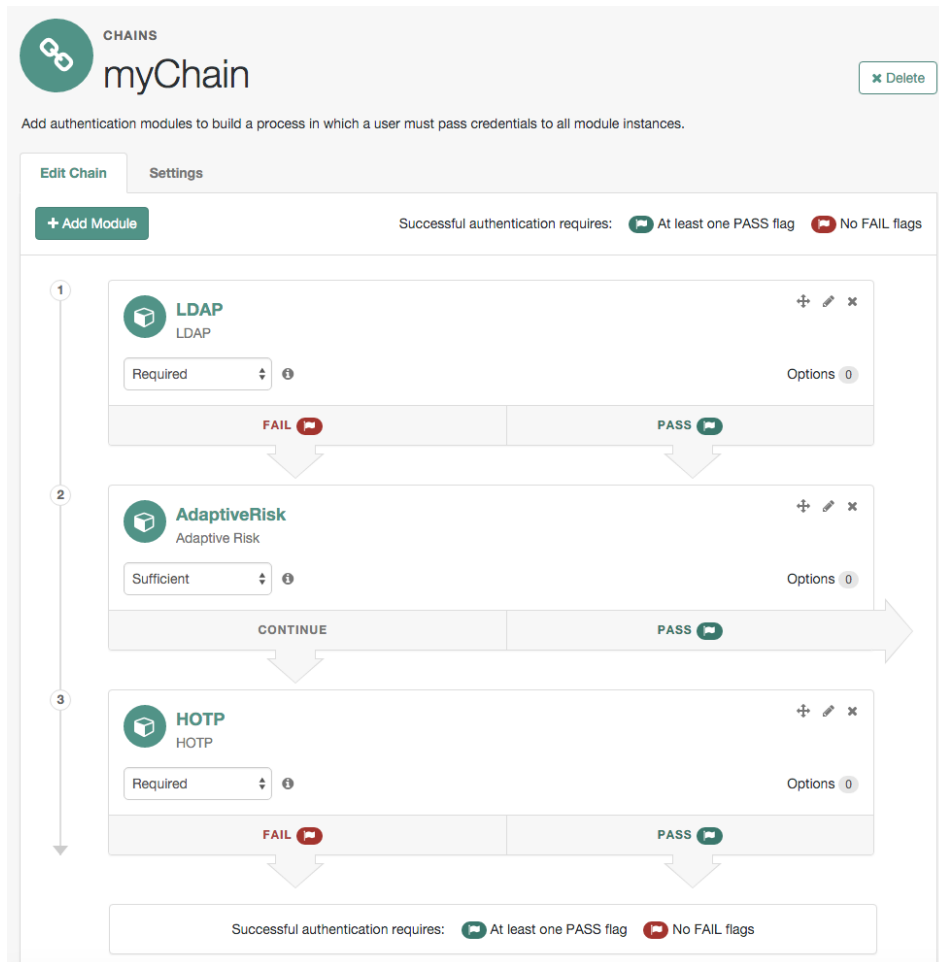
For detailed information about this module's configuration properties, see "Active Directory Module Properties".

### 2.2.2. Adaptive Risk Authentication Module

The Adaptive Risk module is designed to assess risk during authentication, so that AM can determine whether to require the user to complete further authentication steps. After configuring the Adaptive Risk module, insert it in your authentication chain with criteria set to Sufficient as shown in the following example:



## Adaptive Risk Module in an Authentication Chain



In the example authentication chain shown, AM has users authenticate first using the LDAP module providing a user ID and password combination. Upon success, AM calls the Adaptive Risk module. The Adaptive Risk module assesses the risk based on your configured parameters. If the Adaptive Risk module calculates a total score below the threshold you set, the module returns success, and AM finishes authentication processing without requiring further credentials. Otherwise, the Adaptive Risk module evaluates the score to be above the risk threshold, and returns failure. AM then calls the HOTP module, requiring the user to authenticate with a one-time password delivered to her by email or by SMS to her mobile phone.

When you configure the Adaptive Risk module to save cookies and profile attributes after successful authentication, AM performs the save as post-authentication processing, only after the entire authentication chain returns success. You must set up AM to save the data as part of post-authentication processing by editing the authentication chain to add `org.forgerock.openam.authentication.modules.adaptive.AdaptivePostAuthenticationPlugin` to the list of post-authentication plugins.

When the Adaptive Risk module relies on the client IP address, and AM lies behind a load balancer or proxy layer, configure the load balancer or proxy to send the address by using the `X-Forwarded-For` header, and configure AM to consume and forward the header as necessary. For details, see "Handling HTTP Request Headers" in the *Installation Guide*.

For detailed information about this module's configuration properties, see "Adaptive Risk Authentication Module Properties".

### 2.2.3. Anonymous Authentication Module

This module lets you configure and track anonymous users, who can log in to your application or web site without login credentials. Typically, you would provide such users with very limited access, for example, an anonymous user may have access to public downloads on your site. When the user attempts to access resources that require more protection, the module can force further authentication for those resources.

For detailed information about this module's configuration properties, see "Anonymous Authentication Module Properties".

### 2.2.4. Certificate Authentication Module

X.509 digital certificates can enable secure authentication without the need for user names and passwords or other credentials. Certificate authentication can be used to manage authentication by applications. If all certificates are signed by a recognized Certificate Authority (CA), then you might not need additional configuration. If you need to look up public keys of AM clients, this module can also look up public keys in an LDAP directory server.

When you store certificates and certificate revocation lists (CRL) in an LDAP directory service, you must configure:

- How to access the directory service.
- How to look up the certificates and CRLs, based on the fields in the certificates that AM clients present to authenticate.

Access to the LDAP server and how to search for users is similar to LDAP module configuration as in "LDAP Authentication Module". The primary difference is that, unlike for LDAP configuration, AM retrieves the user identifier from a field in the certificate that the client application presents, then uses that identifier to search for the LDAP directory entry that holds the certificate, which should match the certificate presented. For example, if the Subject field of a typical certificate has a DN `C=FR`

, `O=Example Corp, CN=Barbara Jensen`, and Barbara Jensen's entry in the directory has `cn=Barbara Jensen`, then you can use `CN=Barbara Jensen` from the Subject DN to search for the entry with `cn=Barbara Jensen` in the directory.

For detailed information about this module's configuration properties, see "Certificate Authentication Module Properties".

## 2.2.5. Data Store Authentication Module

The Data Store authentication module allows a login using the identity repository of the realm to authenticate users. The Data Store module removes the requirement to write an authentication plugin module, load, and then configure the authentication module if you need to authenticate against the same data store repository. Additionally, you do not need to write a custom authentication module where flatfile authentication is needed for the corresponding repository in that realm.

The Data Store module is generic. It does not implement data store-specific capabilities, such as the password policy and password reset features provided by LDAP modules. Therefore, the Data Store module returns failure when such capabilities are invoked.

For detailed information about this module's configuration properties, see "Data Store Authentication Module Properties".

## 2.2.6. Device ID (Match) Authentication Module

The Device ID (Match) module provides device fingerprinting functionality for risk-based authentication. The Device ID (Match) module collects the unique characteristics of a remote user's computing device and compares them to characteristics on a saved device profile. The module computes any variances between the collected characteristics to those stored on the saved device profile and assigns penalty points for each difference.

For detailed information about this module's configuration properties, see "Device ID (Match) Authentication Module Properties".

In general, you can configure and gather the following device characteristics:

- User agents associated with the configuration of a web browser
- Installed fonts
- Plugins installed for the web browser
- Resolution and color depth associated with a display
- Timezone or geolocation of a device

For example, when a user who typically authenticates to AM using Firefox and then logs on using Chrome, the Device ID (Match) module notes the difference and assigns penalty points to this

change in behavior. If the module detects additional differences in behavior, such as browser fonts, geolocation, and so forth, then additional points are assessed and calculated.

If the total number of penalty points exceeds a pre-configured threshold value, the Device ID (Match) module fails and control is determined by how you configured your authentication chain. If you include the HOTP module in your authentication chain, and if the Device ID (Match) module fails after the maximum number of penalty points have been exceeded, then the authentication chain issues a HOTP request to the user, requiring the user to identify themselves using two-factor authentication.

### Important

By default, the maximum penalty points is set to 0, which you can adjust in the server-side script.

The Device ID (Match) module comes pre-configured with default client-side and server-side JavaScript code, supplying the logic necessary to fingerprint the user agent and computer. Scripting allows you to customize the code, providing more control over the device fingerprint elements that you would like to collect. While AM scripting supports both the JavaScript (default) and Groovy languages, only server-side scripts can be written in either language. The client-side scripts must be written in the JavaScript language.

### Caution

The Device ID (Match) module's default JavaScript client-side and server-side scripts are fully functional. If you change the client-side script, you must also make a corresponding change to the server-side script. For a safer option, if you want to change the behavior of the module, you can make a copy of the scripts, customize the behavior, and update the Device ID (Match) modules to use the new scripts.

The Device ID (Match) module does not stand on its own within an authentication chain and requires additional modules. For example, you can have any module that identifies the user (for example, DataStore, Active Directory or others), Device ID (Match), any module that provides two-factor authentication, for example the ForgeRock Authenticator (OATH) or ForgeRock Authenticator (Push) authentication modules, and Device ID (Save) within your authentication chain.

As an example, you can configure the following modules with the specified criteria:

1. **DataStore - Requisite.** The Device ID (Match) module requires user authentication information to validate the username. You can also use other modules that identify the username, such as LDAP, Active Directory, or RADIUS.
2. **Device ID (Match) - Sufficient.** The Device ID (Match) runs the client-side script, which invokes the device fingerprint collectors, captures the data, and converts it into a JSON string. It then auto-submits the data in a JSP page to the server-side scripting engine.

The server-side script calculates the penalty points based on differences between the client device and stored device profile, and whether the client device successfully "matches" the stored profile. If a match is successful, AM determines that the client's device has the required attributes for a successful authentication.

If the device does not have a match, then the module fails and falls through to the HOTP module for further processing.

3. **HOTP - Requisite.** If the user's device does not match a stored profile, AM presents the user with a HMAC One-Time Password (HOTP) screen either by SMS or email, prompting the user to enter a password.

You can also use any other module that provides two-factor authentication.

After the HOTP has successfully validated the user, the Device ID (Save) module gathers additional data from the user. For specific information about the HOTP module, see "HOTP Authentication Module".

4. **Device ID (Save) - Required.** The Device ID (Save) module provides configuration options to enable an auto-save feature on the device profile as well as set a maximum number of stored device profiles on the user entry or record. Once the maximum number of stored device profiles is reached, AM deletes the old data from the user record as new ones are added. User records could thus contain both old and new device profiles.

If the auto-save feature is not enabled, AM presents the user with a screen to save the new device profile.

The module also takes the device print and creates a JSON object that includes the ID, name, last selected date, selection counter, and device print. For specific information about the Device ID (Save) module, see "Device ID (Save) Module".

#### Note

If a user has multiple device profiles, the profile that is the closest match to the current client details is used for the comparison result.

### *To Configure the Device ID (Match) Authentication Module*

1. Log into the AM console as an administrator.
2. On the Realms page, click the realm from which you want to work.
3. Click Authentication > Modules.
4. To add the Device ID (Match) module, do the following substeps:
  - a. Click Add Module.
  - b. In the Module Name box, enter `Device-ID-Match`.
  - c. In the Type box, select `Device Id (Match)`, and then click Create.
  - d. Click Save Changes.

## Device ID (Match) Module

5. To make adjustments to the default scripts, click Scripts drop-down list, and then click **Device Id (Match) - Client Side**.
6. To make corresponding changes to the server-side script, click Scripts drop-down list, and then click **Device Id (Match) - Server Side**. For more information, see "Managing Scripts".

### To Configure an Authentication Chain With a Device ID (Match) Authentication Module

1. Log into the AM console as an administrator.
2. On the Realms page, click the realm from which you want to work.
3. Click Authentication > Chains.
4. On the Authentication Chains page, do the following steps:
  - a. Click Add Chain. In the Chain Name box, enter a descriptive label for your authentication chain, and then click Create.
  - b. Click Add Module.
  - c. On the New Module dialog, select the authentication module, select the criteria, and then click Ok to save your changes. Repeat the last two steps to enter each module to your chain.

For example, you can enter the following modules and criteria:

## Device ID Chain

Module	Criteria
DataStore	REQUISITE
Device-ID-Match	SUFFICIENT
HOTP	REQUISITE
Device-ID-Save	REQUIRED

It is assumed that you have added the Device ID (Match) and Device ID (Save) modules. If you have not added these modules, see ["To Configure the Device ID \(Match\) Authentication Module"](#) and ["To Configure the Device ID \(Save\) Authentication Module"](#).

5. Review your authentication chain, and then click Save Changes.

### 2.2.6.1. What the User Sees During Authentication

When the user logs on to the AM console, AM determines if the user's device differs from that of the stored profile. If the differences exceed the maximum number of penalty points or a device profile has not yet been stored, AM sends an "Enter OTP" page, requiring the user to enter a one-time password, which is sent to the user via email or SMS. The user also has the option to request a one-time password.

Next, because the Device ID (Save) module is present, AM presents the user with a "Add to Trusted Devices?" page, asking if the user wants to add the device to the list of trusted device profiles. If the user clicks "Yes", AM prompts the user to enter a descriptive name for the trusted device.

Next, AM presents the user with the User Profile page, where the user can click the Dashboard link at top to access the My Applications and Authentication Devices page. Once on the Dashboard, the user can view the list of trusted devices or remove the device by clicking the Delete Device link.

### 2.2.7. Device ID (Save) Module

The Device ID (Save) module saves a user's device profile. The module can either save the profile upon request, requiring the user to provide a name for the device and explicitly save it, or it can save the profile automatically. If a user has multiple device profiles, the profile that is the closest match to the current client details is used for the comparison result.

For detailed information about this module's configuration properties, see ["Device ID \(Save\) Authentication Module Properties"](#).

Within its configured authentication chain, the Device ID (Save) module also takes the device print and creates a JSON object that consists of the ID, name, last selected date, selection counter, and device print itself.

### *To Configure the Device ID (Save) Authentication Module*

1. Log into the AM console as an administrator.
2. Click the realm from which you want to work.
3. Click Authentication > Modules.
4. To add the Device ID (Save) module, click Add Module.
5. In the Module Name box, enter **Device-ID-Save**.
6. In the Type box, select **Device Id (Save)**, and then click Create.
7. To configure the Device-Id (Save) module, do the following:
  - a. Click the Automatically store new profiles checkbox. If this box is left unchecked, the user will be prompted to give consent to store new profiles.
  - b. In the Maximum stored profile quantity box, enter the max number of stored profiles. Any profile that exceeds this number will not be stored.
  - c. In the Authentication Level box, enter a number corresponding to the authentication level of the module.
  - d. Click Save Changes.



## Device ID (Save) Module

The screenshot displays the configuration page for the 'Device ID (Save)' module. On the left is a navigation menu with options: Dashboard, Applications, Authentication (expanded), Settings, Chains, Modules, Services, Sessions, Data Stores, Privileges, Authorization, Subjects, STS, and Scripts. The main content area has a header with a green circular icon containing a white 'ID' and the text 'DEVICE ID (SAVE) Device-ID-Save'. Below this are three configuration items: 'Automatically store new profiles' with a checked toggle switch, 'Maximum stored profile quantity' with a text input field containing '5', and 'Authentication Level' with a text input field containing '0'. Each item has an information icon to its right. At the bottom right are 'Revert' and 'Save Changes' buttons.

### 2.2.8. Federation Authentication Module

The Federation authentication module is used by a service provider to create a user session after validating single sign-on protocol messages. This authentication module is used by the SAML, SAMLv2, ID-FF, and WS-Federation protocols.

For detailed information about this module's configuration properties, see "Federation Authentication Module Properties".

### 2.2.9. ForgeRock Authenticator (OATH) Authentication Module

The ForgeRock Authenticator (OATH) module provides a more secure method for users to access their accounts with the help of a device such as a mobile phone. For detailed information about two-step verification with the ForgeRock Authenticator (OATH) module in AM, see "*Implementing Multi-Factor Authentication*".

For detailed information about this module's configuration properties, see "ForgeRock Authenticator (OATH) Authentication Module Properties".

#### Note

AM provides two authentication modules that support OATH:

- The ForgeRock Authenticator (OATH) authentication module, which is optimized for use with the ForgeRock Authenticator app and provides device profile encryption.
- The OATH authentication module, which is a raw OATH implementation requiring more configuration for users and the AM administrator.

We recommend using the ForgeRock Authenticator (OATH) authentication module when possible.

Also, the ForgeRock Authenticator (OATH), HOTP, and OATH authentication modules all support HOTP passwords, but the way that users obtain passwords differs. See "Differences Among Authentication Modules That Support HOTP" for more information.

## 2.2.10. ForgeRock Authenticator (Push) Authentication Module

The ForgeRock Authenticator (Push) module provides a way to send push notification messages to a device such as a mobile phone, enabling multi-factor authentication. For detailed information about multi-factor authentication with the ForgeRock Authenticator (Push) module in AM, see "*Implementing Multi-Factor Authentication*".

For detailed information about this module's configuration properties, see "ForgeRock Authenticator (Push) Authentication Module Properties".

## 2.2.11. ForgeRock Authenticator (Push) Registration Authentication Module

The ForgeRock Authenticator (Push) Registration module provides a way to register a device such as a mobile phone for multi-factor authentication. For detailed information about multi-factor authentication with the ForgeRock Authenticator (Push) module in AM, see "Managing Devices for Multi-Factor Authentication".

For detailed information about this module's configuration properties, see "ForgeRock Authenticator (Push) Registration Authentication Module Properties".

## 2.2.12. HOTP Authentication Module

The HOTP authentication module works with an authentication chain with any module that stores the `username` attribute. The module uses the `username` from the `sharedState` set by the previous module in the chain and retrieves the user's email address or telephone number to send a one-time password to the user. The user then enters the password on a Login page and completes the authentication process if successful.

For example, to set up HOTP in an authentication chain, you can configure the Data Store module (or any module that stores the user's `username`) as the `requisite` first module, and the HOTP module as the second `requisite` module. When authentication succeeds against the Data Store module, the HOTP module retrieves the Email Address and Telephone Number attributes from the data store based on the `username` value. For the HOTP module to use either attribute, the Email Address must contain a valid email address, or the Telephone Number must contain a valid SMS telephone number.

You can set the HOTP module to automatically generate a password when users begin logging into the system. You can also set up mobile phone, mobile carrier, and email attributes for tighter controls over where the messages are generated and what provider the messages go through to reach the user.

For detailed information about this module's configuration properties, see "HOTP Authentication Module Properties".

#### Note

The ForgeRock Authenticator (OATH), HOTP, and OATH authentication modules all support HOTP passwords, but the way that users obtain passwords differs. See "Differences Among Authentication Modules That Support HOTP" for more information.

### 2.2.13. HTTP Basic Authentication Module

HTTP basic authentication takes a user name and password from HTTP authentication and tries authentication against the backend module in AM, depending on what you configure as the Backend Module Name.

For detailed information about this module's configuration properties, see "HTTP Basic Authentication Module Properties".

### 2.2.14. JDBC Authentication Module

The Java Database Connectivity (JDBC) module lets AM connect to a database, such as MySQL or Oracle DB to authenticate users.

For detailed information about this module's configuration properties, see "JDBC Authentication Module Properties".

### 2.2.15. LDAP Authentication Module

AM connects to directory servers using Lightweight Directory Access Protocol (LDAP). To build an easy-to-manage, high-performance, pure Java directory service, try ForgeRock Directory Services.

For detailed information about this module's configuration properties, see "LDAP Authentication Module Properties".

### 2.2.16. MSISDN Authentication Module

The Mobile Station Integrated Services Digital Network (MSISDN) authentication module enables non-interactive authentication using a mobile subscriber ISDN associated with a terminal, such as a mobile phone. The module checks the subscriber ISDN against the value found on a user's entry in an LDAP directory service.

For detailed information about this module's configuration properties, see "MSISDN Authentication Module Properties".

## 2.2.17. OATH Authentication Module

The Open Authentication (OATH) module provides a more secure method for users to access their accounts with the help of a device, such as their mobile phone or Yubikey. Users can log into AM and update their information more securely from a one-time password (OTP) displayed on their device. The OATH module includes the OATH standard protocols (RFC 4226 and RFC 6238). The OATH module has several enhancements to the HMAC One-Time Password (HOTP) Authentication Module, but does not replace the original module for those already using HOTP prior to the 10.1.0 release. The OATH module includes HOTP authentication and Time-Based One-Time Password (TOTP) authentication. Both types of authentication require an OATH compliant device that can provide the OTP.

HOTP authentication generates the OTP every time the user requests a new OTP on their device. The device tracks the number of times the user requests a new OTP, called the counter. The OTP displays for a period of time you designate in the setup, so the user may be further in the counter on their device than on their account. AM will resynchronize the counter when the user finally logs in. To accommodate this, you set the number of passwords a user can generate before their device cannot be resynchronized. For example, if you set the number of HOTP Window Size to 50 and someone presses the button 30 on the user's device to generate a new OTP, the counter in AM will review the OTPs until it reaches the OTP entered by the user. If someone presses the button 51 times, you will need to reset the counter to match the number on the device's counter before the user can login to AM. HOTP authentication does not check earlier passwords, so if the user attempts to reset the counter on their device, they will not be able to login until you reset the counter in AM to match their device. See "Resetting Registered Devices by using REST" for more information.

TOTP authentication constantly generates a new OTP based on a time interval you specify. The device tracks the last two passwords generated and the current password. The Last Login Time monitors the time when a user logs in to make sure that user is not logged in several times within the present time period. Once a user logs into AM, they must wait for the time it takes TOTP to generate the next two passwords and display them. This prevents others from being able to access the users account using the OTP they entered. The user's account can be accessed again after the generation of the third new OTP is generated and displayed on their device. For this reason, the TOTP Time-Step Interval should not be so long as to lock users out, with a recommended time of 30 seconds.

An authentication chain can be created to generate an OTP from either HOTP or TOTP.

For detailed information about this module's configuration properties, see "OATH Authentication Module Properties".

### Note

AM provides two authentication modules that support OATH:

- The ForgeRock Authenticator (OATH) authentication module, which is optimized for use with the ForgeRock Authenticator app and provides device profile encryption.

- The OATH authentication module, which is a raw OATH implementation requiring more configuration for users and the AM administrator.

We recommend using the ForgeRock Authenticator (OATH) authentication module when possible.

Also, the ForgeRock Authenticator (OATH), HOTP, and OATH authentication modules all support HOTP passwords, but the way that users obtain passwords differs. See "Differences Among Authentication Modules That Support HOTP" for more information.

## 2.2.18. OAuth 2.0/OpenID Connect Authentication Module

The OAuth 2.0/OpenID Connect authentication module lets AM authenticate clients of OAuth resource servers. References in this section are to RFC 6749, The OAuth 2.0 Authorization Framework.

### Tip

AM provides a wizard for configuring common OAuth 2.0/OpenID Connect authentication providers, such as Facebook, Google, and Microsoft. For more information, see "Configuring Pre-Populated Social Authentication Providers".

If the module is configured to create an account if none exists, then you must provide valid SMTP settings. As part of account creation, the OAuth 2.0/OpenID Connect client authentication module sends the resource owner an email with an account activation code. To send email, AM uses the SMTP settings from the configuration for the OAuth 2.0/OpenID Connect authentication module.

For detailed information about this module's configuration properties, see "OAuth 2.0/OpenID Connect Authentication Module Properties".

## 2.2.19. OpenID Connect id\_token bearer Module

The OpenID Connect id\_token bearer module lets AM rely on an OpenID Connect 1.0 provider's ID Token to authenticate an end user.

### Note

This module validates an OpenID Connect ID token and matches it with a user profile. You should not use this module if you want AM to act as a client in the full OpenID Connect authentication flow.

To provision AM as an OpenID Connect client, you should instead configure an OAuth 2.0/OpenID Connect module. AM provides a wizard to configure an OAuth 2.0/OpenID Connect module that will authenticate against an OpenID Connect 1.0 provider. For more information, see "Configuring Custom Social Authentication Providers".

The OpenID Connect id\_token bearer module expects an OpenID Connect ID Token in an HTTP request header. It validates the ID Token, and if successful, looks up the AM user profile

corresponding to the end user for whom the ID Token was issued. Assuming the ID Token is valid and the profile is found, the module authenticates the AM user.

You configure the OpenID Connect `id_token` bearer module to specify how AM gets the information needed to validate the ID Token, which request header contains the ID Token, the issuer identifier for the provider who issued the ID Token, and how to map the ID Token claims to an AM user profile.

For detailed information about this module's configuration properties, see "OpenID Connect `id_token` bearer Authentication Module Properties".

## 2.2.20. Persistent Cookie Module

The Persistent Cookie module supports the configuration of cookie lifetimes based on requests and a maximum time. Note that by default, the persistent cookie is called `session-jwt`.

### Important

If Secure Cookie is enabled (Deployment > Servers > *Server Name* > Security > Cookie), the Persistent Cookie module only works over HTTPS.

Before you begin, make sure a public key alias is defined in AM. The Persistent Cookie module encrypts a JSON Web Token (JWT) using a public key from the AM keystore. The keystore must be configured under Realms > *Realm Name* > Authentication > Settings > Security > Persistent Cookie Encryption Certificate Alias. If the keystore changes and the default `test` key is no longer present, the public key alias must be updated to reflect the change, otherwise the module will fail. Similarly, in multi-instance deployments, the keypair must be available on all AM instances.

When the Persistent Cookie module enforces the client IP address, and AM lies behind a load balancer or proxy layer, configure the load balancer or proxy to send the address by using the `X-Forwarded-For` header, and configure AM to consume and forward the header as necessary. For details, see "Handling HTTP Request Headers" in the *Installation Guide*.

The Persistent Cookie module belongs with a second module in an authentication chain. To see how this works, navigate to Realms > *Realm Name* > Authentication > Chains. Create a new chain and add modules as shown in the figure. The following example shows how a Persistent Cookie module is sufficient. If the persistent cookie does not yet exist, authentication relies on LDAP:

## Persistent Cookie Module in an Authentication Chain

The screenshot shows the CHAINS myChain configuration interface. At the top, there is a 'Delete' button. Below it, a message states: 'Add authentication modules to build a process in which a user must pass credentials to all module instances.' The interface has two tabs: 'Edit Chain' (selected) and 'Settings'. A '+ Add Module' button is on the left. A summary bar indicates: 'Successful authentication requires: At least one PASS flag, No FAIL flags'. The main area shows a vertical flow of two modules:

- Module 1 (Step 1): PersistentCookieModule**
  - Subtype: Persistent Cookie
  - Requirement: Sufficient
  - Options: 0
  - Flow: CONTINUE (left) → PASS (right)
- Module 2 (Step 2): LDAP**
  - Subtype: LDAP
  - Requirement: Required
  - Options: 0
  - Flow: FAIL (left) → PASS (right)

At the bottom, a summary bar repeats: 'Successful authentication requires: At least one PASS flag, No FAIL flags'. A 'Save Changes' button is at the bottom right.

Select the Settings tab and locate settings for the post-authentication processing class. Set the Class Name to `org.forgerock.openam.authentication.modules.persistentcookie.PersistentCookieAuthModulePostAuthenticationPlugin`, as shown in the following figure:

✕ Delete

Add authentication modules to build a process in which a user must pass credentials to all module instances.

Edit Chain
Settings

**REDIRECT URLS**

Specify the URL to which the subject is redirected. You can specify separate URLs for authenticating successfully and when authentication fails.

**Successful Login URL**

**Failed Login URL**

**POST AUTHENTICATION PROCESSING CLASS**

Specify the name of a Java class to execute at the end of the authentication process.

**CLASS NAME**

org.forgerock.openam.authentication.modules.persistentcookie.PersistentCookieAuthModulePostAuthenticationPlugin ✕

+

Save Changes

You should now be able to authenticate automatically, as long as the cookie exists for the associated domain.

**Tip**

To configure the Persistent Cookie module globally in the AM console, navigate to `Configure > Authentication`, and then click `Persistent Cookie`.

For detailed information about this module's configuration properties, see "Persistent Cookie Authentication Module Properties".



### 2.2.21. RADIUS Authentication Module

The Remote Authentication Dial-In User Service (RADIUS) module lets AM authenticate users against RADIUS servers.

For detailed information about this module's configuration properties, see "RADIUS Authentication Module Properties".

### 2.2.22. SAE Authentication Module

The Secure Attribute Exchange (SAE) module lets AM authenticate a user who has already authenticated with an entity that can vouch for the user to AM, so that AM creates a session for the user. This module is useful in virtual federation, where an existing entity instructs the local AM instance to use federation protocols to transfer authentication and attribute information to a partner application.

For detailed information about this module's configuration properties, see "SAE Authentication Module Properties".

### 2.2.23. SAML2 Authentication Module

The SAML2 authentication module lets administrators integrate SAML v2.0 single sign-on and single logout into an AM authentication chain.

You use the SAML2 authentication module when deploying SAML v2.0 single sign-on in integrated mode. In addition to configuring SAML2 authentication module properties, integrated mode deployment requires that you make several changes to service provider configurations. Before attempting to configure a SAML2 authentication module instance, review "Implementing SAML v2.0 Single Sign-On in Integrated Mode" in the *SAML v2.0 Guide* and make sure that you have made any required changes to your service provider configuration.

For detailed information about this module's configuration properties, see "SAML2 Authentication Module Properties".

### 2.2.24. Scripted Authentication Module

A scripted authentication module runs scripts to authenticate a user. The configuration for the module can hold two scripts, one to include in the web page run on the client user-agent, another to run in AM on the server side.

The client-side script is intended to retrieve data from the user-agent. This must be in a language the user-agent can run, such as JavaScript, even if the server-side script is written in Groovy.

The server-side script is intended to handle authentication.

Scripts are stored not as files, but instead as AM configuration data. This makes it easy to update a script on one AM server, and then to allow replication to copy it to other servers. You can manage the

scripts through the AM console, where you can write them in the text boxes provided or upload them from files.

You can also upload scripts and associate them with a scripted authentication module by using the **ssoadm** command.

The following example shows how to upload a server-side script from a file, create a scripted authentication module, and then associate the uploaded script with the new module.

```
#
# Upload a server-side script from a script file, myscript.groovy.
#

ssoadm create-sub-cfg \
--realm / \
--adminid amadmin \
--password-file /tmp/pwd.txt \
--servicename ScriptingService \
--subconfigname scriptConfigurations/scriptConfiguration \
--subconfigid myScriptId \
--attributevalues \
"name=My Scripted Auth Module Script" \
"script-file=myscript.groovy" \
"context=AUTHENTICATION_SERVER_SIDE" \
"language=GROOVY"
#
# Create a scripted authentication module, myScriptedAuthModule.
#

ssoadm create-auth-instance \
--realm / \
--adminid amadmin \
--password-file /tmp/pwd.txt \
--authtype Scripted \
--name myScriptedAuthModule

#
# Associate the script with the auth module, and disable client-side scripts.
#

ssoadm update-auth-instance \
--realm / \
--adminid amadmin \
--password-file /tmp/pwd.txt \
--name myScriptedAuthModule \
--attributevalues \
"iplanet-am-auth-scripted-server-script=myScriptId" \
"iplanet-am-auth-scripted-client-script-enabled=false"
```

If you have multiple separate sets of client-side and server-side scripts, then configure multiple modules, one for each set of scripts.

For details on writing authentication module scripts, see "Using a Server-side Authentication Script".

For detailed information about this module's configuration properties, see "Scripted Authentication Module Properties".

## 2.2.25. SecurID Authentication Module

The SecurID module lets AM authenticate users with RSA Authentication Manager software and RSA SecurID authenticators.

### Important

To use the SecurID authentication module, you must first build an AM `.war` file that includes the supporting library. For more information, see "Enabling RSA SecurID Support" in the *Installation Guide*.

For detailed information about this module's configuration properties, see "SecurID Authentication Module Properties".

## 2.2.26. Windows Desktop SSO Authentication Module

The Windows Desktop SSO module uses Kerberos authentication. The user presents a Kerberos token to AM through the Simple and Protected GSS-API Negotiation Mechanism (SPNEGO) protocol. The Windows Desktop SSO authentication module enables desktop single sign on such that a user who has already authenticated with a Kerberos Key Distribution Center can authenticate to AM without having to provide the login information again. Users might need to set up Integrated Windows Authentication in Internet Explorer or Microsoft Edge to benefit from single sign on when logged on to a Windows desktop.

For detailed information about this module's configuration properties, see "Windows Desktop SSO Authentication Module Properties".

### Warning

If you are using the Windows Desktop SSO module as part of an authentication chain and Windows Desktop SSO fails, you may no longer be able to `POST` data to non-NTLM-authenticated web sites. For information on a possible workaround, see *Microsoft knowledge base article KB251404*.

## 2.2.27. Windows NT Authentication Module

The Windows NT module lets AM authenticate against a Microsoft Windows NT server.

This module requires that you install a Samba client in a `bin` directory under the AM configuration directory, such as `$HOME/openam/openam/bin`.

For detailed information about this module's configuration properties, see "Windows NT Authentication Module Properties".

## 2.3. Configuring Authentication Chains

Once you have configured authentication modules and added the modules to the list of module instances, you can configure authentication chains. Authentication chains let you handle cases

where alternate modules or credentials are needed. If you need modules in the chain to share user credentials, then set options for the module.

**Tip**

AM provides a wizard for configuring authentication providers, including Facebook, Google, and Microsoft. The wizard creates a relevant authentication chain as part of the process. For more information, see "[Implementing Social Authentication](#)".

### To Create an Authentication Chain

1. On the Realms page of the AM console, click the realm for which to create the authentication chain.
2. On the Realm Overview page, click Authentication in the left-hand menu, and then click Chains.
3. On the Authentication Chains page, click Add Chain. Enter new chain name, and then click Create.
4. On the New Module dialog, select the authentication module in the chain, and then assign appropriate criteria (Optional, Required, Requisite, Sufficient) as described in "[About Authentication Modules and Chains](#)". You can also configure where AM redirects the user upon successful and failed authentication, and plug in your post-authentication processing classes as necessary.
5. (Optional) If you need modules in the chain to share user credentials, consider the following available options. Enter the key and its value, and then click Plus (+). When you finish entering the options, click OK.

**`iplanet-am-auth-shared-state-behavior-pattern`**

Set `iplanet-am-auth-shared-state-behavior-pattern=tryFirstPass` to try authenticating with the username and password stored in shared state. If authentication fails, AM displays the login screen of this module for the user to re-enter their credentials.

Set `iplanet-am-auth-shared-state-behavior-pattern=useFirstPass` to prevent the user from entering the username and password twice during authentication. Typically, you set the property to `useFirstPass` for all modules in the chain except the first module. If authentication fails, then the module fails.

Default: `tryFirstPass`

**`iplanet-am-auth-shared-state-enabled`**

Set `iplanet-am-auth-shared-state-enabled=true` to allow this module to access the credentials, such as user name and password, that have been stored in shared state by previous modules in the authentication chain.

Default: `false`

**iplanet-am-auth-store-shared-state-enabled**

Set `iplanet-am-auth-store-shared-state-enabled=true` to store the credentials captured by this module in shared state. This enables subsequent modules in the chain to access the credentials captured by this module. The shared state is cleared when the user successfully authenticates, quits the chain, or logs out.

Default: `true`

For example, consider a chain with two modules sharing credentials according to the following settings: the first module in the chain has the option `iplanet-am-auth-store-shared-state-enabled=true`, and criteria `REQUIRED`.

*Authentication Chain First Module*

### New Module

**Select Module**

DataStore - Data Store ▼

**Select Criteria**

Required ▼

**Options**

KEY	VALUE	
iplanet-am-auth-shared-state-enak	true	<span style="border: 1px solid #ccc; padding: 2px 5px;">+</span>

Cancel

OK

The second module in the chain has options `iplanet-am-auth-shared-state-enabled=true`, `iplanet-am-auth-shared-state-behavior-pattern=useFirstPass` with criteria `REQUIRED`.

### Authentication Chain Second Module

#### New Module

**Select Module**

DataStore - Data Store
▼

**Select Criteria**

Required
▼

**Options**

KEY	VALUE	
iplanet-am-auth-shared-state-enabled	true	✕
<div style="border: 1px solid #ccc; padding: 2px; display: flex; align-items: center;"> <span style="margin-right: 5px;">iplanet-am-auth-shared-state-behavior-</span> <input style="width: 100%; border: none;" type="text" value="useFirstPass"/> </div>		+

Cancel

OK

6. Click Save Changes.

The following authentication sequence would occur: the user enters their credentials for the first module and successfully authenticates. The first module shares the credentials with the second module, successfully authenticating the user without prompting again for their credentials, unless the credentials for the first module do not successfully authenticate the user to the second module.

#### 2.3.1. Configuring the Default Authentication Chain

By default, AM configures a default authentication chain, `ldapService`, which uses the `DataStore` module for authentication. This default authentication chain is configured for both administrators and non-administrators out-of-the-box after installation.

#### Warning

Special care must be given when setting your *default* authentication chain.

If you leave the default authentication as-is (i.e., to the `ldapService`), the user can still post their username and password into the authentication endpoint to retrieve a session, regardless of the services configured for authentication.

For example, consider a deployment where you disable module-based authentication and keep the default authentication chain to the out-of-the-box `ldapStore` authentication chain using `DataStore` module. If you have set up two factor authentication for your users, your users can still access their accounts without performing the correct two factor authentication chain login sequence by using the default `ldapService` chain.

When you set the default authentication chain, make sure your default chain is set to your most secure chain once you are ready to go to production and not left as-is to your default `ldapService` chain.

## To Set the Default Authentication Chain

1. Before you select the default chain for users, and especially for administrators, test the authentication chain first.
2. On the Realms page of the AM console, click the realm for which to set the default authentication chain.

When making a request to the XUI, specify the realm or realm alias as the value of a `realm` parameter in the query string, or the DNS alias in the domain component of the URL. If you do not use a realm alias, then you must specify the entire hierarchy of the realm, starting at the top-level realm. For example <https://openam.example.com:8443/openam/XUI/?realm=/customers/europe#login/>.

For example, to test an authentication chain named `NewChain` in a subrealm called `subrealm`, the URL would be: <http://openam.example.com:8080/openam/XUI/?realm=/subrealm#login&service=NewChain>. If you cannot log in, then go back and fix the authentication chain's configuration before making it the default.

3. (Optional) Navigate to Authentication > Settings.

On the Core tab page for the realm, adjust the drop-down lists for Administrator Authentication Configuration and the Organization Authentication Configuration to the appropriate authentication chains if necessary.

AM the Administrator Authentication Configuration when administrative users, such as `amAdmin`, log in and the Organization Authentication Configuration when non-administrative users log in.

By default, `amAdmin` can log in at `/openam/XUI/#Login`. You can change the URL for your deployment.

4. Save your work.

## 2.4. Implementing Post-Authentication Plugins

Post-authentication plugins (PAP) let you include custom processing at the end of the authentication process and when users log out of AM.

In the AM console, you add post-authentication plugins to an authentication chain. Navigate to Realms > *Realm Name* > Authentication > Chains > *Auth Chain Name* > Settings > Post Authentication Processing Class > Class Name.

See "Creating a Post Authentication Plugin" for more information about post authentication plugins.

### Standard Post-Authentication Plugins

AM provides some post-authentication plugins as part of the standard product delivery.

**Class name:** `org.forgerock.openam.authentication.modules.adaptive.AdaptivePostAuthenticationPlugin`

The adaptive authentication plugin serves to save cookies and profile attributes after successful authentication.

Add it to your authentication chains that use the adaptive authentication module configured to save cookies and profile attributes.

**Class name:** `org.forgerock.openam.authentication.modules.common.JaspiAuthLoginModulePostAuthenticationPlugin`

The Java Authentication Service Provider Interface (JASPI) post authentication plugin initializes the underlying JASPI `ServerAuth` module.

JASPI defines a standard service provider interface (SPI) where developers can write message level authentication agents for Java EE containers on either the client side or the server side.

**Class name:** `org.forgerock.openam.authentication.modules.oauth2.OAuth2PostAuthnPlugin`

The OAuth 2.0 post-authentication plugin builds a global logout URL used by `/oauth2c/OAuthLogout.jsp` after successful OAuth 2.0 client authentication. This logs the resource owner out with the OAuth 2.0 provider when logging out of AM.

Before using this plugin, configure the OAuth 2.0 authentication module with the correct OAuth 2.0 Provider logout service URL, and set the Logout options to Log out or Prompt. This plugin cannot succeed unless those parameters are correctly set.

Sometimes OAuth 2.0 providers change their endpoints, including their logout URLs. When using a provider like Facebook, Google, or MSN, make sure you are aware when they change their endpoint locations so that you can change your client configuration accordingly.

**Class name:** `org.forgerock.openam.authentication.modules.saml2.SAML2PostAuthenticationPlugin`

The SAML v2.0 post-authentication plugin that gets activated for single logout. Supports HTTP-Redirect for logout-sending messages only.

Set the post-authentication processing class for the authentication chain that contains the SAML v2.0 authentication module.



**Class name:** `org.forgerock.openam.authentication.modules.persistentcookie.PersistentCookieAuthModule`

The Persistent Cookie Authentication Module provides logic for persistent cookie authentication in AM. It makes use of the JASPI `JwtSession` module to create and verify the persistent cookie.

If necessary, you can also write your own custom post-authentication plugin as described in "Creating a Post Authentication Plugin".

## Chapter 3

# Implementing Social Authentication

Social authentication refers to AM's ability to delegate authentication through third-party identity providers, such as Facebook, Google, and Microsoft, and other third-party providers.

AM allows delegation of authentication to any third party OpenID Connect 1.0 server that implements the *OpenID Connect Discovery 1.0 specification*. For background information, see "About Social Authentication".

This chapter explains the server configuration required to implement social authentication in AM:

- "Configuring Pre-Populated Social Authentication Providers"
- "Configuring Custom Social Authentication Providers"
- "Configuring the Social Authentication Implementations Service"

## 3.1. Configuring Pre-Populated Social Authentication Providers

AM provides wizards to quickly enable authentication with Facebook, Google, and Microsoft. Most settings are pre-populated, only a *Client ID* and *Client Secret* are required.

To obtain a *Client ID* and *Client Secret* you should register an application with the third party provider, at the following links:

### Facebook

*Facebook App Quickstart*

### Google

*Google Developers Console*

#### Note

You must enable the Google+ API in order to authenticate with Google. To enable the Google+ API, login to the Google Developers Console, select your project, navigate to APIs and auth > APIs, and then set the status of the [Google+ API](#) to ON.

### Microsoft

*Microsoft account Developer Center*

## To Configure Pre-Populated Social Authentication Providers


Once you have registered an application and obtained credentials from the social authentication provider, follow the steps below to configure authentication with the provider:

1. Select **Realms > Realm Name > Dashboard > Configure Social Authentication**, and then click the link for the social authentication provider you want to configure—*Configure Facebook Authentication*, *Configure Google Authentication*, or *Configure Microsoft Authentication*.
2. On the configure third party authentication page:
  - a. Select the realm in which to enable social authentication.
  - b. Enter the *Client ID* obtained from the third party authentication provider.
  - c. Enter the *Client Secret* obtained from the third party authentication provider, and repeat it in the **Confirm Client Secret** field.
  - d. Leave the default **Redirect URL**, unless you are using an external server as a proxy.
  - e. Click **Create**.

### The Configure Google Authentication Wizard

VERSION
LOG OUT

User: amAdmin Server: host1.example.com


FORGEROCK

#### Configure Google Authentication Create Cancel

Configure Social Authentication using Google as the identity provider. Use the [Google Developers Console](#) to register your application with Google. Once created, select "Credentials" in the "APIs & auth" section and then click the "Create new Client ID" button under "OAuth" to be guided through creating an OAuth 2.0 client ID. Once created, copy the CLIENT ID and CLIENT SECRET values into the respective fields below to complete the configuration.

\* Indicates required field

**Realm**

\* Realm:

**Client Details**

\* Client ID:   
For more information on the OAuth client\_id parameter refer to the [OAuth IETF draft](#), chapter 2.1

\* Client Secret:   
For more information on the OAuth client\_secret parameter refer to the [OAuth IETF draft](#), chapter 2.1

\* Confirm Client Secret:

\* Redirect URL:   
This URL should only be changed from the default, if an external server is performing the GET to POST proxying. The default is /openam/oauth2c/OAuthProxy.jsp

On completion, the wizard displays a message confirming the successful creation of a new authentication module and an authentication chain for the provider, and either the creation of a new Social Authentication Implementations service named `socialAuthService`, or an update if it already existed.

You can configure the authentication module, authentication chain, and Social Authentication Implementations service that you created by using the wizards in the same way as manually created versions. For more information, see "Configuring Authentication Modules", "Configuring Authentication Chains", and "Configuring the Social Authentication Implementations Service".

### 3.1.1. Configuring Additional Settings for a ForgeRock Identity Platform Deployment

The wizards configure the settings for logging in to AM using social identity providers such as Google, Facebook and Microsoft.

To use social authentication as part of a ForgeRock Identity Platform full stack deployment, some additional configuration of the created authentication modules is required.

#### *To Configure Social Authentication in a Full-Stack Deployment*

After using the social authentication wizard, perform the following additional steps to configure AM as part of a full stack deployment:

1. When using **Google** as the social identity provider, in the AM console navigate to Realms > Realm Name > Authentication > Modules > GoogleSocialAuthentication.

Modify the configuration as follows:

- a. Add `sub=iplanet-am-user-alias-list` to the Account Mapper Configuration property.

The `iplanet-am-user-alias-list` property defines one or more aliases for mapping a user's multiple profiles.

- b. Add `org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper|iplanet-am-user-alias-list|google-` to the Attribute Mapper property.
- c. Add `org.forgerock.openam.authentication.modules.oidc.JwtAttributeMapper|iplanet-am-user-alias-list|google-` to the Attribute Mapper property.

2. When using **Facebook** as the social identity provider, in the AM console navigate to Realms > Realm Name > Authentication > Modules > FacebookSocialAuthentication.

Modify the configuration as follows:

- a. Add `id=iplanet-am-user-alias-list` to the Account Mapper Configuration property.

The `iplanet-am-user-alias-list` property defines one or more aliases for mapping a user's multiple profiles.

- b. Add `org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper|iplanet-am-user-alias-list|facebook-` to the Attribute Mapper property.
3. Disable the Create account if it does not exist property.
4. Save your changes.

## 3.2. Configuring Custom Social Authentication Providers

AM provides a wizard to quickly enable authentication with any third party provider that supports the *OpenID Connect Discovery 1.0 specification*.

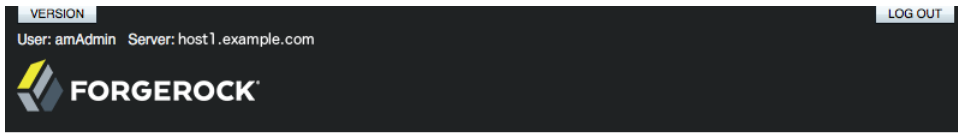
You must first register an application with the third party provider to obtain a *Client ID*, *Client Secret*, and the *OpenID Discovery URL*.

### *To Configure Custom Social Authentication Providers*

Once you have registered an application and obtained your credentials from the social authentication provider, follow the steps below to configure authentication with the provider:

1. Select Realms > *Realm Name* > Dashboard > Configure Social Authentication, and then click the *Configure Other Authentication* link.
2. On the configure social authentication page:
  - a. Select the realm in which to enable social authentication.
  - b. Enter the *OpenID Discovery URL* obtained from the third party authentication provider.
  - c. Enter a name for the provider in the **Provider Name** field. AM uses this as a label on the login page to identify the provider.
  - d. Enter the URL of an image to be used on the login page in the **Image URL** field. AM places the image on the login page, to enable authentication with the provider.
  - e. Enter the *Client ID* obtained from the third party authentication provider.
  - f. Enter the *Client Secret* obtained from the third party authentication provider, and repeat it in the **Confirm Client Secret** field.
  - g. Leave the default **Redirect URL**, unless you are using an external server as a proxy.
  - h. Click **Create**.

## The Configure Social Authentication Wizard



### Configure Social Authentication

[Create](#) [Cancel](#)

Configure a social authentication provider via OpenID Connect.

\* Indicates required field

#### Realm

\* Realm:

#### Provider Details

\* OpenID Discovery URL:   
For more information on the Discovery Document URL, refer to the [OpenID Connect Discovery 1.0 Specification](#)

\* Provider Name:   
Name of the Social Authentication Provider to display to users on the login page.

\* Image URL/Path:   
A path to a logo image to display to users on the login page. Must be an absolute URL or relative path. e.g. /openam/XUI/images/logos/googleplus.png or http://example.com/myimage.png

#### Client Details

\* Client ID:   
For more information on the OAuth client\_id parameter refer to the [OAuth IETF draft](#), chapter 2.1

\* Client Secret:   
For more information on the OAuth client\_secret parameter refer to the [OAuth IETF draft](#), chapter 2.1

\* Confirm Client Secret:

\* Redirect URL:   
This URL should only be changed from the default, if an external server is performing the GET to POST proxying. The default is /openam/oauth2c/OAuthProxy.jsp

On completion, the wizard displays a message confirming the successful creation of a new authentication module and an authentication chain for the provider, and either the creation of a new Social Authentication Implementations service named `socialAuthNService`, or an update if it already existed.

You can configure the authentication module, authentication chain, and Social Authentication Implementations service that you created by using the wizard in the same way as manually created versions. For more information, see "Configuring Authentication Modules", "Configuring Authentication Chains", and "Configuring the Social Authentication Implementations Service".

## 3.3. Configuring the Social Authentication Implementations Service

You can add logos to the login page to allow users to authenticate using configured social authentication providers.

Wizards are provided to configure common social authentication providers, which also configure the Social Authentication Implementations Service to add logos to the login page. You can manually add other authentication chains that contain an OAuth 2.0/OpenID Connect authentication module.

To add a social authentication provider to the login screen, you must first configure an OAuth 2.0/OpenID Connect authentication module, and an authentication chain that contains it:

- Use a wizard. See "Configuring Pre-Populated Social Authentication Providers" and "Configuring Custom Social Authentication Providers".
- Configure the Social Authentication Implementations Service, and then create an authentication module and a chain. See "To Configure the Social Authentication Implementations Service", "Configuring Authentication Modules" and "Configuring Authentication Chains".

### *To Configure the Social Authentication Implementations Service*

Once you have created an authentication chain containing an OAuth 2.0/OpenID Connect authentication module, follow the steps below to add a logo for the authentication provider to the login screen:

1. On the Realms page of the AM console, click the realm containing the authentication module and authentication chain to be added to the login screen.
2. On the Services page for the realm:
  - If the **Social Authentication Implementations Service** exists, click on it.
  - If the **Social Authentication Implementations Service** does not exist, click Add a Service, and then select Social Authentication Implementations, and then click Create.
3. On the Social Authentication Implementations page:
  - a. In the *Display Names* section, enter a Map Key, enter the text to display as ALT text on the logo in the Corresponding Map Value field, and then click Add.

#### Note

AM uses the value in the Map Key fields throughout the configuration to tie the various implementation settings to each other. The value is case-sensitive.

- b. In the *Authentication Chains* section, re-enter the Map Key used in the previous step, select the authentication chain from the Corresponding Map Value list, and then click Add.

- c. In the *Icons* section, re-enter the Map Key used in the previous steps, enter the path to a logo image to be used on the login screen in the Corresponding Map Value list, and then click Add.
- d. In the *Enabled Implementations* field, re-enter the Map Key used in the previous steps, and then click Add.

**Tip**

Removing a Map Key from the Enabled Implementations list removes the associated logo from the login screen. There is no need to delete the Display Name, Authentication Chain or Icon configuration to remove the logo from the login screen.

- e. Click Save Changes.



## Configuring the Social Authentication Implementations service

SERVICE

# Social Authentication Implementations

x Delete

**Display Names** ⓘ

<b>Google</b>	Google	x
<b>Salesforce</b>	Salesforce	x
Key	Value	+ add

**Authentication Chains** ⓘ

<b>Google</b>	GoogleSocialAuthenticationService	x
<b>Salesforce</b>	SalesforceSocialAuthenticationService	x
Key	Value	+ add

**Icons** ⓘ

<b>Google</b>	images/logos/googleplus.png	x
<b>Salesforce</b>	/openam/XUI/images/logos/salesforce.png	x
Key	Value	+ add

**Enabled Implementations**

Google
Salesforce

ⓘ

[AME-10806]

Save Changes

An icon now appears on the AM login screen, allowing users to authenticate with the third party authentication provider.

## Chapter 4

# Implementing Multi-Factor Authentication

Multi-factor authentication is a security process that requires users to provide more than one form of credentials when logging in or accessing a resource. A common multi-factor authentication scenario is for users to submit a user ID and password, and then submit a one-time password generated by an authenticator application on their mobile phone to access a resource.

This chapter covers how administrators implement and support multi-factor authentication, and how end users authenticate using multi-factor authentication. See the following sections:

- "Configuring Multi-Factor Authentication Service Settings"
- "Letting Users Opt Out of One-Time Password Authentication"
- "Creating Multi-Factor Authentication Chains"
- "Managing Devices for Multi-Factor Authentication"
- "Authenticating Using Multi-Factor Authentication"

For conceptual information about multi-factor authentication, see "About Multi-Factor Authentication".

## 4.1. Configuring Multi-Factor Authentication Service Settings

AM provides a number of services that must be configured to provide multi-factor authentication with the ForgeRock Authenticator app.

The service for customizing one-time password implementation is:

### **ForgeRock Authenticator (OATH) Service**

Specifies the attribute in which to store information about a registered device, and whether to encrypt that information.

Also specifies the attribute used to indicate if a user has opted out of one-time passwords.

For detailed information about the available properties, see "ForgeRock Authenticator (OATH) Service" in the *Reference*.

The services required for implementing push notifications are:

### **ForgeRock Authenticator (Push) Service**

Specifies the attribute in which to store information about a registered device, and whether to encrypt the data.

For detailed information about the available properties, see "ForgeRock Authenticator (Push) Service" in the *Reference*.

### Push Notification Service

Configures how AM sends push notifications to registered devices, including endpoints, and access credentials.

For information on provisioning the credentials required by the Push Notification Service, see [How to set up AM Push Notification Service credentials in the ForgeRock Knowledge Base](#).

For detailed information about the available properties, see "Push Notification Service" in the *Reference*.

To configure these services globally for an AM deployment, navigate to **Configure > Global Services**, and then click the service to configure.

To configure these services for a realm, navigate to **Realms > Realm Name**, and then click **Services**. Add an instance of the service to the realm and configure settings in the service as required.

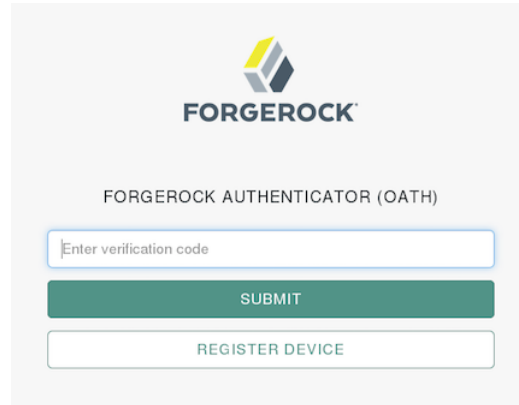
## 4.2. Letting Users Opt Out of One-Time Password Authentication

Letting users opt out of providing one-time passwords when they perform multi-factor authentication is an important implementation decision. The **Two Factor Authentication Mandatory** setting under **Realms > Realm Name > Authentication > Settings > General** configures whether users can opt out.

When the **Two Factor Authentication Mandatory** setting is enabled, users must provide a one-time password every time they authenticate to a chain that includes a ForgeRock Authenticator (OATH) authentication module. When the setting is disabled, the user can optionally skip one-time passwords.

By default, AM lets users opt out of providing one-time passwords. Users authenticating with one-time passwords for the first time are prompted with a screen that lets them opt out of providing one-time passwords.

With the **Two Factor Authentication Mandatory** setting enabled, the user experience differs from the default behavior. AM does not provide an option to skip multi-factor authentication during the initial attempt at multi-factor authentication:



When configuring an authentication chain that implements one-time passwords, you need to be aware that a user's decision to opt out affects the authentication process. When a user who has opted out of providing one-time passwords authenticates to a chain that includes a ForgeRock Authenticator (OATH) authentication module, that module *always* passes authentication.

Consider the example authentication chain in "Creating Authentication Chains for One-Time Password Authentication". The first authentication module is a Data Store module and the second authentication module is a ForgeRock Authenticator (OATH) module. Both authentication modules have the Requisite flag setting.

A user who has opted out of providing one-time passwords might experience the following sequence of events when authenticating to the chain:

1. The Data Store authentication module prompts the user to provide a user ID and password.
2. The user provides a valid user ID and password.
3. Data Store authentication passes, and authentication proceeds to the next module in the chain—the ForgeRock Authenticator (OATH) module.
4. The ForgeRock Authenticator (OATH) authentication module determines that the user has opted out of providing one-time passwords.
5. ForgeRock Authenticator (OATH) authentication passes. Because it is the last authentication module in the chain, AM considers authentication to have completed successfully.

Contrast the preceding sequence of events to the experience of a user who has not opted out of providing one-time passwords, or who is required to provide one-time passwords, while authenticating to the same chain:

1. The Data Store authentication module prompts the user to provide a user ID and password.
2. The user provides a valid user ID and password.

3. Data Store authentication passes, and authentication proceeds to the next module in the chain—the ForgeRock Authenticator (OATH) module.
4. The ForgeRock Authenticator (OATH) authentication module determines that the user has not opted out of providing one-time passwords, and prompts the user for a one-time password.
5. The user obtains a one-time password from the authenticator app on their mobile phone.
6. If the one-time password is valid, ForgeRock Authenticator (OATH) authentication passes. Because it is the last authentication module in the chain, AM considers authentication to have completed successfully. However, if the one-time password is not valid, ForgeRock Authenticator (OATH) authentication fails, and AM considers authentication to have failed.

## 4.3. Creating Multi-Factor Authentication Chains

The following procedures provide steps for creating authentication chains that implement multi-factor authentication.

### 4.3.1. Creating Authentication Chains for Push Authentication

Push authentication uses two separate authentication modules:

- A module to register a device to receive push notifications called *ForgeRock Authenticator (Push) Registration*.
- A module to perform the actual authentication itself, called *ForgeRock Authenticator (Push)*.

You can insert both modules into a single chain to register devices and then authenticate with push notifications. See ["To Create an Authentication Chain for Push Registration and Authentication"](#).

The ForgeRock Authenticator (Push) module can also be used for passwordless authentication using push notifications. If the module is placed at the start of a chain, it will ask the user to enter their user ID, but not their password. A push notification is then sent to their registered device to complete the authentication by using the ForgeRock Authenticator app.

For information on configuring an authentication chain for passwordless authentication, see ["To Create an Authentication Chain for Push Registration and Passwordless Authentication"](#).

For information on the potential limitations of passwordless authentication, see ["Limitations When Using Passwordless Push Authentication"](#).

#### *To Create an Authentication Chain for Push Registration and Authentication*

The procedure assumes the following:

- Users will provide user IDs and passwords as the first step of multi-factor authentication.

- If the user does not have a device registered to receive push notifications, they will be asked to register a device. After successfully registering a device for push, authentication will proceed to the next step.
- A push notification will be sent to the device as a second factor to complete authentication.

To create a multi-factor authentication chain that uses the ForgeRock Authenticator (Push) Registration and ForgeRock Authenticator (Push) modules, follow these steps:

1. Log in to the AM console as an AM administrator, for example `amadmin`.
2. Select the realm that will contain the authentication chain.
3. Create a ForgeRock Authenticator (Push) Registration authentication module as follows:
  - a. Select Authentication > Modules, and then click Add Module.  
The New Module page appears.
  - b. Fill in fields in the Create New Module dialog box as follows:
    - Name: Specify a module name of your choosing, for example `push-reg`.
    - Type: Select ForgeRock Authenticator (Push) Registration.
  - c. Click Create.  
A page that lets you configure the authentication module appears.
  - d. Configure the module to meet your organization's requirements.  
For more information about the authentication module's configuration settings, see "ForgeRock Authenticator (Push) Registration Authentication Module".
4. Create a ForgeRock Authenticator (Push) authentication module as follows:
  - a. Select Authentication > Modules, and then click Add Module.  
The New Module page appears.
  - b. Fill in fields in the Create New Module dialog box as follows:
    - Name: Specify a module name of your choosing, for example `push-authn`.
    - Type: Select ForgeRock Authenticator (Push).
  - c. Click Create.  
A page that lets you configure the authentication module appears.
  - d. Configure the module to meet your organization's requirements.

For more information about the authentication module's configuration settings, see "ForgeRock Authenticator (Push) Authentication Module".

5. Create the authentication chain as follows:

- a. Select Authentication > Chains, and then click Add Chain.

The Add Chain page appears.

- b. Specify a name of your choosing, for example `myPushAuthChain`, and then click Create.

A page appears with the Edit Chain tab selected.

- c. Add the Data Store authentication module to the authentication chain as follows:

- i. Click Add a Module.

The New Module dialog box appears.

- ii. Fill in the New Module dialog box, specifying the Data Store authentication module. For this example, specify the `Requisite` flag.

- iii. Click OK.

The graphic showing your authentication chain now includes a Data Store authentication module.

- d. Add the ForgeRock Authenticator (Push) Registration authentication module to the authentication chain as follows:

- i. Click Add a Module.

The New Module dialog box appears.

- ii. Fill in the New Module dialog box, specifying the ForgeRock Authenticator (Push) Registration authentication module that you just created. For this example, specify the `Requisite` flag.

- iii. Click OK.

The graphic showing your authentication chain now includes a Data Store, and a ForgeRock Authenticator (Push) Registration authentication module.

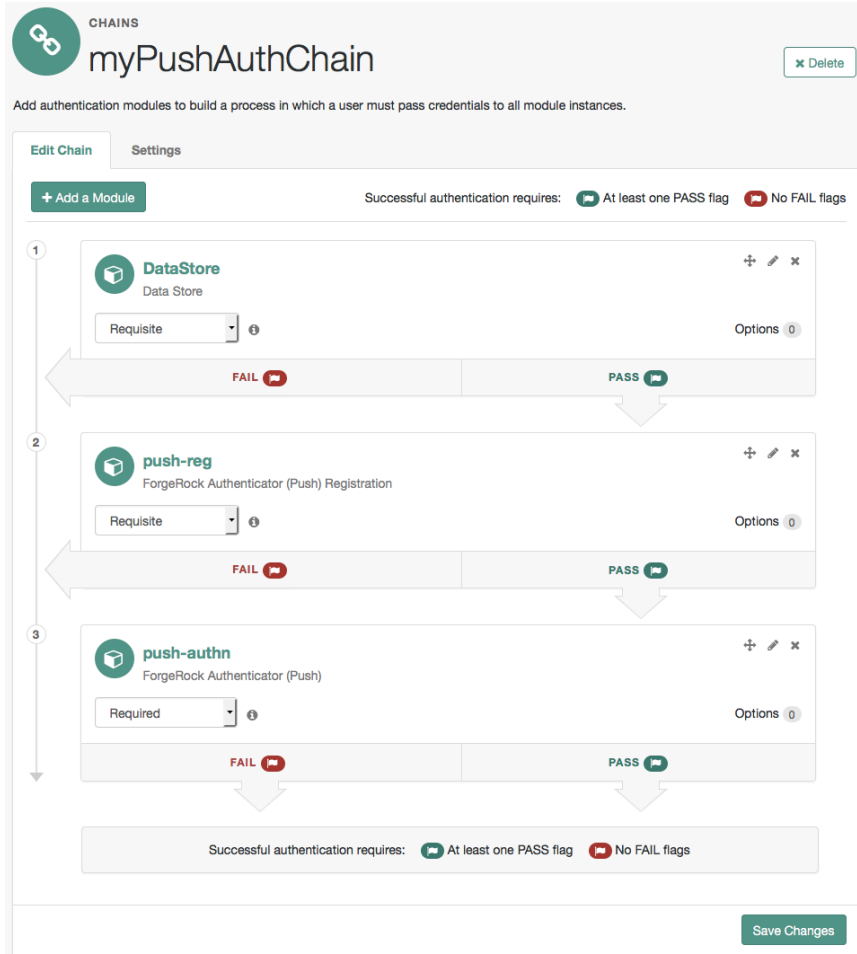
- e. Add the ForgeRock Authenticator (Push) authentication module to the authentication chain as follows:

- i. Click Add a Module.

The New Module dialog box appears.

- ii. Fill in the New Module dialog box, specifying the ForgeRock Authenticator (Push) authentication module that you created. For this example, specify the **Required** flag.
- iii. Click OK.

The graphic showing your authentication chain now includes a Data Store, a ForgeRock Authenticator (Push) Registration, and a ForgeRock Authenticator (Push) authentication module.



- f. Click Save Changes to save the authentication chain.
6. Test your authentication chain as follows:



- a. Navigate to a URL similar to the following: <http://openam.example.com:8080/openam/XUI/?realm=#login/&service=myPushAuthChain>  
A login screen prompting you to enter your user ID and password appears.
- b. Follow the procedure described in "To Perform Authentication using Push Notifications" to verify that you can use the ForgeRock Authenticator app to perform multi-factor authentication. If the chain is correctly configured, authentication is successful and AM displays the user profile page.

### *To Create an Authentication Chain for Push Registration and Passwordless Authentication*

The procedure assumes the following:

- Users will provide only their user IDs as the first step of multi-factor authentication.
- The user already has a device registered for receiving push notifications. For details of an authentication chain which can register a device for push notifications, see "To Create an Authentication Chain for Push Registration and Authentication".
- A push notification will be sent to the device as a second factor, to complete authentication without the need to enter a password.

To create a multi-factor authentication chain that uses the ForgeRock Authenticator (Push) module for passwordless authentication, follow these steps:

1. Log in to the AM console as an AM administrator, for example `amadmin`.
2. Select the realm that will contain the authentication chain.
3. Create a ForgeRock Authenticator (Push) authentication module as follows:
  - a. Select Authentication > Modules, and then click Add Module.  
The New Module page appears.
  - b. Fill in fields in the Create New Module dialog box as follows:
    - Name: Specify a module name of your choosing, for example `push-authn`.
    - Type: Select ForgeRock Authenticator (Push).
  - c. Click Create.

A page that lets you configure the authentication module appears.

- d. Configure the module to meet your organization's requirements.

For more information about the authentication module's configuration settings, see "ForgeRock Authenticator (Push) Authentication Module".

4. Create the authentication chain as follows:

- a. Select Authentication > Chains, and then click Add Chain.

The Add Chain page appears.

- b. Specify a name of your choosing, for example *myPasswordlessAuthChain*, and then click Create.

A page appears with the Edit Chain tab selected.

- c. Add the ForgeRock Authenticator (Push) authentication module to the authentication chain as follows:

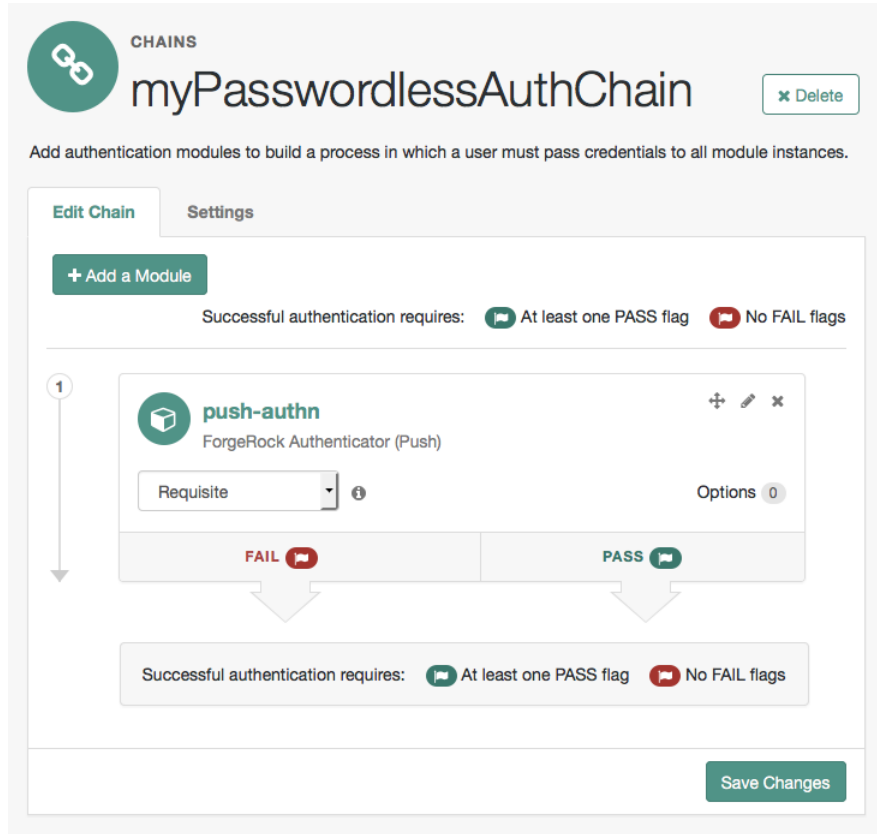
- i. Click Add a Module.

The New Module dialog box appears.

- ii. Fill in the New Module dialog box, specifying the ForgeRock Authenticator (Push) authentication module that you created. For this example, specify the **Requisite** flag.

- iii. Click OK.

The graphic showing your authentication chain now includes a ForgeRock Authenticator (Push) authentication module.



- d. Click Save Changes to save the authentication chain.
5. Test your authentication chain as follows:
    - a. Navigate to a URL similar to the following: <http://openam.example.com:8080/openam/XUI/?realm=/#login/&service=myPasswordlessAuthChain>  
A login screen prompting you to enter your user ID appears.
    - b. Follow the procedure described in "To Perform Authentication using Push Notifications" to verify that you can use the ForgeRock Authenticator app to perform multi-factor authentication. If the chain is correctly configured, authentication is successful and AM displays the user profile page, without having to enter a password.

### 4.3.2. Creating Authentication Chains for One-Time Password Authentication

This section covers one-time password authentication.

#### *To Create an Authentication Chain for One-Time Password Authentication*

The procedure assumes the following:

- Users will provide user IDs and passwords as the first step of multi-factor authentication.
- An existing Data Store authentication module will collect and verify user IDs and passwords.
- All authentication modules in the chain will use the **Requisite** flag setting. See "About Authentication Modules and Chains" for details about authentication module flag settings.
- Users can opt out of one-time password authentication.

To create a multi-factor authentication chain that uses the ForgeRock Authenticator (OATH) module, follow these steps:

1. Log in to the AM console as an AM administrator, for example **amadmin**.
2. Select the realm that will contain the authentication chain.
3. You can allow users to opt out of using OATH-based one-time passwords as follows:
  - a. Select Authentication > Settings > General.
  - b. Make sure that the Two Factor Authentication Mandatory is not enabled.  
See "General" for details about this configuration setting.

For information about how letting users skip multi-factor authentication impacts the behavior of authentication chains, see "Letting Users Opt Out of One-Time Password Authentication".

4. Create a ForgeRock Authenticator (OATH) authentication module as follows:
  - a. Select Authentication > Modules, and then click Add Module.  
The New Module page appears.
  - b. Fill in fields in the Create New Module dialog box as follows:
    - Name: Specify a module name of your choosing.
    - Type: Select ForgeRock Authenticator (OATH).
  - c. Click Create.

A page that lets you configure the authentication module appears.

- d. Configure the ForgeRock Authenticator authentication module to meet your organization's requirements.

For more information about the authentication module's configuration settings, see "ForgeRock Authenticator (OATH) Authentication Module".

5. Create the authentication chain as follows:

- a. Select Authentication > Chains, and then click Add Chain.

The Add Chain page appears.

- b. Specify a name of your choosing, for example *myOathAuthChain*, and then click Create.

A page appears with the Edit Chain tab selected.

- c. Click Add a Module. Fill in fields in the New Module dialog box as follows:

- Select Module: Select the existing Data Store module to use in this chain.
- Select Criteria: Select a flag setting for the module in the authentication chain. For this example, specify the **Requisite** flag.

See "About Authentication Modules and Chains" for information about authentication module flag settings.

- d. Click OK.

A graphic showing an authentication chain with a single Data Store module appears on the page.

- e. Add the ForgeRock Authenticator (OATH) authentication module to the authentication chain as follows:

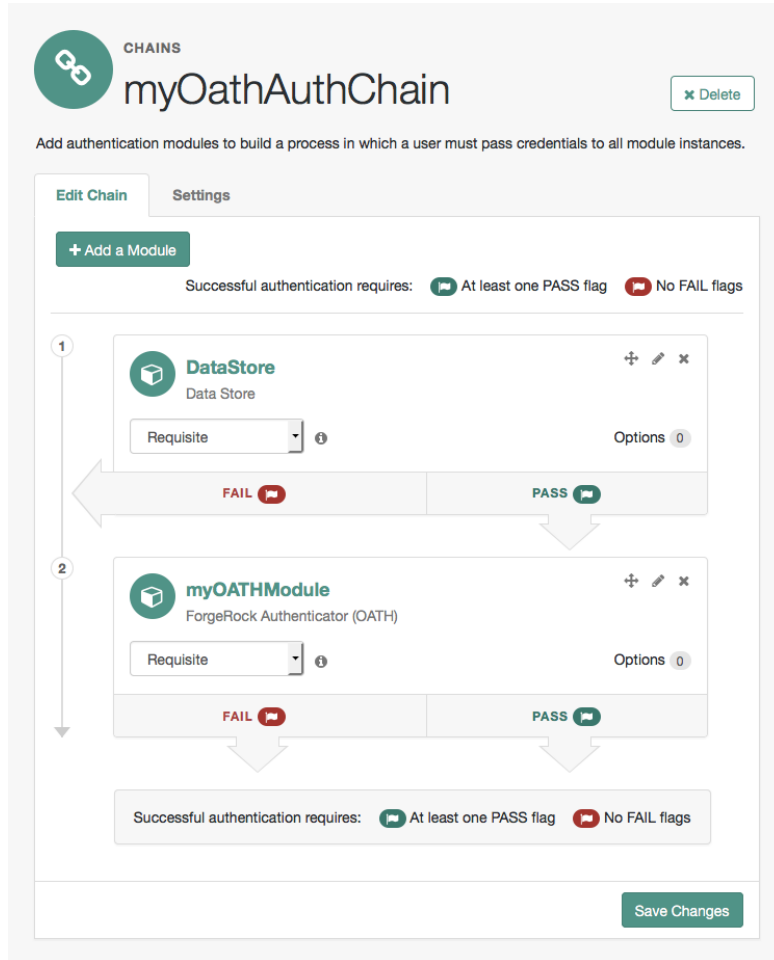
- i. Click Add a Module.

The New Module dialog box appears.

- ii. Fill in the New Module dialog box, specifying the ForgeRock Authenticator (OATH) authentication module that you just created. For this example, specify the **Requisite** flag.

- iii. Click OK.

The graphic showing your authentication chain now includes the Data Store and ForgeRock Authenticator (OATH) authentication module.



- f. Click Save Changes to save the authentication chain.
6. Test your authentication chain as follows:
- a. Navigate to a URL similar to the following: <http://openam.example.com:8080/openam/XUI/?realm=#login/&service=myOathAuthChain>  
 A login screen prompting you to enter your user ID and password appears.
  - b. Follow the procedure described in "To Perform Authentication using a One-Time Password" to verify that you can use the ForgeRock Authenticator app to perform multi-factor

authentication. If the chain is correctly configured, authentication is successful and AM displays the user profile page.

## 4.4. Managing Devices for Multi-Factor Authentication

Multi-factor authentication requires you to register a device, which is used as an additional factor when you log in to AM.

This section covers the following topics relating to devices used for multi-factor authentication:

- "Downloading the ForgeRock Authenticator App"
- "Registering a Device for Multi-Factor Authentication"
- "Accessing Your Recovery Codes"
- "Opting Out of One-Time Password Authentication"
- "Recovering After Replacing a Lost Device"
- "Recovering After a Device Becomes Out of Sync"
- "Resetting Registered Devices by using REST"

### 4.4.1. Downloading the ForgeRock Authenticator App

If you have not already done so, download and install the ForgeRock Authenticator app on your phone, so that you can perform multi-factor authentication.

The ForgeRock Authenticator app supports push authentication notifications and one-time passwords.

The app is available for both Android and iOS devices, and is free to download. Source code is also available:

#### **Android**

Download: [Google Play](#)

Source code: <https://stash.forgerock.org/projects/OPENAM/repos/forgerock-authenticator-android>

#### **iOS**

Download: [App Store](#)

Source code: <https://stash.forgerock.org/projects/OPENAM/repos/forgerock-authenticator-ios>

### 4.4.2. Registering a Device for Multi-Factor Authentication

Registering a device with AM by using the ForgeRock Authenticator app enables it to be used as an additional factor when logging in.

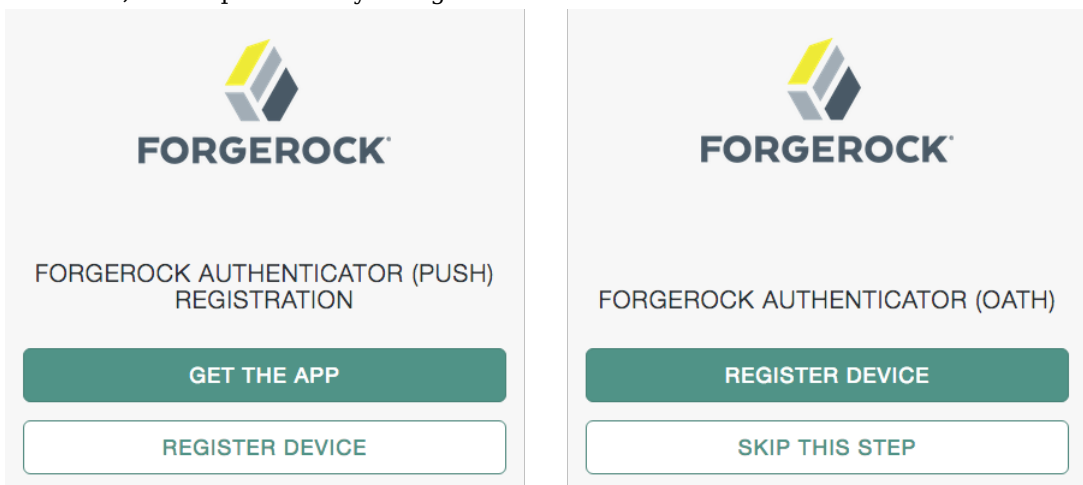
The ForgeRock Authenticator app supports registration of multiple accounts and multiple different authentication methods in each account, such as push notifications and one-time passwords.

Device registration only needs to be completed the first time an authentication method is used with an identity provider. Use of a different authentication method may require that device registration with the identity provider is repeated for that additional method.

The device needs access to the internet to register to receive push notifications. Registering for one-time password authentication does not require a connection to the internet.

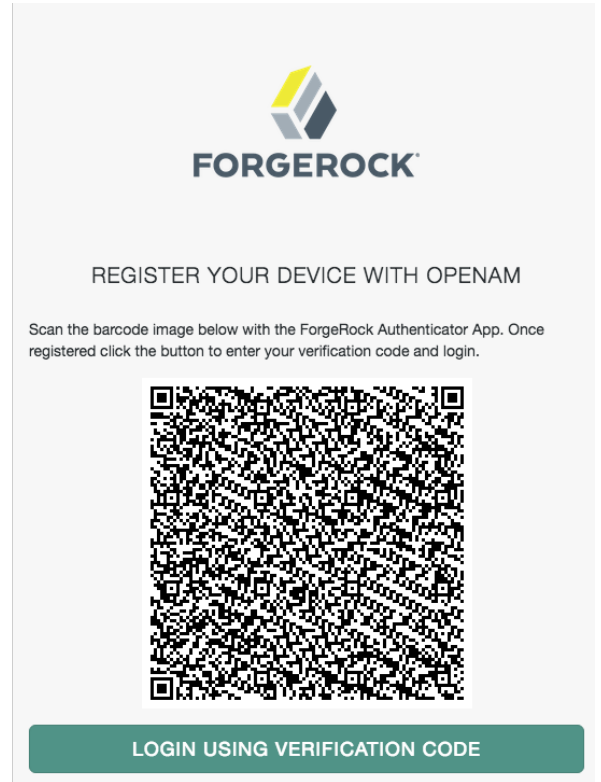
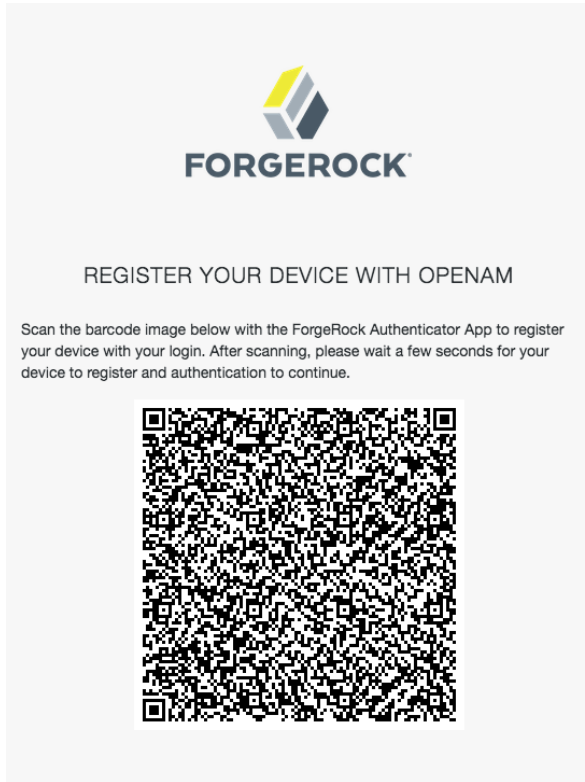
### *To Register a Device for Multi-Factor Authentication*

1. When visiting a protected resource without having any registered devices for multi-factor authentication, AM requires that you register a device.

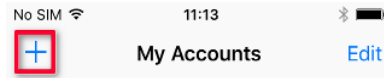


To register your mobile phone with AM, click Register Device. A screen with a QR code appears:





2. Start the ForgeRock Authenticator app on the device to register, and then click the plus icon:



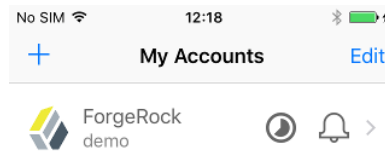
The screen on the device changes to an interface similar to your camera app.

3. Point the camera at the QR code on the AM page and the ForgeRock Authenticator app will acquire the QR code and read the data encoded within.

If you are logging in to AM on the registered device and cannot scan the screen, click the button labelled On a mobile device?. The ForgeRock Authenticator app will request permission to launch. If allowed, the information required to register the device will be transferred to the ForgeRock Authenticator app directly, without the need to scan the QR code.



- After registering, the app displays the registered accounts and the authentication methods they support, for example one-time passwords (a timer icon) or push notifications (a bell icon):



Your device is now registered. You will be able to use it to perform multi-factor authentication.

#### Important

After registering a new device and successfully performing multi-factor authentication, you should obtain the recovery codes for the registered device and store them somewhere safe. See "Accessing Your Recovery Codes".

### 4.4.3. Accessing Your Recovery Codes

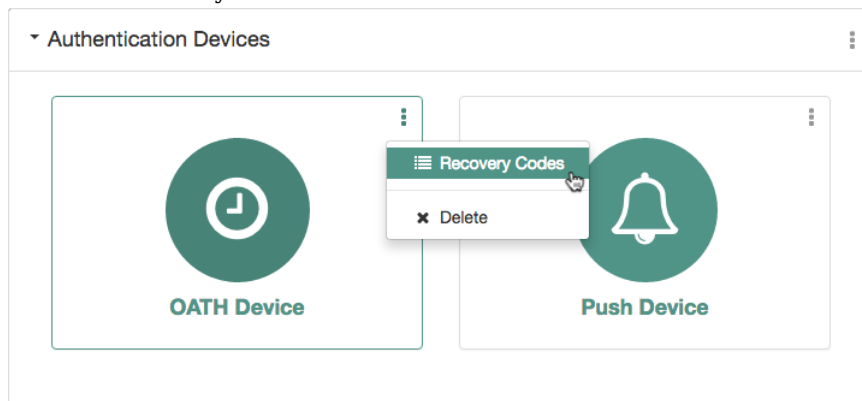
After successful first-time authentication with multi-factor authentication, you should safeguard your ability to use multi-factor authentication in case you lose your phone. AM provides each device you

register with a set of one-time recovery codes that you can use in cases where you cannot complete multi-factor authentication using your registered device.

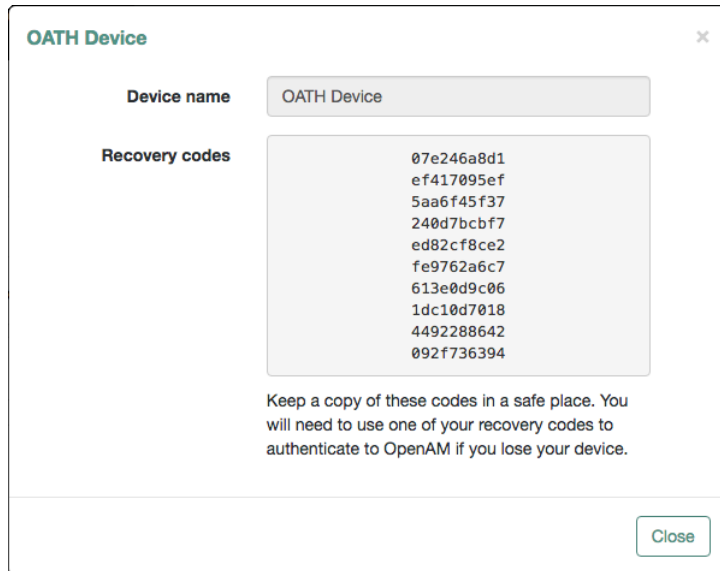
### To Access Your Recovery Codes

After registering a new device with AM, use the following steps to access your recovery codes:

1. Log in to AM.
2. Select Dashboard from the top-level menu.
3. Locate the entry for the device type in the Authentication Devices section, click the context menu button, and then click Recovery Codes:



A list of recovery codes appears:



4. Keep a copy of the codes for each of your registered device types in a safe place. You will need to use one of your recovery codes to authenticate to AM if you lose your phone.

See "Recovering After Replacing a Lost Device" for the procedure to authenticate to AM using a recovery code instead of performing multi-factor authentication.

#### 4.4.4. Opting Out of One-Time Password Authentication

Unless the AM administrator has made one-time password authentication mandatory, users can choose to opt out of using one-time passwords by clicking the Skip This Step button on the ForgeRock Authenticator (OATH) screen.<sup>1</sup> This button appears:

- When users are prompted to register their mobile devices during their initial login from a new device.
- Every time users are prompted by the ForgeRock Authenticator (OATH) authentication module to enter one-time passwords.

Users who decide to opt out of using one-time passwords are not prompted to enter one-time passwords when authenticating to AM.

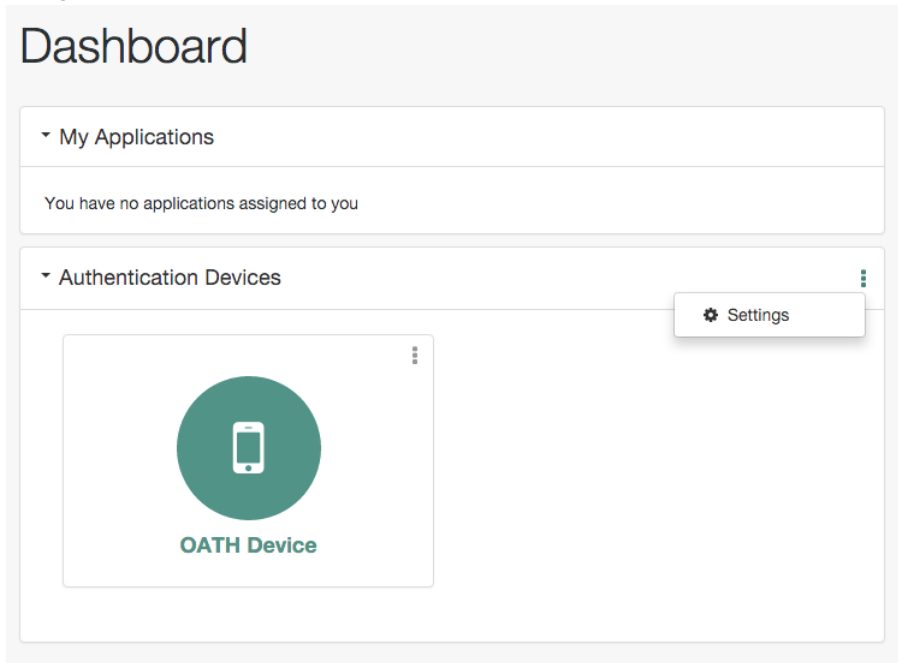
The decision to opt out of using one-time passwords in AM is revocable: users who have decided to opt out of using one-time passwords can reverse their decisions, so that one-time password authentication is once again required.

<sup>1</sup>For information about making the usage of one-time passwords mandatory in AM, see "Letting Users Opt Out of One-Time Password Authentication".

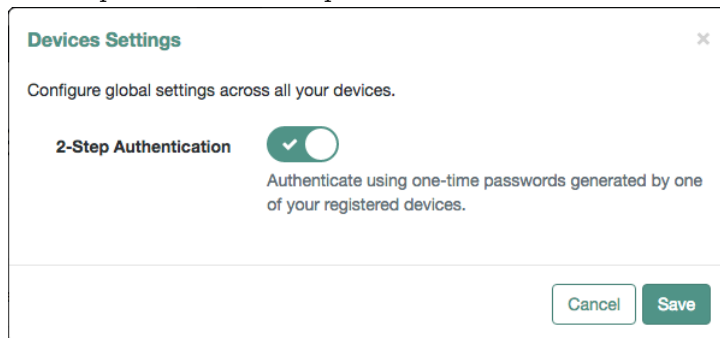
End users should follow these steps to opt out or opt in to using one-time passwords:

*To Opt out or Opt in to Using One-Time Passwords*

1. Log in to AM.
2. Select Dashboard from the top navigation bar.
3. In the Authentication Devices section of the Dashboard page, click the context menu button, and then click Settings:



4. Enable or disable the 2-Step Authentication option:



5. Click Save.

#### 4.4.5. Recovering After Replacing a Lost Device

If you register a device with AM and then lose it, you must authenticate to AM using a recovery code, delete the lost device, and then register the new device. Follow these steps:

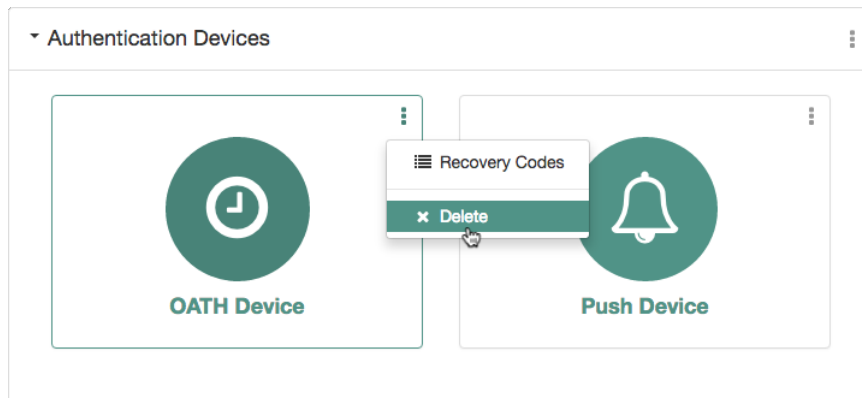
##### *To Register a New Device After Losing a Registered Device*

1. Log in to AM. If push authentication is enabled, enter your user ID, click Log In, and then click Use Emergency Code. If one-time passwords are enabled, when prompted to enter a verification code, instead enter one of your recovery codes.

Because recovery codes are valid for a single use only, make a note to yourself not to attempt to reuse this code.

If you did not save the recovery codes for the lost device, contact your administrator to remove the registered device from your AM user profile.

2. Select Dashboard from the top-level menu.
3. Locate the entry for your phone in the Authentication Devices section, click the context menu button, and then click Delete:



4. If you have not already done so, install the ForgeRock Authenticator app on your new phone. See "Downloading the ForgeRock Authenticator App".
5. Register your new device. See "Registering a Device for Multi-Factor Authentication".

Users who do not save recovery codes or who run out of recovery codes and cannot authenticate to AM without a verification code require administrative support to reset their device profiles. See "Resetting Registered Devices by using REST" for more information.

#### 4.4.6. Recovering After a Device Becomes Out of Sync

If you repeatedly enter valid one-time passwords that appear to be valid passwords, but AM rejects the passwords as unauthorized, it is likely that your device has become out of sync with AM.

When a registered device becomes out of sync with AM, you must authenticate to AM using a recovery code, delete your device, and then re-register your device. You can do so by performing the steps in "To Register a New Device After Losing a Registered Device".

Users who do not save recovery codes or who run out of recovery codes and cannot authenticate to AM without a verification code require administrative support to reset their device profiles. See "Resetting Registered Devices by using REST" for more information.

#### 4.4.7. Resetting Registered Devices by using REST

As described in "Recovering After Replacing a Lost Device", a user who has lost a mobile phone registered with AM can register a replacement device by authenticating using a recovery code, deleting their existing device, and then re-registering a new device.

Additional support is required for users who lose mobile phones but did not save their recovery codes when they initially registered the phone, and for users who have used up all their recovery codes.

AM provides a REST API to reset a device profile by deleting information about a user's registered device. Either the user or an administrator can call the REST API to reset a device profile. Device profile reset can be implemented as follows:

- Administrators provide authenticated users with a self-service page that calls the REST API to let the users reset their own device profiles.
- Administrators can call the REST API themselves to reset users' device profiles.
- Administrators can call the REST API themselves to reset a device when the HOTP counter exceeds the HOTP threshold window and requires a reset.

##### Note

The reset action deletes the OATH device profile, which by default has a limit of one profile per device, and sets the **Select to Enable Skip** option to its default value of **Not Set**.

An administrator or a user can perform an HTTP POST to the `/users/user/devices/2fa/oath?_action=reset` endpoint to reset the user's device profile.

When making a REST API call, specify the realm in the path component of the endpoint. You must specify the entire hierarchy of the realm, starting at the top-level realm. Prefix each realm in the hierarchy with the `realms/` keyword. For example `/realms/root/realms/customers/realms/europe`.

The following example resets the devices of a user named `myUser` in a subrealm of the top-level realm called `mySubrealm`:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "iplanetDirectoryPro: AQIC5w...2NzEz*" \
--data '{}' \
https://openam.example.com:8443/openam/json/realms/root/realms/mySubrealm/users/myUser/devices/2fa/
oath?_action=reset
{"result":true}
```

## 4.5. Authenticating Using Multi-Factor Authentication

This section provides an example of how end users might authenticate with AM configured for multi-factor authentication. Use the following procedures to complete multi-factor authentication using the ForgeRock Authenticator:

- "To Perform Authentication using a One-Time Password"
- "To Perform Authentication using Push Notifications"

### *To Perform Authentication using a One-Time Password*

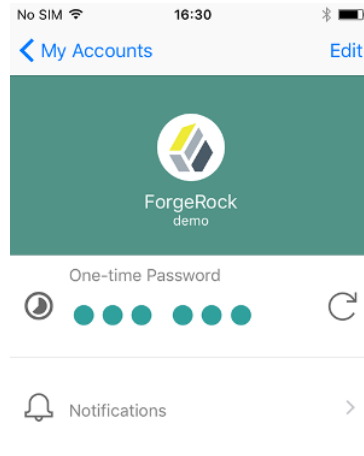
This example uses the authentication chain as created in "Creating Authentication Chains for One-Time Password Authentication".

Because the first module in the authentication chain is a Data Store module, AM presents you with a page for entering your user ID and password. After you provide those credentials, AM verifies them. If your credentials are valid, AM proceeds to the ForgeRock Authenticator (OATH) authentication module.

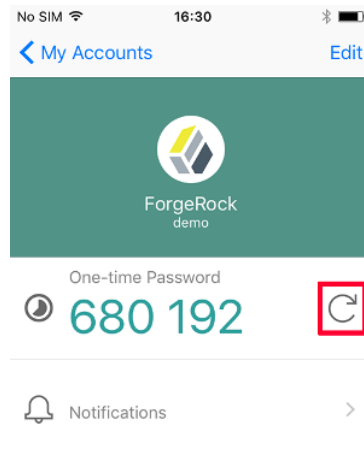
On the ForgeRock Authenticator (OATH) screen, follow these steps to complete one-time password authentication:

1. On your registered device, open the ForgeRock Authenticator app, and then tap the account matching the user ID you entered earlier. The registered authentication methods for that account are displayed:

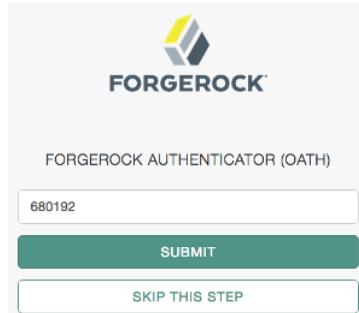




- In the One-time Password section, click the refresh icon. A one-time password is displayed:



- On the ForgeRock Authenticator (OATH) page in AM, enter the one-time password that the authenticator app generated on your phone, and then click Submit:



AM will display the user's profile page.

### *To Perform Authentication using Push Notifications*

This example uses one of the authentication chains as created in "Creating Authentication Chains for Push Authentication".

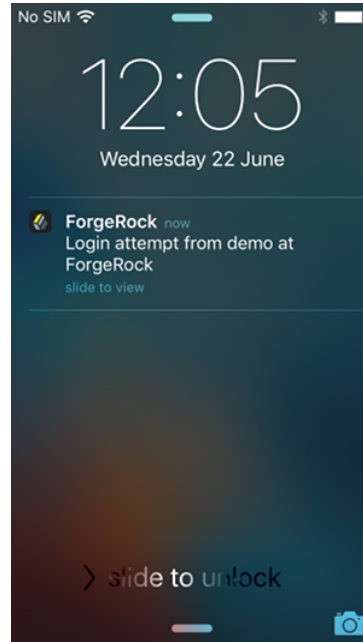
AM presents you with a page for entering only your user ID, or user ID and password. After you provide those credentials, AM verifies them. If your credentials are valid and the account has a device registered for push notifications, AM proceeds to the ForgeRock Authenticator (Push) authentication module, and a push notification is sent to the registered device.

#### **Note**

The device needs access to the Internet to receive push notifications, and the AM server must be able to receive responses from the device.

Follow these steps to complete authentication using push notifications:

1. On your registered device, you will receive a push notification from AM. Depending on the state of the phone and the ForgeRock Authenticator app, respond to the notification as follows:
  - If the phone is locked, the notification may appear similar to the following:



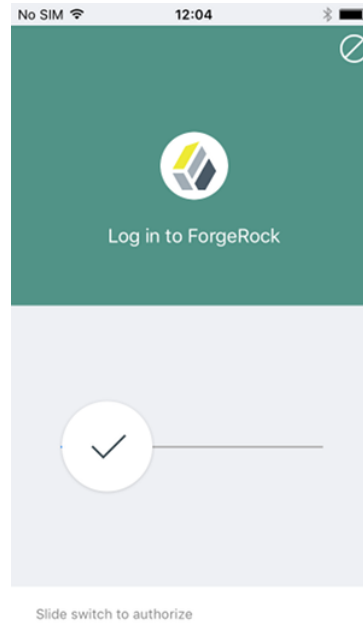
Slide the notification across the screen, then unlock the phone. The ForgeRock Authenticator app will automatically open and display the push notification authentication screen.

- If the phone is not locked, and the ForgeRock Authenticator app is not open, the notification may appear similar to the following:



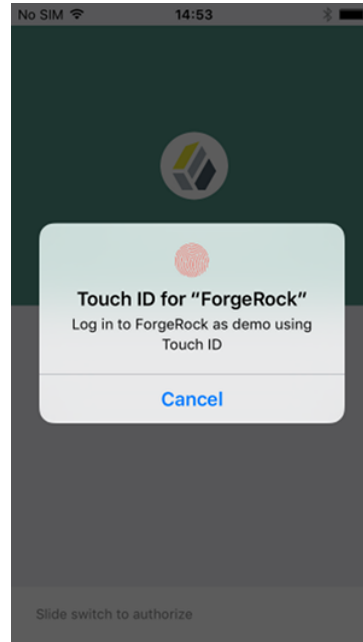
Tap the notification. The ForgeRock Authenticator app will automatically open and display the push notification authentication screen.

- If the phone is not locked, and the ForgeRock Authenticator app is open, the app will open the push notification authentication screen automatically.
2. On the push notification authentication screen, you can approve the request or deny it:
- Slide the switch with a checkmark on horizontally to the right.



AM will display the user's profile page.

- If the registered device supports Touch ID, and fingerprints have been provided, you can approve the request by using a registered fingerprint.



AM will display the user's profile page.

- To deny the request, tap the cancel icon in the top-right of the screen, or if Touch ID is enabled, click the Cancel button.

After a timeout has passed, AM will report that authentication has failed and return to the first screen in the chain.

#### Note

If you do not approve or deny the request on the registered device, the AM Push Authentication page will timeout and the authentication will fail. The timeout can be configured in the ForgeRock Authenticator (Push) authentication module settings. See "ForgeRock Authenticator (Push) Authentication Module".

## Chapter 5

# Implementing Account Lockout

Account lockout is a security mechanism that locks a user after repeated failed login attempts.

Most deployments implement the backend user store's password policy to control account lockout. If that is not an option to your deployment, you can configure account lockout.

AM supports two different approaches to *account lockout*, where AM locks an account after repeated authentication failures—persistent lockout and memory lockout:

- Persistent (physical) lockout sets the user account status to **inactive** in the user profile. For persistent lockout, AM tracks failed authentication attempts by writing to the user repository.

Persistent account lockout works independently of account lockout mechanisms in the underlying directory server that serves as the user data store.

- Memory lockout locks the user account, keeping track of the locked state only in memory, and then unlocking the account after a specified delay. Memory lockout is also released when AM restarts.

This chapter describes how to configure account lockout in AM.

## 5.1. Configuring Account Lockout

You configure account lockout by editing settings for the core authentication module. For details, see "Setting up a Realm for Authentication".

### *To Configure Account Lockout*

1. Access the settings in the AM console under Realms > *Realm Name* > Authentication > Settings > Account Lockout.
2. Enable lockout by checking Login Failure Lockout Mode, setting the number of attempts, and setting the lockout interval and duration.

You can also opt to warn users after several consecutive failures, or to multiply the lockout duration on each successive lockout.

3. You can set up email notification upon lockout to an administrator if AM is configured to send mail. You can configure AM to send mail in Configure > Server Defaults > General > Mail Server.

4. For persistent lockout, AM sets the value of the user's `inetuserstatus` profile attribute to `inactive`. You can also specify another attribute to update on lockout. You can further set a non-default attribute on which to store the number of failed authentication attempts. When you do store the number of failed attempts in the data store, other AM servers accessing the user data store can also see the number.

**Note**

To unlock a user's account, find the user under `Realms > Realm Name > Subjects > User`, set the user's User Status to Active, and click Save.



## Chapter 6

# Implementing Session Options

This chapter covers how to handle sessions.

You can configure AM sessions for:

- Statefulness or statelessness. See "Implementing Session State".
- Quotas, which limit the number of active sessions for a user. See "Implementing Session Quotas".

## 6.1. Implementing Session State

This section covers planning and configuration tasks you perform when implementing stateless sessions.

### 6.1.1. Installation Planning for Stateless Sessions

Session blacklisting uses the Core Token Service's token store during the logout process. For more information about deploying the Core Token Service, see "*Implementing the Core Token Service*" in the *Installation Guide*.

Also, ensure the trust store used by AM has the necessary certificates installed:

- A certificate is required for encrypting JWTs containing stateless sessions.
- If you are using RS256 signing, then a certificate is required to sign JWTs. (HMAC signing uses a shared secret.)

The same certificates must be stored on all servers participating in an AM site.

### 6.1.2. Configuring Stateless Sessions

To configure stateless sessions for a realm, follow these steps:

#### *Enable Stateless Sessions in a Realm*

1. Navigate to Realms > *Realm Name* > Authentication > Settings > General.
2. Select the "Use Stateless Sessions" check box.

3. Click Save.

To verify that AM creates a stateless session when non-administrative users authenticate to the realm, follow these steps:

### *Verify that Stateless Sessions Are Enabled*

1. Authenticate to the AM console as the top-level administrator (by default, the `amadmin` user). Note that the `amadmin` user's session will be stateful, because AM sessions for the top-level administrator are always stateful.
2. Navigate to Realms > *Realm Name* > Sessions.
3. Verify that a session is present for the `amadmin` user.
4. In your browser, examine the AM cookie, named `iPlanetDirectoryPro` by default. Copy and paste the cookie's value into a text file and note its size.
5. Start up a private browser session that will not have access to the `iPlanetDirectoryPro` cookie for the `amadmin` user:
  - On Chrome, open an incognito window.
  - On Internet Explorer or Microsoft Edge, start InPrivate browsing.
  - On Firefox, open a new private window.
  - On Safari, open a new private window.
6. Authenticate to AM as a non-administrative user in the realm for which you enabled stateless sessions. Be sure *not* to authenticate as the `amadmin` user this time.
7. In your browser, examine the `iPlanetDirectoryPro` cookie. Copy and paste the cookie's value into a second text file and note its size. The size of the stateless session cookie's value should be considerably larger than the size of the stateful session cookie's value for the `amadmin` user. If the cookie is not larger, you have not enabled stateless sessions correctly.
8. Return to the original browser window in which the AM console appears.
9. Refresh the window containing the Sessions page.
10. Verify that a session still appears for the `amadmin` user, but that no session appears for the non-administrative user in the realm with stateless sessions enabled.

### 6.1.3. Configuring Stateless Session Cookie Security

When using stateless sessions, you should sign and encrypt JWTs in the `iPlanetDirectoryPro` cookie.

Prior to configuring stateless session cookie security, ensure that you have deployed certificates as needed. For more information about managing certificates for AM, see "*Setting Up Keys and Keystores*" in the *Setup and Maintenance Guide*.

To ensure security of stateless session cookie JWTs, configure a JWT signature and encrypt the entire JWT. The sections that follow provide detailed steps for configuring stateless session cookie security.

For more information about stateless session cookie security, see "Stateless Session Cookie Security".

#### Important

When deploying multiple AM servers in an AM site, every server must have the same security configuration. Shared secrets and security keys must be identical. If you modify shared secrets or keys, you must make the modifications to all the servers on the site.

### 6.1.3.1. Configuring the JWT Signature

Configure a JWT signature to prevent malicious tampering of stateless session cookies.

Perform the following steps to configure the JWT signature:

#### *To Configure the JWT Signature*

1. Navigate to Configure > Global Services, click Session, and then locate the Stateless Sessions section.
2. Specify the Signing Algorithm Type. Enter one of the following algorithms:

- **HS256**. HMAC using SHA-256
- **HS384**. HMAC using SHA-384
- **HS512**. HMAC using SHA-512
- **RS256**. RSASSA-PKCS1-v1\_5 using SHA-256
- **ES256**. ECDSA using SHA-256 and NIST standard P-256 elliptic curve
- **ES384**. ECDSA using SHA-384 and NIST standard P-384 elliptic curve
- **ES512**. ECDSA using SHA-512 and NIST standard P-521 elliptic curve

The default value is **HS256**.

3. If you specified an HMAC signing algorithm, change the value in the Signing HMAC Shared Secret field if you do not want to use the generated default value.
4. If you specified the RS256 signing algorithm, specify a value in the Signing RSA Certificate Alias field to use for signing the JWT signature.
5. Click Save.

For detailed information about Session Service configuration attributes, see the entries for "Session" in the *Reference*.

### 6.1.3.2. Configuring JWT Encryption

Configure JWT encryption to prevent man-in-the-middle attackers from accessing users' session details, and to prevent end users from examining the content in the JWT.

Perform the following steps to encrypt the JWT:

#### *To Configure JWT Encryption*

1. Navigate to Configure > Global Services, click Session, and then scroll to the Stateless Sessions section.
2. For Encryption Algorithm, select one of the following options:
  - **None.** Default. No encryption algorithm is selected.
  - **RSA.** Session content is encrypted with AES using a unique key. The key is then encrypted with an RSA public key and appended to the JWT.
  - **AES KeyWrapping.** Session content is encrypted with AES using a unique key and is then wrapped using AES key wrap and the master key. This algorithm provides additional security, compared to RSA, at the cost of 128 or 256 bits (or 32 bytes) depending on the size of the master key. It also provides authenticated encryption, which removes the need for a separate signature and decreases the byte size of the JWT.
  - **Direct AES Encryption.** Session content is encrypted with direct AES encryption with a symmetric key. This method provides authenticated encryption, which removes the need for a separate signature and decreases the byte size of the JWT.
3. If you selected **RSA** in the previous step, you can select one of three padding options using the advanced property `org.forgerock.openam.session.stateless.rsa.padding`:
  - **RSA1\_5.** RSA with PKCS#1 v1.5 padding.
  - **RSA-OAEP.** RSA with OAEP and SHA-1.
  - **RSA-OAEP-256.** RSA with OAEP padding and SHA-256.
  - a. In the AM console, select Configure > Server Defaults > Advanced.
  - b. In the Add a Value field, enter: `org.forgerock.openam.session.stateless.rsa.padding`.
  - c. In the corresponding Add a Value field, enter one of the padding options. For example, **RSA-OAEP**. The default is **RSA-OAEP-256**.
  - d. Click the plus sign ("+"), and then click Save Changes.
4. For the underlying content encryption method, select one of the following encryption methods supported in AM:
  - **A128CBC-HS256.** AES 128-bit in CBC mode with HMAC-SHA-256-128 hash (HS256 truncated to 128 bits)

- **A192CBC-HS384**. AES 192-bit in CBC mode with HMAC-SHA-384-192 hash (HS384 truncated to 192 bits)
  - **A256CBC-HS512**. AES 256-bit in CBC mode with HMAC-SHA-512-256 hash (HS512 truncated to 256 bits)
  - **A128GCM**. AES 128-bit in GCM mode
  - **A192GCM**. AES 192-bit in GCM mode
  - **A256GCM**. AES 256-bit in GCM mode
- a. In the AM console, select **Configure > Server Defaults > Advanced**.
  - b. In the **Add a Value** field, enter: `org.forgerock.openam.session.stateless.encryption.method`.
  - c. In the corresponding **Add a Value** field, enter one of the padding options. For example, `A128CBC-HS512`. The default is `A128CBC-HS256`.
  - d. Click the plus sign ("+"), and then click **Save Changes**.
5. In the **Encryption RSA Certificate Alias** field, enter an alias value to use for encrypting the JWT signature.
- AM retrieves the certificate from the keystore specified by the `com.sun.identity.saml.xmlsig.keystore` property.
6. If you selected **AES KeyWrapping** or **Direct AES Encryption**, enter the key in the **Symmetric AES Key** and **Symmetric AES Key (Confirm)** fields.
- This should be a base64-encoded random key. For direct encryption with AES-GCM or for AES-KeyWrap with any content encryption method, this should be 128, 192 or 256 bits.
- For direct encryption with AES-CBC-HMAC it should be double those sizes (one half for the AES key, the other half for the HMAC key). AES key sizes greater than 128 bits require installation of the JCE Unlimited Strength policy files in your JRE.
7. Click **Save**.
  8. Ensure that the JWT signature configuration is identical on every AM server in your AM site.
  9. To compress the session state, select **Deflate Compression** next to **Compression Algorithm**.

**Warning**

When set to **Deflate compression**, this option may lead to possible vulnerability with session state information leakage. Because the session token compression depends on the data in the session, an attacker can vary one part of the session (for example, the username or some other property) and then deduce some secret parts of the session state by examining how the session compresses. You should evaluate this threat depending on your use cases before enabling compression and encryption together.

For detailed information about Session Service configuration attributes, see the entries for "Session" in the *Reference*.

### 6.1.3.3. Configuring Elliptic Curve Digital Signature Algorithms

AM supports Elliptic Curve Digital Signature Algorithms (ECDSA) as an alternative to RSA cryptography (RS256) or HMAC with SHA (HS256, HS384, HS512) signatures (see the JSON Web Algorithms specification, RFC 7518). The elliptic curve algorithms provide smaller key lengths for the same level of security that RSA provides (256-bit elliptic curve key vs 2048-bits RSA). The smaller key lengths result in faster signature and key generation times, and faster data transmission over TLS. One disadvantage for ECDSA is that signature verification can be significantly slower on the JVM.

AM supports the following elliptic curve signature algorithms:

- **ES256**. Elliptic Curve Digital Signature Algorithm (ECDSA) using SHA-256 hashes and the NIST standard P-256 elliptic curve. For more information on the NIST curves, see [Digital Signature Standard \(DSS\)](#).
- **ES384**. ECDSA using SHA-384 hashes and NIST standard P-384 curve.
- **ES512**. ECDSA using SHA-512 hashes and NIST standard P-521 curve.

#### *To Configure Elliptic Curve Digital Signature Algorithms*

1. Generate the public and private keys to use with the ECDSA algorithms using the standard curves parameters. You can use **keytool** to generate these key pairs. The following examples use a JCEKS keystore to store the keys:

a. To generate an ES256-compatible keypair (picks the P-256 NIST curve):

```
keytool -genkeypair -keystore mykeystore.jceks -alias ecdsa-test-cert -storepass xxx \  
-keypass yyy -dname 'CN=...' -storetype JCEKS -keyalg ec -keysize 256 \  
-validity 365
```

b. To generate an ES384-compatible keypair (picks the P-384 NIST curve):

```
keytool -genkeypair -keystore mykeystore.jceks -alias ecdsa-test-cert -storepass xxx \  
-keypass yyy -dname 'CN=...' -storetype JCEKS -keyalg ec -keysize 384 \  
-validity 365
```

c. To generate an ES512-compatible keypair (picks the P-521 NIST curve):

```
keytool -genkeypair -keystore mykeystore.jceks -alias ecdsa-test-cert -storepass xxx \  
-keypass yyy -dname 'CN=...' -storetype JCEKS -keyalg ec -keysize 521 \  
-validity 365
```

#### Note

For ES512, the **-keysize** is **521**, not **512**.

2. Configure the ECDSA on AM:

- a. On the AM console, navigate to Configure > Global Services > Session. Click the Stateless Session tab.
- b. On the Signing Algorithm Type drop-down list, select the ECDSA algorithm that matches the alias in your keystore. For example, select **ES256** if you generated a ES256-compatible keypair.
- c. In the Signing RSA/ECDSA Certificate Alias field, enter the certificate alias that points to the ECDSA keypair.

### Stateless Session page with Signing Algorithm Type

## Session

Global Attributes
General
Session Search
Session Property Change Notifications
Session Quotas

<b>Signing Algorithm Type</b>	<input style="width: 90%;" type="text" value="HS256"/>	<a href="#">?</a>
<b>Signing HMAC Shared Secret</b>	<input "="" style="width: 90%;" type="text" value="GVKrcK/DenjD/ZS67IgpJ4VSbRsQIVrzF5wZXGPG+Ug="/>	<a href="#">?</a>
<b>Signing RSA/ECDSA Certificate Alias</b>	<input style="width: 90%;" type="text" value="test"/>	<a href="#">?</a>
<b>Encryption Algorithm</b>	<input style="width: 90%;" type="text" value="DIRECT"/>	<a href="#">?</a>
<b>Encryption RSA Certificate Alias</b>	<input style="width: 90%;" type="text" value="test"/>	<a href="#">?</a>
<b>Enable Session Blacklisting</b>	<input type="checkbox"/>	<a href="#">?</a>
<b>Session Blacklist Cache Size</b>	<input style="width: 90%;" type="text" value="10000"/>	<a href="#">?</a>
<b>Blacklist Poll Interval (seconds)</b>	<input style="width: 90%;" type="text" value="60"/>	<a href="#">?</a>
<b>Blacklist Purge Delay (minutes)</b>	<input style="width: 90%;" type="text" value="1"/>	<a href="#">?</a>
<b>Symmetric AES Key</b>	<input style="width: 90%;" type="text" value="....."/>	<a href="#">?</a>
<b>Compression Algorithm</b>	<input style="width: 90%;" type="text" value="NONE"/>	<a href="#">?</a>

3. Save your changes.

## 6.1.4. Configuring Session Blacklisting

Session blacklisting ensures that users who have logged out of stateless sessions cannot achieve single sign-on without reauthenticating to AM.

Perform the following steps to configure session blacklisting:

### *To Configure Session Blacklisting*

1. Make sure that you deployed the Core Token Service during AM installation. The session blacklist is stored in the Core Token Service's token store.
2. Navigate to Configure > Global Services, click Session, and then locate the Stateless Sessions section.
3. Select the Enable Session Blacklisting option to enable session blacklisting for stateless sessions. When you configure one or more AM realms for stateless sessions, you should enable session blacklisting in order to track session logouts across multiple AM servers.
4. Configure the Session Blacklist Cache Size property.

AM maintains a cache of logged out stateless sessions. The cache size should be around the number of logouts expected in the maximum session time. Change the default value of 10,000 when the expected number of logouts during the maximum session time is an order of magnitude greater than 10,000. An underconfigured session blacklist cache causes AM to read blacklist entries from the Core Token Service store instead of obtaining them from cache, which results in a small performance degradation.

5. Configure the Blacklist Poll Interval property.

AM polls the Core Token Service for changes to logged out sessions if session blacklisting is enabled. By default, the polling interval is 60 seconds. The longer the polling interval, the more time a malicious user has to connect to other AM servers in a cluster and make use of a stolen session cookie. Shortening the polling interval improves the security for logged out sessions, but might incur a minimal decrease in overall AM performance due to increased network activity.

6. Configure the Blacklist Purge Delay property.

When session blacklisting is enabled, AM tracks each logged out session for the maximum session time plus the blacklist purge delay. For example, if a session has a maximum time of 120 minutes and the blacklist purge delay is one minute, then AM tracks the session for 121 minutes. Increase the blacklist purge delay if you expect system clock skews in a cluster of AM servers to be greater than one minute. There is no need to increase the blacklist purge delay for servers running a clock synchronization protocol, such as Network Time Protocol.

7. Click Save.

For detailed information about Session Service configuration attributes, see the entries for "Session" in the *Reference*.



## 6.1.5. Limitations When Using Stateless Sessions

The following AM features are not supported in realms that use stateless sessions:

- **Session upgrade.** See "Session Upgrade".
- **Session quotas.** See "Implementing Session Quotas".
- **Authorization policies with conditions that reference current session properties.** See "Configuring Policies" in the *Authorization Guide*.
- **Cross-domain single sign-on.** See "Cross-Domain SSO".
- **SAML v2.0 single sign-on and single logout.** See "SAML v2.0 and Session State" in the *SAML v2.0 Guide*.
- **SAML 1.x single sign-on.** See the SAML v1.x Guide.
- **SNMP session monitoring.** See "SNMP Monitoring for Sessions" in the *Setup and Maintenance Guide*.
- **Session management by using the AM console.** See "Managing Sessions" in the *Setup and Maintenance Guide*.
- **Session notification.** See "Session" in the *Reference*.

## 6.2. Implementing Session Quotas

AM lets you limit the number of active sessions for a user by setting session quotas. You also configure session quota exhaustion actions so that when a user goes beyond the session quota, AM takes the appropriate action.

AM's support for session quotas requires stateful sessions. Be sure that AM is configured for stateful sessions—the default configuration—before attempting to configure session quotas.

### *To Configure Session Quotas and Exhaustion Actions*

The session quota applies to all sessions opened for the same user (as represented by the user's universal identifier). To configure:

1. Log in to the AM console as administrator, navigate to Configure > Global Services, and then click Session.
2. Set Enable Quota Constraints to **ON**.
3. Set Resulting behavior if session quota exhausted.

The following settings are available by default:

**DENY\_ACCESS**

Deny access, preventing the user from creating an additional session.

**DESTROY\_NEXT\_EXPIRING**

Remove the next session to expire, and create a new session for the user. The next session to expire is the session with the minimum time left until expiration.

This is the default setting.

**DESTROY\_OLDEST\_SESSION**

Remove the oldest session, and create a new session for the user.

**DESTROY\_OLD\_SESSIONS**

Remove all existing sessions, and create a new session for the user.

If none of these session quota exhaustion actions fit your deployment, you can implement a custom session quota exhaustion action. For an example, see "Customizing Session Quota Exhaustion Actions".

4. Set Active User Sessions to the session quota.

The default is 5 sessions.

5. Save your work.

## Chapter 7

# Implementing Single Sign-On

Single sign-on (SSO) allows a user or an entity to access multiple independent services from a single login session. AM supports SSO on the domain level and across multiple domains using cross-domain single sign-on (CDSSO).

This chapter explains how to set up SSO and CDSSO in AM:

- "About HTTP Cookies"
- "Implementing Single Sign-On Within One Domain"
- "Implementing Cross-Domain Single Sign-On"

## 7.1. About HTTP Cookies

To understand how SSO works, you need to understand some key elements of the HTTP cookie, as described in RFC 6525, HTTP State Management Mechanism .

Within an HTTP cookie, you can store a single custom *name=value* pair, such as *sessionid=value*. Other custom names within a cookie are as follows:

### Domain

Normally set to the full URL that was used to access the configurator. To work with multiple subdomains, the `Domain` should be set to a URL like `Domain=server.example.net`. This is also known as the cookie domain.

### Path

The directory in the URL to which the cookie applies. If the `Path=/openam`, the cookie applies to the `/openam` subdirectory of the URL, and lower level directories, including `openam/XUI`.

### Secure

If the `Secure` name is included, the cookie can be transferred only over HTTPS. When a request is made over HTTP, the cookie is not made available to the application.

### HttpOnly

When the `HttpOnly` flag is included, that cookie will not be accessible through JavaScript. According to RFC 6265, the noted flag "instructs the user agent to omit the cookie when

providing access to cookies via 'non-HTTP' APIs (for example, a web browser API that exposes cookies to scripts)."

For more information, see "Configuring HttpOnly".

## Expires

The lifetime of a cookie can be limited, with an `Expires` name configured with a time, based on UTC (GMT).

### Warning

Do not take a shortcut with a top-level domain. Web browser clients today are designed to ignore cookies set to top-level domains including `com`, `net`, and `co.uk`. In addition, a cookie with a value like `Domain= app1.example.net` will not work for similar subdomains, such as `app2.example.net`.

## 7.1.1. Configuring HttpOnly

AM supports an `HttpOnly` flag, which is affixed to the `Set-cookie` HTTP response header transmitted from the server to the browser. The `HttpOnly` flag mitigates against cross-site scripting (XSS) vulnerabilities that can be exploited through JavaScript or other scripting languages.

When the `HttpOnly` flag is enabled:

- AM sets the token as `HttpOnly`. For example, the `/json/authenticate` endpoint returns a `Set-Cookie` header upon successful authentication. When `HttpOnly` is enabled, the header will include an `HttpOnly` flag with the original token in the payload of the `Set-Cookie` header as shown in the following example:

```
Set-Cookie: iPlanetDirectoryPro='AQIC5..*'; Domain=example.com; Path=/; HttpOnly
...
```

- When an invalid token is detected when calling the `/json/authenticate` endpoint, the token is ignored and authentication continues. An additional `Set-Cookie` header is set to remove the invalid token from the client.
- Upon logout, the session cookie on the client is cleared by the `Set-Cookie` header in the response:

```
Set-Cookie: iPlanetDirectoryPro=""; Expires=Thu, 01 Jan 1970 00:00:10 GMT; Path=/; Domain=example.com; HttpOnly
Set-Cookie: amlbcookie=LOGOUT; Expires=Thu, 01 Jan 1970 00:00:10 GMT; Path=/; Domain=example.com
...
```

- The User self-service auto login feature during the user registration process returns a `Set-Cookie` header in the response.

- Session upgrade automatically occurs upon the current SSO token when the `/json/authenticate` endpoint is called and the token was previously passed in.

You can configure HttpOnly using the administration console:

### *To Configure the HttpOnly Flag*

1. Log into the AM console as an administrator.
2. In the AM console, select Configure > Server Defaults > Advanced.
3. Search for `com.sun.identity.cookie.httponly`. In the Add a Value field, change the value to `true`, and then click the checkmark.
4. Click Save Changes, and then restart your server.

## 7.2. Implementing Single Sign-On Within One Domain

This section describes how you configure AM for SSO on a single domain. It also covers several potential problems you might encounter when implementing SSO.

For general information about how SSO works in AM, see "Single Domain SSO".

The following procedure assumes that you know how to configure AM, the Apache Web server, and associated AM Apache agent.

### *To Configure SSO on One Domain*

1. Install AM as described in the "Installing and Starting Servers" in the *Installation Guide*. This procedure uses a Server URL of `http://openam.example.net:8080/openam`.
2. Install the appropriate policy agent, as described in the *ForgeRock Access Management Web Policy Agent User's Guide* or the *ForgeRock Access Management Java EE Policy Agent User's Guide*. This procedure uses an agent URL of `http://app.example.net:80`, and an agent name of `webagent1`.
3. Return to the AM server on `http://openam.example.net:8080/openam`. Log in as the administrative user, normally `amadmin`. To activate and configure the agent, follow the procedure described in the *ForgeRock Access Management Web Policy Agent User's Guide* or the *ForgeRock Access Management Java EE Policy Agent User's Guide*.
4. Now you can configure SSO Only mode. In the AM console, navigate to Realms > *Realm Name* > Applications > Agents > J2EE > `webagent1`. Scroll down to SSO Only Mode and activate the Enabled box.
5. Save your changes.

6. Make sure you have configured the SSO domain, in this case, `example.net`. Navigate to Configure > Global Services > System, and then click Platform. Make sure `example.net` (or your chosen domain) is selected as a cookie domain.
7. Save your changes.
8. Restart the web server. The agent should be active. You should now be able to log out of the AM server.
9. Verify the agent URL, in this case, `http://app.example.net`. The AM web agent should now redirect requests to the AM server.

If you want to configure AM and an application on two different cookie domains, such as `example.org` and `example.net`, you need to set up cross-domain SSO (CDSSO). For more information, see "Implementing Cross-Domain Single Sign-On".

### 7.2.1. Potential Problems

In general, problems with SSO relate to some sort of mismatch of domain names. For example, a cookie that is configured on a third-level domain, such as `sso.example.net` will not work with an application on a similar domain, such as `app.example.net`. Even if the Session ID is valid, the application will not receive the SSO Token. The request is then redirected to AM. The client gets what appears as a SSO Token in the diagram, which is actually a valid SSO tracking cookie that redirects immediately, and the cycle continues. Other issues that may lead to similar problems are shown here:

- When a cookie domain does not match a domain for the protected application.

Assume the application is configured on a domain named `example.org`. That application will not receive an SSO Token configured on the `example.net` domain.

- When a third-level domain is used for the SSO Token.

If an SSO Token is configured on `sso.example.net`, an application on `app.example.net` does not receive the corresponding cookie. In this case, the solution is to configure the SSO Token on `example.net`.

- When the Secure flag is used with a regular HTTP application.

If you need encrypted communications for an application protected by AM, use the Secure flag and make sure the application is accessible over HTTPS.

- When the path listed in the cookie does not match the path for the application.

Perhaps the cookie is configured with a `/helloworld` path; that will not match an application that might be configured with a `/hellomars` path. In that case, the application will not receive the cookie.

- When an inappropriate name is used for the cookie domain

As noted earlier, client browsers are configured to ignore first-level domains, such as `com` and `net` as well as functional equivalents, such as `co.uk` and `co.jp`.

- When working with different browsers

The `name = value` pairs described earlier may not apply to all browsers. The requirements for an HTTP cookie sent to an IE browser may differ from the requirements for other standard browsers, such as Firefox and Chrome. Based on anecdotal reports, IE does not recognize domain names that start with a number. In addition, IE reportedly refuses cookies that include the underscore ( `_` ) character in the FQDN.

- When a stateless session cookie exceeds the maximum size permitted by the browser

As described in "Session Cookies", the default size of the `iPlanetDirectoryPro` cookie is approximately 2,000 bytes. When you customize AM sessions by adding attributes, the cookie size grows. Browsers allow cookie sizes between 4,000 and 5,200 bytes, depending on the browser. AM single sign-on does not function correctly when the cookie size exceeds the maximum size allowed by the browser.

## 7.3. Implementing Cross-Domain Single Sign-On

This section shows you how to implement cross-domain single sign-on (CDSSO). For general information about how CDSSO works in AM, see "Cross-Domain SSO".

This section includes the following procedures:

- "To Enable CDSSO For a Java EE Policy Agent"
- "To Enable CDSSO For a Web Policy Agent"
- "To Indicate Progress During CDSSO Login"
- "To Protect Against Cookie Hijacking"

The federation mechanism associated with SAML v2.0 can be used as an alternative to CDSSO for both Web and Java EE policy agents. While using SAML v2.0 adds complexity, it supports attribute mapping, which may be useful when the two domains are associated with data stores that use different attribute names. For details, see "Using Policy Agents With Standalone Mode" in the *SAML v2.0 Guide*.

### *To Enable CDSSO For a Java EE Policy Agent*

1. In the AM console, navigate to Realms > *Realm Name* > Applications > Agents > J2EE > *Agent Name* > SSO.
2. Scroll down and enable Cross Domain SSO.
3. Check that the CDSSO Redirect URI is set.

Depending on where you deployed your Java EE agent application, the default is something like `/agentapp/sunwCDSSORedirectURI`.

4. Set the list of URLs for CDSSO Servlet URL to the Cross Domain Controller Servlet URLs of the servers the agent accesses, such as `http://openam.example.com:8080/openam/cdcervlet`.

If the agent accesses AM through a load balancer, use the load balancer URLs, such as <http://load-balancer.example.com:8080/openam/cdcservlet>.

5. Leave the CDSSO Clock Skew set to 0.

Make sure instead that the clocks on the servers where you run AM and policy agents are synchronized.

6. Set the list of URLs for CDSSO Trusted ID Provider to the Cross Domain Controller Servlet URLs of the AM servers the agent accesses, such <http://openam.example.com:8080/openam/cdcservlet>.

This list should include one CDC Servlet URL for every AM server the agent might access. You do not need to include site or load balancer URLs.

7. (Optional) To protect the SSO token from network snooping, you can select CDSSO Secure Enable to mark the SSO token cookie as secure.

If you select this, then the SSO token cookie can only be sent over a secure connection (HTTPS).

8. Add the domains involved in CDSSO in the CDSSO Domain List.

9. If necessary, update the Agent Root URL for CDSSO list on the Global tab page.

If the policy agent is on a server with virtual host names, add the virtual host URLs to the list.

If the policy agent is behind a load balancer, add the load balancer URL to the list.

10. Save your work.

### *To Enable CDSSO For a Web Policy Agent*

1. In the AM console, navigate to Realms > *Realm Name* > Applications > Agents > Web > *Agent Name* > SSO.

2. Enable Cross Domain SSO.

3. Set the list of URLs for CDSSO Servlet URL to the Cross Domain Controller Servlet URLs of the servers the agent accesses, such as <http://openam.example.com:8080/openam/cdcservlet>.

If the agent accesses AM through a load balancer, use the load balancer URLs, such as <http://load-balancer.example.com:8080/openam/cdcservlet>.

4. Add the domains involved in CDSSO in the Cookies Domain List.

5. If necessary, update the Agent Root URL for CDSSO list on the Global tab page.

If the policy agent is on a server with virtual host names, add the virtual host URLs to the list.

If the policy agent is behind a load balancer, add the load balancer URL to the list.



6. Save your work.

### *To Indicate Progress During CDSSO Login*

The default self-submitting form page that AM presents to users contains hidden fields, but is otherwise blank. If you want to show users that the operation is in progress, then customize the necessary JSP.

1. Edit a copy of the file `config/federation/default/cdclogin.jsp` to add a clue that SSO is in progress, such as an image.

You can find this file where you deployed AM, such as `/path/to/tomcat/webapps/openam/config/federation/default/cdclogin.jsp`.

When you add an image or other presentation element, make sure that you retain the form and JavaScript as is.

2. Unpack the `AM-5.1.1.war` file and replace the `cdclogin.jsp` file with your modified version. Also, include any images you reference in the page.
3. Pack up your custom version of AM, and then deploy it in your web container.

### *To Access the CDSSO Authentication Login*

When a client makes an access request to some protected resource in a cross domain single sign-on deployment, the policy agent redirects the client to the Cross Domain Controller Servlet (CDCServlet) URL. The CDCServlet determines that the client needs to be authenticated and proxies the request to an authentication interface, typically at `/XUI/#login`:

```
http://openam.example.com:8080/openam/XUI/#login
```

If your application requires access to a specific URL, you can use the `loginURI` parameter to do so.

1. For example, you can access the previous authentication UI URL as follows:

```
http://openam.example.com:8080/openam/cdcservlet?loginURI=/XUI/#login
```

2. If you have another authentication UI deployed at `/openam/customLoginURI`, you can access this URL at:

```
http://openam.example.com:8080/openam/cdcservlet?loginURI=/customLoginURI
```

In this case, you must also add the custom login URI to the whitelist that is specified by using the `org.forgerock.openam.cdc.validLoginURIs` property.

- a. In the AM console, navigate to `Configure > Server Defaults > Advanced`.
- b. Set the value of the `org.forgerock.openam.cdc.validLoginURIs` property to `/XUI/#login,/customLoginURI`.
- c. Save your work.

For more information about this property, see "Advanced Properties" in the *Reference*.

## To Protect Against Cookie Hijacking

When cookies are set for an entire domain, such as `.example.com`, an attacker who steals a cookie can use it from any host in the domain, such as `untrusted.example.com`. Cookie hijacking protection restricts cookies to the fully-qualified domain name (FQDN) of the host where they are issued, such as `openam-server.example.com` and `server-with-agent.example.com`, using CDSSO to handle authentication and authorization.

For CDSSO with cookie hijacking protection, when a client successfully authenticates AM issues the master SSO token cookie for its FQDN. AM issues *restricted token* cookies for the other FQDNs where the policy agents reside. The client ends up with cookies having different session identifiers for different FQDNs, and the AM server stores the correlation between the master SSO token and restricted tokens, such that the client only has one master session internally in AM.

To protect against cookie hijacking, you restrict the AM server domain to the server where AM runs. This sets the domain of the SSO token cookie to the host running the AM server that issued the token. You also enable use of a unique SSO token cookie. For your Java EE policy agents, you enable use of the unique SSO token cookie in the agent configuration.

1. In the AM console, navigate to Configuration > Global Services > System, and then select Platform.
  - a. Remove all domains from the Cookies Domains list.
  - b. Save your work.
2. Navigate to Configure > Server Defaults > Advanced.
  - a. Change the value of the `com.sun.identity.enableUniqueSSOTokenCookie` property to `true`, from the default `false`.
  - b. Make sure that the property `com.sun.identity.authentication.uniqueCookieName` is set to the name of the cookie that will hold the URL to the AM server that authenticated the user.  
  
The default name is `sunIdentityServerAuthNServer`.
  - c. Save your work.
3. Navigate to Deployment > Servers > *Server Name* > Advanced, and add the property `com.sun.identity.authentication.uniqueCookieDomain`, setting the value to the FQDN of the current AM server, such as `openam.example.com`.  
  
Save your work.
4. (Optional) For each Java EE policy agent, navigate to Realms > *Realm Name* > Applications > Agents > J2EE > *Agent Name* > Advanced > Custom Properties, and add the `com.sun.identity.enableUniqueSSOTokenCookie=true` property to the list.

Save your work.

5. Restart AM or the container in which it runs for the configuration changes to take effect.

## Chapter 8

# Using Authentication

This chapter covers how to authenticate and log out.

You can authenticate:

- From a browser, using the *extended user interface (XUI)*. See "Authenticating Using the XUI".
- By using the REST API. See "Authenticating by Using the REST API".

## 8.1. Authenticating From a Browser

You can use the XUI to authenticate from a browser.

### 8.1.1. Authenticating Using the XUI

When using the XUI, the base URL to authenticate to points to `/XUI/#login` under the deployment URL, such as `http://openam.example.com:8080/openam/XUI/#login`.

The base URL to log out is similar, for example, `http://openam.example.com:8080/openam/XUI/#logout/`.

#### 8.1.1.1. Specifying the Realm in the Login URL

When making a request to the XUI, specify the realm or realm alias as the value of a `realm` parameter in the query string, or the DNS alias in the domain component of the URL. If you do not use a realm alias, then you must specify the entire hierarchy of the realm, starting at the top-level realm. For example `https://openam.example.com:8443/openam/XUI?realm=/customers/europe#login/`.

The following table demonstrates additional examples:

*Options for Specifying the Realm in XUI Login URLs*

Description	Example URL
Full path of the realm as a parameter of <code>XUI</code>	<code>http://openam.example.com:8080/openam/XUI?realm=/customers/europe#login</code>
Realm alias of the realm as a parameter of <code>XUI</code>	<code>http://openam.example.com:8080/openam/XUI?realm=myrealm#login</code>

Description	Example URL
DNS Alias of the realm as the fully-qualified host name in the URL	<code>http://myRealm.example.com:8080/openam/XUI/#login</code>

The DNS alias is overridden by any use of either the full path or a realm alias as a query string parameter.

### 8.1.1.2. Example XUI Login URLs

Use any of the options listed in "Authentication Parameters" as URL parameters. The following are example URLs with parameters:

#### *Example XUI Login URLs*

Description	Example URL
Log in to the top level realm, requesting that AM display the user interface in German.	<code>http://openam.example.com:8080/openam/XUI/?realm=#login&amp;locale=de</code>
Log in to the <code>myRealm</code> subrealm whose parent is the top-level realm, requesting that AM display the user interface in German.	<code>http://openam.example.com:8080/openam/XUI/?realm=/myRealm#login&amp;locale=de</code>
Log in to the <code>myRealm</code> subrealm whose parent is the top-level realm using the <code>HOTPChain</code> authentication chain, requesting that AM display the user interface in German.	<code>http://openam.example.com:8080/openam/XUI/?realm=/myRealm#login&amp;locale=de&amp;service=HOTPChain</code>

### 8.1.2. Authentication Parameters

AM accepts the following parameters in the query string. With the exception of `IDToken` parameters, use no more than one occurrence of each.

#### **arg=newsession**

Request that AM end the user's current session and start a new session.

#### **authlevel**

Request that AM authenticate the user using a module with at least the specified authentication level that you have configured.

As this parameter determines authentication module selection, do not use it with `module`, `service`, or `user`.

## ForceAuth

If `ForceAuth=true`, request that AM force the user to authenticate even if they already has a valid session. On successful authentication, AM updates the session token.

## goto

On successful authentication, or successful logout, request that AM redirect the user to the specified location. Values must be URL-encoded. See "Constraining Post-Login Redirects" for more information.

## gotoOnFail

On authentication failure, request that AM redirect the user to the specified location. Values must be URL-encoded. See "Constraining Post-Login Redirects" for more information.

## IDToken1, IDToken2, ..., IDTokenN

Pass the specified credentials as `IDToken` parameters in the URL. The `IDToken` credentials map to the fields in the login page for the authentication module, such as `IDToken1` as user ID and `IDToken2` as password for basic user name, password authentication. The order depends on the callbacks in login page for the module; `IDTokenN` represents the N<sup>th</sup> callback of the login page.

## locale

Request that AM display the user interface in the specified, supported locale. Locale can also be set in the user's profile, in the HTTP header from her browser, configured in AM, and so on.

## module

Request that AM use the authentication module instance as configured for the realm where the user is authenticating.

As this parameter determines authentication module selection, do not use it with `authlevel`, `service`, or `user`.

## realm

Request that AM authenticate the user to the specified realm.

## service

Request that AM authenticate the user with the specified authentication chain.

As this parameter determines authentication module selection, do not use it with `authlevel`, `module`, or `user`.

## user

Request that the user, specified by their AM universal ID, authenticates according to the chain specified by the User Authentication Configuration property in their user profile. You can configure this property for a user under Realms > *Realm Name* > Subjects > User > *User Name*.

In order for the User Authentication Configuration property to appear in user profiles, the `iplanet-am-user-service` object class must contain the `iplanet-am-user-auth-config` attribute in the identity repository schema. The default identity repository schemas provided with AM include this object class and attribute. See "Preparing an External Identity Repository" in the *Installation Guide* for information about identity repository schema.

As this parameter determines authentication module selection, do not use it with `authlevel`, `module`, or `service`.

### 8.1.3. Constraining Post-Login Redirects

By default, AM redirects the user to the URL specified in the `goto` and `gotoOnFail` query string parameters supplied to the authentication interface during login and logout. You can increase security against possible phishing attacks through open redirect by specifying a list of valid URL resources using the Validation Service.

AM only redirects a user if the `goto` and `gotoOnFail` URL matches any of the resources specified in this setting. If no setting is present, it is assumed that the `goto` or `gotoOnFail` URL is valid.

The URL whitelisting and pattern matching follow the wildcard rules as specified in "Specifying Resource Patterns with Wildcards" in the *Authorization Guide*.

Here are some general examples of URL pattern matching:

- If no port is specified, `http://www.example.com` canonicalizes to `http://www.example.com:80` and `https://www.example.com` canonicalizes to `https://www.example.com:443`.

- A wildcard before `://` only matches up to `://`

For example, `http*://*.com/*` matches `http://www.example.com/hello/world` and `https://www.example.com/hello`.

- A wildcard between `://` and `:` matches up to `:`

For example, `http*/*:85` matches `http://www.example.com:85`.

- A wildcard between `:` and `/` only matches up to the first `/`

For example, `http://www.*:*/` matches `http://www.example.com:80`. In another example, `http://www.example.com:*` matches `http://www.example.com:[any port]` and `http://www.example.com:[any port]/`, but nothing more.

- A wildcard after `/` matches anything, depending on whether it is single-level or a wildcard appropriately.

For example, `https://www.example.com/*` matches `https://www.example.com:443/foo/bar/baz/me`

- If you do not use any wildcards, AM exactly matches the string, so `http://www.example.com` only matches `http://www.example.com`, but NOT `http://www.example.com/` (trailing slash).

If you put the wildcard after the path, AM expects a path (even if it is blank), so `http://www.example.com/*` matches `http://www.example.com/` and `http://www.example.com/foo/bar/baz.html`, but NOT `http://www.example.com`.

- `http://www.example.com:*/` matches `http://www.example.com/`, which also canonicalizes to `http://www.example.com:80/`.
- `https://www.example.com:*/` matches `https://www.example.com/`, which also canonicalizes to `https://www.example.com:443/`.

### To Configure the Validation Service

1. In the AM console, navigate to Realms > *Realm Name* > Services.
2. Click Add a Service.
3. In the Choose a service type drop-down list, select Validation Service.
4. In the Valid goto URL Resources field, enter a valid URL pattern to whitelist.

For example, `http://app.example.com:80/*?*`

5. Click Create to save your settings.

## 8.2. Authenticating by Using the REST API

For information about how to authenticate to AM using the REST API, see "Authentication and Logout".

For information about how to use the session token returned from the REST API when authentication is successful, see "Using the Session Token After Authentication".

### 8.2.1. Sample Mobile Authentication Applications

Source code for sample mobile applications is available in sample repositories in the ForgeRock commons project. Get local clones of one or more of the following repositories so that you can try these sample applications on your system:

- AM access from iOS
- AM single sign-on from iOS
- AM authentication and logout using PhoneGap



## Chapter 9

# Using Sessions

This chapter covers how to use the REST API to work with OpenAM sessions.

OpenAM provides REST APIs under `/json/sessions` for validating SSO tokens and getting information about active sessions.

## 9.1. Obtaining Information About Sessions

To obtain information about a session, perform an HTTP POST to the `/json/sessions/` endpoint, using the `getSessionInfo` action. The endpoint will return information about the session token provided in the `iPlanetDirectoryPro` header by default. To get information about a different session token, include it as the value of the `tokenId` query parameter.

For example, the following shows an administrative user passing their session token in the `iPlanetDirectoryPro` header, and the session token of the `demo` user as the `tokenId` query parameter:

```
$ curl \
--request POST \
--header "iPlanetDirectoryPro: AQIC4Dm...NTcy*" \
http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=getSessionInfo&tokenId=AQIC5..
.QAA*
{
  "username": "demo",
  "universalId": "id=demo,ou=user,dc=openam,dc=forgerock,dc=org",
  "realm": "/",
  "sessionHandle": "shandle:AQIC5wM2LY4SfcwbAHB6MVwCq-0Yvy9j0vjlbjLrT-797oE
.*AAJTSQACMDEAALNLABQtMzQ20TawMTU3MTg5MTUzNDUzOAACUzEAAA.*",
  "latestAccessTime": "2017-01-16T13:37:44Z",
  "maxIdleExpirationTime": "2017-01-16T14:07:44Z",
  "maxSessionExpirationTime": "2017-01-16T15:34:41Z"
}
```

## 9.2. Validating Sessions

To check over REST whether a session token is valid, perform an HTTP POST to the `/json/sessions/` endpoint using the `getSessionInfo` action. The endpoint validates the session token provided in the `iPlanetDirectoryPro` header by default. To validate a different session token, include it as the value of the `tokenId` query parameter.

If the session token is not valid, a `"valid": false` JSON message is returned, as shown below:

```
$ curl \
  --request POST \
  --header "iplanetDirectoryPro: AQIC4Dm...NTcy*" \
  http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=getSessionInfo&tokenId=644
.5e5510n.1d
{
  "valid": false
}
```

## 9.3. Refreshing Stateful Sessions

To reset the idle time of a stateful session using REST, perform an HTTP POST to the `/json/sessions/` endpoint, using the `refresh` action. The endpoint will refresh the session token provided in the `iPlanetDirectoryPro` header by default. To refresh a different session token, include it as the value of the `tokenId` query parameter.

The following example shows an administrative user passing their session token in the `iPlanetDirectoryPro` header, and the session token of the `demo` user as the `tokenId` query parameter:

```
$ curl \
  --request POST \
  --header "iplanetDirectoryPro: AQIC5w...NTcy*" \
  http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=refresh&tokenId=BXCCq...NX*1*
{
  "username": "demo",
  "universalId": "id=demo,ou=user,dc=openam,dc=forgerock,dc=org",
  "realm": "/",
  "latestAccessTime": "2017-09-06T15:31:37Z",
  "maxIdleExpirationTime": "2017-09-06T16:01:37Z",
  "maxSessionExpirationTime": "2017-09-06T17:28:47Z",
  "properties":{}
}
```

On success, OpenAM resets the idle time for the stateful session, and returns timeout details of the session.

Resetting a stateful session's idle time triggers a write operation to the Core Token Service token store. Therefore, to avoid the overhead of write operations to the token store, be careful to use the `refresh` action only if you want to reset a stateful session's idle time.

Because OpenAM does not monitor idle time for stateless sessions, do not use the `tokenId` of a stateless session when refreshing a session's idle time.

## 9.4. Invalidating Sessions

To invalidate a session, perform an HTTP POST to the `/json/sessions/` endpoint using the `logout` action. The endpoint will invalidate the session token provided in the `iPlanetDirectoryPro` header:

```
$ curl \
--request POST \
--header "iplanetDirectoryPro: BXCCq...NX*1*" \
http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=logout
{
  "result": "Successfully logged out"
}
```

On success, OpenAM invalidates the session and returns a success message.

If the token is not valid and cannot be invalidated an error message is returned, as follows:

```
{
  "result": "Token has expired"
}
```

To invalidate a different session token, include it as the value of the `tokenId` query parameter.

For example, the following command shows an administrative user passing their session token in the `iPlanetDirectoryPro` header, and the session token of the `demo` user as the `tokenId` query parameter:

```
$ curl \
--request POST \
--header "iplanetDirectoryPro: AQIC5w...NTcy*" \
"http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=logout&tokenId=BXCCq...NX*1*"
{
  "result": "Successfully logged out"
}
```

## 9.5. Getting and Setting Session Properties

OpenAM lets you read and update properties on users' sessions using REST API calls.

Before you can perform operations on session properties using the REST API, you must first define the properties you want to set in the Session Property Whitelist Service configuration. For information on whitelisting session properties, see "Session Property Whitelist Service" in the *Reference*.

You can use REST API calls for the following purposes:

- To retrieve the names of the properties that you can read or update. This is the same set of properties configured in the Session Property Whitelist Service.
- To read property values.
- To update property values.

Session state affects the ability to set and delete properties as follows:

- You can set and delete properties on a stateful session at any time during the session's lifetime.

- You can only set and update properties on a stateless session during the authentication process, before the user receives the session token from OpenAM. For example, you could set or delete properties on a stateless session from within a post-authentication plugin.

Differentiate the user who performs the operation on session properties from the session affected by the operation as follows:

- Specify the session token of the user performing the operation on session properties in the `iPlanetDirectoryPro` header.
- Specify the session token of the user whose session is to be read or modified as the `tokenId` parameter to the REST API call.
- Omit the `tokenId` parameter from the REST API call if the session of the user performing the operation is the session that you want to read or modify.

The following examples assume that you configured a property named `LoginLocation` in the Session Property Whitelist Service configuration.

To retrieve the names of the properties you can get or set, and their values, perform an HTTP POST to the resource URL, `/json/sessions/`, using the `getSessionProperties` action as shown in the following example:

```
$ curl \
  --request POST \
  --header "iPlanetDirectoryPro: AQIC5w...NTcy*" \
  http://openam.example.com:8080/openam/json/realms/root/sessions/?
  _action=getSessionProperties&tokenId=BXCc...NX*1*
{
  "LoginLocation": ""
}
```

To set the value of a session property, perform an HTTP POST to the resource URL, `/json/sessions/`, using the `updateSessionProperties` action. If no `tokenId` parameter is present in the REST API call, the session affected by the operation is the session specified in the `iPlanetDirectoryPro` header, as follows:

```
$ curl \
  --request POST \
  --header "Content-Type: application/json" \
  --header "iPlanetDirectoryPro: BXCc...NX*1*" \
  --data '{"LoginLocation": "40.748440, -73.984559"}' \
  http://openam.example.com:8080/openam/realms/root/json/sessions/?_action=updateSessionProperties
{
  "LoginLocation": "40.748440, -73.984559"
}
```

You can set multiple properties in a single REST API call by specifying a set of fields and their values in the JSON data. For example:

```
--data '{"property1": "value1", "property2": "value2"}'
```

To set the value of a session property on another user's session, specify the session token of the user performing the `updateSessionProperties` action in the `iPlanetDirectoryPro`, and specify the session token to be modified as the value of the `tokenId` parameter:

```
$ curl \
  --request POST \
  --header "Content-Type: application/json" \
  --header "iplanetDirectoryPro: AQIC5w...NTcy*" \
  --data '{"LoginLocation": "40.748440, -73.984559"}' \
  http://openam.example.com:8080/openam/json/realms/root/sessions/?
  _action=updateSessionProperties&tokenId=BXCCq...NX*1*
{
  "LoginLocation": "40.748440, -73.984559"
}
```

If the user attempting to modify the session does not have sufficient access privileges, the preceding examples result in a 403 Forbidden error.

You cannot set properties internal to OpenAM sessions. If you try to modify an internal property in a REST API call, a 403 Forbidden error is returned. For example:

```
$ curl \
  --request POST \
  --header "Content-Type: application/json" \
  --header "iplanetDirectoryPro: AQIC5w...NTcy*" \
  --data '{"AuthLevel": "5"}' \
  http://openam.example.com:8080/openam/json/realms/root/sessions/?
  _action=updateSessionProperties&tokenId=BXCCq...NX*1*
{
  "code": 403,
  "reason": "Forbidden",
  "message": "Forbidden"
}
```

## Chapter 10

# Customizing Authentication

This chapter describes how to customize authentication.

Your deployment might require customizing some standard authentication features. See the following sections for customization examples:

- [Creating a Custom Authentication Module](#)
- [Using a Server-side Authentication Script](#)
- [Creating a Post Authentication Plugin](#)
- [Customizing Session Quota Exhaustion Actions](#)

## 10.1. Creating a Custom Authentication Module

This section shows how to customize authentication with a sample custom authentication module. For deployments with particular requirements not met by existing AM authentication modules, determine whether you can adapt one of the built-in or extension modules for your needs. If not, build the functionality into a custom authentication module.

### 10.1.1. About the Sample Authentication Module

The sample authentication module prompts for a user name and password to authenticate the user, and handles error conditions. The sample shows how you integrate an authentication module into AM such that you can configure the module through the AM console, and also localize the user interface.

For information on downloading and building AM sample source code, see [How do I access and build the sample code provided for OpenAM 12.x, 13.x and AM \(All versions\)?](#) in the *Knowledge Base*.

Get a local clone so that you can try the sample on your system. In the sources, you find the following files under the `/path/to/openam-source/openam-samples/custom-authentication-module` directory:

`pom.xml`

Apache Maven project file for the module

This file specifies how to build the sample authentication module, and also specifies its dependencies on AM components and on the Java Servlet API.

`src/main/java/org/forgerock/openam/examples/SampleAuth.java`

Core class for the sample authentication module

This class is called by AM to initialize the module and to process authentication. See "The Sample Authentication Logic" for details.

`src/main/java/org/forgerock/openam/examples/SampleAuthPrincipal.java`

Class implementing `java.security.Principal` interface that defines how to map credentials to identities

This class is used to process authentication. See "The Sample Auth Principal" for details.

`src/main/resources/amAuthSampleAuth.properties`

Properties file mapping UI strings to property values

This file makes it easier to localize the UI. See "Sample Auth Properties" for details.

`src/main/resources/amAuthSampleAuth.xml`

Configuration file for the sample authentication service

This file is used when registering the authentication module with AM. See "The Sample Auth Service Configuration" for details.

`src/main/resources/config/auth/default/SampleAuth.xml`

Callback file for deprecated AM classic UI authentication pages

The sample authentication module does not include localized versions of this file. See "Sample Auth Callbacks" for details.

## 10.1.2. Sample Auth Properties

AM uses a Java properties file per locale to retrieve the appropriate, localized strings for the authentication module.

The following is the Sample Authentication Module properties file, `amAuthSampleAuth.properties`.

```
sampleauth-service-description=Sample Authentication Module
a500=Authentication Level
a501=Service Specific Attribute

sampleauth-ui-login-header=Login
sampleauth-ui-username-prompt=User Name:
sampleauth-ui-password-prompt=Password:

sampleauth-error-1=Error 1 occurred during the authentication
sampleauth-error-2=Error 2 occurred during the authentication
```

### 10.1.3. Sample Auth Callbacks

AM callbacks XML files are used to build the deprecated classic UI to prompt the user for identity information needed to process the authentication. The document type for a callback XML file is described in `WEB-INF/Auth_Module_Properties.dtd` where AM is deployed.

The value of the `moduleName` property in the callbacks file must match your custom authentication module's class name. Observe that the module name `SampleAuth`, shown in the example below, matches the class name in "The Sample Authentication Logic" [124].

The following is the `SampleAuth.xml` callbacks file.

```
<!DOCTYPE ModuleProperties PUBLIC
  "-//iPlanet//Authentication Module Properties XML Interface 1.0 DTD//EN"
  "jar://com/sun/identity/authentication/Auth_Module_Properties.dtd">

<ModuleProperties moduleName="SampleAuth" version="1.0" >
  <Callbacks length="0" order="1" timeout="600" header="#NOT SHOWN#" />
  <Callbacks length="2" order="2" timeout="600" header="#TO BE SUBSTITUTED#">
    <NameCallback isRequired="true">
      <Prompt>#USERNAME#</Prompt>
    </NameCallback>
    <PasswordCallback echoPassword="false" >
      <Prompt>#PASSWORD#</Prompt>
    </PasswordCallback>
  </Callbacks>
  <Callbacks length="1" order="3" timeout="600" header="#TO BE SUBSTITUTED#"
    error="true" >
    <NameCallback>
      <Prompt>#THE DUMMY WILL NEVER BE SHOWN#</Prompt>
    </NameCallback>
  </Callbacks>
</ModuleProperties>
```

This file specifies three states.

1. The initial state (`order="1"`) is used dynamically to replace the dummy strings shown between hashes (for example, `#USERNAME#`) by the `substituteUIStrings()` method in `SampleAuth.java`.
2. The next state (`order="2"`) handles prompting the user for authentication information.
3. The last state (`order="3"`) has the attribute `error="true"`. If the authentication module state machine reaches this order then the authentication has failed. The `NameCallback` is not used and not displayed to user. AM requires that the callbacks array have at least one element. Otherwise AM does not permit header substitution.

### 10.1.4. The Sample Authentication Logic

An AM authentication module must extend the `com.sun.identity.authentication.spi.AMLoginModule` abstract class, and must implement the methods shown below.



**Tip**

The account lockout functionality in AM is triggered by counting invalid password exceptions, rather than invalid login exceptions.

To trigger account lockouts after repeated failed attempts, ensure your modules throw `InvalidPasswordException` exceptions instead of `AuthLoginException` exceptions when appropriate, as per the code below.

See the *ForgeRock Access Management Java SDK API Specification* for reference.

```
public void init(Subject subject, Map sharedState, Map options)

// OpenAM calls the process() method when the user submits authentication
// information. The process() method determines what happens next:
// success, failure, or the next state specified by the order
// attribute in the callbacks XML file.
public int process(Callback[] callbacks, int state) throws LoginException

// OpenAM expects the getPrincipal() method to return an implementation of
// the java.security.Principal interface.
public Principal getPrincipal()
```

AM does not reuse authentication module instances. This means that you can store information specific to the authentication process in the instance.

The implementation, `SampleAuth.java`, is shown below.

```
/**
 * DO NOT ALTER OR REMOVE COPYRIGHT NOTICES OR THIS HEADER.
 *
 * Copyright (c) 2011-2016 ForgeRock AS. All Rights Reserved
 *
 * The contents of this file are subject to the terms
 * of the Common Development and Distribution License
 * (the License). You may not use this file except in
 * compliance with the License.
 *
 * You can obtain a copy of the License at legal/CDDLv1.0.txt.
 * See the License for the specific language governing
 * permission and limitations under the License.
 *
 * When distributing Covered Code, include this CDDL
 * Header Notice in each file and include the License file at legal/CDDLv1.0.txt.
 * If applicable, add the following below the CDDL Header,
 * with the fields enclosed by brackets [] replaced by
 * your own identifying information:
 * "Portions Copyrighted [year] [name of copyright owner]"
 */

package org.forgerock.openam.examples;

import java.security.Principal;
import java.util.Map;
import java.util.ResourceBundle;
```

```

import javax.security.auth.Subject;
import javax.security.auth.callback.Callback;
import javax.security.auth.callback.NameCallback;
import javax.security.auth.callback.PasswordCallback;
import javax.security.auth.login.LoginException;

import com.sun.identity.authentication.spi.AMLoginModule;
import com.sun.identity.authentication.spi.AuthLoginException;
import com.sun.identity.authentication.spi.InvalidPasswordException;
import com.sun.identity.authentication.util.ISAuthConstants;
import com.sun.identity.shared.datastruct.CollectionHelper;
import com.sun.identity.shared.debug.Debug;

/**
 * SampleAuth authentication module example.
 *
 * If you create your own module based on this example, you must modify all
 * occurrences of "SampleAuth" in addition to changing the name of the class.
 *
 * Please refer to OpenAM documentation for further information.
 *
 * Feel free to look at the code for authentication modules delivered with
 * OpenAM, as they implement this same API.
 */
public class SampleAuth extends AMLoginModule {

    // Name for the debug-log
    private final static String DEBUG_NAME = "SampleAuth";
    private final static Debug debug = Debug.getInstance(DEBUG_NAME);

    // Name of the resource bundle
    private final static String amAuthSampleAuth = "amAuthSampleAuth";

    // User names for authentication logic
    private final static String USERNAME = "demo";
    private final static String PASSWORD = "changeit";

    private final static String ERROR_1_USERNAME = "test1";
    private final static String ERROR_2_USERNAME = "test2";

    // Orders defined in the callbacks file
    private final static int STATE_BEGIN = 1;
    private final static int STATE_AUTH = 2;
    private final static int STATE_ERROR = 3;

    // Errors properties
    private final static String SAMPLE_AUTH_ERROR_1 = "sampleauth-error-1";
    private final static String SAMPLE_AUTH_ERROR_2 = "sampleauth-error-2";

    private Map<String, String> options;
    private ResourceBundle bundle;
    private Map<String, String> sharedState;

    public SampleAuth() {
        super();
    }
}

```

```

/**
 * This method stores service attributes and localized properties for later
 * use.
 * @param subject
 * @param sharedState
 * @param options
 */
@Override
public void init(Subject subject, Map sharedState, Map options) {

    debug.message("SampleAuth::init");

    this.options = options;
    this.sharedState = sharedState;
    this.bundle = amCache.getResBundle(amAuthSampleAuth, getLoginLocale());
}

@Override
public int process(Callback[] callbacks, int state) throws LoginException {

    debug.message("SampleAuth::process state: {}", state);

    switch (state) {

        case STATE_BEGIN:
            // No time wasted here - simply modify the UI and
            // proceed to next state
            substituteUIStrings();
            return STATE_AUTH;

        case STATE_AUTH:
            // Get data from callbacks. Refer to callbacks XML file.
            NameCallback nc = (NameCallback) callbacks[0];
            PasswordCallback pc = (PasswordCallback) callbacks[1];
            String username = nc.getName();
            String password = String.valueOf(pc.getPassword());

            //First errorstring is stored in "sampleauth-error-1" property.
            if (ERROR_1_USERNAME.equals(username)) {
                setErrorText(SAMPLE_AUTH_ERROR_1);
                return STATE_ERROR;
            }

            //Second errorstring is stored in "sampleauth-error-2" property.
            if (ERROR_2_USERNAME.equals(username)) {
                setErrorText(SAMPLE_AUTH_ERROR_2);
                return STATE_ERROR;
            }

            if (USERNAME.equals(username) && PASSWORD.equals(password)) {
                debug.message("SampleAuth::process User '{}', " +
                    "authenticated with success.", username);
                return ISAuthConstants.LOGIN_SUCCEED;
            }

            throw new InvalidPasswordException("password is wrong",
                USERNAME);

        case STATE_ERROR:
    }
}

```

```

        return STATE_ERROR;
    default:
        throw new AuthLoginException("invalid state");
    }
}

@Override
public Principal getPrincipal() {
    return new SampleAuthPrincipal(USERNAME);
}

private void setErrorText(String err) throws AuthLoginException {
    // Receive correct string from properties and substitute the
    // header in callbacks order 3.
    substituteHeader(STATE_ERROR, bundle.getString(err));
}

private void substituteUIStrings() throws AuthLoginException {
    // Get service specific attribute configured in OpenAM
    String ssa = CollectionHelper.getMapAttr(options, "specificAttribute");

    // Get property from bundle
    String new_hdr = ssa + " " +
        bundle.getString("sampleauth-ui-login-header");
    substituteHeader(STATE_AUTH, new_hdr);

    replaceCallback(STATE_AUTH, 0, new NameCallback(
        bundle.getString("sampleauth-ui-username-prompt")));
    replaceCallback(STATE_AUTH, 1, new PasswordCallback(
        bundle.getString("sampleauth-ui-password-prompt"), false));
}
}

```

### 10.1.5. The Sample Auth Principal

The implementation, [SampleAuthPrincipal.java](#), is shown below.

```

/**
 * DO NOT ALTER OR REMOVE COPYRIGHT NOTICES OR THIS HEADER.
 *
 * Copyright (c) 2011-2016 ForgeRock AS. All Rights Reserved
 *
 * The contents of this file are subject to the terms
 * of the Common Development and Distribution License
 * (the License). You may not use this file except in
 * compliance with the License.
 *
 * You can obtain a copy of the License at legal/CDDLv1.0.txt.
 * See the License for the specific language governing
 * permission and limitations under the License.
 *
 * When distributing Covered Code, include this CDDL
 * Header Notice in each file and include the License file at legal/CDDLv1.0.txt.
 * If applicable, add the following below the CDDL Header,
 * with the fields enclosed by brackets [] replaced by
 * your own identifying information:
 * "Portions Copyrighted [year] [name of copyright owner]"

```

```
*/
*/

package org.forgerock.openam.examples;

import java.io.Serializable;
import java.security.Principal;

/**
 * SampleAuthPrincipal represents the user entity.
 */
public class SampleAuthPrincipal implements Principal, Serializable {
    private final static String COLON = " : ";

    private final String name;

    public SampleAuthPrincipal(String name) {

        if (name == null) {
            throw new NullPointerException("illegal null input");
        }

        this.name = name;
    }

    /**
     * Return the LDAP username for this SampleAuthPrincipal.
     *
     * @return the LDAP username for this SampleAuthPrincipal
     */
    @Override
    public String getName() {
        return name;
    }

    /**
     * Return a string representation of this SampleAuthPrincipal.
     *
     * @return a string representation of this
     *         TestAuthModulePrincipal.
     */
    @Override
    public String toString() {
        return new StringBuilder().append(this.getClass().getName())
            .append(COLON).append(name).toString();
    }

    /**
     * Compares the specified Object with this SampleAuthPrincipal
     * for equality. Returns true if the given object is also a
     * SampleAuthPrincipal and the two SampleAuthPrincipal have
     * the same username.
     *
     * @param o Object to be compared for equality with this
     *         SampleAuthPrincipal.
     * @return true if the specified Object is equal equal to this
     *         SampleAuthPrincipal.
     */
    @Override
```

```
public boolean equals(Object o) {
    if (o == null) {
        return false;
    }

    if (this == o) {
        return true;
    }

    if (!(o instanceof SampleAuthPrincipal)) {
        return false;
    }
    SampleAuthPrincipal that = (SampleAuthPrincipal) o;

    if (this.getName().equals(that.getName())) {
        return true;
    }
    return false;
}

/**
 * Return a hash code for this SampleAuthPrincipal.
 *
 * @return a hash code for this SampleAuthPrincipal.
 */
@Override
public int hashCode() {
    return name.hashCode();
}
}
```

### 10.1.6. The Sample Auth Service Configuration

AM requires that all authentication modules be configured by means of an AM service. At minimum, the service must include an authentication level attribute. Your module can access these configuration attributes in the `options` parameter passed to the `init()` method.

Some observations about the service configuration file follow in the list below.

- The document type for a service configuration file is described in `WEB-INF/sms.dtd` where AM is deployed.
- The service name is derived from the module name. The service name must have the following format:
  - It must start with either `iPlanetAMAuth` or `sunAMAuth`.
  - The module name must follow. The case of the module name must match the case of the class that implements the custom authentication module.
  - It must end with `Service`.

In the Sample Auth service configuration, the module name is `SampleAuth` and the service name is `iPlanetAMAuthSampleAuthService`.

- The service must have a localized description, retrieved from a properties file.
- The `i18nFileName` attribute in the service configuration holds the default (non-localized) base name of the Java properties file. The `i18nKey` attributes indicate properties keys to string values in the Java properties file.
- The authentication level attribute name must have the following format:
  - It must start with `iplanet-am-auth-`, `sun-am-auth-`, or `forgerock-am-auth-`.
  - The module name must follow, and must appear in lower case if the attribute name starts with `iplanet-am-auth-` or `forgerock-am-auth-`. If the attribute name starts with `sun-am-auth-`, it must exactly match the case of the module name as it appears in the service name.
  - It must end with `-auth-level`.

In the Sample Auth service configuration, the authentication level attribute name is `iplanet-am-auth-sampleauth-auth-level`.

- The Sample Auth service configuration includes an example `sampleauth-service-specific-attribute`, which can be configured through the AM console.

The service configuration file, `amAuthSampleAuth.xml`, is shown below. Save a local copy of this file, which you use when registering the module.

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
  DO NOT ALTER OR REMOVE COPYRIGHT NOTICES OR THIS HEADER.

  Copyright (c) 2011-2016 ForgeRock AS.

  The contents of this file are subject to the terms
  of the Common Development and Distribution License
  (the License). You may not use this file except in
  compliance with the License.

  You can obtain a copy of the License at legal/CDDLv1.0.txt.
  See the License for the specific language governing
  permission and limitations under the License.

  When distributing Covered Code, include this CDDL
  Header Notice in each file and include the License file at legal/CDDLv1.0.txt.
  If applicable, add the following below the CDDL Header,
  with the fields enclosed by brackets [] replaced by
  your own identifying information:
  "Portions Copyrighted [year] [name of copyright owner]"
-->
<!DOCTYPE ServicesConfiguration
  PUBLIC "-//iPlanet//Service Management Services (SMS) 1.0 DTD//EN"
  "jar://com/sun/identity/sm/sms.dtd">
<ServicesConfiguration>
  <Service name="iPlanetAMAuthSampleAuthService" version="1.0">
    <Schema
      serviceHierarchy="/DSAMEConfig/authentication/iPlanetAMAuthSampleAuthService"
```

```

i18nFileName="amAuthSampleAuth" revisionNumber="10"
i18nKey="sampleauth-service-description" resourceName="sample">
<Organization>
  <!-- Specify resourceName for a JSON-friendly property in the REST SMS -->
  <AttributeSchema name="iplanet-am-auth-sampleauth-auth-level" resourceName="authLevel"
    type="single" syntax="number_range" rangeStart="0" rangeEnd="2147483647"
    i18nKey="a500">
    <DefaultValues>
      <Value>1</Value>
    </DefaultValues>
  </AttributeSchema>

  <!-- No need for resourceName when the name is JSON-compatible -->
  <AttributeSchema name="specificAttribute"
    type="single" syntax="string" validator="no" i18nKey="a501" />

  <!--
  For Auth Modules, the parent Schema element specifies the REST SMS resourceName,
  and the nested SubSchema must have resourceName="USE-PARENT"
  -->
  <SubSchema name="serverconfig" inheritance="multiple" resourceName="USE-PARENT">
    <AttributeSchema name="iplanet-am-auth-sampleauth-auth-level" resourceName="authLevel"
      type="single" syntax="number_range" rangeStart="0" rangeEnd="2147483647"
      i18nKey="a500">
      <DefaultValues>
        <Value>1</Value>
      </DefaultValues>
    </AttributeSchema>

    <!-- No need for a DefaultValues element when the default is blank -->
    <AttributeSchema name="specificAttribute"
      type="single" syntax="string" validator="no" i18nKey="a501" />

  </SubSchema>
</Organization>
</Schema>
</Service>
</ServicesConfiguration>

```

## 10.1.7. Building and Installing the Sample Auth Module

Build the module with Apache Maven, and install the module in AM.

### 10.1.7.1. Building the Module

Build the module with Apache Maven, and install the module in AM.

After you successfully build the module, you find the `.jar` file in the `target/` directory of the project.

For information on downloading and building AM sample source code, see [How do I access and build the sample code provided for OpenAM 12.x, 13.x and AM \(All versions\)?](#) in the *Knowledge Base*.



### 10.1.7.2. Installing the Module

Installing the sample authentication module consists of copying the `.jar` file to AM's `WEB-INF/lib/` directory, registering the module with AM, and then restarting AM or the web application container where it runs.

1. Copy the sample authentication module `.jar` file to `WEB-INF/lib/` where AM is deployed.

```
$ cp target/custom*.jar /path/to/tomcat/webapps/openam/WEB-INF/lib/
```

2. Register the module with AM using the `ssoadm` command.

```
$ ssoadm \  
  create-svc \  
    --adminid amadmin \  
    --password-file /tmp/pwd.txt \  
    --xmlfile src/main/resources/amAuthSampleAuth.xml  
  
Service was added.  
$ ssoadm \  
  register-auth-module \  
    --adminid amadmin \  
    --password-file /tmp/pwd.txt \  
    --authmodule org.forgerock.openam.examples.SampleAuth  
  
Authentication module was registered.
```

See `ssoadm(1)` in the *Reference* for a full list of authentication service management subcommands.

3. Restart AM or the container in which it runs.

For example if you deployed AM in Apache Tomcat, then you shut down Tomcat and start it again.

```
$ /path/to/tomcat/bin/shutdown.sh  
$ /path/to/tomcat/bin/startup.sh  
$ tail -1 /path/to/tomcat/logs/catalina.out  
INFO: Server startup in 14736 ms
```

### 10.1.8. Configuring & Testing the Sample Auth Module

Authentication modules are registered as services with AM globally, and then set up for use in a particular realm. In this example, you set up the sample authentication module for use in the realm / (Top Level Realm).

Log in to the AM console as an administrator, such as `amadmin`, and browse to Realms > Top Level Realm > Authentication > Modules. Click Add Module to create an instance of the Sample Authentication Module. Name the module `Sample`.


## New Module

Name

Type

- RADIUS
- SAE
- SAML2
- Sample Authentication Module
- Scripted Module
- SecurID
- Windows Desktop SSO
- Windows NT

Click Create, and then configure the authentication module as appropriate.

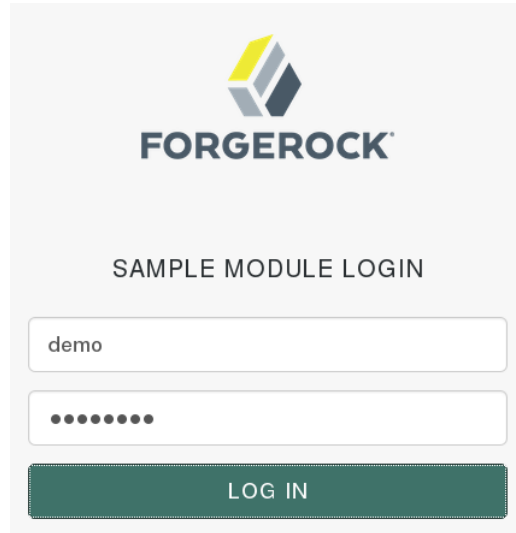
 **SAMPLE**  
**Sample**

Authentication Level

Service Specific Attribute

Now that the module is configured, log out of the AM console.

Finally, try the module by specifying the `Sample` module. Browse to the login URL such as <https://openam.example.com:8443/openam/XUI/?realm=/&module=Sample#login>, and then authenticate with user name `demo` and password `changeit`.



After authentication you are redirected to the end user page for the demo user. You can log out of the AM console, and then try to authenticate as the non-existent user `test123` to see what the error handling looks like to the user.

## 10.2. Using a Server-side Authentication Script

This section demonstrates how to use the default server-side authentication script. An authentication script can be called from a Scripted authentication module.

The default server-side authentication script only authenticates a subject when the current time on the AM server is between 09:00 and 17:00. The script also uses the `logger` and `httpClient` functionality provided in the scripting API.

To examine the contents of the default server-side authentication script in the AM console browse to Realms > Top Level Realm > Scripts, and then click Scripted Module - Server Side.

For general information about scripting in AM, see "[About Scripting](#)".

For information about APIs available for use when scripting authentication, see the following sections:

- "[Global Scripting API Functionality](#)"
- "[Authentication API Functionality](#)"

## 10.2.1. Preparing

AM requires a small amount of configuration before trying the example server-side authentication script. You must create an authentication module of the Scripted type, and then include it in an authentication chain, which can then be used when logging in to AM. You must also ensure the `demo` user has an associated postal address.

The procedures in this section are:

- "To Create a Scripted Authentication Module that Uses the Default Server-side Authentication Script"
- "To Create an Authentication Chain that Uses a Scripted Authentication Module"
- "To Add a Postal Address to the Demo User"

### *To Create a Scripted Authentication Module that Uses the Default Server-side Authentication Script*

In this procedure, create a Scripted Authentication module, and link it to the default server-side authentication script.

1. Log in as an AM administrator, for example `amadmin`.
2. Click Realms > Top Level Realm > Authentication > Modules.
3. On the Authentication Modules page, click Add Module.
4. On the New Module page, enter a module name, such as `myScriptedAuthModule`, in the Type drop-down menu, select `Scripted Module`, and then click Create.
5. On the module configuration page:
  - a. Uncheck the Client-side Script Enabled checkbox.
  - b. In the Server-side Script drop-down menu, select `Scripted Module - Server Side`.
  - c. Click Save Changes.

### *To Create an Authentication Chain that Uses a Scripted Authentication Module*

In this procedure, create an authentication chain that uses a Data Store authentication module and the Scripted authentication module created in the previous procedure.

1. Log in as an AM administrator, for example `amadmin`.
2. Click Realms > Top Level Realm > Authentication > Chains.

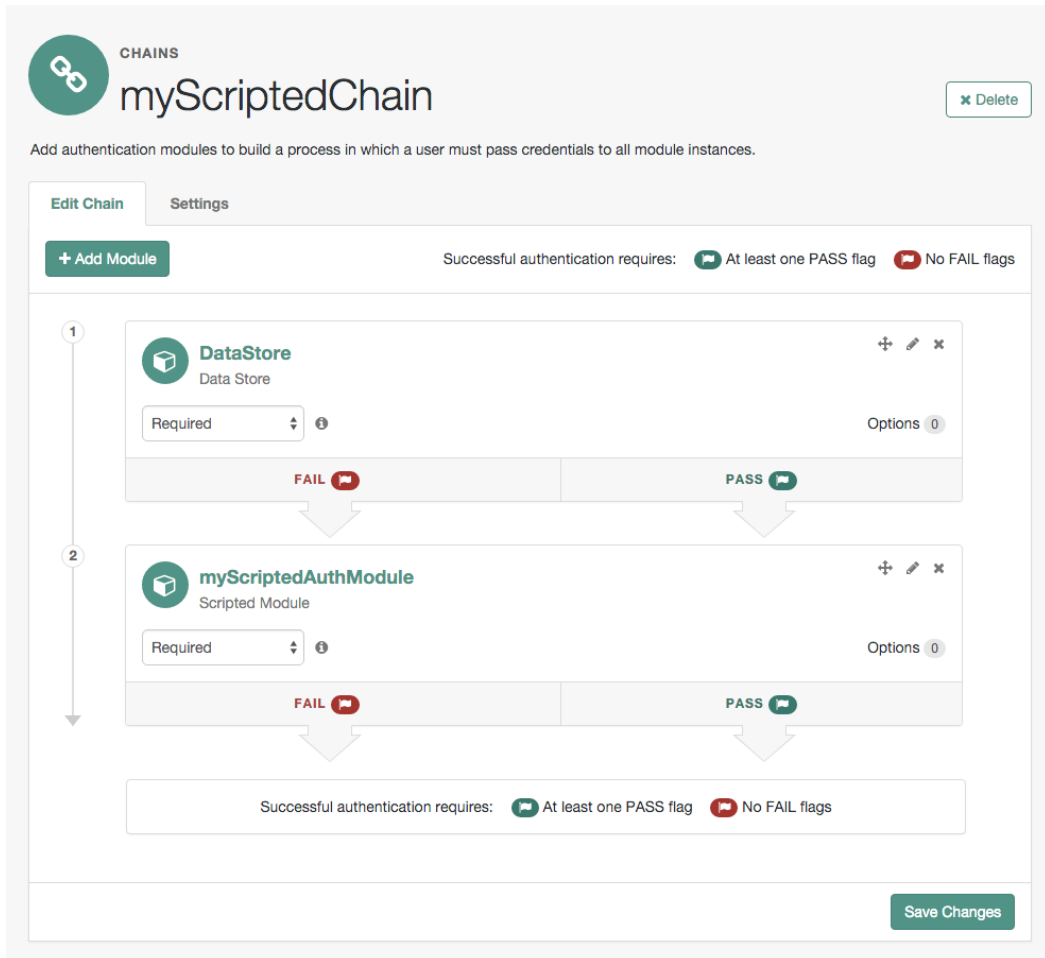
3. On the Authentication Chains page, click Add Chain.
4. On the Add Chain page, enter a name, such as `myScriptedChain`, and then click Create.
5. On the Edit Chain tab, click Add a Module.
6. In the New Module dialog box:
  - a. In the Select Module drop-down menu, select `DataStore`.
  - b. In the Select Criteria drop-down menu, select `Required`.
  - c. Click OK.

**Note**

The Data Store authentication module checks the user credentials, whereas the Scripted authentication module does not check credentials, but instead only checks that the authentication request is processed during working hours. Without the Data Store module, the username in the Scripted authentication module cannot be determined. Therefore, do not configure the Scripted authentication module (server-side script) as the *first* module in an authentication chain, because it needs a username.

7. On the Edit Chain tab, click Add Module.
8. In the New Module dialog box:
  - a. In the Select Module drop-down menu, select the Scripted Module from the previous procedure, for example `myScriptedAuthModule`.
  - b. In the Select Criteria drop-down menu, select `Required`.
  - c. Click OK.

The resulting chain resembles the following:



**CHAINS**  
**myScriptedChain** ✕ Delete

Add authentication modules to build a process in which a user must pass credentials to all module instances.

**Edit Chain** Settings

+ Add Module Successful authentication requires: At least one PASS flag No FAIL flags

1 **DataStore**  
Data Store  
Required Options 0  
FAIL PASS

2 **myScriptedAuthModule**  
Scripted Module  
Required Options 0  
FAIL PASS

Successful authentication requires: At least one PASS flag No FAIL flags

Save Changes

9. On the Edit Chain tab, click Save Changes.

### To Add a Postal Address to the Demo User

1. Log in as an AM administrator, for example `amadmin`.
2. Click Realms > Top Level Realm > Subjects.
3. On the User page, click the `demo` user.
4. In the Home Address field, enter a valid postal address, with lines separated by commas.

For example:

ForgeRock Inc., 201 Mission St #2900, San Francisco, CA 94105, USA

5. Save your changes.

## 10.2.2. Trying the Default Server-side Authentication Script

This section shows how to log in using an authentication chain that contains a Scripted authentication module, which in turn uses the default server-side authentication script.

The default server-side authentication script gets the postal address of a user after they authenticate using a Data Store authentication module, and then makes an HTTP call to an external web service to determine the longitude and latitude of the address. Using these details, a second HTTP call is performed to get the local time at those coordinates. If that time is between two preset limits, authentication is allowed, and the user is given a session and redirected to the profile page.

### *To Log in Using a Chain Containing a Scripted Authentication Module*

1. Log out of AM.
2. In a browser, navigate to the AM login URL, and specify the authentication chain created in the previous procedure as the value of the `service` parameter.

For example:

```
https://openam.example.com:8443/openam/XUI/#login/&service=myScriptedChain
```

3. Log in as user `demo` with password `changeit`.

If login is successful, the user profile page appears. The script will also output messages, such as the following in the `debug/Authentication` log file:

```
Starting scripted authentication
amScript:02/27/2017 03:22:42:881 PM GMT: Thread[ScriptEvaluator-5,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
User: demo
amScript:02/27/2017 03:22:42:882 PM GMT: Thread[ScriptEvaluator-5,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
User address: ForgeRock Inc., 201 Mission St #2900, San Francisco, CA 94105, USA
amScript:02/27/2017 03:22:42:929 PM GMT: Thread[ScriptEvaluator-5,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
User REST Call. Status: [Status: 200 OK]
amScript:02/27/2017 03:27:31:646 PM GMT: Thread[ScriptEvaluator-7,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
latitude:37.7914374 longitude:-122.3950694
amScript:02/27/2017 03:27:31:676 PM GMT: Thread[ScriptEvaluator-7,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
User REST Call. Status: [Status: 200 OK]
amScript:02/27/2017 03:27:31:676 PM GMT: Thread[ScriptEvaluator-7,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
Current time at the users location: 10
amScript:02/27/2017 03:27:31:676 PM GMT: Thread[ScriptEvaluator-7,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
Authentication allowed!
amLoginModule:02/27/2017 03:27:31:676 PM GMT: Thread[http-nio-8080-exec-4,5,main]:
TransactionId[7635cd7c-ea97-4be6-8694-9e2be8642d56-8581]
Login NEXT State : -1
amLoginModule:02/27/2017 03:27:31:676 PM GMT: Thread[http-nio-8080-exec-4,5,main]:
TransactionId[7635cd7c-ea97-4be6-8694-9e2be8642d56-8581]
SETTING Module name... :myScriptedAuthModule
amAuth:02/27/2017 03:27:31:676 PM GMT: Thread[http-nio-8080-exec-4,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
Module name is .. myScriptedAuthModule
amAuth:02/27/2017 03:27:31:676 PM GMT: Thread[http-nio-8080-exec-4,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
successModuleSet is : [DataStore, myScriptedAuthModule]
amJAAS:02/27/2017 03:27:31:676 PM GMT: Thread[http-nio-8080-exec-4,5,main]: TransactionId[7635cd7c-
ea97-4be6-8694-9e2be8642d56-8581]
login success
```

### Tip

The default server-side authentication script outputs log messages at the **message** and **error** level.

AM does not log debug messages from scripts by default. You can configure AM to log such messages by setting the debug log level for the **amScript** service. For details, see "Debug Logging By Service" in the *Setup and Maintenance Guide*.

4. (Optional) To test that the script is being used as part of the login process, edit the script to alter the times when authentication is allowed:
  - a. Log out the **demo** user.
  - b. Log in as an AM administrator, for example **amadmin**.
  - c. Click Realms > Top Level Realm > Scripts > Scripted Module - Server Side.



- d. In the script, swap the values for `START_TIME` and `END_TIME`, for example:

```
var START_TIME = 17;  
var END_TIME   = 9; //
```

- e. Click Save.
- f. Repeat steps 1, 2, and 3 above, logging into the module as the `demo` user as before. The authentication result will be the opposite of the previous result, as the allowed times have inverted.

## 10.3. Creating a Post Authentication Plugin

Post authentication plugins (PAP) let you include custom processing at the following places in the authentication cycle:

- At the end of the authentication process, immediately before a user is authenticated
- When a user logs out of an AM session

A common use of post authentication plugins is to set state information in the session object in conjunction with policy agents. The post authentication plugin sets custom session properties, and then the policy agent injects the custom properties into the header sent to the protected application.

Two issues should be considered when writing a post authentication plugin for an AM deployment that uses stateless sessions:

### Cookie size

You can set an unlimited number of session properties in a post authentication plugin. When AM creates a stateless session, it writes the session properties into the session cookie, increasing the size of the cookie. Very large session cookies can exceed browser limitations. Therefore, when implementing a post authentication plugin in a deployment with stateless sessions, be sure to monitor the session cookie size and verify that you have not exceeded browser cookie size limits.

For more information about stateless session cookies, see "Session Cookies".

### Cookie security

The AM administrator secures custom session properties in sessions residing in the CTS token store for stateful sessions by using firewalls and other typical security techniques.

However, when using stateless sessions, custom session properties are written in cookies and reside on end users' systems. Cookies can be long-lasting and might represent a security issue if any session properties are of a sensitive nature. When developing a post authentication plugin for a deployment that uses stateless sessions, be sure that you are aware of the measures securing the session contained within the cookie.

For more information about stateless session cookie security, see "Stateless Session Cookie Security".

This section explains how to create a post authentication plugin.

### 10.3.1. Designing Your Post Authentication Plugin

Your post authentication plugin class implements the `AMPostAuthProcessInterface` interface, and in particular the following three methods.

```
public void onLoginSuccess(
    Map requestParamsMap,
    HttpServletRequest request,
    HttpServletResponse response,
    SSOToken token
) throws AuthenticationException

public void onLoginFailure(
    Map requestParamsMap,
    HttpServletRequest request,
    HttpServletResponse response
) throws AuthenticationException

public void onLogout(
    HttpServletRequest request,
    HttpServletResponse response,
    SSOToken token
) throws AuthenticationException
```

AM calls the `onLoginSuccess()` and `onLoginFailure()` methods immediately before informing the user of login success or failure, respectively. AM calls the `onLogout()` method only when the user actively logs out, not when a user's session times out. See the *ForgeRock Access Management Java SDK API Specification* for reference.

These methods can perform whatever processing you require. Yet, know that AM calls your methods synchronously as part of the authentication process. Therefore, if your methods take a long time to complete, you will keep users waiting. Minimize the processing done in your post authentication methods.

#### Important

Implementing a post authentication processing plugin in the top level realm can have unexpected effects. OpenAM invokes a post authentication plugin when the plugin is configured in the top level realm, which will then run for all types of authentication during startup, including user logins and internal administrative logins. The best practice first and foremost is to configure end-users to only log into subrealms, while administrators only log into the top level realm. If you need to execute the post authentication plugin for administrative logins, make sure that the plugin can also handle internal authentications.

An alternate solution is to configure the post authentication plugin on a per authentication chain basis, which can be configured separately for user logins or internal administrative logins.

Post authentication plugins must be stateless: they do not maintain state between login and logout. Store any information that you want to save between login and logout in a session property. AM

stores session properties in the CTS token store after login, and retrieves them from the token store as part of the logout process.

### 10.3.2. Building Your Sample Post Authentication Plugin

The following example post authentication plugin sets a session property during successful login, writing to its debug log if the operation fails.

```
package com.forgerock.openam.examples;

import java.util.Map;

import com.ipianet.sso.SSOException;
import com.ipianet.sso.SSOToken;

import com.sun.identity.authentication.spi.AMPostAuthProcessInterface;
import com.sun.identity.authentication.spi.AuthenticationException;
import com.sun.identity.shared.debug.Debug;

import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;

public class SamplePAP implements AMPostAuthProcessInterface {
    private final static String PROP_NAME = "MyProperty";
    private final static String PROP_VALUE = "MyValue";
    private final static String DEBUG_FILE = "SamplePAP";

    protected Debug debug = Debug.getInstance(DEBUG_FILE);

    public void onLoginSuccess(
        Map requestParamsMap,
        HttpServletRequest request,
        HttpServletResponse response,
        SSOToken token
    ) throws AuthenticationException {
        try {
            token.setProperty(PROP_NAME, PROP_VALUE);
        } catch (SSOException e) {
            debug.error("Unable to set property");
        }
    }

    public void onLoginFailure(
        Map requestParamsMap,
        HttpServletRequest request,
        HttpServletResponse response
    ) throws AuthenticationException {
        // Not used
    }

    public void onLogout(
        HttpServletRequest request,
        HttpServletResponse response,
        SSOToken token
    ) throws AuthenticationException {
        // Not used
    }
}
```

```
}
```

The sample post authentication plugin source is available online. Get a local clone so that you can try the sample on your system. In the sources you find the following files.

#### `pom.xml`

Apache Maven project file for the module

This file specifies how to build the sample post authentication plugin, and also specifies its dependencies on AM components and on the Servlet API.

#### `src/main/java/com/forgerock/openam/examples/SamplePAP.java`

Core class for the sample post authentication plugin

Build the module using Apache Maven.

```
$ cd /path/to/openam-post-auth-sample
$ mvn install
[INFO] Scanning for projects...
[INFO]
[INFO] -----
[INFO] Building openam-post-auth-sample 1.0.0-SNAPSHOT
[INFO] -----
...
[INFO]
[INFO] --- maven-jar-plugin:2.3.1:jar (default-jar) @ openam-post-auth-sample ---
[INFO] Building jar: ../target/openam-post-auth-sample-1.0.0-SNAPSHOT.jar
...
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 6.727s
[INFO] Finished at: Mon Nov 25 17:07:23 CET 2013
[INFO] Final Memory: 20M/227M
[INFO] -----
```

Copy the `.jar` to the `WEB-INF/lib` directory where you deployed AM.

```
$ cp target/*.jar /path/to/tomcat/webapps/openam/WEB-INF/lib/
```

Restart AM or the container in which it runs.

### 10.3.3. Configuring Your Post Authentication Plugin

You can associate post authentication plugins with realms or services (authentication chains). Where you configure the plugin depends on the scope to which the plugin should apply:

- Plugins configured at the realm level are executed when authenticating to any authentication chain in the realm, provided the authentication chain does not have an associated plugin.
- Plugins configured at the service level are executed if that authentication chain is used for authentication. Any plugins configured at the realm level will not execute.

In OpenAM Console, navigate to Realms > *Realm Name* > Authentication > Settings > Post Authentication Processing. In the Authentication Post Processing Classes list, add the sample plugin class, `com.forgerock.openam.examples.SamplePAP`, and then click Save.

Alternatively, you can configure sample plugin for the realm by using the `ssoadm` command.

```
$ ssoadm set-svc-attrs \  
--adminid amadmin \  
--password-file /tmp/pwd.txt \  
--servicename iPlanetAMAuthService \  
--realm /myRealm \  
--attributevalues iplanet-am-auth-post-login-process-class=  
com.forgerock.openam.examples.SamplePAP  
  
iPlanetAMAuthService under /myRealm was  
modified.
```

### 10.3.4. Testing Your Post Authentication Plugin

To test the sample post authentication plugin, login successfully to AM in the scope where the plugin is configured. For example, if you configured your plugin for the realm, `/myRealm`, specify the realm in the login URL.

```
http://openam.example.com:8080/openam/XUI/?realm=/myRealm#login
```

Although you will not notice anywhere in the user interface that AM calls your plugin, a policy agent or custom client code could retrieve the session property that your plugin added to the user session.

## 10.4. Customizing Session Quota Exhaustion Actions

This section demonstrates a custom session quota exhaustion action plugin. AM calls a session quota exhaustion action plugin when a user tries to open more stateful sessions than their quota allows. Note that session quotas are not available for stateless sessions.

You only need a custom session quota exhaustion action plugin if the built-in actions are not flexible enough for your deployment. See "Implementing Session Quotas".

### 10.4.1. Creating & Installing a Custom Session Quota Exhaustion Action

You build custom session quota exhaustion actions into a `.jar` that you then plug in to AM. You must also add your new action to the Session service configuration, and restart AM in order to be able to configure it for your use.

Your custom session quota exhaustion action implements the `com.ipianet.dpro.session.service.QuotaExhaustionAction` interface, overriding the `action` method. The `action` method performs the action when the session quota is met, and returns `true` only if the request for a new session should *not* be granted.

The example in this section simply removes the first session it finds as the session quota exhaustion action.

```
package org.forgerock.openam.examples.quotaexhaustionaction;

import static org.forgerock.openam.session.SessionConstants.SESSION_DEBUG;
import com.google.inject.Key;
import com.google.inject.name.Names;
import com.ipianet.dpro.session.SessionException;
import com.ipianet.dpro.session.SessionID;
import com.ipianet.dpro.session.service.InternalSession;
import com.ipianet.dpro.session.service.QuotaExhaustionAction;
import com.sun.identity.shared.debug.Debug;
import org.forgerock.guice.core.InjectorHolder;
import org.forgerock.openam.session.Session;
import org.forgerock.openam.session.clientsdk.SessionCache;

import javax.inject.Inject;
import java.util.Map;

/**
 * This is a sample {@link QuotaExhaustionAction} implementation,
 * which randomly kills the first session it finds.
 */
public class SampleQuotaExhaustionAction implements QuotaExhaustionAction {

    private static Debug debug = InjectorHolder.getInstance(Key.get(Debug.class,
Names.named(SESSION_DEBUG)));

    private final SessionCache sessionCache;

    public SampleQuotaExhaustionAction() {
        this.sessionCache = InjectorHolder.getInstance(SessionCache.class);
    }

    @Inject
    public SampleQuotaExhaustionAction(SessionCache sessionCache) {
        this.sessionCache = sessionCache;
    }

    /**
     * Check if the session quota for a given user has been exhausted and
     * if so perform the necessary actions. This implementation randomly
     * destroys the first session it finds.
     *
     * @param is The InternalSession to be activated.
     * @param existingSessions All existing sessions that belong to the same
     * uuid (Map:sid->expiration_time).
     * @return true If the session activation request should be rejected,
     * otherwise false.
     */
    @Override
    public boolean action(
```

```
InternalSession is,
Map<String, Long> existingSessions) {
for (Map.Entry<String, Long> entry : existingSessions.entrySet()) {
    try {
        // Get a Session from the cache based on the session ID, and destroy it.
        SessionID sessionId = new SessionID(entry.getKey());
        Session session = sessionCache.getSession(sessionId);
        session.destroySession(sessionId);
        // Only destroy the first session.
        break;
    } catch (SessionException se) {
        if (debug.messageEnabled()) {
            debug.message("Failed to destroy existing session.", se);
        }
        // In this case, deny the session activation request.
        return true;
    }
}
return false;
}
```

The sample plugin source is available online. Get a local clone so that you can try the sample on your system. In the sources you find the following files.

[pom.xml](#)

Apache Maven project file for the module

This file specifies how to build the sample plugin, and also specifies its dependencies on AM components and on the Servlet API.

[src/main/java/org/forgerock/openam/examples/quotaexhaustionaction/SampleQuotaExhaustionAction.java](#)

Core class for the sample quota exhaustion action plugin

Build the module using Apache Maven.

```

$ cd /path/to/openam-examples-quotaexhaustionaction
$ mvn install
[INFO] Scanning for projects...
[INFO]
[INFO] -----
[INFO] Building OpenAM Example Quota Exhaustion Action 1.0.0-SNAPSHOT
[INFO] -----
...
[INFO]
[INFO] --- maven-jar-plugin:2.3.1:jar (default-jar) @ quotaexhaustionaction ---
[INFO] Building jar: ../target/quotaexhaustionaction-1.0.0-SNAPSHOT.jar
...
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----

```

Copy the .jar to `WEB-INF/lib/` where AM is deployed.

```
$ cp target/*.jar /path/to/tomcat/webapps/openam/WEB-INF/lib/
```

Using the `ssoadm` command, update the Session Service configuration:

```

$ ssoadm \
  set-attr-choicevals \
  --adminid amadmin \
  --password-file /tmp/pwd.txt \
  --servicename iPlanetAMSessionService \
  --schematype Global \
  --attributename iplanet-am-session-constraint-handler \
  --add \
  --choicevalues myKey=\
  org.forgerock.openam.examples.quotaexhaustionaction.SampleQuotaExhaustionAction
Choice Values were set.

```

Extract `amSession.properties` and if necessary the localized versions of this file from `openam-core-14.1.1.jar` to `WEB-INF/classes/` where AM is deployed. For example, if AM is deployed under `/path/to/tomcat/webapps/openam`, then you could run the following commands.

```

$ cd /path/to/tomcat/webapps/openam/WEB-INF/classes/
$ jar -xvf ../lib/openam-core-14.1.1.jar amSession.properties
inflated: amSession.properties

```

Add the following line to `amSession.properties`.

```
myKey=Randomly Destroy Session
```

Restart AM or the container in which it runs.



You can now use the new session quota exhaustion action. In the AM console, navigate to Configure > Global Services, click Session, scroll to Resulting behavior if session quota exhausted, and then choose an option.

Before moving to your test and production environments, be sure to add your `.jar` file and updates to `amSession.properties` into a custom `.war` file that you can then deploy. You must still update the Session service configuration in order to use your custom session quota exhaustion action.

### 10.4.2. Listing Session Quota Exhaustion Actions

List session quota exhaustion actions by using the **ssoadm** command:

```
$ ssoadm \
  get-attr-choicevals \
  --adminid amadmin \
  --password-file /tmp/pwd.txt \
  --servicename iPlanetAMSessionService \
  --schematype Global \
  --attributename iplanet-am-session-constraint-handler
```

I18n Key	Choice Value
choiceDestroyOldSession	org...session.service.DestroyOldestAction
choiceDenyAccess	org...session.service.DenyAccessAction
choiceDestroyNextExpiring	org...session.service.DestroyNextExpiringAction
choiceDestroyAll	org...session.service.DestroyAllAction
myKey	org...examples...SampleQuotaExhaustionAction

### 10.4.3. Removing a Session Quota Exhaustion Action

Remove a session quota exhaustion action by using the **ssoadm** command:

```
$ ssoadm \
  remove-attr-choicevals \
  --adminid amadmin \
  --password-file /tmp/pwd.txt \
  --servicename iPlanetAMSessionService \
  --schematype Global \
  --attributename iplanet-am-session-constraint-handler \
  --choicevalues \
  org.forgerock.openam.examples.quotaexhaustionaction.SampleQuotaExhaustionAction
```

Choice Values were removed.

## Chapter 11

# Reference

This reference section covers settings and the scripting API relating to authentication in AM.

## 11.1. Core Authentication Attributes

Every AM realm has a set of authentication properties that applies to all authentication performed to that realm. The settings are referred to as core authentication attributes.

To configure core authentication attributes for an entire AM deployment, navigate to Configure > Authentication in the AM console, and then click Core Attributes.

To override the global core authentication configuration in a realm, navigate to Realms > *Realm Name* > Authentication > Settings in the AM console. Note that when you configure core authentication attributes in a realm, the Global tab does not appear.

**ssoadm** service name: `iPlanetAMAuthService`

### 11.1.1. Global Attributes

The following properties are available under the Global Attributes tab:

#### Pluggable Authentication Module Classes

Lists the authentication modules classes available to AM. If you have custom authentication modules, add classes to this list that extend from the `com.sun.identity.authentication.spi.AMLoginModule` class.

For more information about custom authentication modules, see "Creating a Custom Authentication Module".

**ssoadm** attribute: `iplanet-am-auth-authenticators`

#### LDAP Connection Pool Size

Sets a minimum and a maximum number of LDAP connections to be used by any authentication module that connects to a specific directory server. This connection pool is different than the SDK connection pool configured in `serverconfig.xml` file.

Format is `host:port:minimum:maximum`.

This attribute is for LDAP and Membership authentication modules only.

**ssoadm** attributes: `iplanet-am-auth-ldap-connection-pool-size`

### Default LDAP Connection Pool Size

Sets the default minimum and maximum number of LDAP connections to be used by any authentication module that connects to any directory server. This connection pool is different than the SDK connection pool configured in `serverconfig.xml` file.

Format is `minimum:maximum`.

When tuning for production, start with 10 minimum, 65 maximum. For example, `10:65`.

This attribute is for LDAP and Membership authentication modules only.

**ssoadm** attributes: `iplanet-am-auth-ldap-connection-pool-default-size`

### Remote Auth Security

When enabled, AM requires the authenticating application to send its SSO token. This allows AM to obtain the username and password associated with the application.

**ssoadm** attribute: `sunRemoteAuthSecurityEnabled`

### Keep Post Process Objects for Logout Processing

When enabled, AM stores instances of post-processing classes into the user session. When the user logs out, the original post-processing classes are called instead of new instances. This may be required for special logout processing.

Enabling this setting increases the memory usage of AM.

**ssoadm** attribute: `sunAMAuthKeepPostProcessInstances`

## 11.1.2. Core

The following properties are available under the Core tab:

### Administrator Authentication Configuration

Specifies the default authentication chain used when an administrative user, such as `amAdmin`, logs in to the AM console.

**ssoadm** attribute: `iplanet-am-auth-admin-auth-module`

### Organization Authentication Configuration

Specifies the default authentication chain used when a non-administrative user logs in to AM.

**ssoadm** attribute: `iplanet-am-auth-org-config`

### 11.1.3. User Profile

The following properties are available under the User Profile tab:

#### User Profile

Specifies whether a user profile needs to exist in the user data store, or should be created on successful authentication. The possible values are:

##### **true. Dynamic.**

After successful authentication, AM creates a user profile if one does not already exist. AM then issues the SSO token. AM creates the user profile in the user data store configured for the realm.

##### **createAlias. Dynamic with User Alias.**

After successful authentication, AM creates a user profile that contains the **User Alias List** attribute, which defines one or more aliases for mapping a user's multiple profiles.

##### **ignore. Ignored.**

After successful authentication, AM issues an SSO token regardless of whether a user profile exists in the data store. The presence of a user profile is not checked.

#### Warning

Any functionality which needs to map values to profile attributes, such as SAML or OAuth 2.0, will not operate correctly if the User Profile property is set to **ignore**.

##### **false. Required.**

After successful authentication, the user must have a user profile in the user data store configured for the realm in order for AM to issue an SSO token.

**ssoadm** attribute: **iplanet-am-auth-dynamic-profile-creation**. Set this attribute's value to one of the following: **true**, **createAlias**, **ignore**, or **false**.

#### User Profile Dynamic Creation Default Roles

Specifies the distinguished name (DN) of a role to be assigned to a new user whose profile is created when either the **true** or **createAlias** options are selected under the User Profile property. There are no default values. The role specified must be within the realm for which the authentication process is configured.

This role can be either an AM or Sun DSEE role, but it cannot be a filtered role. If you wish to automatically assign specific services to the user, you have to configure the Required Services property in the user profile.

This functionality is deprecated in the *Release Notes*.

**ssoadm** attribute: `iplanet-am-auth-default-role`

### Alias Search Attribute Name

After a user is successfully authenticated, the user's profile is retrieved. AM first searches for the user based on the data store settings. If that fails to find the user, AM will use the attributes listed here to look up the user profile. This setting accepts any data store specific attribute name.

**ssoadm** attribute: `iplanet-am-auth-alias-attr-name`

#### Note

If the `Alias Search Attribute Name` property is empty, AM uses the `iplanet-am-auth-user-naming-attr` property from the `iPlanetAmAuthService`. The `iplanet-am-auth-user-naming-attr` property is only configurable through the `ssoadm` command-line tool and not through the AM console.

```
$ ssoadm get-realm-svc-attrs \
  \
  --adminid amadmin \
  \
  --password-file PATH_TO_PWDFILE \
  \
  --realm REALM \
  \
  --servicename iPlanetAMAuthService

$ ssoadm set-realm-svc-attrs \
  --adminid amadmin \
  --password-file PATH_TO_PWDFILE \
  --realm REALM \
  --servicename iPlanetAMAuthService \
  --attributevalues iplanet-am-auth-user-naming-attr=SEARCH_ATTRIBUTE
```

## 11.1.4. Account Lockout

The following properties are available under the Account Lockout tab:

### Login Failure Lockout Mode

When enabled, AM deactivates the LDAP attribute defined in the Lockout Attribute Name property in the user's profile upon login failure. This attribute works in conjunction with the other account lockout and notification attributes.

**ssoadm** attribute: `iplanet-am-auth-login-failure-lockout-mode`

### Login Failure Lockout Count

Defines the number of attempts that a user has to authenticate within the time interval defined in Login Failure Lockout Interval before being locked out.

**ssoadm** attribute: `iplanet-am-auth-login-failure-count`

## Login Failure Lockout Interval

Defines the time in minutes during which failed login attempts are counted. If one failed login attempt is followed by a second failed attempt within this defined lockout interval time, the lockout count starts, and the user is locked out if the number of attempts reaches the number defined by the Login Failure Lockout Count property. If an attempt within the defined lockout interval time proves successful before the number of attempts reaches the number defined by the Login Failure Lockout Count property, the lockout count is reset.

**ssoadm** attribute: `iplanet-am-auth-login-failure-duration`

## Email Address to Send Lockout Notification

Specifies one or more email addresses to which notification is sent if a user lockout occurs.

Separate multiple addresses with spaces, and append `|locale|charset` to addresses for recipients in non-English locales.

**ssoadm** attribute: `iplanet-am-auth-lockout-email-address`

## Warn User After N Failures

Specifies the number of authentication failures after which AM displays a warning message that the user will be locked out.

**ssoadm** attribute: `iplanet-am-auth-lockout-warn-user`

## Login Failure Lockout Duration

Defines how many minutes a user must wait after a lockout before attempting to authenticate again. Entering a value greater than 0 enables memory lockout and disables physical lockout. *Memory lockout* means the user's account is locked in memory for the number of minutes specified. The account is unlocked after the time period has passed.

**ssoadm** attribute: `iplanet-am-auth-lockout-duration`

## Lockout Duration Multiplier

Defines a value with which to multiply the value of the Login Failure Lockout Duration attribute for each successive lockout. For example, if Login Failure Lockout Duration is set to 3 minutes, and the Lockout Duration Multiplier is set to 2, the user is locked out of the account for 6 minutes. After the 6 minutes has elapsed, if the user again provides the wrong credentials, the lockout duration is then 12 minutes. With the Lockout Duration Multiplier, the lockout duration is incrementally increased based on the number of times the user has been locked out.

**ssoadm** attribute: `sunLockoutDurationMultiplier`

## Lockout Attribute Name

Defines the LDAP attribute used for physical lockout. The default attribute is `inetuserstatus`, although the field in the AM console is empty. The Lockout Attribute Value field must also contain an appropriate value.

**ssoadm** attribute: `iplanet-am-auth-lockout-attribute-name`

### Lockout Attribute Value

Specifies the action to take on the attribute defined in Lockout Attribute Name. The default value is `inactive`, although the field in the AM console is empty. The Lockout Attribute Name field must also contain an appropriate value.

**ssoadm** attribute: `iplanet-am-auth-lockout-attribute-value`

### Invalid Attempts Data Attribute Name

Specifies the LDAP attribute used to hold the number of failed authentication attempts towards Login Failure Lockout Count. Although the field appears empty in the AM console, AM stores this data in the `sunAMAuthInvalidAttemptsDataAttrName` attribute defined in the `sunAMAuthAccountLockout` objectclass by default.

**ssoadm** attribute: `sunAMAuthInvalidAttemptsDataAttrName`

### Store Invalid Attempts in Data Store

When enabled, AM stores the information regarding failed authentication attempts as the value of the Invalid Attempts Data Attribute Name in the user data store. Information stored includes number of invalid attempts, time of last failed attempt, lockout time and lockout duration. Storing this information in the identity repository allows it to be shared among multiple instances of AM.

**ssoadm** attribute: `sunStoreInvalidAttemptsInDS`

## 11.1.5. General

The following properties are available under the General tab:

### Default Authentication Locale

Specifies the default language subtype to be used by the Authentication Service. The default value is `en_US`.

**ssoadm** attribute: `iplanet-am-auth-locale`

### Identity Types

Lists the type or types of identities used during a profile lookup. You can choose more than one to search on multiple types if you would like AM to conduct a second lookup if the first lookup fails. The possible values are:

#### Agent

Searches for identities under your agents.

**agentgroup**

Searches for identities according to your established agent group.

**agentonly**

Searches for identities only under your agents.

**Group**

Searches for identities according to your established groups.

**User**

Searches for identities according to your users.

Default: **Agent** and **User**.

**ssoadm** attribute: `sunAMIdentityType`

## Pluggable User Status Event Classes

Specifies one or more Java classes used to provide a callback mechanism for user status changes during the authentication process. The Java class must implement the `com.sun.identity.authentication.spi.AMAuthCallBack` interface. AM supports account lockout and password changes. AM supports password changes through the LDAP authentication module, and so the feature is only available for the LDAP module.

A `.jar` file containing the user status event class belongs in the `WEB-INF/lib` directory of the deployed AM instance. If you do not build a `.jar` file, add the class files under `WEB-INF/classes`.

**ssoadm** attribute: `sunAMUserStatusCallbackPlugins`

## Use Stateless Sessions

When enabled, AM assigns *stateless* sessions to users authenticating to this realm. Otherwise, AM users authenticating to this realm are assigned *stateful* sessions.

For more information about session state, see "Session State".

**ssoadm** attribute: `openam-auth-stateless-sessions`

## Two Factor Authentication Mandatory

When enabled, users authenticating to a chain that includes a ForgeRock Authenticator (OATH) module are always required to perform authentication using a registered device before they can access AM. When not selected, users can opt to forego registering a device and providing a token and still successfully authenticate.

Letting users choose not to provide a verification token while authenticating carries implications beyond the `required`, `optional`, `requisite`, or `sufficient` flag settings on the ForgeRock Authenticator



(OATH) module in the authentication chain. For example, suppose you configured authentication as follows:

- The ForgeRock Authenticator (OATH) module is in an authentication chain.
- The ForgeRock Authenticator (OATH) module has the `required` flag set.
- Two Factor Authentication Mandatory is not selected.

Users authenticating to the chain can authenticate successfully *without* providing tokens from their devices. The reason for successful authentication in this case is that the `required` setting relates to the execution of the ForgeRock Authenticator (OATH) module itself. Internally, the ForgeRock Authenticator (OATH) module has the ability to forego processing a token while still returning a passing status to the authentication chain.

**ssoadm** attribute: `forgerockTwoFactorAuthMandatory`

### Default Authentication Level

Specifies the default authentication level for authentication modules.

**ssoadm** attribute: `iplanet-am-auth-default-auth-level`

## 11.1.6. Security

The following properties are available under the Security tab:

### Module Based Authentication

When enabled, users can authenticate using module-based authentication. Otherwise, all attempts at authentication using the `module=module-name` login parameter result in failure.

ForgeRock recommends disabling module-based authentication in production environments.

**ssoadm** attribute: `sunEnableModuleBasedAuth`

### Persistent Cookie Encryption Certificate Alias

Specifies the key pair alias in the AM keystore to use for encrypting persistent cookies.

Default: `test`

**ssoadm** attribute: `iplanet-am-auth-key-alias`

### Zero Page Login

When enabled, AM allows users to authenticate using only GET request parameters without showing a login screen.

**Caution**

Enable with caution as browsers can cache credentials and servers can log credentials when they are part of the URL.

AM always allows HTTP POST requests for zero page login.

Default: false (disabled)

**ssoadm** attribute: `openam.auth.zero.page.login.enabled`

**Zero Page Login Referer Whitelist**

Lists the HTTP referer URLs for which AM allows zero page login. These URLs are supplied in the `Referer` HTTP request header, allowing clients to specify the web page that provided the link to the requested resource.

When zero page login is enabled, including the URLs for the pages from which to allow zero page login will provide some mitigation against Login Cross-Site Request Forgery (CSRF) attacks. Leave this list blank to allow zero page login from any Referer.

This setting applies for both HTTP GET and also HTTP POST requests for zero page login.

**ssoadm** attribute: `openam.auth.zero.page.login.referer.whitelist`

**Zero Page Login Allowed Without Referer?**

When enabled, allows zero page login for requests without an HTTP `Referer` request header. Zero page login must also be enabled.

Enabling this setting reduces the risk of login CSRF attacks with zero page login enabled, but may potentially deny legitimate requests.

**ssoadm** attribute: `openam.auth.zero.page.login.allow.null.referer`

**Organization Authentication Signing Secret**

Specifies a cryptographically-secure random-generated HMAC shared secret for signing RESTful authentication requests. When users attempt to authenticate to the XUI, AM signs a JSON Web Token (JWT) containing this shared secret. The JWT contains the authentication session ID, realm, and authentication index type value, but does *not* contain the user's credentials.

When modifying this value, ensure the new shared secret is Base-64 encoded and at least 128 bits in length.

**ssoadm** attribute: `iplanet-am-auth-hmac-signing-shared-secret`

### 11.1.7. Post Authentication Processing

The following properties are available under the Post Authentication Processing tab:

## Default Success Login URL

Accepts a list of values that specifies where users are directed after successful authentication. The format of this attribute is `client-type|URL` although the only value you can specify at this time is a URL which assumes the type HTML. The default value is `/openam/console`. Values that do not specify HTTP have that appended to the deployment URI.

**ssoadm** attribute: `iplanet-am-auth-login-success-url`

## Default Failure Login URL

Accepts a list of values that specifies where users are directed after authentication has failed. The format of this attribute is `client-type|URL` although the only value you can specify at this time is a URL which assumes the type HTML. Values that do not specify HTTP have that appended to the deployment URI.

**ssoadm** attribute: `iplanet-am-auth-login-failure-url`

## Authentication Post Processing Classes

Specifies one or more Java classes used to customize post authentication processes for successful or unsuccessful logins. The Java class must implement the `com.sun.identity.authentication.spi.AMPostAuthProcessInterface` AM interface.

A `.jar` file containing the post processing class belongs in the `WEB-INF/lib` directory of the deployed AM instance. If you do not build a `.jar` file, add the class files under `WEB-INF/classes`. For deployment, add the `.jar` file or classes into a custom AM `.war` file.

For information on creating post-authentication plugins, see "Creating a Post Authentication Plugin".

**ssoadm** attribute: `iplanet-am-auth-post-login-process-class`

## Generate UserID Mode

When enabled, the Membership module generates a list of alternate user identifiers if the one entered by a user during the self-registration process is not valid or already exists. The user IDs are generated by the class specified in the Pluggable User Name Generator Class property.

**ssoadm** attribute: `iplanet-am-auth-username-generator-enabled`

## Pluggable User Name Generator Class

Specifies the name of the class used to generate alternate user identifiers when Generate UserID Mode is enabled. The default value is `com.sun.identity.authentication.spi.DefaultUserIDGenerator`.

**ssoadm** attribute: `iplanet-am-auth-username-generator-class`

## User Attribute Mapping to Session Attribute

Enables the authenticating user's identity attributes (stored in the identity repository) to be set as session properties in the user's SSO token. The value takes the format `User-Profile-`

*Attribute|Session-Attribute-Name*. If *Session-Attribute-Name* is not specified, the value of *User-Profile-Attribute* is used. All session attributes contain the `am.protected` prefix to ensure that they cannot be edited by the Client SDK.

For example, if you define the user profile attribute as `mail` and the user's email address, available in the user session, as `user.mail`, the entry for this attribute would be `mail|user.mail`. After a successful authentication, the `SSOToken.getProperty(String)` method is used to retrieve the user profile attribute set in the session. The user's email address is retrieved from the user's session using the `SSOToken.getProperty("am.protected.user.mail")` method call.

Properties that are set in the user session using User Attribute Mapping to Session Attributes cannot be modified (for example, `SSOToken.setProperty(String, String)`). This results in an `SSOException`. Multivalued attributes, such as `memberOf`, are listed as a single session variable with a `|` separator.

When configuring authentication for a realm that uses stateless sessions, be careful not to add so many session attributes that the session cookie size exceeds the maximum allowable cookie size. For more information about stateless session cookies, see "Session Cookies".

**ssoadm** attribute: `sunAMUserAttributesSessionMapping`

## 11.2. Authentication Module Properties

This section provides a reference to configuration properties for AM authentication modules.

### 11.2.1. Active Directory Module Properties

**ssoadm** service name: `sunAMAuthADService`

#### Primary Active Directory Server

#### Secondary Active Directory Server

Specify the primary and secondary Active Directory server(s). AM attempts to contact the primary server(s) first. If no primary server is available, then AM attempts to contact the secondary server(s).

When authenticating users from a directory server that is remote to AM, set the primary server values, and optionally the secondary server values. Primary servers have priority over secondary servers.

To allow users to change passwords through AM, Active Directory requires that you connect over SSL. The default port for LDAP is 389. If you are connecting to Active Directory over SSL, the default port for LDAP/SSL is 636.

For SSL or TLS security, enable the SSL/TLS Access to Active Directory Server property. Make sure that AM can trust the Active Directory certificate when using this option.

**ssoadm** attributes are: primary is `iplanet-am-auth-ldap-server`; secondary is `iplanet-am-auth-ldap-server2`.

Both properties may take a single value in the form of `server:port`, or more than one value in the form of `openam_full_server_name | server:port`; thus, allowing more than one primary or secondary remote server, respectively.

Assuming a multi-data center environment, AM determines priority within the primary and secondary remote servers as follows:

- Every LDAP server that is mapped to the current AM instance has highest priority.

For example, if you are connected to `openam1.example.com` and `ldap1.example.com` is mapped to that AM instance, then AM uses `ldap1.example.com`.

- Every LDAP server that was not specifically mapped to a given AM instance has the next highest priority.

For example, if you have another LDAP server, `ldap2.example.com`, that is not connected to a specific AM server and if `ldap1.example.com` is unavailable, AM connects to the next highest priority LDAP server, `ldap2.example.com`.

- LDAP servers that are mapped to different AM instances have the lowest priority.

For example, if `ldap3.example.com` is connected to `openam3.example.com` and `ldap1.example.com` and `ldap2.example.com` are unavailable, then `openam1.example.com` connects to `ldap3.example.com`.

## DN to Start User Search

Specifies the base DN from which AM searches for users to authenticate.

LDAP data is organized hierarchically, a bit like a file system on Windows or UNIX. More specific DNs likely result in better performance. When configuring the module for a particular part of the organization, you can perhaps start searches from a specific organizational unit, such as `OU=sales,DC=example,DC=com`.

If multiple entries exist with identical search attribute values, make this value specific enough to return only one entry.

**ssoadm** attribute: `iplanet-am-auth-ldap-base-dn`

## Bind User DN, Bind User Password

Specify the user and password to authenticate to Active Directory.

If AM stores attributes in Active Directory, for example to manage account lockout, or if Active Directory requires that AM authenticate in order to read users' attributes, then AM needs the DN and password to authenticate to Active Directory.

If the administrator authentication chain (default: `ldapService`) has been configured to include only the Active Directory module, then make sure that the password is correct before you logout. If it

is incorrect, you will be locked out. If you do get locked out, you can login with the superuser DN, which by default is `uid=amAdmin,ou=People,AM-deploy-base`, where `AM-deploy-base` was set during AM configuration.

**ssoadm** attributes: `iplanet-am-auth-ldap-bind-dn` and `iplanet-am-auth-ldap-bind-passwd`

### Attribute Used to Retrieve User Profile

### Attributes Used to Search for a User to be Authenticated

### User Search Filter

### Search Scope

LDAP searches for user entries with attribute values matching the filter you provide. For example, if you search under `CN=Users,DC=example,DC=com` with a filter `"(MAIL=bjensen@example.com)"`, then the directory returns the entry that has `MAIL=bjensen@example.com`. In this example the attribute used to search for a user is `mail`. Multiple attribute values mean the user can authenticate with any one of the values. For example, if you have both `uid` and `mail`, then Barbara Jensen can authenticate with either `bjensen` or `bjensen@example.com`.

The User Search Filter text box provides a more complex filter. For example, if you search on `mail` and add User Search Filter `(objectClass=inetOrgPerson)`, then AM uses the resulting search filter `(&(mail=address)(objectClass=inetOrgPerson))`, where `address` is the mail address provided by the user.

This controls how and the level of the directory that will be searched. You can set the search to run at a high level or against a specific area:

- OBJECT will search only for the entry specified as the DN to Start User Search.
- ONELEVEL will search only the entries that are directly children of that object.
- SUBTREE will search the entry specified and every entry under it.

**ssoadm** attributes: `iplanet-am-auth-ldap-user-naming-attribute`, `iplanet-am-auth-ldap-user-search-attributes`, `iplanet-am-auth-ldap-search-filter`, and `iplanet-am-auth-ldap-search-scope`

### LDAP Connection Mode

If you want to initiate secure communications to data stores using SSL or StartTLS, AM must be able to trust Active Directory certificates, either because the Active Directory certificates were signed by a CA whose certificate is already included in the trust store used by the container where AM runs, or because you imported the certificates into the trust store.

**ssoadm** attribute: `openam-auth-ldap-connection-mode`

Possible values: `LDAP`, `LDAPS`, and `StartTLS`

### Return User DN to DataStore

When enabled, and AM uses Active Directory as the user store, the module returns the DN rather than the User ID, so the bind for authentication can be completed without a search to retrieve the DN.

**ssoadm** attribute: `iplanet-am-auth-ldap-return-user-dn`

### User Creation Attributes

Maps internal attribute names used by AM to external attribute names from Active Directory for dynamic profile creation. Values are of the format `internal_attr1|external_attr1`.

**ssoadm** attribute: `iplanet-am-ldap-user-creation-attr-list`

### Trust All Server Certificates

When enabled, the module trusts all server certificates, including self-signed certificates.

**ssoadm** attribute: `iplanet-am-auth-ldap-ssl-trust-all`

### LDAP Connection Heartbeat Interval

Specifies how often AM should send a heartbeat request to the directory server to ensure that the connection does not remain idle. Some network administrators configure firewalls and load balancers to drop connections that are idle for too long. You can turn this off by setting the value to 0 or to a negative number. To set the units for the interval, use LDAP Connection Heartbeat Time Unit.

Default: 1

**ssoadm** attribute: `openam-auth-ldap-heartbeat-interval`

### LDAP Connection Heartbeat Time Unit

Specifies the time unit corresponding to LDAP Connection Heartbeat Interval. Possible values are `SECONDS`, `MINUTES`, and `HOURS`.

**ssoadm** attribute: `openam-auth-ldap-heartbeat-timeunit`

### LDAP operations timeout

Defines the timeout in milliseconds that AM should wait for a response from the directory server.

Default: 0 (means no timeout)

**ssoadm** attribute: `openam-auth-ldap-operation-timeout`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthADAuthLevel`

## 11.2.2. Adaptive Risk Authentication Module Properties

**ssoadm** service name: `sunAMAuthAdaptiveService`

### 11.2.2.1. General

The following properties are available under the General tab:

#### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `openam-auth-adaptive-auth-level`

#### Risk Threshold

Sets the risk threshold score. If the sum of the scores is greater than the threshold, the Adaptive Risk module fails.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-auth-threshold`

### 11.2.2.2. Failed Authentications

The following properties are available under the Failed Authentications tab:

#### Failed Authentication Check

When enabled, checks the user profile for authentication failures since the last successful login. This check therefore requires AM to have access to the user profile, and Account Lockout to be enabled (otherwise, AM does not record authentication failures).

**ssoadm** attribute: `openam-auth-adaptive-failure-check`

#### Score

Sets the value to add to the total score if the user fails the Failed Authentication Check. Default: 1

**ssoadm** attribute: `openam-auth-adaptive-failure-score`

#### Invert Result

When enabled, adds the score to the total score if the user passes the Failed Authentication Check.

**ssoadm** attribute: `openam-auth-adaptive-failure-invert`

### 11.2.2.3. IP Address Range

The following properties are available under the IP Address Range tab:



## IP Range Check

When enabled, checks whether the client IP address is within one of the specified IP Ranges.

**ssoadm** attribute: `openam-auth-adaptive-ip-range-check`

## IP Range

For IPv4, specifies a list of IP ranges either in CIDR-style notation (`x.x.x.x/YY`) or as a range from one address to another (`x.x.x.x-y.y.y.y`, meaning from `x.x.x.x` to `y.y.y.y`).

For IPv6, specifies a list of IP ranges either in CIDR-style notation (`X:X:X:X:X:X/YY`) or as a range from one address to another (`X:X:X:X:X:X-Y:Y:Y:Y:Y:Y:Y`, (`X:X:X:X:X:X-X:Y:Y:Y:Y:Y:Y`), meaning from `X:X:X:X:X:X` to `Y:Y:Y:Y:Y:Y`).

**ssoadm** attribute: `openam-auth-adaptive-ip-range-range`

## Score

Sets the value to add to the total score if the user fails the IP Range Check.

**ssoadm** attribute: `openam-auth-adaptive-ip-range-score`

## Invert Result

When enabled, adds the Score to the total score if the user passes the IP Range Check.

**ssoadm** attribute: `openam-auth-adaptive-ip-range-invert`

## 11.2.2.4. IP Address History

The following properties are available under the IP Address History tab:

### IP History Check

When enabled, checks whether the client IP address matches one of the known values stored on the profile attribute you specify. This check therefore requires that AM have access to the user profile.

**ssoadm** attribute: `openam-auth-adaptive-ip-history-check`

### History size

Specifies how many IP address values to retain on the profile attribute you specify.

Default: 5

**ssoadm** attribute: `openam-auth-ip-adaptive-history-count`

### Profile Attribute Name

Specifies the name of the user profile attribute in which to store known IP addresses. Ensure the specified attribute exists in your user data store; the `iphistory` attribute does not exist by default, and it is not created when performing AM schema updates.

Default: `iphistory`

**ssoadm** attribute: `openam-auth-adaptive-ip-history-attribute`

### Save Successful IP Address

When enabled, saves new client IP addresses to the known IP address list following successful authentication.

**ssoadm** attribute: `openam-auth-adaptive-ip-history-save`

### Score

Sets the value to add to the total score if the user fails the IP History Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-ip-history-score`

### Invert Result

When enabled, adds the Score to the total score if the user passes the IP History Check.

**ssoadm** attribute: `openam-auth-adaptive-ip-history-invert`

## 11.2.2.5. Known Cookie

The following properties are available under the Known Cookie tab:

### Cookie Value Check

When enabled, checks whether the client browser request has the specified cookie and optional cookie value.

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-check`

### Cookie Name

Specifies the name of the cookie for which AM checks when you enable the Cookie Value Check.

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-name`

### Cookie Value

Specifies the value of the cookie for which AM checks. If no value is specified, AM does not check the cookie value.

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-value`

### Save Cookie Value on Successful Login

When enabled, saves the cookie as specified in the client's browser following successful authentication. If no Cookie Value is specified, the value is set to 1.

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-save`

### Score

Sets the value to add to the total score if user passes the Cookie Value Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-score`

### Invert Result

When enabled, adds the Score to the total score if the user passes the Cookie Value Check.

**ssoadm** attribute: `openam-auth-adaptive-known-cookie-invert`

## 11.2.2.6. Device Cookie

The following properties are available under the Device Cookie tab:

### Device Registration Cookie Check

When enabled, the cookie check passes if the client request contains the cookie specified in Cookie Name.

**ssoadm** attribute: `openam-auth-adaptive-device-cookie-check`

### Cookie Name

Specifies the name of the cookie for the Device Registration Cookie Check.

Default: Device

**ssoadm** attribute: `openam-auth-adaptive-device-cookie-name`

### Save Device Registration on Successful Login

When enabled, saves the specified cookie with a hashed device identifier value in the client's browser following successful authentication.

**ssoadm** attribute: `openam-auth-adaptive-device-cookie-save`

### Score

Sets the value to add to the total score if the user fails the Device Registration Cookie Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-device-cookie-score`

### Invert Result

When enabled, adds the Score to the total score if the user passes the Device Registration Cookie Check.

**ssoadm** attribute: `openam-auth-adaptive-device-cookie-invert`

## 11.2.2.7. Time Since Last Login

The following properties are available under the Time Since Last Login tab:

### Time since Last login Check

When enabled, checks whether the client browser request has the specified cookie that holds the encrypted last login time, and check that the last login time is more recent than a maximum number of days you specify.

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-check`

### Cookie Name

Specifies the name of the cookie holding the encrypted last login time value.

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-cookie-name`

### Max Time since Last login

Specifies a threshold age of the last login time in days. If the client's last login time is more recent than the number of days specified, then the client successfully passes the check.

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-value`

### Save time of Successful Login

When enabled, saves the specified cookie with the current time encrypted as the last login value in the client's browser following successful authentication.

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-save`

### Score

Sets the value to add to the total score if the user fails the Time Since Last Login Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-score`

## Invert Result

When enabled, adds the Score to the total score if the user passes the Time Since Last Login Check.

**ssoadm** attribute: `openam-auth-adaptive-time-since-last-login-invert`

## 11.2.2.8. Profile Attribute

The following properties are available under the Profile Attribute tab:

### Profile Risk Attribute check

When enabled, checks whether the user profile contains the specified attribute and value.

**ssoadm** attribute: `openam-auth-adaptive-risk-attribute-check`

### Attribute Name

Specifies the attribute to check on the user profile for the specified value.

**ssoadm** attribute: `openam-auth-adaptive-risk-attribute-name`

### Attribute Value

Specifies the value to match on the profile attribute. If the attribute is multi-valued, a single match is sufficient to pass the check.

**ssoadm** attribute: `openam-auth-adaptive-risk-attribute-value`

### Score

Sets the value to add to the total score if the user fails the Profile Risk Attribute Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-risk-attribute-score`

## Invert Result

When enabled, adds the Score to the total score if the user passes the Profile Risk Attribute Check.

**ssoadm** attribute: `openam-auth-adaptive-risk-attribute-invert`

## 11.2.2.9. Geo Location

The following properties are available under the Geo Location tab:

## Geolocation Country Code Check

When enabled, checks whether the client IP address location matches a country specified in the Valid Country Codes list.

**ssoadm** attribute: `forgerock-am-auth-adaptive-geo-location-check`

## Geolocation Database Location

Path to GeoIP data file used to convert IP addresses to country locations. The geolocation database is not packaged with AM. You can download the GeoIP Country database from [MaxMind](#). Use the binary `.mmdb` file format, rather than `.csv`. You can use the GeoLite Country database for testing.

**ssoadm** attribute: `openam-auth-adaptive-geo-location-database`

## Valid Country Codes

Specifies the list of country codes to match. Use `|` to separate multiple values.

**ssoadm** attribute: `openam-auth-adaptive-geo-location-values.`

## Score

Value to add to the total score if the user fails the Geolocation Country Code Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-geo-location-score`

## Invert Result

When enabled, adds the Score to the total score if the user passes the Geolocation Country Code Check.

**ssoadm** attribute: `openam-auth-adaptive-geo-location-invert`

## 11.2.2.10. Request Header

The following properties are available under the Request Header tab:

### Request Header Check

When enabled, checks whether the client browser request has the specified header with the correct value.

**ssoadm** attribute: `openam-auth-adaptive-req-header-check`

### Request Header Name

Specifies the name of the request header for the Request Header Check.

**ssoadm** attribute: `openam-auth-adaptive-req-header-name`

### Request Header Value

Specifies the value of the request header for the Request Header Check.

**ssoadm** attribute: `openam-auth-adaptive-req-header-value`

### Score

Value to add to the total score if the user fails the Request Header Check.

Default: 1

**ssoadm** attribute: `openam-auth-adaptive-req-header-score`

### Invert Result

When enabled, adds the Score to the total score if the user passes the Request Header Check.

**ssoadm** attribute: `openam-auth-adaptive-req-header-invert`

## 11.2.3. Anonymous Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthAnonymousService`

### Valid Anonymous Users

Specifies the list of valid anonymous user IDs that can log in without submitting a password.

**ssoadm** attribute: `iplanet-am-auth-anonymous-users-list`

When user accesses the default module instance login URL, then the module prompts the user to enter a valid anonymous user name.

The default module instance login URL is defined as follows:

```
protocol://hostname:port/deploy_URI/XUI/#login?module=Anonymous&org=org_name
```

### Default Anonymous User Name

Specifies the user ID assigned by the module if the Valid Anonymous Users list is empty. The default value is `anonymous`. Note that the anonymous user must be defined in the realm.

**ssoadm** attribute: `iplanet-am-auth-anonymous-default-user-name`

### Case Sensitive User IDs

When enabled, determines whether case matters for anonymous user IDs.

**ssoadm** attribute: `iplanet-am-auth-anonymous-case-sensitive`

## Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 (default) to any positive integer and is set for each authentication method. The higher number corresponds to a higher level of authentication. If you configured your authentication levels from a 0 to 5 scale, then an authentication level of 5 will require the highest level of authentication.

After a user has authenticated, AM stores the authentication level in the session token. When the user attempts to access a protected resource, the token is presented to the application. The application uses the token's value to determine if the user has the correct authentication level required to access the resource. If the user does not have the required authentication level, the application can prompt the user to authenticate with a higher authentication level.

**ssoadm** attribute: `iplanet-am-auth-anonymous-auth-level`

## 11.2.4. Certificate Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthCertService`

### Match Certificate in LDAP

When enabled, AM searches for a match for the user's certificate in the LDAP directory. If a match is found and not revoked according to a CRL or OCSP validation, then authentication succeeds.

**ssoadm** attribute: `iplanet-am-auth-cert-check-cert-in-ldap`

### Subject DN Attribute Used to Search LDAP for Certificates

Indicates which attribute and value in the certificate Subject DN is used to find the LDAP entry holding the certificate.

Default: CN

**ssoadm** attribute: `iplanet-am-auth-cert-attr-check-ldap`

### Match Certificate to CRL

When enabled, AM checks whether the certificate has been revoked according to a CRL in the LDAP directory.

**ssoadm** attribute: `iplanet-am-auth-cert-check-crl`

### Issuer DN Attribute Used to Search LDAP for CRLs

Indicates which attribute and value in the certificate Issuer DN is used to find the CRL in the LDAP directory.



Default: CN

If only one attribute is specified, the LDAP search filter used to find the CRL based on the Subject DN of the CA certificate is `(attr-name=attr-value-in-subject-DN)`.

For example, if the subject DN of the issuer certificate is `C=US, CN=Some CA, serialNumber=123456`, and the attribute specified is `CN`, then the LDAP search filter used to find the CRL is `(CN=Some CA)`.

In order to distinguish among different CRLs for the same CA issuer, specify multiple attributes separated by commas (,) in the same order they occur in the subject DN. When multiple attribute names are provided in a comma-separated list, the LDAP search filter used is `(cn=attr1=attr1-value-in-subject-DN,attr2=attr2-value-in-subject-DN,...,attrN=attrN-value-in-subject-DN)`.

For example, if the subject DN of the issuer certificate is `C=US, CN=Some CA, serialNumber=123456`, and the attributes specified are `CN,serialNumber`, then the LDAP search filter used to find the CRL is `(cn=CN=Some CA,serialNumber=123456)`.

**ssoadm** attribute: `iplanet-am-auth-cert-attr-check-crl`

### HTTP Parameters for CRL Update

Specifies parameters to be included in any HTTP CRL call to the CA that issued the certificate.

This property supports key pairs of values separated by commas, for example, `param1=value1,param2=value2`.

If the client or CA contains the Issuing Distribution Point Extension, AM uses this information to retrieve the CRL from the distribution point.

**ssoadm** attribute: `iplanet-am-auth-cert-param-get-crl`

### Match CA Certificate to CRL

When enabled, AM checks the CRL against the CA certificate to ensure it has not been compromised.

**ssoadm** attribute: `sunAMValidateCACert`

### Cache CRLs in memory

When enabled, AM caches CRLs.

**ssoadm** attribute: `openam-am-auth-cert-attr-cache-crl`

### Update CA CRLs from CRLDistributionPoint

When enabled, AM updates the CRLs stored in the LDAP directory store.

**ssoadm** attribute: `openam-am-auth-cert-update-crl`

## OCSP Validation

When enabled, AM checks the revocation status of certificates using the Online Certificate Status Protocol (OCSP).

You must configure OSCP for AM under Configure > Server Defaults or Deployment > Servers > *Server Name* > Security.

**ssoadm** attribute: `iplanet-am-auth-cert-check-ocsp`

## LDAP Server Where Certificates are Stored

Identifies the LDAP server that holds users; certificates. The property has the format `ldap_server:port`, for example, `ldap1.example.com:636`. To configure a secure connection, enable the Use SSL/TLS for LDAP Access property.

AM servers can be associated with LDAP servers by writing multiple chains with the format `openam_server|ldapservers:port`, for example, `openam.example.com|ldap1.example.com:636`.

**ssoadm** attribute: `iplanet-am-auth-cert-ldap-provider-url`

## LDAP Search Start or Base DN

Valid base DN for the LDAP search, such as `dc=example,dc=com`. To associate AM servers with different search base DN's, use the format `openam_server|base_dn`, for example, `openam.example.com|dc=example,dc=com` `openam1.test.com|dc=test, dc=com`

**ssoadm** attribute: `iplanet-am-auth-cert-start-search-loc`

## LDAP Server Authentication User, LDAP Server Authentication Password

If AM stores attributes in the LDAP directory, for example to manage account lockout, or if the LDAP directory requires that AM authenticate in order to read users' attributes, then AM needs the DN and password to authenticate to the LDAP directory.

**ssoadm** attributes: `iplanet-am-auth-cert-principal-user`, and `iplanet-am-auth-cert-principal-passwd`

## Use SSL/TLS for LDAP Access

If you use SSL/TLS for LDAP access, AM must be able to trust the LDAP server certificate.

**ssoadm** attribute: `iplanet-am-auth-cert-use-ssl`

## Certificate Field Used to Access User Profile

If the user profile is in a different entry from the user certificate, then this can be different from subject DN attribute used to find the entry with the certificate. When you select other, provide an attribute name in the Other Certificate Field Used to Access User Profile text box.

**ssoadm** attribute: `iplanet-am-auth-cert-user-profile-mapper`

Valid values: `subject DN`, `subject CN`, `subject UID`, `email address`, `other`, and `none`.

### Other Certificate Field Used to Access User Profile

This field is only used if the Certificate Field Used to Access User Profile attribute is set to `other`. This field allows a custom certificate field to be used as the basis of the user search.

**ssoadm** attribute: `iplanet-am-auth-cert-user-profile-mapper-other`

### SubjectAltNameExt Value Type to Access User Profile

Specifies how to look up the user profile:

- Let the property default to `none` to give preference to the Certificate Field Used to Access User Profile or Other Certificate Field Used to Access User Profile attributes when looking up the user profile.
- Select `RFC822Name` if you want AM to look up the user profile from an RFC 822 style name.
- Select `UPN` if you want AM to look up the user profile as the User Principal Name attribute used in Active Directory.

**ssoadm** attribute: `iplanet-am-auth-cert-user-profile-mapper-ext`

### Trusted Remote Hosts

Defines a list of hosts trusted to send certificates to AM, such as load balancers doing SSL termination.

Valid values are `none`, `any`, and `IP_ADDR`, where `IP_ADDR` is one or more IP addresses of trusted hosts that can send client certificates to AM.

**ssoadm** attribute: `iplanet-am-auth-cert-gw-cert-auth-enabled`

### HTTP Header Name for Client Certificates

Specifies the name of the HTTP request header containing the PEM-encoded certificate. If Trusted Remote Hosts is set to `any` or specifies the IP address of the trusted host (for example, an SSL-terminated load balancer) that can supply client certificates to AM, the administrator must specify the header name in this attribute.

**ssoadm** attribute: `sunAMHttpParamName`

### Use only Certificate from HTTP request header

When enabled, AM always uses the client certificate from the HTTP header rather than the certificate the servlet container receives during the SSL handshake.

Default: `false`

**ssoadm** attribute: `iplanet-am-auth-cert-gw-cert-preferred`

## Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-cert-auth-level`

## 11.2.5. Data Store Authentication Module Properties

**ssoadm** service name: `sunAMAuthDataStoreService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthDataStoreAuthLevel`

## 11.2.6. Device ID (Match) Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthDeviceIdMatchService`

### Client-Side Script Enabled

Enable Device ID (Match) to send JavaScript in an authentication page to the device to collect data about the device by a self-submitting form.

**ssoadm** attribute: `iplanet-am-auth-scripted-client-script-enabled`

### Client-Side Script, Server-Side Script

Specify the client-side and server-side Javascript scripts to use with the Device Id (Match) module.

To view and modify the contents of the scripts, navigate to Realms > *Realm Name* > Scripts and select the name of the script.

If you change the client-side script, you must make a corresponding change in the server-side script to account for the specific addition or removal of an element.

**ssoadm** attribute: `iplanet-am-auth-scripted-client-script` and `iplanet-am-auth-scripted-server-script`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-scripted-auth-level`

## 11.2.7. Device ID (Save) Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthDeviceIdSaveService`

### Automatically store new profiles

When enabled, AM assumes user consent to store new profiles. After successful HOTP confirmation, AM stores the new profile automatically.

**ssoadm** attribute: `iplanet-am-auth-device-id-save-auto-store-profile`

### Maximum stored profile quantity

Sets the maximum number of stored profiles on the user's record.

**ssoadm** attribute: `iplanet-am-auth-device-id-save-max-profiles-allowed`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-device-id-save-auth-level`

## 11.2.8. Federation Authentication Module Properties

**ssoadm** service name: `sunAMAuthFederationService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthFederationAuthLevel`

## 11.2.9. Amster Authentication Module Properties

**amster** service name: `iPlanetAMAuthAmsterService`

### Authorized Keys

Specifies the location of the `authorized_keys` file that contains the private and public keys used to validate remote **amster** client connections.

The default location for the `authorized_keys` file is the `/path/to/openam/` path. Its content is similar to an OpenSSH `authorized_keys` file.

**amster** attribute: `forgerock-am-auth-amster-authorized-keys`

## Enabled

When enabled, allows **amster** clients to authenticate using PKI. When disabled, allows **amster** clients to authenticate using interactive login only.

**amster** attribute: `forgerock-am-auth-amster-enabled`

## Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**amster** attribute: `forgerock-am-auth-amster-auth-level`

## 11.2.10. ForgeRock Authenticator (OATH) Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthAuthenticatorOATHService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-auth-level`

### One-Time Password Length

Sets the length of the OTP to six digits or longer. The default value is six.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-password-length`

### Minimum Secret Key Length

The minimum number of hexadecimal characters allowed for the secret key.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-min-secret-key-length`

### OATH Algorithm to Use

Select whether to use HOTP or TOTP. You can create an authentication chain to allow for a greater variety of devices. The default value is HOTP.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-algorithm`

### HOTP Window Size

The window that the OTP device and the server counter can be out of sync. For example, if the window size is 100 and the server's last successful login was at counter value 2, then the server will accept an OTP from device counter 3 to 102. The default value is 100.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-hotp-window-size`

## Add Checksum Digit

Adds a checksum digit at the end of the HOTP password to verify the OTP was generated correctly. This is in addition to the actual password length. Set this only if your device supports it. The default value is No.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-add-checksum`

## Truncation Offset

Advanced feature that is device-specific. Let this value default unless you know your device uses a truncation offset. The default value is -1.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-truncation-offset`

## TOTP Time Step Interval

The time interval for which an OTP is valid. For example, if the time step interval is 30 seconds, a new OTP will be generated every 30 seconds, and an OTP will be valid for 30 seconds. The default value is 30 seconds.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-size-of-time-step`

## TOTP Time Steps

The number of time step intervals that the system and the device can be off before password resynchronization is required. For example, if the number of TOTP time steps is 2 and the TOTP time step interval is 30 seconds, the server will allow an 89 second clock skew between the client and the server—two 30 second steps plus 29 seconds for the interval in which the OTP arrived. The default value is 2.

**ssoadm** attribute: `iplanet-am-auth-fr-oath-steps-in-window`

## One Time Password Max Retry

The number of times entry of the OTP may be attempted. Minimum is 1, maximum is 10.

Default: 3

**ssoadm** attribute: `forgerock-oath-max-retry`

## Maximum Allowed Clock Drift

The maximum acceptable clock skew before authentication fails. When this value is exceeded, the user must re-register the device.

**ssoadm** attribute: `openam-auth-fr-oath-maximum-clock-drift`

## Name of the Issuer

A value that appears as an identifier on the user's device. Common choices are a company name, a web site, or an AM realm.

**ssoadm** attribute: `openam-auth-fr-oath-issuer-name`

### 11.2.11. ForgeRock Authenticator (Push) Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthAuthenticatorPushService`

#### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `forgerock-am-auth-authenticatorpush-auth-level`

#### Return Message Timeout (ms)

The period of time (in milliseconds) within which a push notification should be replied to.

Default: `120000`

**ssoadm** attribute: `forgerock-am-auth-push-message-response-timeout`

#### Login Message

Text content of the push message, which is used for the notification displayed on the registered device. The following variables can be used in the message:

`{{user}}`

Replaced with the username value of the account registered in the ForgeRock Authenticator app, for example *Demo*.

`{{issuer}}`

Replaced with the issuer value of the account registered in the ForgeRock Authenticator app, for example *ForgeRock*.

Default: `Login attempt from {{user}} at {{issuer}}`

**ssoadm** attribute: `forgerock-am-auth-push-message`

### 11.2.12. ForgeRock Authenticator (Push) Registration Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthAuthenticatorPushRegistrationService`

#### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.



**ssoadm** attribute: `forgerock-am-auth-push-reg-auth-level`

### Issuer Name

A value that appears as an identifier on the user's device. Common choices are a company name, a web site, or an AM realm.

**ssoadm** attribute: `forgerock-am-auth-push-reg-issuer`

### Registration Response Timeout (ms)

The period of time (in milliseconds) to wait for a response to the registration QR code. If no response is received during this time the QR code times out and the registration process fails.

Default: `120000`

**ssoadm** attribute: `forgerock-am-auth-push-message-registration-response-timeout`

### Background Color

The background color in hex notation to display behind the issuer's logo within the ForgeRock Authenticator app.

Default: `#519387`

**ssoadm** attribute: `forgerock-am-auth-hex-bgcolour`

### Image URL

The location of an image to download and display as the issuer's logo within the ForgeRock Authenticator app.

**ssoadm** attribute: `forgerock-am-auth-img-url`

### App Store App URL

URL of the app to download on the App Store.

Default: `https://itunes.apple.com/app/forgerock-authenticator/id1038442926` (the ForgeRock Authenticator app)

**ssoadm** attribute: `forgerock-am-auth-apple-link`

### Google Play URL

URL of the app to download on Google Play.

Default: `https://play.google.com/store/apps/details?id=com.forgerock.authenticator` (the ForgeRock Authenticator app)

**ssoadm** attribute: `forgerock-am-auth-google-link`

## 11.2.13. HOTP Authentication Module Properties

**ssoadm** service name: `sunAMAuthHOTPService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthHOTPAuthLevel`

### SMS Gateway Implementation Class

Specifies the class the HOTP module uses to send SMS or email messages. Specify a class that implements the `com.sun.identity.authentication.modules.hotp.SMSGateway` interface to customize the SMS gateway implementation.

**ssoadm** attribute: `sunAMAuthHOTPSMSGatewayImplClassName`

### Mail Server Host Name

Specifies the hostname of the mail server supporting SMTP for electronic mail.

**ssoadm** attribute: `sunAMAuthHOTPSMTPHostName`

### Mail Server Host Port

Specifies the outgoing mail server port. The default port is 25, 465 (when connecting over SSL).

**ssoadm** attribute: `sunAMAuthHOTPSMTPHostPort`

### Mail Server Authentication Username

Specifies the username for AM to connect to the mail server.

**ssoadm** attribute: `sunAMAuthHOTPSMTPUserName`

### Mail Server Authentication Password

Specifies the password for AM to connect to the mail server.

**ssoadm** attribute: `sunAMAuthHOTPSMTPUserPassword`

### Mail Server Secure Connection

Specifies whether to connect to the mail server securely. If enabled, AM must be able to trust the server certificate.

**ssoadm** attribute: `sunAMAuthHOTPSMTPSSLEnabled`

### Email From Address

Specifies the **From:** address when sending a one-time password by mail.

**ssoadm** attribute: `sunAMAuthHOTPSMTPFromAddress`

### One-Time Password Validity Length (in minutes)

Specifies the amount of time, in minutes, the one-time passwords are valid after they are generated. The default is 5 minutes.

**ssoadm** attribute: `sunAMAuthHOTPPasswordValidityDuration`

### One-Time Password Length

Sets the length of one-time passwords.

**ssoadm** attribute: `sunAMAuthHOTPPasswordLength`

Valid values: 6 and 8.

### One Time Password Max Retry

The number of times entry of the OTP may be attempted. Minimum is 1, maximum is 10.

Default: 3

**ssoadm** attribute: `forgerock-oath-max-retry`

### One-Time Password Delivery

Specifies whether to send the one-time password by SMS, by mail, or both.

**ssoadm** attribute: `sunAMAuthHOTPPasswordDelivery`

Valid values: SMS, E-mail, and SMS and E-mail.

### Mobile Phone Number Attribute Name

Provides the attribute name used for the text message. The default value is `telephoneNumber`.

**ssoadm** attribute: `openamTelephoneAttribute`

### Mobile Carrier Attribute Name

Specifies a user profile attribute that contains a mobile carrier domain for sending SMS messages.

The uncustomized AM user profile does not have an attribute for the mobile carrier domain. You can:

- Customize the AM user profile by adding a new attribute to it. Then you can populate the new attribute with users' SMS messaging domains.

All mobile carriers and bulk SMS messaging services have associated SMS messaging domains. For example, Verizon uses `vtext.com`, T-Mobile uses `tmomail.net`, and the TextMagic service

uses `textmagic.com`. If you plan to send text messages internationally, determine whether the messaging service requires a country code.

- Leave the value for Mobile Carrier Attribute Name blank, and let AM default to sending SMS messages using `txt.att.net` for all users.

**ssoadm** attribute: `openamSMSCarrierAttribute`

### Email Attribute Name

Provides the attribute name used to email the OTP. The default value is `mail` (email).

**ssoadm** attribute: `openamEmailAttribute`

### Auto Send OTP Code

When enabled, configures the HOTP module to automatically generate an email or text message when users begin the login process.

**ssoadm** attribute: `sunAMAuthHOTPAutoClicking`

## 11.2.14. HTTP Basic Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthHTTPBasicService`

### Backend Module Name

Specifies the module that checks the user credentials. The credentials are then supplied to either a data store or other identity repository module for authentication.

**ssoadm** attribute: `iplanet-am-auth-http-basic-module-configured`

Valid values: `LDAP` and `DataStore`.

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-httpbasic-auth-level`

## 11.2.15. JDBC Authentication Module Properties

**ssoadm** service name: `sunAMAuthJDBCService`

### Connection Type

Determines how the module obtains the connection to the database.

**ssoadm** attribute: `sunAMAuthJDBCConnectionType`

Valid values: `JNDI` and `JDBC`.

### Connection Pool JNDI Name

Specifies the URL of the connection pool for JNDI connections. Refer to your web container's documentation for instructions on setting up the connection pool.

**ssoadm** attribute: `sunAMAuthJDBCJndiName`

### JDBC Driver

Specifies the JDBC driver to use for JDBC connections.

Install a suitable Oracle or MySQL driver in the container where AM is installed, for example in the `/path/to/tomcat/webapps/openam/WEB-INF/lib` path. You can add it to the AM `.war` file when you deploy AM.

**ssoadm** attribute: `sunAMAuthJBCDriver`

### JDBC URL

Specifies the URL to connect to the database when using a JDBC connection.

**ssoadm** attribute: `sunAMAuthJDBCUrl`

### Database Username, Database Password

Specifies the user name and password used to authenticate to the database when using a JDBC connection.

**ssoadm** attribute: `sunAMAuthJDBCdbuser` and `sunAMAuthJDBCdbpassword`

### Password Column Name

Specifies the database column name where passwords are stored.

**ssoadm** attribute: `sunAMAuthJBCPasswordColumn`

### Prepared Statement

Specifies the SQL query to return the password corresponding to the user to authenticate.

**ssoadm** attribute: `sunAMAuthJDBCStatement`

### Class to Transform Password Syntax

Specifies the class that transforms the password retrieved to the same format as provided by the user.

The default class expects the password in cleartext. Custom classes must implement the `JDBCPasswordSyntaxTransform` interface.

**ssoadm** attribute: `sunAMAuthJDBCPasswordSyntaxTransformPlugin`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthJDBCAuthLevel`

#### Note

AM provides two properties, `iplanet-am-admin-console-invalid-chars` and `iplanet-am-auth-ldap-invalid-chars`, that store LDAP-related special characters that are not allowed in username searches.

When using JDBC databases, consider adding the '%' wildcard character to the `iplanet-am-admin-console-invalid-chars` and `iplanet-am-auth-ldap-invalid-chars` properties. By default, the '%' character is not included in the properties.

## 11.2.16. LDAP Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthLDAPService`

### Primary LDAP Server

### Secondary LDAP Server

Directory servers generally use built-in data replication for high availability. Thus, a directory service likely consists of a pool of replicas to which AM can connect to retrieve and update directory data. You set up primary and secondary servers in case a replica is down due to maintenance or to a problem with a particular server.

Set one or more primary and optionally, one or more secondary directory server for each AM server. For the current AM server, specify each directory server as a `host:port` combination. For other AM servers in the deployment, you can specify each directory server as `server-name|host:port`, where `server-name` is the FQDN portion of the AM server from the list under Deployment > Servers, and `host:port` identifies the directory server.

For example, if the `server-name` that is listed is `http://openam.example.com:8080/openam`, and the directory server is accessible at `opendj.example.com:1389`, you would enter `openam.example.com|opendj.example.com:1389`.

When authenticating users from a directory server that is remote to AM, set the primary server values, and optionally the secondary server values. Primary servers have priority over secondary servers.

**ssoadm** attributes are: primary is `iplanet-am-auth-ldap-server`; secondary is `iplanet-am-auth-ldap-server2`.

Both properties take more than one value; thus, allowing more than one primary or secondary remote server, respectively. Assuming a multi-data center environment, AM determines priority within the primary and secondary remote servers, respectively, as follows:

- Every LDAP server that is mapped to the current AM instance has highest priority.

For example, if you are connected to `openam1.example.com` and `ldap1.example.com` is mapped to that AM instance, then AM uses `ldap1.example.com`.

- Every LDAP server that was not specifically mapped to a given AM instance has the next highest priority.

For example, if you have another LDAP server, `ldap2.example.com`, that is not connected to a specific AM server and if `ldap1.example.com` is unavailable, AM connects to the next highest priority LDAP server, `ldap2.example.com`.

- LDAP servers that are mapped to different AM instances have the lowest priority.

For example, if `ldap3.example.com` is connected to `openam3.example.com` and `ldap1.example.com` and `ldap2.example.com` are unavailable, then `openam1.example.com` connects to `ldap3.example.com`.

If you want use SSL or StartTLS to initiate a secure connection to a data store, then scroll down to enable SSL/TLS Access to LDAP Server. Make sure that AM can trust the server's certificates when using this option.

**ssoadm** attributes: `openam-auth-ldap-connection-mode`

Possible values: `LDAP`, `LDAPS`, and `StartTLS`

## DN to Start User Search

LDAP data is organized hierarchically, a bit like a file system on Windows or UNIX. More specific DNs likely result in better search performance. When configuring the module for a particular part of the organization, you can perhaps start searches from a specific organizational unit, such as `ou=sales,dc=example,dc=com`.

If multiple entries exist with identical search attribute values, make this value specific enough to return only one entry.

**ssoadm** attribute: `iplanet-am-auth-ldap-base-dn`

## Bind User DN, Bind User Password

If AM stores attributes in the directory, for example to manage account lockout, or if the directory requires that AM authenticate in order to read users' attributes, then AM needs the DN and password to authenticate to the directory.

The default is `cn=Directory Manager`. Make sure that password is correct before you log out. If it is incorrect, you will be locked out. If this should occur, you can login with the superuser DN, which

by default is `uid=amAdmin,ou=People,AM-deploy-base`, where *AM-deploy-base* is the value you set during AM configuration.

**ssoadm** attributes: `iplanet-am-auth-ldap-bind-dn`, `iplanet-am-auth-ldap-bind-passwd`

### Attribute Used to Retrieve User Profile

### Attributes Used to Search for a User to be Authenticated

### User Search Filter

### Search Scope

LDAP searches for user entries return entries with attribute values matching the filter you provide. For example, if you search under `ou=people,dc=example,dc=com` with a filter `"(mail=bjensen@example.com)"`, then the directory returns the entry that has `mail=bjensen@example.com`. In this example the attribute used to search for a user is `mail`. Multiple attribute values mean the user can authenticate with any one of the values. For example, if you have both `uid` and `mail`, then Barbara Jensen can authenticate with either `bjensen` or `bjensen@example.com`.

Should you require a more complex filter for performance, you add that to the User Search Filter text box. For example, if you search on `mail` and add User Search Filter `(objectClass=inetOrgPerson)`, then AM uses the resulting search filter `(&(mail=address)(objectClass=inetOrgPerson))`, where *address* is the mail address provided by the user.

Scope OBJECT means search only the entry specified as the DN to Start User Search, whereas ONELEVEL means search only the entries that are directly children of that object. SUBTREE means search the entry specified and every entry under it.

**ssoadm** attributes: `iplanet-am-auth-ldap-user-naming-attribute`, `iplanet-am-auth-ldap-user-search-attributes`, `iplanet-am-auth-ldap-search-filter`, and `iplanet-am-auth-ldap-search-scope`

### LDAP Connection Mode

If you want use SSL or StartTLS to initiate a secure connection to a data store, AM must be able to trust LDAP certificates, either because the certificates were signed by a CA whose certificate is already included in the trust store used by the container where AM runs, or because you imported the certificates into the trust store.

**ssoadm** attribute: `openam-auth-ldap-connection-mode`

Possible values: `LDAP`, `LDAPS`, and `StartTLS`

### Return User DN to DataStore

When enabled, and AM uses the directory service as the user store, the module returns the DN, rather than the User ID. From the DN value, AM uses the RDN to search for the user profile. For example, if a returned DN value is `uid=demo,ou=people,dc=openam,dc=example,dc=org`, AM uses `uid=demo` to search the data store.

**ssoadm** attribute: `iplanet-am-auth-ldap-return-user-dn`



## User Creation Attributes

This list lets you map (external) attribute names from the LDAP directory server to (internal) attribute names used by AM.

**ssoadm** attribute: `iplanet-am-ldap-user-creation-attr-list`

## Minimum Password Length

Specifies the minimum acceptable password length.

**ssoadm** attribute: `iplanet-am-auth-ldap-min-password-length`

## LDAP Behera Password Policy Support

When enabled, support interoperability with servers that implement the Internet-Draft, Password Policy for LDAP Directories.

Support for this Internet-Draft is limited to the LDAP authentication module. Other components of AM, such as the password change functionality in the `/idm/EndUser` page, do not support the Internet-Draft. In general, outside of the LDAP authentication module, AM binds to the directory server as an administrator, such as Directory Manager. When AM binds to the directory server as an administrator rather than as an end user, many features of the Internet-Draft password policies do not apply.

**ssoadm** attribute: `iplanet-am-auth-ldap-behera-password-policy-enabled`

## Trust All Server Certificates

When enabled, blindly trust server certificates, including self-signed test certificates.

**ssoadm** attribute: `iplanet-am-auth-ldap-ssl-trust-all`

## LDAP Connection Heartbeat Interval

Specifies how often AM should send a heartbeat request to the directory server to ensure that the connection does not remain idle. Some network administrators configure firewalls and load balancers to drop connections that are idle for too long. You can turn this off by setting the value to 0 or to a negative number. To set the units for the interval use LDAP Connection Heartbeat Time Unit.

Default: 1

**ssoadm** attribute: `openam-auth-ldap-heartbeat-interval`

## LDAP Connection Heartbeat Time Unit

Specifies the time unit corresponding to LDAP Connection Heartbeat Interval.

Default: minute

**ssoadm** attribute: `openam-auth-ldap-heartbeat-timeunit`

### LDAP operations timeout

Defines the timeout in milliseconds that AM should wait for a response from the directory server.

Default: 0 (means no timeout)

**ssoadm** attribute: `openam-auth-ldap-operation-timeout`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-ldap-auth-level`

## 11.2.17. MSISDN Authentication Module Properties

**ssoadm** service name: `sunAMAuthMSISDNService`

### Trusted Gateway IP Address

Specifies a list of IP addresses of trusted clients that can access MSISDN modules. Either restrict the clients allowed to access the MSISDN module by adding each IPv4 or IPv6 address here, or leave the list empty to allow all clients to access the module. If you specify the value `none`, no clients are allowed access.

**ssoadm** attribute: `sunAMAuthMSISDNTrustedGatewayList`

### MSISDN Number Search Parameter Name

Specifies a list of parameter names that identify which parameters to search in the request header or cookie header for the MSISDN number. For example, if you define `x-Cookie-Param`, `AM_NUMBER`, and `COOKIE-ID`, the MSISDN authentication service checks those parameters for the MSISDN number.

**ssoadm** attribute: `sunAMAuthMSISDNParameterNameList`

### LDAP Server and Port

Specifies the LDAP server FQDN and its port in the format `ldap_server:port`. AM servers can be paired with LDAP servers and ports by adding entries with the format `AM_server|ldap_server:port`, for example, `openam.example.com|ldap1.example.com:649`.

To use SSL or TLS for security, enable the SSL/TLS Access to LDAP property. Make sure that AM can trust the servers' certificates when using this option.

**ssoadm** attribute: `sunAMAuthMSISDNLdapProviderUrl`

## LDAP Start Search DN

Specifies the DN of the entry where the search for the user's MSISDN number should start. AM servers can be paired with search base DN's by adding entries with the format `AM_server|base_dn`. For example, `openam.example.com|dc=openam,dc=forgerock,dc=com`.

**ssoadm** attribute: `sunAMAuthMSISDNBaseDn`

## Attribute To Use To Search LDAP

Specifies the name of the attribute in the user's profile that contains the MSISDN number to search for the user. The default is `sunIdentityMSISDNNumber`.

**ssoadm** attribute: `sunAMAuthMSISDNUserSearchAttribute`

## LDAP Server Authentication User, LDAP Server Authentication Password

Specifies the bind DN and password to authenticate to the directory server. The default is `cn=Directory Manager`.

**ssoadm** attribute: `sunAMAuthMSISDNPrincipalUser` and `sunAMAuthMSISDNPrincipalPasswd`.

## SSL/TLS for LDAP Access

When enabled, AM uses LDAPS or StartTLS to connect to the directory server. If you choose to enable SSL or TLS, then make sure that AM can trust the servers' certificates.

**ssoadm** attribute: `sunAMAuthMSISDNUseSsl`

## MSISDN Header Search Attribute

Specifies which elements are searched for the MSISDN number. The possible values are:

`searchCookie`

To search the cookie.

`searchRequest`

To search the request header.

`searchParam`

To search the request parameters.

**ssoadm** attribute: `sunAMAuthMSISDNHeaderSearch`

## LDAP Attribute Used to Retrieve User Profile

Specify the LDAP attribute that is used during a search to return the user profile for MSISDN authentication service. The default is `uid`.

**ssoadm** attribute: `sunAMAuthMSISDNUserNamingAttribute`

## Return User DN to DataStore

When enabled, this option allows the authentication module to return the DN instead of the User ID. AM thus does not need to perform an additional search with the user ID to find the user's entry.

Enable this option only when the AM directory is the same as the directory configured for MSISDN searches.

**ssoadm** attribute: `sunAMAuthMSISDNReturnUserDN`

## Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `sunAMAuthMSISDNAuthLevel`

## 11.2.18. OATH Authentication Module Properties

**ssoadm** service name: `iplanetAMAuthOATHService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-oath-auth-level`

### One Time Password Length

Sets the length of the OTP to six digits or longer. The default value is six.

**ssoadm** attribute: `iplanet-am-auth-oath-password-length`

### Minimum Secret Key Length

The minimum number of hexadecimal characters allowed for the secret key.

**ssoadm** attribute: `iplanet-am-auth-oath-min-secret-key-length`

### Secret Key Attribute Name

The name of the attribute where the key will be stored in the user profile.

**ssoadm** attribute: `iplanet-am-auth-oath-secret-key-attribute`

### OATH Algorithm to Use

Select whether to use HOTP or TOTP. You can create an authentication chain to allow for a greater variety of devices. The default value is HOTP.

**ssoadm** attribute: `iplanet-am-auth-oath-algorithm`

## HOTP Window Size

The window that the OTP device and the server counter can be out of sync. For example, if the window size is 100 and the server's last successful login was at counter value 2, then the server will accept an OTP from device counter 3 to 102. The default value is 100.

**ssoadm** attribute: `iplanet-am-auth-oath-hotp-window-size`

### Note

For information on resetting the HOTP counter, see "Resetting Registered Devices by using REST".

## Counter Attribute Name

The name of the HOTP attribute where the counter will be stored in the user profile.

**ssoadm** attribute: `iplanet-am-auth-oath-hotp-counter-attribute`

## Add Checksum Digit

Adds a checksum digit at the end of the HOTP password to verify the OTP was generated correctly. This is in addition to the actual password length. Set this only if your device supports it. The default value is No.

**ssoadm** attribute: `iplanet-am-auth-oath-add-checksum`

## Truncation Offset

Advanced feature that is device-specific. Let this value default unless you know your device uses a truncation offset. The default value is -1.

**ssoadm** attribute: `iplanet-am-auth-oath-truncation-offset`

## TOTP Time Step Interval

The time interval for which an OTP is valid. For example, if the time step interval is 30 seconds, a new OTP will be generated every 30 seconds, and an OTP will be valid for 30 seconds. The default value is 30 seconds.

**ssoadm** attribute: `iplanet-am-auth-oath-size-of-time-step`

## One Time Password Max Retry

The number of times entry of the OTP may be attempted. Minimum is 1, maximum is 10.

Default: 3

**ssoadm** attribute: `forgerock-oath-max-retry`

## TOTP Time Steps

The number of time step intervals that the system and the device can be off before password resynchronization is required. For example, if the number of TOTP time steps is 2 and the TOTP time step interval is 30 seconds, the server will allow an 89 second clock skew between the client and the server—two 30 second steps plus 29 seconds for the interval in which the OTP arrived. The default value is 2.

**ssoadm** attribute: `iplanet-am-auth-oath-steps-in-window`

## Last Login Time Attribute

The name of the attribute where both HOTP and TOTP authentication will store information on when a person last logged in.

**ssoadm** attribute: `iplanet-am-auth-oath-last-login-time-attribute-name`

## The Shared Secret Provider Class

The class that processes the user profile attribute where the user's secret key is stored. The name of this attribute is specified in the Secret Key Attribute Name property.

Default: `org.forgerock.openam.authentication.modules.oath.plugins.DefaultSharedSecretProvider`

**ssoadm** attribute: `forgerock-oath-sharedsecret-implementation-class`

## Clock Drift Attribute Name

The user profile attribute where the clock drift is stored. If this field is not specified, then AM does not check for clock drift.

**ssoadm** attribute: `forgerock-oath-observed-clock-drift-attribute-name`

## Maximum Allowed Clock Drift

The maximum acceptable clock drift before authentication fails. If this value is exceeded, the user must register their device again.

The Maximum Allowed Clock Drift value should be greater than the TOTP Time Steps value.

**ssoadm** attribute: `forgerock-oath-maximum-clock-drift`

## 11.2.19. OAuth 2.0/OpenID Connect Authentication Module Properties

The default settings are for Facebook.

**ssoadm** service name: `sunAMAuthOAuthService`

### Client id

Specifies the OAuth 2.0 `client_id` parameter as described in section 2.2 of RFC 6749.

**ssoadm** attribute: `iplanet-am-auth-oauth-client-id`

### Client Secret

Specifies the OAuth 2.0 `client_secret` parameter as described in section 2.3 of RFC 6749.

**ssoadm** attribute: `iplanet-am-auth-oauth-client-secret`

### Authentication Endpoint URL

Specifies the URL to the endpoint handling OAuth 2.0 authentication as described in section 3.1 of RFC 6749.

Default: `https://www.facebook.com/dialog/oauth`.

**ssoadm** attribute: `iplanet-am-auth-oauth-auth-service`

### Access Token Endpoint URL

Specifies the URL to the endpoint handling access tokens as described in section 3.2 of RFC 6749.

Default: `https://graph.facebook.com/oauth/access_token`.

**ssoadm** attribute: `iplanet-am-auth-oauth-token-service`

### User Profile Service URL

Specifies the user profile URL that returns profile information in JSON format.

Default: `https://graph.facebook.com/me`.

**ssoadm** attribute: `iplanet-am-auth-oauth-user-profile-service`

### Scope

Specifies a space-delimited list of user profile attributes that the client application requires, according to *The OAuth 2.0 Authorization Framework*. The list depends on the permissions that the resource owner, such as the end user, grants to the client application.

Some authorization servers use non-standard separators for scopes. Facebook, for example, takes a comma-separated list.

Default: `email,read_stream` (Facebook example)

**ssoadm** attribute: `iplanet-am-auth-oauth-scope`

### OAuth2 Access Token Profile Service Parameter name

Specifies the name of the parameter that contains the access token value when accessing the profile service.

Default: `access_token`.

**ssoadm** attribute: `iplanet-am-auth-oauth-user-profile-param`

## Proxy URL

Sets the URL to the `/oauth2c/0AuthProxy.jsp` file, which provides AM with GET to POST proxying capabilities. Change this URL only if an external server performs the GET to POST proxying.

Default: `@SERVER_PROTO@://@SERVER_HOST@:@SERVER_PORT@/@SERVER_URI@/oauth2c/0AuthProxy.jsp`.

**ssoadm** attribute: `iplanet-am-auth-oauth-ssso-proxy-url`

## Account Provider

Specifies the name of the class that implements the account provider.

Default: `org.forgerock.openam.authentication.modules.common.mapping.DefaultAccountProvider`

**ssoadm** attribute: `org-forgerock-auth-oauth-account-provider`

## Account Mapper

Specifies the name of the class that implements the attribute mapping for the account search.

Default: Depends on how the module is created:

- If the OAuth 2.0 authentication module is created from the AM console authentication tab of a realm, the default is: `org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper`.
- If the OAuth 2.0 authentication module is created from the AM console Facebook authentication wizard, the default is: `org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper|*|facebook-`.
- If the OAuth 2.0 authentication module is created from the AM console Google authentication wizard, the default is: `org.forgerock.openam.authentication.modules.oidc.JwtAttributeMapper|*|Google-`.

**ssoadm** attribute: `org-forgerock-auth-oauth-account-mapper`

## Account Mapper Configuration

Specifies the attribute configuration used to map the account of the user authenticated in the OAuth 2.0 provider to the local data store in AM. Valid values are in the form `provider-attr=local-attr`.

Default: `email=mail` and `id=facebook-id`.

**ssoadm** attribute: `org-forgerock-auth-oauth-account-mapper-configuration`

## Attribute Mapper

Specifies the list of fully qualified class names for implementations that map attributes from the OAuth 2.0 authorization server or OpenID Connect provider to AM profile attributes.



Default: `org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper`

Provided implementations are:

`org.forgerock.openam.authentication.modules.common.mapping.JsonAttributeMapper`  
`org.forgerock.openam.authentication.modules.oidc.JwtAttributeMapper` (can only be used when using the `openid` scope)

#### Tip

You can provide string constructor parameters by appending pipe (`|`) separated values.

For example, the `org.forgerock.openam.authentication.modules.oidc.JwtAttributeMapper` class can take two constructor parameters: a comma-separated list of attributes and a prefix to apply to their values. Specify these as follows:

```
org.forgerock.openam.authentication.modules.oidc.JsonAttributeMapper
```

**ssoadm** attribute: `org-forgerock-auth-oauth-attribute-mapper`

## Attribute Mapper Configuration

Map of OAuth 2.0 provider user account attributes to local user profile attributes, with values in the form `provider-attr=local-attr`.

Default: `first_name=givenname, last_name=sn, name=cn, email=mail, id=facebook-id, first_name=facebook-fname, last_name=facebook-lname, email=facebook-email`.

**ssoadm** attribute: `org-forgerock-auth-oauth-attribute-mapper-configuration`

## Save attributes in the session

When enabled, saves the attributes in the Attribute Mapper Configuration field to the AM session.

**ssoadm** attribute: `org-forgerock-auth-oauth-save-attributes-to-session-flag`

## Email attribute in OAuth2 Response

Specifies the attribute identifying the authenticated user's email address in the response from the profile service in the OAuth 2.0 provider. This setting is used to send an email message with an activation code for accounts created dynamically.

**ssoadm** attribute: `org-forgerock-auth-oauth-mail-attribute`

## Create account if it does not exist

When enabled, AM creates an account for the user if the user profile does not exist. If the Prompt for password setting and activation code attribute is enabled, AM prompts the user for a password and activation code before creating the account.

When the OAuth 2.0/OpenID Connect client is configured to create new accounts, the SMTP settings must also be valid. As part of account creation, the OAuth 2.0/OpenID Connect client authentication module sends the resource owner an email with an account activation code. To send the mail, AM uses the SMTP settings you provide here in the OAuth 2.0/OpenID Connect client configuration.

When disabled, a user without a profile may still log into AM if the Ignore Profile attribute is set in the authentication service of the realm, or if the account is mapped to an anonymous account.

**ssoadm** attribute: `org-forgerock-auth-oauth-createaccount-flag`

### Prompt for password setting and activation code

When enabled, the user must set a password before AM creates an account dynamically. An activation code is also sent to the user's email address. Both the password and the code are required before the account is created.

**ssoadm** attribute: `org-forgerock-auth-oauth-prompt-password-flag`

### Map to anonymous user

When enabled, maps the OAuth 2.0 authenticated user to the specified anonymous user. If the Create account if it does not exist property is enabled, AM creates an account for the authenticated user instead of mapping the account to the anonymous user.

**ssoadm** attribute: `org-forgerock-auth-oauth-map-to-anonymous-flag`

### Anonymous User

Specifies an anonymous user that exists in the current realm. The Map to anonymous user property maps authorized users without a profile to this anonymous user, if enabled.

Default: `anonymous`.

**ssoadm** attribute: `org-forgerock-auth-oauth-anonymous-user`

### OAuth 2.0 Provider logout service

Specifies the optional URL of the OAuth 2.0 provider's logout service, if required.

**ssoadm** attribute: `org-forgerock-auth-oauth-logout-service-url`

### Logout options

Specifies whether not to log the user out without prompting from the OAuth 2.0 provider on logout, to log the user out without prompting, or to prompt the user regarding whether to log out from the OAuth 2.0 provider.

Valid values are:

- `prompt`, to ask the user whether or not to log out from the OAuth 2.0 provider.

- `logout`, to log the user out of the OAuth 2.0 provider without prompting.
- `donotlogout`, to keep the user logged in to the OAuth 2.0 provider. There is no prompt to the user.

Default: `prompt`.

**ssoadm** attribute: `org-forgerock-auth-oauth-logout-behaviour`

### Mail Server Gateway implementation class

Specifies the class used by the module to send email. A custom subclass of `org.forgerock.openam.authentication.modules.oauth2.EmailGateway` class can be provided.

Default: `org.forgerock.openam.authentication.modules.oauth2.DefaultEmailGatewayImpl`

**ssoadm** attribute: `org-forgerock-auth-oauth-email-gwy-impl`

### SMTP host

Specifies the host name of the mail server.

Default: `localhost`.

**ssoadm** attribute: `org-forgerock-auth-oauth-smtp-hostname`

### SMTP port

Specifies the SMTP port number for the mail server.

Default: `25`.

**ssoadm** attribute: `org-forgerock-auth-oauth-smtp-port`

### SMTP User Name, SMTP User Password

Specifies the username and password AM uses to authenticate to the mail server.

**ssoadm** attribute: `org-forgerock-auth-oauth-smtp-username` and `org-forgerock-auth-oauth-smtp-password`.

### SMTP SSL Enabled

When enabled, connects to the mail server over SSL. AM must be able to trust the SMTP server certificate.

**ssoadm** attribute: `org-forgerock-auth-oauth-smtp-ssl_enabled`

### SMTP From address

Specifies the address of the email sender, such as `no-reply@example.com`.

Default: `info@forgerock.com`.

**ssoadm** attribute: `org-forgerock-auth-oauth-smtp-email-from`

## Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

Default: 0.

**ssoadm** attribute: `iplanet-am-auth-oauth-auth-level`

## OpenID Connect validation configuration type

Validates the ID token from the OpenID Connect provider. The module needs either a URL to get the public keys for the provider or the symmetric key for an ID token signed with a HMAC-based algorithm.

By default, the configuration type is `.well-known/openid-configuration_url`. This means the module should retrieve the keys based on information in the OpenID Connect provider configuration document.

You can instead configure the authentication module to validate the ID token signature with the client secret key you provide, or to validate the ID token with the keys retrieved from the URL to the OpenID Connect provider's JSON web key set.

### `/oauth2/realms/root/.well-known/openid-configuration_url` (Default)

Retrieve the provider keys based on the information provided in the OpenID Connect Provider Configuration Document.

Specify the URL to the document as the discovery URL.

### `client_secret`

Use the client secret that you specify as the key to validate the ID token signature according to the HMAC by using the client secret to the decrypt the hash, and then checking that the hash matches the hash of the ID token JWT.

### `jwk_url`

Retrieve the provider's JSON web key set as the URL that you specify.

**ssoadm** attribute: `openam-auth-openidconnect-crypto-context-type`

## OpenID Connect validation configuration value

Edit this field depending on the Configuration type you specified in the OpenId Connect validation configuration type field.

**ssoadm** attribute: `openam-auth-openidconnect-crypto-context-value`

### Token Issuer

Required when the `openid` scope is included. Value must match the `iss` field in the issued ID token. For example, `accounts.google.com`.

The issuer value MUST be provided when OAuth 2.0 Mix-Up Mitigation is enabled. For more information, see "OAuth 2.0 Mix-Up Mitigation".

**ssoadm** attribute: `openam-auth-openidconnect-issuer-name`

#### Note

Old uses of `DefaultAccountMapper` are automatically upgraded to the equivalent default implementations.

The following table shows endpoint URLs for AM when configured as an OAuth 2.0 provider. For details, see the OAuth 2.0 Guide. The default endpoints are for Facebook as the OAuth 2.0 provider.

In addition to the endpoint URLs you can set other fields, like scope and attribute mapping, depending on the provider you use:

### *Endpoint URLs*

AM Field	Details
Authorization Endpoint URL	<code>/oauth2/authorize</code> under the deployment URL. <sup>a</sup> Example: <code>https://openam.example.com:8443/openam/oauth2/realms/root/authorize</code> .
Access Token Endpoint URL	<code>/oauth2/access_token</code> under the deployment URL. <sup>a</sup> Example: <code>https://openam.example.com:8443/openam/oauth2/realms/root/access_token</code> .
User Profile Service URL	<code>/oauth2/tokeninfo</code> under the deployment URL. Example: <code>https://openam.example.com:8443/openam/oauth2/realms/root/tokeninfo</code> .

<sup>a</sup>This AM endpoint can take additional parameters. In particular, you must specify the realm if the AM OAuth 2.0 provider is configured for a subrealm rather than the top-level realm.

When making a REST API call, specify the realm in the path component of the endpoint. You must specify the entire hierarchy of the realm, starting at the top-level realm. Prefix each realm in the hierarchy with the `realms/` keyword. For example `/realms/root/realms/customers/realms/europe`.

For example, if the OAuth 2.0 provider is configured for the subrealm `customers` within the top-level realm, then the authentication endpoint URL is as follows: `https://openam.example.com:8443/openam/oauth2/realms/root/realms/customers/authorize`

The `/oauth2/authorize` endpoint can also take `module` and `service` parameters. Use either as described in "Authenticating From a Browser", where `module` specifies the authentication module instance to use or `service` specifies the authentication chain to use when authenticating the resource owner.

### 11.2.19.1. OAuth 2.0 Mix-Up Mitigation

AM has added a new property to the OAuth 2.0 authentication module, `openam-auth-oauth-mix-up-mitigation-enabled`. This OAuth 2.0 Mix-Up Mitigation property controls whether the OAuth 2.0 authentication module carries out additional verification steps when it receives the authorization code from the authorization server. This setting should be only enabled when the authorization server also supports OAuth 2.0 Mix-Up Mitigation.

#### OAuth 2.0 Mix-Up Mitigation Enabled

Specifies that the client must compare the issuer identifier of the authorization server upon registration with the issuer value returned in the `iss` response parameter. If they do not match, the client must abort the authorization process. The client must also confirm that the authorization server's response is intended for the client by comparing the client's client identifier to the value of the `client_id` response parameter.

For more information, see section 4 of OAuth 2.0 Mix-Up Mitigation Draft.

#### Note

At the time of this release, Facebook, Google, and Microsoft identity providers do not support this draft.

**ssoadm** attribute: `openam-auth-oauth-mix-up-mitigation-enabled`

On the AM console, the field Token Issuer must be provided when the OAuth 2.0 Mix-Up Mitigation feature is enabled. The authorization code response will contain an issuer value (`iss`) that will be validated by the client. When the module is an OAuth2-only module (that is, OIDC is not used), the issuer value needs to be explicitly set in the Token Issuer field, so that the validation can succeed.

#### Note

Consult with the authorization server's documentation on what value it uses for the issuer field.

### 11.2.20. OpenID Connect id\_token bearer Authentication Module Properties

The default settings are for Google's provider.

**ssoadm** service name: `amAuthOpenIdConnect`

#### Account provider class

The account provider provides the means to search for and create OpenID Connect users given a set of attributes.

Default: `org.forgerock.openam.authentication.modules.common.mapping.DefaultAccountProvider`

**ssoadm** attribute: `openam-auth-openidconnect-account-provider-class`

## OpenID Connect validation configuration type

In order to validate the ID token from the OpenID Connect provider, the module needs either a URL to get the public keys for the provider, or the symmetric key for an ID token signed with a HMAC-based algorithm.

By default, the configuration type is `.well-known/openid-configuration_url`. This means the module should retrieve the keys based on information in the OpenID Connect Provider Configuration Document.

You can instead configure the authentication module to validate the ID token signature with the client secret key you provide, or to validate the ID token with the keys retrieved from the URL to the OpenID Connect provider's JSON web key set.

### `.well-known/openid-configuration_url` (Default)

Retrieve the provider keys based on the information provided in the OpenID Connect Provider Configuration Document.

Specify the URL to the document as the discovery URL.

### `client_secret`

Use the client secret that you specify as the key to validate the ID token signature according to the HMAC, using the client secret to the decrypt the hash and then checking that the hash matches the hash of the ID token JWT.

### `jwk_url`

Retrieve the provider's JSON web key set at the URL that you specify.

**ssoadm** attribute: `openam-auth-openidconnect-crypto-context-type`

## OpenID Connect validation configuration value

Specifies the discovery URL, JWK or the client secret corresponding to the configuration type selected in the OpenID Connect validation configuration type property.

**ssoadm** attribute: `openam-auth-openidconnect-crypto-context-value`

## Name of header referencing the ID Token

Specifies the name of the HTTP request header to search for the ID token.

Default: `oidc_id_token`

**ssoadm** attribute: `openam-auth-openidconnect-header-name`

## Name of OpenID Connect ID Token Issuer

Corresponds to the expected issue identifier value in the `iss` field of the ID token.

Default: `accounts.google.com`

**ssoadm** attribute: `openam-auth-openidconnect-issuer-name`

### Mapping of jwt attributes to local LDAP attributes

Maps OpenID Connect ID token claims to local user profile attributes, allowing the module to retrieve the user profile based on the ID token.

In OpenID Connect, an ID token is represented as a JSON Web Token (JWT). The ID Token section of the OpenID Connect Core 1.0 specification defines a number of claims included in the ID token for all flows. Additional claims depend on the scopes requested of the OpenID Connect provider.

For each item in the map, the key is the ID token field name and the value is the local user profile attribute name.

Default: `mail=email, uid=sub`

**ssoadm** attribute: `openam-auth-openidconnect-local-to-jwt-attribute-mappings`

### Audience name

Specifies a case-sensitive audience name for this OpenID Connect authentication module. Used to check that the ID token received is intended for this module as an audience.

Default: `example`

**ssoadm** attribute: `openam-auth-openidconnect-audience-name`

### List of accepted authorized parties

Specifies a list of case-sensitive strings and/or URIs from which this authentication module accepts ID tokens. This list is checked against the authorized party claim of the ID token.

Default: `AuthorizedPartyExample http://www.example.com/authorized/party`

**ssoadm** attribute: `openam-auth-openidconnect-accepted-authorized-parties`

### Principal Mapper class

Specifies the class that implements the mapping of the OpenID Connect end user to an AM account. The default principal mapper uses the mapping of local attributes to ID token attributes to find a user profile.

Default: `org.forgerock.openam.authentication.modules.oidc.JwtAttributeMapper`

**ssoadm** attribute: `openam-auth-openidconnect-principal-mapper-class`

## 11.2.21. Persistent Cookie Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthPersistentCookieService`



## Idle Timeout

Specifies the maximum idle time between requests in hours. If that time is exceeded, the cookie is no longer valid.

**ssoadm** attribute: `openam-auth-persistent-cookie-idle-time`

## Max Life

Specifies the maximum life of the cookie in hours.

**ssoadm** attribute: `openam-auth-persistent-cookie-max-life`

## Enforce Client IP

When enabled, enforces that the persistent cookie can only be used from the same client IP to which the cookie was issued.

**ssoadm** attribute: `openam-auth-persistent-cookie-enforce-ip`

## Use secure cookie

When enabled, adds the "Secure" attribute to the persistent cookie.

**ssoadm** attribute: `openam-auth-persistent-cookie-secure-cookie`

## Use HTTP only cookie

When enabled, adds the `HttpOnly` attribute to the persistent cookie.

**ssoadm** attribute: `openam-auth-persistent-cookie-http-only-cookie`

## HMAC Signing Key

Specifies a key to use for HMAC signing of the persistent cookie. Values must be base64-encoded and at least 256 bits (32 bytes) long.

For example, to generate an HMAC signing key, run the following:

```
openssl rand -base64 32
```

or

```
cat /dev/urandom | tr -dc 'a-zA-Z0-9' | fold -w 32 | head -n 1|base64
```

Default: a random 256-bit secret key.

**ssoadm** attribute: `openam-auth-persistent-cookie-hmac-key`

## 11.2.22. RADIUS Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthRadiusService`

## Primary Radius Servers, Secondary Radius Servers

Specify the IP address or fully qualified domain name of one or more primary RADIUS server. The default is `127.0.0.1` (localhost loopback), and optionally, set secondary servers.

**ssoadm** attribute: `primary is iplanet-am-auth-radius-server1; secondary is iplanet-am-auth-radius-server2`

When authenticating users from a directory server that is remote to AM, set the primary values, and optionally, the secondary server values. Primary servers have priority over secondary servers.

Both properties take more than one value; thus, allowing more than one primary or secondary remote server, respectively. Assuming a multi-data center environment, AM determines priority within the primary and secondary remote servers, respectively, as follows:

- Every RADIUS server that is mapped to the current AM instance has highest priority.
- Every RADIUS server that was not specifically mapped to a given AM instance has the next highest priority.
- RADIUS servers that are mapped to different AM instances have the lowest priority.

## Shared Secret

Specify the shared secret for RADIUS authentication. The shared secret should be as secure as a well-chosen password.

**ssoadm** attribute: `iplanet-am-auth-radius-secret`

## Port Number

Specify the RADIUS server port.

Default is 1645.

**ssoadm** attribute: `iplanet-am-auth-radius-server-port`

## Timeout

Specify how many seconds to wait for the RADIUS server to respond. The default value is 3 seconds.

**ssoadm** attribute: `iplanet-am-auth-radius-timeout`

## Health Check Interval

Used for failover. Specify how often AM performs a health check on a previously unavailable RADIUS server by sending an invalid authentication request.

Default: 5 minutes

**ssoadm** attribute: `openam-auth-radius-healthcheck-interval`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-radius-auth-level`

## 11.2.23. SAE Authentication Module Properties

**ssoadm** attribute: `sunAMAuthSAEService`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** service name: `sunAMAuthSAEAuthLevel`

## 11.2.24. SAML2 Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthSAML2Service`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-saml2-auth-level`

### IdP Entity ID

Specifies the identity provider (IdP) for authentication requests to this module. Specify the name of a SAML v2.0 entity provider that is defined in the SAML2 authentication module's realm.

You can find configured entity providers in the AM console under Federation. The Realm column identifies the realm in which an entity provider has been configured.

**ssoadm** attribute: `forgerock-am-auth-saml2-entity-name`

### SP MetaAlias

Specifies the local alias for the service provider (SP).

For service providers configured in the Top Level Realm, use the format */SP Name*.

For service providers configured in subrealms, use the format */Realm Name/SP Name*.

To find the local aliases for entity providers in the AM console, navigate to Realms > *Realm Name* > Applications > SAML > Entity Providers > *Entity Provider Name* > Services.

**ssoadm** attribute: `forgerock-am-auth-saml2-meta-alias`

### Allow IdP to Create NameID

Specifies whether the IdP should create a new identifier for the authenticating user if none exists.

A value of `true` permits the IdP to create an identifier for the authenticating user if none exists. A value of `false` indicates a request to constrain the IdP from creating an identifier.

For detailed information, see the section on the `AllowCreate` property in SAML Version 2.0 Errata 05.

Default: `true`

**ssoadm** attribute: `forgerock-am-auth-saml2-allow-create`

### Linking Authentication Chain

Specifies an authentication chain that is invoked when a user requires authentication to the SP.

Authentication to the SP is required when the authentication module running on the SP is unable to determine the user's identity based on the assertion received from the IdP. In this case, the linking authentication chain is invoked to allow the end user to link their remote and local accounts.

**ssoadm** attribute: `forgerock-am-auth-saml2-login-chain`

### Comparison Type

Specifies a comparison method to evaluate authentication context classes or statements. The value specified in this property overrides the value set in the SP configuration under Realms > *Realm Name* > Applications > SAML > Entity Providers > *Service Provider Name* > Assertion Content > Authentication Context > Comparison Type.

Valid comparison methods are `exact`, `minimum`, `maximum`, or `better`.

For more information about the comparison methods, see the section on the `<RequestedAuthnContext>` element in Assertions and Protocols for the OASIS Security Assertion Markup Language (SAML) V2.0.

Default: `exact`

**ssoadm** attribute: `forgerock-am-auth-saml2-auth-comparison`

### Authentication Context Class Reference

Specifies one or more URIs for authentication context classes to be included in the SAML request. Authentication context classes are unique identifiers for an authentication mechanism.

The SAML v2.0 protocol supports a standard set of authentication context classes, defined in Authentication Context for the OASIS Security Assertion Markup Language (SAML) V2.0. In addition to the standard authentication context classes, you can specify customized authentication context classes.

Any authentication context class that you specify in this field must be supported for the service provider. To determine which authentication context classes are supported, locate the list of authentication context classes that are available to the SP under Realms > *Realm Name* > Applications > SAML > Entity Providers > *Service Provider Name* > Assertion Content > Authentication Context, and then review the values in the Supported column.

When specifying multiple authentication context classes, use the | character to separate the classes.

Example value: `urn:oasis:names:tc:SAML:2.0:ac:classes:Password|urn:oasis:names:tc:SAML:2.0:ac:classes:TimesyncToken`

**ssoadm** attribute: `forgerock-am-auth-saml2-authn-context-class-ref`

## Authentication Context Declaration Reference

Specifies one or more URIs that identify authentication context declarations.

This field is optional.

When specifying multiple URIs, use the | character to separate the URIs.

For more information, see the section on the `<RequestedAuthnContext>` element in Assertions and Protocols for the OASIS Security Assertion Markup Language (SAML) V2.0.

**ssoadm** attribute: `forgerock-am-auth-saml2-authn-context-decl-ref`

## Request Binding

Specifies the format used to send the authentication request from the SP to the IdP.

Valid values are `HTTP-Redirect` and `HTTP-POST`.

Default: `HTTP-Redirect`

**ssoadm** attribute: `forgerock-am-auth-saml2-req-binding`. When using the **ssoadm** command, set this attribute's value to `urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect` or `urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST`.

## Response Binding

Specifies the format used to send the response from the IdP to the SP.

A value of `HTTP-POST` indicates that the HTTP POST binding with a self-submitting form should be used in assertion processing. A value of `HTTP-Artifact` indicates that the HTTP Artifact binding should be used.

Default: `HTTP-Artifact`

**ssoadm** attribute: `forgerock-am-auth-saml2-binding`. When using the **ssoadm** command, set this attribute's value to `urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact` or `urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST`.

## Force IdP Authentication

Specifies whether the IdP should force authentication or can reuse existing security contexts.

A value of `true` indicates that the IdP should force authentication. A value of `false` indicates that the IdP can reuse existing security contexts.

**ssoadm** attribute: `forgerock-am-auth-saml2-force-authn`

## Passive Authentication

Specifies whether the IdP should use passive authentication or not. Passive authentication requires the IdP to only use authentication methods that do not require user interaction. For example, authenticating using an X.509 certificate.

A value of `true` indicates that the IdP should authenticate passively. A value of `false` indicates that the IdP should not authenticate passively.

**ssoadm** attribute: `forgerock-am-auth-saml2-is-passive`

## NameID Format

Specifies a SAML name ID format to be requested in the SAML authentication request.

Default: `urn:oasis:names:tc:SAML:2.0:nameid-format:persistent`

**ssoadm** attribute: `forgerock-am-auth-saml2-name-id-format`

## Single Logout Enabled

Specifies whether AM should attempt to log out of the user's IdP session during session logout.

When enabling SAML v2.0 single logout, you must also configure the post-authentication processing class for the authentication chain containing the SAML2 authentication module to `org.forgerock.openam.authentication.modules.saml2.SAML2PostAuthenticationPlugin`.

For more information about configuring single logout when implementing SAML v2.0 federation using the SAML2 authentication module, see "Configuring Single Logout in an Integrated Mode Implementation" in the *SAML v2.0 Guide*.

Default: `false`

**ssoadm** attribute: `forgerock-am-auth-saml2-slo-enabled`

## Single Logout URL

Specifies the URL to which the user is forwarded after successful IdP logout. Configure this property only if you have enabled SAML v2.0 single logout by selecting the Single Logout Enabled check box.

**ssoadm** attribute: `forgerock-am-auth-saml2-slo-relay`

## 11.2.25. Scripted Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthScriptedService`

Use the following settings at the realm level when configuring an individual scripted authentication module, in the AM console under Realms > *Realm Name* > Authentication > Modules.

### Client-Side Script Enabled

When enabled, the module includes the specified client-side script in the login page to be executed on the user-agent prior to the server-side script.

**ssoadm** attribute: `iplanet-am-auth-scripted-client-script-enabled`

### Client-Side Script

Specifies the ID of the script to include in the login page. This script is run on the user-agent prior to the server-side script. This script must be written in a language the user-agent can interpret, such as JavaScript, even if the server-side script is written in Groovy.

To create, view, or modify the content of the scripts, navigate to Realms > *Realm Name* > Scripts.

**ssoadm** attribute: `iplanet-am-auth-scripted-client-script`

### Server Side Script

Specifies the ID of the script to run in AM after the client-side script has completed.

To create, view, or modify the content of the scripts, navigate to Realms > *Realm Name* > Scripts.

**ssoadm** attribute: `iplanet-am-auth-scripted-server-script`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the scripted authentication module.

The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-scripted-auth-level`

In the AM console, navigate to Configure > Global Services > Scripting > Secondary Configurations > *Server-Side Script Type*, > Secondary Configurations > EngineConfiguration.

On the EngineConfiguration page, configure the following settings for the scripting engine of the selected type:

### Server-side Script Timeout

Specifies the maximum execution time any individual script should take on the server (in seconds). AM terminates scripts which take longer to run than this value.

**ssoadm** attribute: `serverTimeout`

### Core thread pool size

Specifies the initial number of threads in the thread pool from which scripts operate. AM will ensure the pool contains at least this many threads.

**ssoadm** attribute: `coreThreads`

### Maximum thread pool size

Specifies the maximum number of threads in the thread pool from which scripts operate. If no free thread is available in the pool, AM creates new threads in the pool for script execution up to the configured maximum.

**ssoadm** attribute: `maxThreads`

### Thread pool queue size

Specifies the number of threads to use for buffering script execution requests when the maximum thread pool size is reached.

**ssoadm** attribute: `queueSize`

### Thread idle timeout (seconds)

Specifies the length of time (in seconds) for a thread to be idle before AM terminates created threads. If the current pool size contains the number of threads set in `Core thread pool size`, then idle threads will not be terminated, maintaining the initial pool size.

**ssoadm** attribute: `idleTimeout`

### Java class whitelist

Specifies the list of class name patterns allowed to be invoked by the script. Every class accessed by the script must match at least one of these patterns.



You can specify the class name as-is or use a regular expression.

**ssoadm** attribute: `whiteList`

### Java class blacklist

Specifies the list of class name patterns that are NOT allowed to be invoked by the script. The blacklist is applied AFTER the whitelist to exclude those classes. Access to a class specified in both the whitelist and the blacklist will be denied.

You can specify the class name to exclude as-is or use a regular expression.

**ssoadm** attribute: `blackList`

### Use system SecurityManager

When enabled, AM makes a call to the `System.getSecurityManager().checkPackageAccess(...)` method for each class that is accessed. The method throws `SecurityException` if the calling thread is not allowed to access the package.

#### Note

This feature only takes effect if the security manager is enabled for the JVM.

**ssoadm** attribute: `useSecurityManager`

## 11.2.26. SecurID Authentication Module Properties

### Important

To use the SecurID authentication module, you must first build an AM `.war` file that includes the supporting library. For more information, see "Enabling RSA SecurID Support" in the *Installation Guide*.

**ssoadm** service name: `iPlanetAMAuthSecurIDService`

### ACE/Server Configuration Path

Specify the directory where the SecurID ACE/Server `sdconf.rec` file is located, which by default is expected under the AM configuration directory, such as `$HOME/openam/openam/auth/ace/data`. The directory must exist before AM can use SecurID authentication.

**ssoadm** attribute: `iplanet-am-auth-securid-server-config-path`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-securid-auth-level`

## 11.2.27. Windows Desktop SSO Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthWindowsDesktopSSOService`

### Tip

Before configuring the authentication module, create an Active Directory account and a `keytab` file.

### Service Principal

Specifies the Kerberos principal for authentication in the format `HTTP/host.domain@DC-DOMAIN-NAME`, where *host.domain* corresponds to the host and domain names of the AM instance and *DC-DOMAIN-NAME* is the domain name of the Kerberos realm (the FQDN of the Active Directory domain). *DC-DOMAIN-NAME* can differ from the domain name for AM.

In multi-server deployments, configure *host.domain* as the load balancer FQDN or IP address in front of the AM instances. For example, `HTTP/openamLB.example.com@KERBEROSREALM.INTERNAL.COM`.

For more information, see the KB article *How do I set up the WSSO authentication module in AM in a load-balanced environment?*.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-principal-name`

### Keytab File Name

Specifies the full path of the keytab file for the Service Principal. You generate the keytab file using the Windows `ktpass` utility.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-keytab-file`

### Kerberos Realm

Specifies the Kerberos Key Distribution Center realm. For the Windows Kerberos service, this is the domain controller server domain name.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-kerberos-realm`

### Kerberos Server Name

Specifies the fully qualified domain name of the Kerberos Key Distribution Center server, such as that of the domain controller server.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-kdc`

### Return Principal with Domain Name

When enabled, AM automatically returns the Kerberos principal with the domain controller's domain name during authentication.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-returnRealm`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-auth-level`

### Trusted Kerberos realms

List of trusted Kerberos realms for user Kerberos tickets. If realms are configured, then Kerberos tickets are only accepted if the realm part of the user principal name of the user's Kerberos ticket matches a realm from the list.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-kerberos-realms-trusted`

### Search for the user in the realm

Validates the user against the configured data stores. If the user from the Kerberos token is not found, authentication will fail. If an authentication chain is set, the user is able to authenticate through another module. This search uses the `Alias Search Attribute Name` from the core realm attributes. See "User Profile" for more information about this property.

**ssoadm** attribute: `iplanet-am-auth-windowsdesktopsso-lookupUserInRealm`

#### Note

Sending a `ForceAuth=true` authentication request when the user has a valid session may result in failed authentication unless the request hits the authoritative AM server.

Authentication cross-talk requires an authorization header in the request that grants the new server access to the user's authentication token.

To ensure the authorization headers are included in the cross-talk requests, perform the following steps:

1. Navigate to Deployment > Servers > *Server Name* > Advanced.
2. Modify the following advanced properties:
  - Add the `WWW-Authenticate` value to the `openam.retained.http.headers` property.
  - Add the `Authorization` value to the `openam.retained.http.request.headers` property.
3. Save your changes.

## 11.2.28. Windows NT Authentication Module Properties

**ssoadm** service name: `iPlanetAMAuthNTService`

### Authentication Domain

Specifies the Windows domain name to which users belong.

**ssoadm** attribute: `iplanet-am-auth-nt-domain`

### Authentication Host

Specifies the NetBIOS name of the Windows NT domain controller to which to authenticate users.

**ssoadm** attribute: `iplanet-am-auth-nt-host`

### Samba Configuration File Name

Specifies the full path to the Samba configuration file, for example, `/opt/openam/smb.conf`.

AM uses the **smbclient** command to validate user credentials against the domain controller, which must be available in the `$PATH` variable associated with AM.

**ssoadm** attribute: `iplanet-am-auth-samba-config-file-name`

### Authentication Level

Sets the authentication level used to indicate the level of security associated with the module. The value can range from 0 to any positive integer.

**ssoadm** attribute: `iplanet-am-auth-nt-auth-level`

## 11.3. Global Service Properties

The following sections document AM services with configuration properties that affect AM authentication, sessions, and single sign-on:

- "ForgeRock Authenticator (OATH) Service"
- "ForgeRock Authenticator (Push) Service"
- "Push Notification Service"
- "Session"
- "Session Property Whitelist Service"
- "Social Authentication Implementations"

### 11.3.1. ForgeRock Authenticator (OATH) Service

**amster** type ID: `authenticatorOathService`

### 11.3.1.1. Realm Defaults

The following settings appear on the *Realm Defaults* tab:

#### Profile Storage Attribute

Attribute for storing ForgeRock Authenticator OATH profiles.

The default attribute is added to the user store during OpenAM installation. If you want to use a different attribute, you must make sure to add it to your user store schema prior to deploying two-step verification with a ForgeRock OATH authenticator app in OpenAM. OpenAM must be able to write to the attribute.

Default value: `oathDeviceProfiles`

**amster** data attribute: `oathAttrName`

#### Device Profile Encryption Scheme

Encryption scheme for securing device profiles stored on the server.

If enabled, each device profile is encrypted using a unique random secret key using the given strength of AES encryption in CBC mode with PKCS#5 padding. A HMAC-SHA of the given strength (truncated to half-size) is used to ensure integrity protection and authenticated encryption. The unique random key is encrypted with the given RSA key-pair and stored with the device profile.

*Note:* AES-256 may require installation of the JCE Unlimited Strength policy files.

The possible values for this property are:

```
RSAES_AES256CBC_HS512
RSAES_AES128CBC_HS256
NONE
```

Default value: `NONE`

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionScheme`

#### Encryption Key Store

Path to the keystore from which to load encryption keys.

Default value: `/path/to/openam/openam/keystore.jks`

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionKeystore`

#### Key Store Type

Type of encryption keystore.

*Note:* PKCS#11 keystores require hardware support such as a security device or smart card and is not available by default in most JVM installations.

See the JDK 8 PKCS#11 Reference Guide for more details.

The possible values for this property are:

```
JKS
JCEKS
PKCS11
PKCS12
```

Default value: `JKS`

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionKeystoreType`

### Key Store Password

Password to unlock the keystore. This password will be encrypted.

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionKeystorePassword`

### Key-Pair Alias

Alias of the certificate and private key in the keystore. The private key is used to encrypt and decrypt device profiles.

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionKeystoreKeyPairAlias`

### Private Key Password

Password to unlock the private key.

**amster** data attribute: `authenticatorOATHDeviceSettingsEncryptionKeystorePrivateKeyPassword`

### ForgeRock Authenticator (OATH) Device Skippable Attribute Name

The data store attribute that holds the user's decision to enable or disable obtaining and providing a password obtained from the ForgeRock Authenticator app. This attribute must be writable.

Default value: `oath2faEnabled`

**amster** data attribute: `authenticatorOATHSkippableName`

## 11.3.2. ForgeRock Authenticator (Push) Service

**amster** type ID: `authenticatorPushService`

### 11.3.2.1. Realm Defaults

The following settings appear on the *Realm Defaults* tab:

#### Profile Storage Attribute

The user's attribute in which to store Push Notification profiles.

The default attribute is added to the schema when you prepare a user store for use with OpenAM. If you want to use a different attribute, you must make sure to add it to your user store schema prior to deploying push notifications with the ForgeRock Authenticator app in OpenAM. OpenAM must be able to write to the attribute.

Default value: `pushDeviceProfiles`

**amster** data attribute: `pushAttrName`

#### Device Profile Encryption Scheme

Encryption scheme to use to secure device profiles stored on the server.

If enabled, each device profile is encrypted using a unique random secret key using the given strength of AES encryption in CBC mode with PKCS#5 padding. A HMAC-SHA of the given strength (truncated to half-size) is used to ensure integrity protection and authenticated encryption. The unique random key is encrypted with the given RSA key-pair and stored with the device profile.

*Note:* AES-256 may require installation of the JCE Unlimited Strength policy files.

The possible values for this property are:

```
RSAES_AES256CBC_HS512
RSAES_AES128CBC_HS256
NONE
```

Default value: `NONE`

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionScheme`

#### Encryption Key Store

Path to the keystore from which to load encryption keys.

Default value: `/path/to/openam/openam/keystore.jks`

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionKeystore`

#### Key Store Type

Type of KeyStore to load.

*Note:* PKCS#11 keystores require hardware support such as a security device or smart card and is not available by default in most JVM installations.

See the JDK 8 PKCS#11 Reference Guide for more details.

The possible values for this property are:

```
JKS
JCEKS
PKCS11
PKCS12
```

Default value: **JKS**

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionKeystoreType`

### Key Store Password

Password to unlock the keystore. This password is encrypted when it is saved in the OpenAM configuration. You should modify the default value.

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionKeystorePassword`

### Key-Pair Alias

Alias of the certificate and private key in the keystore. The private key is used to encrypt and decrypt device profiles.

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionKeystoreKeyPairAlias`

### Private Key Password

Password to unlock the private key.

**amster** data attribute: `authenticatorPushDeviceSettingsEncryptionKeystorePrivateKeyPassword`

## 11.3.3. Push Notification Service

**amster** type ID: `pushNotification`

### 11.3.3.1. Realm Defaults

The following settings appear on the *Realm Defaults* tab:

#### SNS Access Key ID

Amazon Simple Notification Service Access Key ID. For more information, see <https://aws.amazon.com/developers/access-keys/>.



For example, you might set this property to: *AKIAIOSFODNN7EXAMPLE*

**amster** data attribute: *accessKey*

### SNS Access Key Secret

Amazon Simple Notification Service Access Key Secret. For more information, see <https://aws.amazon.com/developers/access-keys/>.

For example, you might set this property to: *wJalrXUtnFEMI/K7MDENG/bP×RfiCYEXAMPLEKEY*

**amster** data attribute: *secret*

### SNS Endpoint for APNS

The Simple Notification Service endpoint in Amazon Resource Name format, used to send push messages to the Apple Push Notification Service (APNS).

For example, you might set this property to: *arn:aws:sns:us-east-1:1234567890:app/APNS/production*

**amster** data attribute: *appleEndpoint*

### SNS Endpoint for GCM

The Simple Notification Service endpoint in Amazon Resource Name format, used to send push messages over Google Cloud Messaging (GCM).

For example, you might set this property to: *arn:aws:sns:us-east-1:1234567890:app/GCM/production*

**amster** data attribute: *googleEndpoint*

### SNS Client Region

Region of your registered Amazon Simple Notification Service client. For more information, see <https://docs.aws.amazon.com/general/latest/gr/rande.html>.

The possible values for this property are:

```
us-gov-west-1
us-east-1
us-west-1
us-west-2
eu-west-1
eu-central-1
ap-southeast-1
ap-southeast-2
ap-northeast-1
ap-northeast-2
sa-east-1
```

```
cn-north-1
```

Default value: `us-east-1`

**amster** data attribute: `region`

### Message Transport Delegate Factory

The fully qualified class name of the factory responsible for creating the `PushNotificationDelegate`. The class must implement `org.forgerock.openam.services.push.PushNotificationDelegate`.

Default value: `org.forgerock.openam.services.push.sns.SnsHttpDelegateFactory`

**amster** data attribute: `delegateFactory`

### Response Cache Duration

The minimum lifetime to keep unanswered message records in the message dispatcher cache, in seconds. To keep unanswered message records indefinitely, set this property to `0`. Should be tuned so that it is applicable to the use case of this service. For example, the ForgeRock Authenticator (Push) authentication module has a default timeout of 120 seconds.

Default value: `120`

**amster** data attribute: `mdDuration`

### Response Cache Concurrency

Level of concurrency to use when accessing the message dispatcher cache. Defaults to `16`, and must be greater than `0`. Choose a value to accommodate as many threads as will ever concurrently access the message dispatcher cache.

Default value: `16`

**amster** data attribute: `mdConcurrency`

### Response Cache Size

Maximum size of the message dispatcher cache, in number of records. If set to `0` the cache can grow indefinitely. If the number of records that need to be stored exceeds this maximum, then older items in the cache will be removed to make space.

Default value: `10000`

**amster** data attribute: `mdCacheSize`

## 11.3.4. Session

**amster** type ID: `session`

### 11.3.4.1. Global Attributes

The following settings appear on the **Global Attributes** tab:

#### Resulting behavior if session quota exhausted

Specify the action to take if a session quota is exhausted:

- **Deny Access.** New session creation requests will be denied.
- **Destroy Next Expiring.** The session that would expire next will be destroyed.
- **Destroy Oldest.** The oldest session will be destroyed.
- **Destroy All.** All previous sessions will be destroyed.

The possible values for this property are:

```
DENY_ACCESS  
DESTROY_OLD_SESSION
```

Default value: `DESTROY_OLD_SESSION`

**amster** data attribute: `iplanet-am-session-constraint-resulting-behavior`

### 11.3.4.2. General

The following settings appear on the **General** tab:

#### Latest Access Time Update Frequency

Defaults to `60` seconds. At most, OpenAM updates a session's latest access time this often.

Subsequent touches to the session that occur less than the specified number of seconds after an update will not cause additional updates to the session's access time.

Refreshing a session returns the idle time as the number of seconds since an update has occurred, which will be between `0` and the specified Latest Access Time Update Frequency.

Default value: `60`

**amster** data attribute: `latestAccessTimeUpdateFrequency`

#### DN Restriction Only Enabled

If enabled, OpenAM will not perform DNS lookups when checking restrictions in cookie hijacking mode.

Default value: `false`

**amster** data attribute: `dnRestrictionOnly`

## Session Timeout Handler implementations

Lists plugin classes implementing session timeout handlers. Specify the fully qualified name.

**amster** data attribute: `timeoutHandlers`

### 11.3.4.3. Session Search

The following settings appear on the **Session Search** tab:

#### Maximum Number of Search Results

Maximum number of results from a session search. Do not set this attribute to a large value, for example more than 1000, unless sufficient system resources are allocated.

Default value: `120`

**amster** data attribute: `maxSessionListSize`

#### Timeout for Search

Time after which OpenAM sees an incomplete search as having failed, in seconds.

Default value: `5`

**amster** data attribute: `sessionListRetrievalTimeout`

### 11.3.4.4. Session Property Change Notifications

The following settings appear on the **Session Property Change Notifications** tab:

#### Enable Property Change Notifications

If on, then OpenAM notifies other applications participating in SSO when a session property in the Notification Properties list changes on a stateful session.

The possible values for this property are:

ON  
OFF

Default value: `OFF`

**amster** data attribute: `propertyChangeNotifications`

#### Notification Properties

Lists session properties for which OpenAM can send notifications upon modification. Session notification applies to stateful sessions only.

**amster** data attribute: `notificationPropertyList`

### 11.3.4.5. Session Quotas

The following settings appear on the **Session Quotas** tab:

#### Enable Quota Constraints

If on, then OpenAM allows you to set quota constraints on stateful sessions.

The possible values for this property are:

```
ON  
OFF
```

Default value: `OFF`

**amster** data attribute: `iplanet-am-session-enable-session-constraint`

#### Read Timeout for Quota Constraint

Maximum wait time after which OpenAM considers a search for live session count as having failed if quota constraints are enabled, in milliseconds.

Default value: `6000`

**amster** data attribute: `quotaConstraintMaxWaitTime`

#### Resulting behavior if session quota exhausted

Specify the action to take if a session quota is exhausted:

- **Deny Access.** New session creation requests will be denied.
- **Destroy Next Expiring.** The session that would expire next will be destroyed.
- **Destroy Oldest.** The oldest session will be destroyed.
- **Destroy All.** All previous sessions will be destroyed.

The possible values for this property are:

```
org.forgerock.openam.session.service.DenyAccessAction  
org.forgerock.openam.session.service.DestroyNextExpiringAction  
org.forgerock.openam.session.service.DestroyOldestAction  
org.forgerock.openam.session.service.DestroyAllAction
```

Default value: `org.forgerock.openam.session.service.DestroyNextExpiringAction`

**amster** data attribute: `behaviourWhenQuotaExhausted`

## Deny user login when session repository is down

This property only takes effect when the session quota constraint is enabled, and the session data store is unavailable.

The possible values for this property are:

YES  
NO

Default value: **NO**

**amster** data attribute: `denyLoginWhenRepoDown`

### 11.3.4.6. Stateless Sessions

The following settings appear on the **Stateless Sessions** tab:

#### Signing Algorithm Type

Specifies the algorithm that OpenAM uses to sign a JSON Web Token (JWT) containing a stateless session. Signing the JWT enables tampering detection. Note that OpenAM stores stateless sessions in a JWT that resides in an HTTP cookie.

Applies only to deployments using stateless sessions. OpenAM supports the following signing algorithms:

- **HS256**. HMAC using SHA-256.
- **HS384**. HMAC using SHA-384.
- **HS512**. HMAC using SHA-512.
- **RS256**. RSASSA-PKCS1-v1\_5 using SHA-256.
- **ES256**. ECDSA using SHA-256 and NIST standard P-256 elliptic curve.
- **ES384**. ECDSA using SHA-384 and NIST standard P-384 elliptic curve.
- **ES512**. ECDSA using SHA-512 and NIST standard P-521 elliptic curve.

The possible values for this property are:

NONE  
HS256  
HS384  
HS512  
RS256  
ES256  
ES384

ES512

Default value: `HS256`

**amster** data attribute: `statelessSigningType`

### Signing HMAC Shared Secret

Specifies the shared secret that OpenAM uses when performing HMAC signing on the stateless session JWT.

Specify a shared secret when using a "Signing Algorithm Type" of `HS256`, `HS384`, or `HS512`. Applies only to deployments using stateless sessions.

Default value: `MSq4Vgp9uy6ZP/I0uWqvB1VEVtDQBTwMkXVhn0BgHGg=`

**amster** data attribute: `statelessSigningHmacSecret`

### Signing RSA/ECDSA Certificate Alias

Specify the alias of a certificate containing a public/private key pair that OpenAM uses when performing RSA or ECDSA signing on the stateless session JWT. Specify a signing certificate alias when using a "Signing Algorithm Type" of `RS256`, `ES256`, `ES384`, or `ES512`.

Certificate will be retrieved from the keystore specified by the `com.sun.identity.saml.xmlsig.keystore` property.

Default value: `test`

**amster** data attribute: `statelessSigningRsaCertAlias`

### Encryption Algorithm

Specifies the algorithm that OpenAM uses to encrypt JWTs containing stateless sessions.

Applies only to deployments using stateless sessions. OpenAM supports the following algorithms:

- **NONE**. No encryption is selected.
- **RSA**. Session content is encrypted with AES using a unique key. The key is then encrypted with an RSA public key and appended to the JWT.

OpenAM supports the three padding modes, which you can set using the `org.forgerock.openam.session.stateless.rsa.padding` advanced property:

- **RSA1\_5**. RSA with PKCS#1 v1.5 padding.
- **RSA-OAEP**. RSA with optimal asymmetric encryption padding (OAEP) and SHA-1.
- **RSA-OAEP-256**. RSA with OAEP padding and SHA-256.

- **AES KeyWrapping.** Session content is encrypted with AES using a unique key and is then wrapped using AES KeyWrap and the master key. This provides additional security, compared to RSA, at the cost of 128 or 256 bits (or 32 bytes) depending on the size of the master key. This method provides authenticated encryption, which removes the need for a separate signature and decreases the byte size of the JWT. See RFC 3394.
- **Direct AES Encryption.** Session content is encrypted with direct AES encryption with a symmetric key. This method provides authenticated encryption, which removes the need for a separate signature and decreases the byte size of the JWT.

**Important:** To prevent users from accidentally disabling all authentication support, which can be accomplished by disabling signing and not using an authenticated encryption mode, you must set the `org.forgerock.openam.session.stateless.signing.allownone` system property to `true` to turn off signing completely.

The possible values for this property are:

```
NONE
RSA
AES_KEYWRAP
DIRECT
```

Default value: `DIRECT`

**amster** data attribute: `statelessEncryptionType`

### Encryption RSA Certificate Alias

Specifies the alias of a certificate containing a public/private key pair that OpenAM uses when encrypting a JWT. Specify an encryption certificate alias when using an Encryption Algorithm Type of RSA.

Applies only to deployments using stateless sessions.

Certificate will be retrieved from the keystore referenced by the `com.sun.identity.saml.xmlsig.keystore` property.

Default value: `test`

**amster** data attribute: `statelessEncryptionRsaCertAlias`

### Enable Session Blacklisting

Enables session blacklisting for logged out stateless sessions.

It is recommended to enable this setting if the maximum session time is high. Blacklist state is stored in the core token service (CTS) until the session token expires in order to ensure that session tokens cannot continue to be used. Requires a server restart for changes to take effect.

Default value: `false`



**amster** data attribute: `openam-session-stateless-enable-session-blacklisting`

### Session Blacklist Cache Size

Number of blacklisted stateless sessions to cache in memory to speed up blacklist checks and reduce load on the CTS. The cache size should be around the number of logouts expected in the maximum session time.

Applies only to deployments using stateless sessions.

Default value: `10000`

**amster** data attribute: `openam-session-stateless-blacklist-cache-size`

### Blacklist Poll Interval (seconds)

Specifies the interval at which OpenAM polls the Core Token Service for changes to logged out sessions, in seconds.

The longer the polling interval, the more time a malicious user has to connect to other OpenAM servers in a cluster and make use of a stolen session cookie. Shortening the polling interval improves the security for logged out sessions, but might incur a minimal decrease in overall OpenAM performance due to increased network activity. Set to `0` to disable this feature completely.

Applies only to deployments using stateless sessions and session blacklisting.

Default value: `60`

**amster** data attribute: `openam-session-stateless-blacklist-poll-interval`

### Blacklist Purge Delay (minutes)

When added to the maximum session time, specifies the amount of time that OpenAM tracks logged out sessions.

Increase the blacklist purge delay if you expect system clock skews in a cluster of OpenAM servers to be greater than one minute. There is no need to increase the blacklist purge delay for servers running a clock synchronization protocol, such as Network Time Protocol.

Applies only to deployments using stateless sessions and session blacklisting.

Default value: `1`

**amster** data attribute: `openam-session-stateless-blacklist-purge-delay`

### Symmetric AES Key

AES key for use with Direct or AES KeyWrap encryption modes.

The symmetric AES key is a base64-encoded random key.

For direct encryption with **AES-GCM** or for **AES-KeyWrap** with any content encryption method, this should be 128, 192, or 256 bits.

For direct encryption with **AES-CBC-HMAC**, the key should be double those sizes (one half for the AES key, the other have for the HMAC key).

AES key sizes greater than 128 bits require installation of the JCE Unlimited Strength policy files in your JRE.

**amster** data attribute: `statelessEncryptionAesKey`

### Compression Algorithm

If enabled the session state will be compressed before signing and encryption.

**WARNING:** Enabling compression may compromise encryption. This may leak information about the content of the session state if encryption is enabled.

The possible values for this property are:

```
NONE  
DEF
```

Default value: **NONE**

**amster** data attribute: `statelessCompressionType`

### 11.3.4.7. Dynamic Attributes

#### Note

Configuring any of the following properties at the realm level (Realms > *Realm Name* > Services > Session) causes the values to be stored in the identity data store configured in that realm.

If you remove the identity data store from the realm, the properties will use the values configured at the global level (Configure > Global Services > Session).

The following settings appear on the **Dynamic Attributes** tab:

#### Maximum Session Time

Maximum time a session can remain valid before OpenAM requires the user to authenticate again, in minutes.

Default value: **120**

**amster** data attribute: `maxSessionTime`

## Maximum Idle Time

Maximum time a stateful session can remain idle before OpenAM requires the user to authenticate again, in minutes.

Default value: 30

**amster** data attribute: `maxIdleTime`

## Maximum Caching Time

Maximum time before OpenAM refreshes a session that has been cached, in minutes.

Default value: 3

**amster** data attribute: `maxCachingTime`

## Active User Sessions

Maximum number of concurrent stateful sessions OpenAM allows a user to have.

Default value: 5

**amster** data attribute: `quotaLimit`

## 11.3.5. Session Property Whitelist Service

**amster** type ID: `amSessionPropertyWhitelist`

### 11.3.5.1. Realm Defaults

The following settings appear on the *Realm Defaults* tab:

#### Whitelisted Session Property Names

A list of properties that users may read, edit the value of, or delete from their session.

Adding properties to sessions can impact OpenAM's performance. Because there is no size constraint limiting the set of properties that you can add to sessions, and no limit on the number of session properties you can add, keep in mind that adding session properties can increase the load on an OpenAM deployment in the following areas:

- OpenAM server memory
- OpenDJ storage
- OpenDJ replication

Protected attributes will NOT be allowed to be set, edited or deleted, even if they are included in this whitelist.

**amster** data attribute: `sessionPropertyWhitelist`

## 11.3.6. Social Authentication Implementations

**amster** type ID: `socialauthentication`

### 11.3.6.1. Realm Defaults

The following settings appear on the *Realm Defaults* tab:

#### Display Names

The display names for the implementations - this will be used to provide a name for the icon displayed on the login page. The key should be used across all the settings on this page to join them together.

For example:

Key	Value
google	Google

**amster** data attribute: `displayNames`

#### Authentication Chains

The name of the authentication chains that are the entry points to being authenticated by each respective social authentication provider. The key should correspond to a key used to define a Display Name above.

For example:

Key	Value
google	socialAuthChainGoogle

**amster** data attribute: `authenticationChains`

#### Icons

Either a full URL or a path relative to the base of the site/server where the image can be found. The image will be used on the login page to link to the authentication chain defined above. The key should correspond to a key used to define a Display Name above.

For example:

Key	Value
google	/images/google-sign-in.png

**amster** data attribute: `icons`

## Enabled Implementations

Provide a key that has been used to define the settings above to enable that set of settings.

For example: `google`

**amster** data attribute: `enabledKeys`

## 11.4. Authentication API Functionality

This section covers the available functionality when Scripting authentication modules use client-side and server-side authentication script types.

Authentication API functionality includes:

- Accessing Authentication State
- Accessing Profile Data
- Accessing Client-Side Script Output Data
- Accessing Request Data

### 11.4.1. Accessing Authentication State

AM passes `authState` and `sharedState` objects to server-side scripts in order for the scripts to access authentication state.

Server-side scripts can access the current authentication state through the `authState` object.

The `authState` value is `SUCCESS` if the authentication is currently successful, or `FAILED` if authentication has failed. Server-side scripts must set a value for `authState` before completing.

If an earlier authentication module in the authentication chain has set the login name of the user, server-side scripts can access the login name through `username`.

The following authentication modules set the login name of the user:

- Anonymous
- Certificate
- Data Store
- Federation
- HTTP Basic

- JDBC
- LDAP
- Membership
- RADIUS
- SecurID
- Windows Desktop SSO
- Windows NT

### 11.4.2. Accessing Profile Data

Server-side authentication scripts can access profile data through the methods of the `idRepository` object.

*Profile Data Methods*

Method	Parameters	Return Type	Description
<code>idRepository</code> <code>.getAttribute</code>	<i>User Name</i> (type: <code>String</code> ) <i>Attribute Name</i> (type: <code>String</code> )	<code>Set</code>	Return the values of the named attribute for the named user.
<code>idRepository</code> <code>.setAttribute</code>	<i>User Name</i> (type: <code>String</code> ) <i>Attribute Name</i> (type: <code>String</code> ) <i>Attribute Values</i> (type: <code>Array</code> )	<code>Void</code>	Set the named attribute as specified by the attribute value for the named user, and persist the result in the user's profile.
<code>idRepository</code> <code>.addAttribute</code>	<i>User Name</i> (type: <code>String</code> ) <i>Attribute Name</i> (type: <code>String</code> ) <i>Attribute Value</i> (type: <code>String</code> )	<code>Void</code>	Add an attribute value to the list of attribute values associated with the attribute name for a particular user.

### 11.4.3. Accessing Client-Side Script Output Data

Client-side scripts add data they gather into a `String` object named `clientScriptOutputData`. Client-side scripts then cause the user-agent automatically to return the data to AM by HTTP POST of a self-submitting form.

### 11.4.4. Accessing Request Data

Server-side scripts can get access to the login request by using the methods of the `requestData` object.

The following table lists the methods of the `requestData` object. Note that this object differs from the client-side `requestData` object and contains information about the original authentication request made by the user.

### Request Data Methods

Method	Parameters	Return Type	Description
<code>requestData.getHeader</code>	<i>Header Name</i> (type: <code>String</code> )	<code>String</code>	Return the <code>String</code> value of the named request header, or <code>null</code> if parameter is not set.
<code>requestData.getHeaders</code>	<i>Header Name</i> (type: <code>String</code> )	<code>String[]</code>	Return the array of <code>String</code> values of the named request header, or <code>null</code> if parameter is not set.
<code>requestData.getParameter</code>	<i>Parameter Name</i> (type: <code>String</code> )	<code>String</code>	Return the <code>String</code> value of the named request parameter, or <code>null</code> if parameter is not set.
<code>requestData.getParameters</code>	<i>Parameter Name</i> (type: <code>String</code> )	<code>String[]</code>	Return the array of <code>String</code> values of the named request parameter, or <code>null</code> if parameter is not set.

## 11.5. Redirection URL Precedence

AM determines the redirection URL based on authentication success or failure.

### 11.5.1. Successful Authentication URL Precedence

Upon a successful authentication, AM determines the redirection URL in the following order:

1. The URL set in the authentication chain.

In the AM console, you can set the Successful Login URL parameter by navigating to *realm* > Authentication > Chains > *chain* > Settings.

2. The URL set in the `goto` login URL parameter. For example,

```
http://openam.example.com:8080/openam/XUI/?realm=#login/&goto=http%3A%2F%2Fwww.example.com
```

3. The URL set in the Success URL attribute in the user's profile.

In the AM console, you can set the Success URL parameter by navigating to *realm* > Subjects > *subject*. Scroll down to Success URL, enter a URL in the New Value field, and then click Add.

You can also specify the client type by entering `ClientType|URL` as the property value. If the client type is specified, it will have precedence over a regular URL in the user's profile.

4. The URL set in the Default Success Login URL attribute in the Top Level realm.

You can set this property on the AM console by navigating to Configure > Authentication > Core Attributes > Post Authentication Processing.

You can also specify the client type by entering `ClientType|URL` as the property value. If the client type is specified, it will have precedence over a Default Success Login URL in the Top Level realm.

### 11.5.2. Failed Authentication URL Precedence

Upon a failed authentication, AM determines the redirection URL in the following order:

1. The URL set in the authentication chain.

In the AM console, you can set the Failed Login URL parameter by navigating to *realm* > Authentication > Chains > *chain* > Settings.

2. The URL set in the `gotoOnFail` URL parameter. For example,

```
http://openam.example.com:8080/openam/XUI/?realm=#login/&gotoOnFail=http%3A%2F%2Fwww.example.com
```

3. The URL set in the Failure URL attribute in the user's profile.

In the AM console, you can set the Failure URL parameter by navigating to *realm* > Subjects > *subject*. Scroll down to Failure URL, and enter a URL in the New Value field, and then click Add.

You can also specify the client type by entering `ClientType|URL` as the property value. If the client type is specified, it will have precedence over a regular URL in the user's profile.

4. The URL set in the Default Failure Login URL attribute in the Top Level realm.

You can set this property on the AM console by navigating to Configure > Authentication > Core Attributes > Post Authentication Processing.

You can also specify the client type by entering `ClientType|URL` as the property value. If the client type is specified, it will have precedence over a Default Failure Login URL in the Top Level realm.



## Appendix A. About the REST API

This appendix shows how to use the RESTful interfaces for direct integration between web client applications and ForgeRock Access Management.

### A.1. Introducing REST

Representational State Transfer (REST) is an architectural style that sets certain constraints for designing and building large-scale distributed hypermedia systems.

As an architectural style, REST has very broad applications. The designs of both HTTP 1.1 and URIs follow RESTful principles. The World Wide Web is no doubt the largest and best known REST application. Many other web services also follow the REST architectural style. Examples include OAuth 2.0, OpenID Connect 1.0, and User-Managed Access (UMA).

The ForgeRock Common REST (CREST) API applies RESTful principles to define common verbs for HTTP-based APIs that access web resources and collections of web resources.

Interface Stability: Evolving

Most native AM REST APIs use the CREST verbs. (In contrast, OAuth 2.0, OpenID Connect 1.0 and UMA APIs follow their respective standards.)

### A.2. About ForgeRock Common REST

ForgeRock® Common REST is a common REST API framework. It works across the ForgeRock platform to provide common ways to access web resources and collections of resources. Adapt the examples in this section to your resources and deployment.

### A.2.1. Common REST Resources

Servers generally return JSON-format resources, though resource formats can depend on the implementation.

Resources in collections can be found by their unique identifiers (IDs). IDs are exposed in the resource URIs. For example, if a server has a user collection under `/users`, then you can access a user at `/users/user-id`. The ID is also the value of the `_id` field of the resource.

Resources are versioned using revision numbers. A revision is specified in the resource's `_rev` field. Revisions make it possible to figure out whether to apply changes without resource locking and without distributed transactions.

### A.2.2. Common REST Verbs

The Common REST APIs use the following verbs, sometimes referred to collectively as CRUDPAQ. For details and HTTP-based examples of each, follow the links to the sections for each verb.

#### **Create**

Add a new resource.

This verb maps to HTTP PUT or HTTP POST.

For details, see "Create".

#### **Read**

Retrieve a single resource.

This verb maps to HTTP GET.

For details, see "Read".

#### **Update**

Replace an existing resource.

This verb maps to HTTP PUT.

For details, see "Update".

#### **Delete**

Remove an existing resource.

This verb maps to HTTP DELETE.

For details, see "Delete".

## Patch

Modify part of an existing resource.

This verb maps to HTTP PATCH.

For details, see "Patch".

## Action

Perform a predefined action.

This verb maps to HTTP POST.

For details, see "Action".

## Query

Search a collection of resources.

This verb maps to HTTP GET.

For details, see "Query".

## A.2.3. Common REST Parameters

Common REST reserved query string parameter names start with an underscore, `_`.

Reserved query string parameters include, but are not limited to, the following names:

```
_action  
_api  
_crestapi  
_fields  
_mimeType  
_pageSize  
_pagedResultsCookie  
_pagedResultsOffset  
_prettyPrint  
_queryExpression  
_queryFilter  
_queryId  
_sortKeys  
_totalPagedResultsPolicy
```

### Note

Some parameter values are not safe for URLs, so URL-encode parameter values as necessary.

Continue reading for details about how to use each parameter.

## A.2.4. Common REST Extension Points

The *action* verb is the main vehicle for extensions. For example, to create a new user with HTTP POST rather than HTTP PUT, you might use `/users?_action=create`. A server can define additional actions. For example, `/tasks/1?_action=cancel`.

A server can define *stored queries* to call by ID. For example, `/groups?_queryId=hasDeletedMembers`. Stored queries can call for additional parameters. The parameters are also passed in the query string. Which parameters are valid depends on the stored query.

## A.2.5. Common REST API Documentation

Common REST APIs often depend at least in part on runtime configuration. Many Common REST endpoints therefore serve *API descriptors* at runtime. An API descriptor documents the actual API as it is configured.

Use the following query string parameters to retrieve API descriptors:

### `_api`

Serves an API descriptor that complies with the OpenAPI specification.

This API descriptor represents the API accessible over HTTP. It is suitable for use with popular tools such as Swagger UI.

### `_crestapi`

Serves a native Common REST API descriptor.

This API descriptor provides a compact representation that is not dependent on the transport protocol. It requires a client that understands Common REST, as it omits many Common REST defaults.

#### Note

Consider limiting access to API descriptors in production environments in order to avoid unnecessary traffic.

To provide documentation in production environments, see "To Publish OpenAPI Documentation" instead.

### *To Publish OpenAPI Documentation*

In production systems, developers expect stable, well-documented APIs. Rather than retrieving API descriptors at runtime through Common REST, prepare final versions, and publish them alongside the software in production.

Use the OpenAPI-compliant descriptors to provide API reference documentation for your developers as described in the following steps:

1. Configure the software to produce production-ready APIs.

In other words, the software should be configured as in production so that the APIs are identical to what developers see in production.

2. Retrieve the OpenAPI-compliant descriptor.

The following command saves the descriptor to a file, `myapi.json`:

```
$ curl -o myapi.json endpoint?_api
```

3. (Optional) If necessary, edit the descriptor.

For example, you might want to add security definitions to describe how the API is protected.

If you make any changes, then also consider using a source control system to manage your versions of the API descriptor.

4. Publish the descriptor using a tool such as Swagger UI.

You can customize Swagger UI for your organization as described in the documentation for the tool.

## A.2.6. Create

There are two ways to create a resource, either with an HTTP POST or with an HTTP PUT.

To create a resource using POST, perform an HTTP POST with the query string parameter `_action=create` and the JSON resource as a payload. Accept a JSON response. The server creates the identifier if not specified:

```
POST /users?_action=create HTTP/1.1
Host: example.com
Accept: application/json
Content-Length: ...
Content-Type: application/json
{ JSON resource }
```

To create a resource using PUT, perform an HTTP PUT including the case-sensitive identifier for the resource in the URL path, and the JSON resource as a payload. Use the `If-None-Match: *` header. Accept a JSON response:

```
PUT /users/some-id HTTP/1.1
Host: example.com
Accept: application/json
Content-Length: ...
Content-Type: application/json
If-None-Match: *
{ JSON resource }
```

The `_id` and content of the resource depend on the server implementation. The server is not required to use the `_id` that the client provides. The server response to the create request indicates the resource location as the value of the `Location` header.

If you include the `If-None-Match` header, its value must be `*`. In this case, the request creates the object if it does not exist, and fails if the object does exist. If you include the `If-None-Match` header with any value other than `*`, the server returns an HTTP 400 Bad Request error. For example, creating an object with `If-None-Match: revision` returns a bad request error. If you do not include `If-None-Match: *`, the request creates the object if it does not exist, and *updates* the object if it does exist.

## Parameters

You can use the following parameters:

`_prettyPrint=true`

Format the body of the response.

`_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

## A.2.7. Read

To retrieve a single resource, perform an HTTP GET on the resource by its case-sensitive identifier (`_id`) and accept a JSON response:

```
GET /users/some-id HTTP/1.1
Host: example.com
Accept: application/json
```

## Parameters

You can use the following parameters:

`_prettyPrint=true`

Format the body of the response.

`_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

### `_mimeType=mime-type`

Some resources have fields whose values are multi-media resources such as a profile photo for example.

By specifying both a single *field* and also the *mime-type* for the response content, you can read a single field value that is a multi-media resource.

In this case, the content type of the field value returned matches the *mime-type* that you specify, and the body of the response is the multi-media resource.

The `Accept` header is not used in this case. For example, `Accept: image/png` does not work. Use the `_mimeType` query string parameter instead.

## A.2.8. Update

To update a resource, perform an HTTP PUT including the case-sensitive identifier (`_id`) as the final element of the path to the resource, and the JSON resource as the payload. Use the `If-Match: _rev` header to check that you are actually updating the version you modified. Use `If-Match: *` if the version does not matter. Accept a JSON response:

```
PUT /users/some-id HTTP/1.1
Host: example.com
Accept: application/json
Content-Length: ...
Content-Type: application/json
If-Match: _rev
{ JSON resource }
```

When updating a resource, include all the attributes to be retained. Omitting an attribute in the resource amounts to deleting the attribute unless it is not under the control of your application. Attributes not under the control of your application include private and read-only attributes. In addition, virtual attributes and relationship references might not be under the control of your application.

### Parameters

You can use the following parameters:

#### `_prettyPrint=true`

Format the body of the response.

#### `_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

## A.2.9. Delete

To delete a single resource, perform an HTTP DELETE by its case-sensitive identifier (`_id`) and accept a JSON response:

```
DELETE /users/some-id HTTP/1.1
Host: example.com
Accept: application/json
```

### Parameters

You can use the following parameters:

`_prettyPrint=true`

Format the body of the response.

`_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

## A.2.10. Patch

To patch a resource, send an HTTP PATCH request with the following parameters:

- `operation`
- `field`
- `value`
- `from` (optional with copy and move operations)

You can include these parameters in the payload for a PATCH request, or in a JSON PATCH file. If successful, you'll see a JSON response similar to:

```
PATCH /users/some-id HTTP/1.1
Host: example.com
Accept: application/json
Content-Length: ...
Content-Type: application/json
If-Match: _rev
{ JSON array of patch operations }
```

PATCH operations apply to three types of targets:

- **single-valued**, such as an object, string, boolean, or number.



- **list semantics array**, where the elements are ordered, and duplicates are allowed.
- **set semantics array**, where the elements are not ordered, and duplicates are not allowed.

ForgeRock PATCH supports several different **operations**. The following sections show each of these operations, along with options for the **field** and **value**:

### A.2.10.1. Patch Operation: Add

The **add** operation ensures that the target field contains the value provided, creating parent fields as necessary.

If the target field is single-valued, then the value you include in the PATCH replaces the value of the target. Examples of a single-valued field include: object, string, boolean, or number.

An **add** operation has different results on two standard types of arrays:

- **List semantic arrays**: you can run any of these **add** operations on that type of array:
  - If you **add** an array of values, the PATCH operation appends it to the existing list of values.
  - If you **add** a single value, specify an ordinal element in the target array, or use the **{-}** special index to add that value to the end of the list.
- **Set semantic arrays**: The list of values included in a patch are merged with the existing set of values. Any duplicates within the array are removed.

As an example, start with the following list semantic array resource:

```
{
  "fruits" : [ "orange", "apple" ]
}
```

The following add operation includes the pineapple to the end of the list of fruits, as indicated by the **-** at the end of the **fruits** array.

```
{
  "operation" : "add",
  "field" : "/fruits/-",
  "value" : "pineapple"
}
```

The following is the resulting resource:

```
{
  "fruits" : [ "orange", "apple", "pineapple" ]
}
```

### A.2.10.2. Patch Operation: Copy

The copy operation takes one or more existing values from the source field. It then adds those same values on the target field. Once the values are known, it is equivalent to performing an **add** operation on the target field.

The following `copy` operation takes the value from a field named `mail`, and then runs a `replace` operation on the target field, `another_mail`.

```
[
  {
    "operation": "copy",
    "from": "mail",
    "field": "another_mail"
  }
]
```

If the source field value and the target field value are configured as arrays, the result depends on whether the array has list semantics or set semantics, as described in "Patch Operation: Add".

### A.2.10.3. Patch Operation: Increment

The `increment` operation changes the value or values of the target field by the amount you specify. The value that you include must be one number, and may be positive or negative. The value of the target field must accept numbers. The following `increment` operation adds `1000` to the target value of `/user/payment`.

```
[
  {
    "operation": "increment",
    "field": "/user/payment",
    "value": "1000"
  }
]
```

Since the `value` of the `increment` is a single number, arrays do not apply.

### A.2.10.4. Patch Operation: Move

The move operation removes existing values on the source field. It then adds those same values on the target field. It is equivalent to performing a `remove` operation on the source, followed by an `add` operation with the same values, on the target.

The following `move` operation is equivalent to a `remove` operation on the source field, `surname`, followed by a `replace` operation on the target field value, `lastName`. If the target field does not exist, it is created.

```
[
  {
    "operation": "move",
    "from": "surname",
    "field": "lastName"
  }
]
```

To apply a `move` operation on an array, you need a compatible single-value, list semantic array, or set semantic array on both the source and the target. For details, see the criteria described in "Patch Operation: Add".

### A.2.10.5. Patch Operation: Remove

The **remove** operation ensures that the target field no longer contains the value provided. If the remove operation does not include a value, the operation removes the field. The following **remove** deletes the value of the **phoneNumber**, along with the field.

```
[
  {
    "operation" : "remove",
    "field" : "phoneNumber"
  }
]
```

If the object has more than one **phoneNumber**, those values are stored as an array.

A **remove** operation has different results on two standard types of arrays:

- **List semantic arrays:** A **remove** operation deletes the specified element in the array. For example, the following operation removes the first phone number, based on its array index (zero-based):

```
[
  {
    "operation" : "remove",
    "field" : "/phoneNumber/0"
  }
]
```

- **Set semantic arrays:** The list of values included in a patch are removed from the existing array.

### A.2.10.6. Patch Operation: Replace

The **replace** operation removes any existing value(s) of the targeted field, and replaces them with the provided value(s). It is essentially equivalent to a **remove** followed by a **add** operation. If the arrays are used, the criteria is based on "Patch Operation: Add". However, indexed updates are not allowed, even when the target is an array.

The following **replace** operation removes the existing **telephoneNumber** value for the user, and then adds the new value of **+1 408 555 9999**.

```
[
  {
    "operation" : "replace",
    "field" : "/telephoneNumber",
    "value" : "+1 408 555 9999"
  }
]
```

A PATCH replace operation on a list semantic array works in the same fashion as a PATCH remove operation. The following example demonstrates how the effect of both operations. Start with the following resource:

```
{
  "fruits" : [ "apple", "orange", "kiwi", "lime" ],
}
```

Apply the following operations on that resource:

```
[
  {
    "operation" : "remove",
    "field" : "/fruits/0",
    "value" : ""
  },
  {
    "operation" : "replace",
    "field" : "/fruits/1",
    "value" : "pineapple"
  }
]
```

The PATCH operations are applied sequentially. The `remove` operation removes the first member of that resource, based on its array index, (`fruits/0`), with the following result:

```
[
  {
    "fruits" : [ "orange", "kiwi", "lime" ],
  }
]
```

The second PATCH operation, a `replace`, is applied on the second member (`fruits/1`) of the intermediate resource, with the following result:

```
[
  {
    "fruits" : [ "orange", "pineapple", "lime" ],
  }
]
```

### A.2.10.7. Patch Operation: Transform

The `transform` operation changes the value of a field based on a script or some other data transformation command. The following `transform` operation takes the value from the field named `/objects`, and applies the `something.js` script as shown:

```
[
  {
    "operation" : "transform",
    "field" : "/objects",
    "value" : {
      "script" : {
        "type" : "text/javascript",
        "file" : "something.js"
      }
    }
  }
]
```

## A.2.10.8. Patch Operation Limitations

Some HTTP client libraries do not support the HTTP PATCH operation. Make sure that the library you use supports HTTP PATCH before using this REST operation.

For example, the Java Development Kit HTTP client does not support PATCH as a valid HTTP method. Instead, the method `URLConnection.setRequestMethod("PATCH")` throws `ProtocolException`.

### Parameters

You can use the following parameters. Other parameters might depend on the specific action implementation:

`_prettyPrint=true`

Format the body of the response.

`_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

## A.2.11. Action

Actions are a means of extending Common REST APIs and are defined by the resource provider, so the actions you can use depend on the implementation.

The standard action indicated by `_action=create` is described in "Create".

### Parameters

You can use the following parameters. Other parameters might depend on the specific action implementation:

`_prettyPrint=true`

Format the body of the response.

`_fields=field[,field...]`

Return only the specified fields in the body of the response.

The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

## A.2.12. Query

To query a resource collection (or resource container if you prefer to think of it that way), perform an HTTP GET and accept a JSON response, including at least a `_queryExpression`, `_queryFilter`, or `_queryId` parameter. These parameters cannot be used together:

```
GET /users?_queryFilter=true HTTP/1.1
Host: example.com
Accept: application/json
```

The server returns the result as a JSON object including a "results" array and other fields related to the query string parameters that you specify.

### Parameters

You can use the following parameters:

`_queryFilter=filter-expression`

Query filters request that the server return entries that match the filter expression. You must URL-escape the filter expression.

The string representation is summarized as follows. Continue reading for additional explanation:

```
Expr           = OrExpr
OrExpr         = AndExpr ( 'or' AndExpr ) *
AndExpr        = NotExpr ( 'and' NotExpr ) *
NotExpr        = '!' PrimaryExpr | PrimaryExpr
PrimaryExpr    = '(' Expr ')' | ComparisonExpr | PresenceExpr | LiteralExpr
ComparisonExpr = Pointer OpName JsonValue
PresenceExpr   = Pointer 'pr'
LiteralExpr    = 'true' | 'false'
Pointer        = JSON pointer
OpName         = 'eq' | # equal to
                'co' | # contains
                'sw' | # starts with
                'lt' | # less than
                'le' | # less than or equal to
                'gt' | # greater than
                'ge' | # greater than or equal to
                STRING # extended operator
JsonValue      = NUMBER | BOOLEAN | ''' UTF8STRING '''
STRING         = ASCII string not containing white-space
UTF8STRING     = UTF-8 string possibly containing white-space
```

*JsonValue* components of filter expressions follow RFC 7159: *The JavaScript Object Notation (JSON) Data Interchange Format*. In particular, as described in section 7 of the RFC, the escape character in strings is the backslash character. For example, to match the identifier `test\`, use `_id eq 'test\\'`. In the JSON resource, the `\` is escaped the same way: `"_id": "test\\"`.

When using a query filter in a URL, be aware that the filter expression is part of a query string parameter. A query string parameter must be URL encoded as described in RFC 3986: *Uniform Resource Identifier (URI): Generic Syntax*. For example, white space, double quotes ("), parentheses, and exclamation characters need URL encoding in HTTP query strings. The following rules apply to URL query components:

```

query      = *( pchar / "/" / "?" )
pchar      = unreserved / pct-encoded / sub-delims / ":" / "@"
unreserved = ALPHA / DIGIT / "-" / "." / "_" / "~"
pct-encoded = "%" HEXDIG HEXDIG
sub-delims = "!" / "$" / "&" / "'" / "(" / ")"
           / "*" / "+" / "," / ";" / "="

```

**ALPHA**, **DIGIT**, and **HEXDIG** are core rules of RFC 5234: *Augmented BNF for Syntax Specifications*:

```

ALPHA      = %x41-5A / %x61-7A ; A-Z / a-z
DIGIT      = %x30-39 ; 0-9
HEXDIG     = DIGIT / "A" / "B" / "C" / "D" / "E" / "F"

```

As a result, a backslash escape character in a *JsonValue* component is percent-encoded in the URL query string parameter as %5C. To encode the query filter expression `_id eq 'test\\'`, use `_id +eq+'test%5C%5C'`, for example.

A simple filter expression can represent a comparison, presence, or a literal value.

For comparison expressions use *json-pointer comparator json-value*, where the *comparator* is one of the following:

- eq** (equals)
- co** (contains)
- sw** (starts with)
- lt** (less than)
- le** (less than or equal to)
- gt** (greater than)
- ge** (greater than or equal to)

For presence, use *json-pointer pr* to match resources where the JSON pointer is present.

Literal values include `true` (match anything) and `false` (match nothing).

Complex expressions employ **and**, **or**, and **!** (not), with parentheses, (*expression*), to group expressions.

### **\_queryId=identifier**

Specify a query by its identifier.

Specific queries can take their own query string parameter arguments, which depend on the implementation.

### `_pagedResultsCookie=string`

The string is an opaque cookie used by the server to keep track of the position in the search results. The server returns the cookie in the JSON response as the value of `pagedResultsCookie`.

In the request `_pageSize` must also be set and non-zero. You receive the cookie value from the provider on the first request, and then supply the cookie value in subsequent requests until the server returns a `null` cookie, meaning that the final page of results has been returned.

The `_pagedResultsCookie` parameter is supported when used with the `_queryFilter` parameter. The `_pagedResultsCookie` parameter is not guaranteed to work when used with the `_queryExpression` and `_queryId` parameters.

The `_pagedResultsCookie` and `_pagedResultsOffset` parameters are mutually exclusive, and not to be used together.

### `_pagedResultsOffset=integer`

When `_pageSize` is non-zero, use this as an index in the result set indicating the first page to return.

The `_pagedResultsCookie` and `_pagedResultsOffset` parameters are mutually exclusive, and not to be used together.

### `_pageSize=integer`

Return query results in pages of this size. After the initial request, use `_pagedResultsCookie` or `_pageResultsOffset` to page through the results.

### `_totalPagedResultsPolicy=string`

When a `_pageSize` is specified, and non-zero, the server calculates the "totalPagedResults", in accordance with the `totalPagedResultsPolicy`, and provides the value as part of the response. The "totalPagedResults" is either an estimate of the total number of paged results (`_totalPagedResultsPolicy=ESTIMATE`), or the exact total result count (`_totalPagedResultsPolicy=EXACT`). If no count policy is specified in the query, or if `_totalPagedResultsPolicy=NONE`, result counting is disabled, and the server returns value of -1 for "totalPagedResults".

### `_sortKeys=[+/-]field[, [+/-]field...]`

Sort the resources returned based on the specified field(s), either in `+` (ascending, default) order, or in `-` (descending) order.

The `_sortKeys` parameter is not supported for predefined queries (`_queryId`).

### `_prettyPrint=true`

Format the body of the response.

### `_fields=field[,field...]`

Return only the specified fields in each element of the "results" array in the response.



The `field` values are JSON pointers. For example if the resource is `{"parent":{"child":"value"}}`, `parent/child` refers to the `"child":"value"`.

### A.2.13. HTTP Status Codes

When working with a Common REST API over HTTP, client applications should expect at least the following HTTP status codes. Not all servers necessarily return all status codes identified here:

#### **200 OK**

The request was successful and a resource returned, depending on the request.

#### **201 Created**

The request succeeded and the resource was created.

#### **204 No Content**

The action request succeeded, and there was no content to return.

#### **304 Not Modified**

The read request included an `If-None-Match` header, and the value of the header matched the revision value of the resource.

#### **400 Bad Request**

The request was malformed.

#### **401 Unauthorized**

The request requires user authentication.

#### **403 Forbidden**

Access was forbidden during an operation on a resource.

#### **404 Not Found**

The specified resource could not be found, perhaps because it does not exist.

#### **405 Method Not Allowed**

The HTTP method is not allowed for the requested resource.

#### **406 Not Acceptable**

The request contains parameters that are not acceptable, such as a resource or protocol version that is not available.

#### **409 Conflict**

The request would have resulted in a conflict with the current state of the resource.

#### **410 Gone**

The requested resource is no longer available, and will not become available again. This can happen when resources expire for example.

#### **412 Precondition Failed**

The resource's current version does not match the version provided.

#### **415 Unsupported Media Type**

The request is in a format not supported by the requested resource for the requested method.

#### **428 Precondition Required**

The resource requires a version, but no version was supplied in the request.

#### **500 Internal Server Error**

The server encountered an unexpected condition that prevented it from fulfilling the request.

#### **501 Not Implemented**

The resource does not support the functionality required to fulfill the request.

#### **503 Service Unavailable**

The requested resource was temporarily unavailable. The service may have been disabled, for example.

## **A.3. REST API Versioning**

In OpenAM 12.0.0 and later, REST API features are assigned version numbers.

Providing version numbers in the REST API helps ensure compatibility between releases. The version number of a feature increases when AM introduces a non-backwards-compatible change that affects clients making use of the feature.

AM provides versions for the following aspects of the REST API.

#### ***resource***

Any changes to the structure or syntax of a returned response will incur a *resource* version change. For example changing `errorMessage` to `message` in a JSON response.

## *protocol*

Any changes to the methods used to make REST API calls will incur a *protocol* version change. For example changing `_action` to `$action` in the required parameters of an API feature.

### A.3.1. Supported REST API Versions

The REST API version numbers supported in AM 5.1 are as follows:

#### **Supported protocol versions**

The *protocol* versions supported in AM 5.1 are:

1.0

#### **Supported resource versions**

The *resource* versions supported in AM 5.1 are shown in the following table.

*Supported resource Versions*

Base	End Point	Supported Versions
/json	/authenticate	1.1, 2.0
	/users	1.1, 1.2, 2.0, 2.1, 3.0
	/groups	1.1, 2.0, 2.1, 3.0
	/agents	1.1, 2.0, 2.1, 3.0
	/realms	1.0
	/dashboard	1.0
	/sessions	1.1
	/serverinfo/*	1.1
	/users/{user}/devices/trusted	1.0
	/users/{user}/uma/policies	1.0
	/applications	1.0, 2.0
	/resourcetypes	1.0
	/policies	1.0, 2.0
	/applicationtypes	1.0
	/conditiontypes	1.0
	/subjecttypes	1.0
	/subjectattributes	1.0
	/decisioncombiners	1.0

Base	End Point	Supported Versions
	/subjectattributes	1.0
/xacml	/policies	1.0
/frrest	/token	1.0
	/client	1.0

The *AM Release Notes* section, "*Changes and Deprecated Functionality*" in the *Release Notes* describes the differences between API versions.

### A.3.2. Specifying an Explicit REST API Version

You can specify which version of the REST API to use by adding an `Accept-API-Version` header to the request, as in the following example, which is requesting *resource* version 2.0 and *protocol* version 1.0:

```
$ curl \
  --request POST \
  --header "X-OpenAM-Username: demo" \
  --header "X-OpenAM-Password: changeit" \
  --header "Accept-API-Version: resource=2.0, protocol=1.0" \
  https://openam.example.com:8443/openam/json/realms/root/authenticate
```

You can configure the default behavior AM will take when a REST call does not specify explicit version information. For more information, see "Configuring the Default REST API Version for a Deployment".

### A.3.3. Configuring the Default REST API Version for a Deployment

You can configure the default behavior AM will take when a REST call does not specify explicit version information using either of the following procedures:

- "Configure Versioning Behavior by using the AM Console"
- "Configure Versioning Behavior by using the ssoadm"

The available options for default behavior are as follows:

#### **Latest**

The latest available supported version of the API is used.

This is the preset default for new installations of AM.

#### **Oldest**

The oldest available supported version of the API is used.

This is the preset default for upgraded AM instances.

#### Note

The oldest supported version may not be the first that was released, as APIs versions become deprecated or unsupported. See "Deprecated Functionality" in the *Release Notes*.

### None

No version will be used. When a REST client application calls a REST API without specifying the version, AM returns an error and the request fails.

### Configure Versioning Behavior by using the AM Console

1. Log in as AM administrator, `amadmin`.
2. Click Configure > Global Services, and then click REST APIs.
3. In Default Version, select the required response to a REST API request that does not specify an explicit version: `Latest`, `Oldest`, or `None`.
4. (Optional) Optionally, enable `Warning Header` to include warning messages in the headers of responses to requests.
5. Save your work.

### Configure Versioning Behavior by using the `ssoadm`

- Use the `ssoadm set-attr-defs` command with the `openam-rest-apis-default-version` attribute set to either `Latest`, `Oldest` or `None`, as in the following example:

```
$ ssh openam.example.com
$ cd /path/to/openam-tools/admin/openam/bin
$ ./ssoadm \
  set-attr-defs \
  --adminid amadmin \
  --password-file /tmp/pwd.txt \
  --servicename RestApisService \
  --schematype Global \
  --attributevalues openam-rest-apis-default-version=None
Schema attribute defaults were set.
```

### A.3.4. REST API Versioning Messages

AM provides REST API version messages in the JSON response to a REST API call. You can also configure AM to return version messages in the response headers.

Messages include:

- Details of the REST API versions used to service a REST API call.
- Warning messages if REST API version information is not specified or is incorrect in a REST API call.

The `resource` and `protocol` version used to service a REST API call are returned in the `Content-API-Version` header, as shown below:

```
$ curl \
-i \
--request POST \
--header "X-OpenAM-Username: demo" \
--header "X-OpenAM-Password: changeit" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
https://openam.example.com:8443/openam/json/realms/root/authenticate

HTTP/1.1 200 OK
Content-API-Version: protocol=1.0,resource=2.0
Server: Restlet-Framework/2.1.7
Content-Type: application/json;charset=UTF-8

{
  "tokenId":"AQIC5wM...TU30Q*",
  "successUrl":"/openam/console"
}
```

If the default REST API version behavior is set to `None`, and a REST API call does not include the `Accept-API-Version` header, or does not specify a `resource` version, then a `400 Bad Request` status code is returned, as shown below:

```
$ curl \
--header "Content-Type: application/json" \
--header "Accept-API-Version: protocol=1.0" \
https://openam.example.com:8443/openam/json/realms/root/serverinfo/*

{
  "code":400,
  "reason":"Bad Request",
  "message":"No requested version specified and behavior set to NONE."
}
```

If a REST API call does include the `Accept-API-Version` header, but the specified `resource` or `protocol` version does not exist in AM, then a `404 Not Found` status code is returned, as shown below:

```
$ curl \
--header "Content-Type: application/json" \
--header "Accept-API-Version: protocol=1.0, resource=999.0" \
https://openam.example.com:8443/openam/json/realms/root/serverinfo/*

{
  "code":404,
  "reason":"Not Found",
  "message":"Accept-API-Version: Requested version \"999.0\" does not match any routes."
}
```

### Tip

For more information on setting the default REST API version behavior, see "Specifying an Explicit REST API Version".

## A.4. Specifying Realms in REST API Calls

This section describes how to work with realms when making REST API calls to AM.

Realms can be specified in the following ways when making a REST API call to AM:

### DNS Alias

When making a REST API call, the DNS alias of a realm can be specified in the subdomain and domain name components of the REST endpoint.

To list all users in the top-level realm use the DNS alias of the AM instance, for example the REST endpoint would be:

```
https://openam.example.com:8443/openam/json/users?_queryId=*
```

To list all users in a realm with DNS alias `suppliers.example.com` the REST endpoint would be:

```
https://suppliers.example.com:8443/openam/json/users?_queryId=*
```

### Path

When making a REST API call, specify the realm in the path component of the endpoint. You must specify the entire hierarchy of the realm, starting at the top-level realm. Prefix each realm in the hierarchy with the `realms/` keyword. For example `/realms/root/realms/customers/realms/europe`.

To authenticate a user in the top-level realm, use the `root` keyword. For example:

```
https://openam.example.com:8443/openam/json/realms/root/authenticate
```

To authenticate a user in a subrealm named `customers` within the top-level realm, the REST endpoint would be:

```
https://openam.example.com:8443/openam/json/realms/root/realms/customers/authenticate
```

If realms are specified using both the DNS alias and path methods, the path is used to determine the realm.

For example, the following REST endpoint returns users in a subrealm of the top-level realm named `europe`, not the realm with DNS alias `suppliers.example.com`:

```
https://suppliers.example.com:8443/openam/json/realms/root/realms/europe/users?_queryId=*
```

## A.5. Authentication and Logout

You can use REST-like APIs under `/json/authenticate` and `/json/sessions` for authentication and for logout.

The `/json/authenticate` endpoint does not support the CRUDPAQ verbs and therefore does not technically satisfy REST architectural requirements. The term *REST-like* describes this endpoint better than *REST*.

The simplest user name/password authentication returns a `tokenId` that applications can present as a cookie value for other operations that require authentication. The type of `tokenId` returned varies depending on whether stateless sessions are enabled in the realm to which the user authenticates:

- If stateless sessions are not enabled, the `tokenId` is an AM SSO token.
- If stateless sessions are enabled, the `tokenId` is an AM SSO token that includes an encoded AM session.

Developers should be aware that the size of the `tokenId` for stateless sessions—2000 bytes or greater—is considerably longer than for stateful sessions—approximately 100 bytes. For more information about stateful and stateless session tokens, see "Session Cookies".

When authenticating with a user name and password, use HTTP POST to prevent the web container from logging the credentials. Pass the user name in an `X-OpenAM-Username` header, and the password in an `X-OpenAM-Password` header:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "X-OpenAM-Username: demo" \
--header "X-OpenAM-Password: changeit" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
--data "{}" \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{
  "tokenId": "AQIC5w...NTcy*",
  "successUrl": "/openam/console",
  "realm": "/"
}
```

To use UTF-8 user names and passwords in calls to the `/json/authenticate` endpoint, base64-encode the string, and then wrap the string as described in RFC 2047:

```
encoded-word = "=?" charset "?" encoding "?" encoded-text "=?"
```

For example, to authenticate using a UTF-8 username, such as `dēmø`, perform the following steps:

1. Encode the string in base64 format: `yZfDq8mxw7g=`.
2. Wrap the base64-encoded string as per RFC 2047: `=?UTF-8?B?yZfDq8mxw7g=?`.
3. Use the result in the `X-OpenAM-Username` header passed to the authentication endpoint as follows:



```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "X-OpenAM-Username: =?UTF-8?B?yZfDq8mxw7g=?=" \
--header "X-OpenAM-Password: changeit" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
--data "{}" \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{
  "tokenId": "AQIC5w...NTcy*",
  "successUrl": "/openam/console",
  "realm": "/"
}
```

This zero page login mechanism works only for name/password authentication. If you include a POST body with the request, it must be an empty JSON string as shown in the example. Alternatively, you can leave the POST body empty. Otherwise, AM interprets the body as a continuation of an existing authentication attempt, one that uses a supported callback mechanism.

The authentication service at `/json/authenticate` supports callback mechanisms that make it possible to perform other types of authentication in addition to simple user name/password login.

Callbacks that are not completed based on the content of the client HTTP request are returned in JSON as a response to the request. Each callback has an array of output suitable for displaying to the end user, and input which is what the client must complete and send back to AM. The default is still user name/password authentication:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{
  "authId": "...jwt-value...",
  "template": "",
  "stage": "DataStore1",
  "callbacks": [
    {
      "type": "NameCallback",
      "output": [
        {
          "name": "prompt",
          "value": " User Name: "
        }
      ],
      "input": [
        {
          "name": "IDToken1",
          "value": ""
        }
      ]
    }
  ],
  {
    "type": "PasswordCallback",
    "output": [
```

```

    {
      "name": "prompt",
      "value": " Password: "
    }
  ],
  "input": [
    {
      "name": "IDToken2",
      "value": ""
    }
  ]
}
]
}
}

```

The `authID` value is a JSON Web Token (JWT) that uniquely identifies the authentication context to AM, and so must also be sent back with the requests.

To respond to the callback, send back the JSON object with the missing values filled, as in this case where the user name is `demo` and the password is `changeit`:

```

$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
--data '{ "authId": "...jwt-value...", "template": "", "stage": "DataStore1",
"callbacks": [ { "type": "NameCallback", "output": [ { "name": "prompt",
"value": " User Name: " } ] }, { "type": "PasswordCallback", "output": [ { "name": "prompt", "value": " Password: " } ] },
"input": [ { "name": "IDToken1", "value": "demo" } ] }, { "type": "NameCallback", "output": [ { "name": "prompt",
"value": " User Name: " } ] }, { "type": "PasswordCallback", "output": [ { "name": "prompt", "value": " Password: " } ] },
"input": [ { "name": "IDToken2", "value": "changeit" } ] } ] }' \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{ "tokenId": "AQIC5wM2...U3MTE4NA...*", "successUrl": "/openam/console", "realm": "/" }

```

The response is a token ID holding the SSO token value.

Alternatively, you can authenticate without requesting a session using the `noSession` query string parameter:

```

$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
--data '{ "authId": "...jwt-value...", "template": "", "stage": "DataStore1",
"callbacks": [ { "type": "NameCallback", "output": [ { "name": "prompt",
"value": " User Name: " } ] }, { "type": "PasswordCallback", "output": [ { "name": "prompt", "value": " Password: " } ] },
"input": [ { "name": "IDToken1", "value": "demo" } ] }, { "type": "NameCallback", "output": [ { "name": "prompt",
"value": " User Name: " } ] }, { "type": "PasswordCallback", "output": [ { "name": "prompt", "value": " Password: " } ] },
"input": [ { "name": "IDToken2", "value": "changeit" } ] } ] }' \
https://openam.example.com:8443/openam/json/realms/root/authenticate?noSession=true
{ "message": "Authentication Successful", "successUrl": "/openam/console", "realm": "/" }

```

AM can be configured to return a failure URL value when authentication fails. No failure URL is configured by default. The Default Failure Login URL can be set per realm; see "Post Authentication

Processing" for details. Alternatively, failure URLs can be configured per authentication chain, which your client can specify using the `service` parameter described below. On failure AM then returns HTTP status code 401 Unauthorized, and the JSON in the reply indicates the failure URL:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "X-OpenAM-Username: demo" \
--header "X-OpenAM-Password: badpassword" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{
  "code":401,
  "reason":"Unauthorized",
  "message":"Invalid Password!!",
  "failureUrl": "http://www.example.com/401.html"
}
```

When making a REST API call, specify the realm in the path component of the endpoint. You must specify the entire hierarchy of the realm, starting at the top-level realm. Prefix each realm in the hierarchy with the `realms/` keyword. For example `/realms/root/realms/customers/realms/europe`.

For example, to authenticate to a subrealm `customers` within the top-level realm, then the authentication endpoint URL is as follows: `https://openam.example.com:8443/openam/json/realms/root/realms/customers/authenticate`

The following additional parameters are supported:

You can use the `authIndexType` and `authIndexValue` query string parameters as a pair to provide additional information about how you are authenticating. The `authIndexType` can be one of the following types:

#### **composite**

Set the value to a composite advice string.

#### **level**

Set the value to the authentication level.

#### **module**

Set the value to the name of an authentication module.

#### **resource**

Set the value to a URL protected by an AM policy.

#### **role**

Set the value to an AM role.

## service

Set the value to the name of an authentication chain.

## user

Set the value to an AM user ID.

For example, to log into AM using the built-in `ldapService` authentication chain, you could use the following:

```
$ curl \
--request POST \
--header 'Accept-API-Version: resource=2.0, protocol=1.0' \
--header 'X-OpenAM-Username: demo' \
--header 'X-OpenAM-Password: changeit' \
'http://openam.example.com:8080/openam/json/authenticate?authIndexType=service&authIndexValue=ldapService'
```

You can use the query string parameter, `sessionUpgradeSSOTokenId=tokenId`, to request session upgrade. Before the *tokenId* is searched for in the query string for session upgrade, the token is grabbed from the cookie. For an explanation of session upgrade, see "Session Upgrade".

AM uses the following callback types depending on the authentication module in use:

- `ChoiceCallback`: Used to display a list of choices and retrieve the selected choice.
- `ConfirmationCallback`: Used to ask for a confirmation such as Yes, No, or Cancel and retrieve the selection.
- `HiddenValueCallback`: Used to return form values that are not visually rendered to the end user.
- `HttpCallback`: Used for HTTP handshake negotiations.
- `LanguageCallback`: Used to retrieve the locale for localizing text presented to the end user.
- `NameCallback`: Used to retrieve a name string.
- `PasswordCallback`: Used to retrieve a password value.
- `RedirectCallback`: Used to redirect the client user-agent.
- `ScriptTextOutputCallback`: Used to insert a script into the page presented to the end user. The script can, for example, collect data about the user's environment.
- `TextInputCallback`: Used to retrieve text input from the end user.
- `TextOutputCallback`: Used to display a message to the end user.

- `X509CertificateCallback`: Used to retrieve the content of an x.509 certificate.

## A.5.1. Logout

Authenticated users can log out with the token cookie value and an HTTP POST to `/json/sessions/?_action=logout`:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "Cache-Control: no-cache" \
--header "iPlanetDirectoryPro: AQIC5wM2...U3MTE4NA..*" \
--header "Accept-API-Version: resource=1.1, protocol=1.0" \
https://openam.example.com:8443/openam/json/realms/root/sessions/?_action=logout

{"result":"Successfully logged out"}
```

## A.5.2. logoutByHandle

To log out a session using a session handle, first perform an HTTP GET to the resource URL, `/json/sessions/`, using the `queryFilter` action to get the session handle:

```
$ curl \
--request GET \
--header "Content-Type: application/json" \
--header "Cache-Control: no-cache" \
--header "iPlanetDirectoryPro: AQICS...NzEz*" \
--header "Accept-API-Version: resource=1.1, protocol=1.0" \
http://openam.example.com:8080/openam/json/realms/root/sessions?_queryFilter=username%20eq%20%22demo%22%20and%20realm%20eq%20%22%2F%22
{
  "result": [
    {
      "username": "demo",
      "universalId": "id=demo,ou=user,dc=openam,dc=forgerock,dc=org",
      "realm": "\\",
      "sessionHandle": "shandle:AQIC5w...MTY3*",
      "latestAccessTime": "2016-11-09T14:14:11Z",
      "maxIdleExpirationTime": "2016-11-09T14:44:11Z",
      "maxSessionExpirationTime": "2016-11-09T16:14:11Z"
    }
  ],
  "resultCount": 1,
  "pagedResultsCookie": null,
  "totalPagedResultsPolicy": "NONE",
  "totalPagedResults": -1,
  "remainingPagedResults": -1
}
```

To log out a session using a session handle, perform an HTTP POST to the resource URL, `/json/sessions/`, using the `logoutByHandle` action.

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "Cache-Control: no-cache" \
--header "iplanetDirectoryPro: AQIC5w...NTcy*" \
--header "Accept-API-Version: resource=1.1, protocol=1.0" \
--data '{"sessionHandles": [{"shandle:AQIC5w...MTY3*"}, {"shandle:AQIC5w...NDcx*"}]}' \
http://openam.example.com:8080/openam/json/realms/root/sessions/?_action=LogoutByHandle
{
  "result": {
    "shandle:AQIC5w...NDcx*": true,
    "shandle:AQIC5w...MTY3*": true
  }
}
```

### A.5.3. Load Balancer and Proxy Layer Requirements

When authentication depends on the client IP address and AM lies behind a load balancer or proxy layer, configure the load balancer or proxy to send the address by using the `X-Forwarded-For` header, and configure AM to consume and forward the header as necessary. For details, see "Handling HTTP Request Headers" in the *Installation Guide*.

### A.5.4. Windows Desktop SSO Requirements

When authenticating with Windows Desktop SSO, add an `Authorization` header containing the string `Basic`, followed by a base64-encoded string of the username, a colon character, and the password. In the following example, the credentials `demo:changeit` are base64-encoded into the string `ZGVtbzpjajGFuZ2VpdA==`:

```
$ curl \
--request POST
\
--header "Content-Type: application/json"
\
--header "X-OpenAM-Username: demo"
\
--header "X-OpenAM-Password: changeit"
\
--header "Authorization: Basic ZGVtbzpjajGFuZ2VpdA=="
\
--header "Accept-API-Version: resource=2.0, protocol=1.0"
\
--data "{}" \
https://openam.example.com:8443/openam/json/realms/root/authenticate
{ "tokenId": "AQIC5w...NTcy*", "successUrl": "/openam/console", "realm": "/" }
```

## A.6. Using the Session Token After Authentication

The following is a common scenario when accessing AM by using REST API calls:

- First, call the `/json/authenticate` endpoint to log a user in to AM. This REST API call returns a `tokenId` value, which is used in subsequent REST API calls to identify the user:

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "X-OpenAM-Username: demo" \
--header "X-OpenAM-Password: changeit" \
--header "Accept-API-Version: resource=2.0, protocol=1.0" \
--data "{}" \
https://openam.example.com:8443/openam/json/realms/root/authenticate

{ "tokenId": "AQIC5w...NTcy*", "successUrl": "/openam/console" }
```

The returned `tokenId` is known as a session token (also referred to as an SSO token). REST API calls made after successful authentication to AM must present the session token in the HTTP header as proof of authentication.

- Next, call one or more additional REST APIs on behalf of the logged-in user. Each REST API call passes the user's `tokenId` back to AM in the HTTP header as proof of previous authentication.

The following is a *partial* example of a `curl` command that inserts the token ID returned from a prior successful AM authentication attempt into the HTTP header:

```
$ curl \
--request POST
\
--header "Content-Type: application/json"
\
--header "iPlanetDirectoryPro: AQIC5w...NTcy*"
\
--header "Accept-API-Version: resource=2.0, protocol=1.0"
\
--data '{
...

```

Observe that the session token is inserted into a header field named `iPlanetDirectoryPro`. This header field name must correspond to the name of the AM session cookie—by default, `iPlanetDirectoryPro`. You can find the cookie name in the AM console by navigating to `Deployment > Servers > Server Name > Security > Cookie`, in the `Cookie Name` field of the AM console.

Once a user has authenticated, it is *not* necessary to insert login credentials in the HTTP header in subsequent REST API calls. Note the absence of `X-OpenAM-Username` and `X-OpenAM-Password` headers in the preceding example.

Users are required to have appropriate privileges in order to access AM functionality using the REST API. For example, users who lack administrative privileges cannot create AM realms. For

more information on the AM privilege model, see "Delegating Realm Administration Privileges" in the *Setup and Maintenance Guide*.

- Finally, call the REST API to log the user out of AM as described in "Authentication and Logout". As with other REST API calls made after a user has authenticated, the REST API call to log out of AM requires the user's `tokenID` in the HTTP header.

## A.7. Server Information

You can retrieve AM server information by using HTTP GET on `/json/serverinfo/*` as follows:

```
$ curl \
  --request GET \
  --header "Content-Type: application/json" \
  --header "Accept-API-Version: resource=1.1, protocol=1.0" \
  https://openam.example.com:8443/openam/json/serverinfo/*
{
  "domains": [
    ".example.com"
  ],
  "protectedUserAttributes": [],
  "cookieName": "iPlanetDirectoryPro",
  "secureCookie": false,
  "forgotPassword": "false",
  "forgotUsername": "false",
  "kbaEnabled": "false",
  "selfRegistration": "false",
  "lang": "en-US",
  "successfulUserRegistrationDestination": "default",
  "socialImplementations": [
    {
      "iconPath": "XUI/images/logos/facebook.png",
      "authnChain": "FacebookSocialAuthenticationService",
      "displayName": "Facebook",
      "valid": true
    }
  ],
  "referralsEnabled": "false",
  "zeroPageLogin": {
    "enabled": false,
    "referrerWhitelist": [
      ""
    ],
    "allowedWithoutReferer": true
  },
  "realm": "/",
  "xuiUserSessionValidationEnabled": true,
  "FQDN": "openam.example.com"
}
```



## A.8. Token Encoding

Valid tokens in AM requires configuration either in percent encoding or in *C66Encode* format. C66Encode format is encouraged. It is the default token format for AM, and is used in this section. The following is an example token that has not been encoded:

```
AQIC5wM2LY4SfczntBbXvEA0uECbqMY3J4NW3byH6xwgkGE=@AAJTSQACMDE=#
```

This token includes reserved characters such as `+`, `/`, and `=` (The `@`, `#`, and `*` are not reserved characters per se, but substitutions are still required). To c66encode this token, you would substitute certain characters for others, as follows:

- + is replaced with -
- / is replaced with \_
- = is replaced with .
- @ is replaced with \*
- # is replaced with \*
- \* (first instance) is replaced with @
- \* (subsequent instances) is replaced with #

In this case, the translated token would appear as shown here:

```
AQIC5wM2LY4SfczntBbXvEA0uECbqMY3J4NW3byH6xwgkGE.*AAJTSQACMDE.*
```

## A.9. Logging

AM 5.1 supports two Audit Logging Services: a new common REST-based Audit Logging Service, and the legacy Logging Service, which is based on a Java SDK and is available in AM versions prior to OpenAM 13. The legacy Logging Service is deprecated.

Both audit facilities log AM REST API calls.

### A.9.1. Common Audit Logging of REST API Calls

AM logs information about all REST API calls to the `access` topic. For more information about AM audit topics, see "Audit Log Topics" in the *Setup and Maintenance Guide*.

Locate specific REST endpoints in the `http.path` log file property.

### A.9.2. Legacy Logging of REST API Calls

AM logs information about REST API calls to two files:

- **amRest.access**. Records accesses to a CREST endpoint, regardless of whether the request successfully reached the endpoint through policy authorization.

An `amRest.access` example is as follows:

```
$ cat openam/openam/log/amRest.access

#Version: 1.0
#Fields: time Data LoginID ContextID IPAddr LogLevel Domain LoggedBy MessageID ModuleName
NameID HostName
"2011-09-14 16:38:17" /home/user/openam/openam/log/ "cn=dsameuser,ou=DSAME Users,o=openam"
aa307b2dcb721d4201 "Not Available" INFO o=openam "cn=dsameuser,ou=DSAME Users,o=openam"
LOG-1 amRest.access "Not Available" 192.168.56.2
"2011-09-14 16:38:17" "Hello World" id=bjensen,ou=user,o=openam 8a4025a2b3af291d01 "Not Available"
INFO o=openam id=amadmin,ou=user,o=openam "Not Available" amRest.access "Not Available"
192.168.56.2
```

- **amRest.authz.** Records all CREST authorization results regardless of success. If a request has an entry in the `amRest.access` log, but no corresponding entry in `amRest.authz`, then that endpoint was not protected by an authorization filter and therefore the request was granted access to the resource.

The `amRest.authz` file contains the `Data` field, which specifies the authorization decision, resource, and type of action performed on that resource. The `Data` field has the following syntax:

```
("GRANT"|"DENY") > "RESOURCE | ACTION"

where
"GRANT > " is prepended to the entry if the request was allowed
"DENY > " is prepended to the entry if the request was not allowed
"RESOURCE" is "ResourceLocation | ResourceParameter"
  where
    "ResourceLocation" is the endpoint location (e.g., subrealm/applicationtypes)
    "ResourceParameter" is the ID of the resource being touched
    (e.g., myApplicationType) if applicable. Otherwise, this field is empty
    if touching the resource itself, such as in a query.

"ACTION" is "ActionType | ActionParameter"
  where
    "ActionType" is "CREATE||READ||UPDATE||DELETE||PATCH||ACTION||QUERY"
    "ActionParameter" is one of the following depending on the ActionType:
      For CREATE: the new resource ID
      For READ: empty
      For UPDATE: the revision of the resource to update
      For DELETE: the revision of the resource to delete
      For PATCH: the revision of the resource to patch
      For ACTION: the actual action performed (e.g., "forgotPassword")
      For QUERY: the query ID if any
```

```

$ cat openam/openam/Log/amRest.authz

#Version: 1.0
#Fields: time Data ContextID LoginID IPAddr LogLevel Domain MessageID LoggedBy NameID
ModuleName HostName
"2014-09-16 14:17:28" /var/root/openam/openam/log/ 7d3af9e799b6393301
"cn=dsameuser,ou=DSAME Users,dc=openam,dc=forgerock,dc=org" "Not Available" INFO
dc=openam,dc=forgerock,dc=org LOG-1 "cn=dsameuser,ou=DSAME Users,dc=openam,dc=forgerock,dc=org"
"Not Available" amRest.authz 10.0.1.5
"2014-09-16 15:56:12" "GRANT > sessions|ACTION|logout|AdminOnlyFilter" d3977a55a2ee18c201
id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org "Not Available" INFO dc=openam,dc=forgerock,dc=org
OAuth2Provider-2 "cn=dsameuser,ou=DSAME Users,dc=openam,dc=forgerock,dc=org" "Not Available"
amRest.authz 127.0.0.1
"2014-09-16 15:56:40" "GRANT > sessions|ACTION|logout|AdminOnlyFilter" eedbc205bf51780001
id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org "Not Available" INFO dc=openam,dc=forgerock,dc=org
OAuth2Provider-2 "cn=dsameuser,ou=DSAME Users,dc=openam,dc=forgerock,dc=org" "Not Available"
amRest.authz 127.0.0.1

```

AM also provides additional information in its debug notifications for accesses to any endpoint, depending on the message type (error, warning or message) including realm, user, and result of the operation.

## A.10. Reference

This reference section covers return codes and system settings relating to REST API support in AM.

### A.10.1. REST APIs

**amster** type ID: **rest**

The following settings are available in this service:

#### Default Resource Version

The API resource version to use when the REST request does not specify an explicit version. Choose from:

- **Latest**. If an explicit version is not specified, the latest resource version of an API is used.
- **Oldest**. If an explicit version is not specified, the oldest supported resource version of an API is used. Note that since APIs may be deprecated and fall out of support, the oldest *supported* version may not be the first version.
- **None**. If an explicit version is not specified, the request will not be handled and an error status is returned.

The possible values for this property are:

```
Latest
```

Oldest  
None

Default value: **Latest**

**amster** data attribute: **defaultVersion**

## Warning Header

Whether to include a warning header in the response to a request which fails to include the **Accept-API-Version** header.

Default value: **false**

**amster** data attribute: **warningHeader**

## API Descriptions

Whether API Explorer and API Docs are enabled in OpenAM and how the documentation for them is generated. Dynamic generation includes descriptions from any custom services and authentication modules you may have added. Static generation only includes services and authentication modules that were present when OpenAM was built. Note that dynamic documentation generation may not work in some application containers.

The possible values for this property are:

DYNAMIC  
STATIC  
DISABLED

Default value: **STATIC**

**amster** data attribute: **descriptionsState**

## Default Protocol Version

The API protocol version to use when a REST request does not specify an explicit version. Choose from:

- **Oldest**. If an explicit version is not specified, the oldest protocol version is used.
- **Latest**. If an explicit version is not specified, the latest protocol version is used.
- **None**. If an explicit version is not specified, the request will not be handled and an error status is returned.

The possible values for this property are:

Oldest  
Latest  
None

Default value: `Latest`

**amster** data attribute: `defaultProtocolVersion`

# Appendix B. About Scripting

You can use scripts for client-side and server-side authentication, policy conditions, and handling OpenID Connect claims.

## B.1. The Scripting Environment

This section introduces how AM executes scripts, and covers thread pools and security configuration.

You can use scripts to modify default AM behavior in the following situations, also known as *contexts*:

### Client-side Authentication

Scripts that are executed on the client during authentication. Client-side scripts must be in JavaScript.

### Server-side Authentication

Scripts are included in an authentication module and are executed on the server during authentication.

### Policy Condition

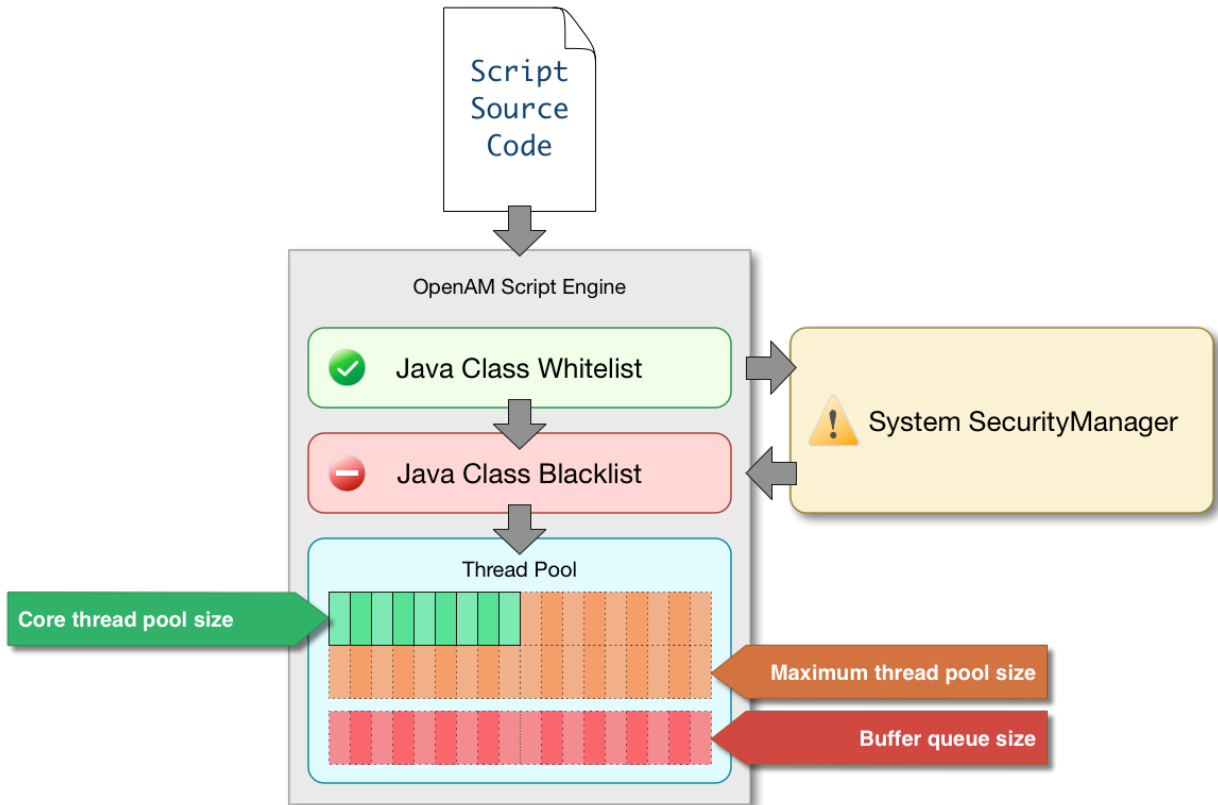
Scripts used as conditions within policies.

### OIDC Claims

Scripts that gather and populate the claims in a request when issuing an ID token or making a request to the `userinfo` endpoint.

AM implements a configurable scripting engine for each of the context types that are executed on the server.

The scripting engines in AM have two main components: security settings, and the thread pool.



### B.1.1. Security

AM scripting engines provide security features for ensuring that malicious Java classes are not directly called. The engines validate scripts by checking all directly-called Java classes against a configurable blacklist and whitelist, and, optionally, against the JVM SecurityManager, if it is configured.

Whitelists and blacklists contain class names that are allowed or denied execution respectively. Specify classes in whitelists and blacklists by name or by using regular expressions.

Classes called by the script are checked against the whitelist first, and must match at least one pattern in the list. The blacklist is applied after the whitelist, and classes matching any pattern are disallowed.

You can also configure the scripting engine to make an additional call to the JVM security manager for each class that is accessed. The security manager throws an exception if a class being called is not allowed to execute.

For more information on configuring script engine security, see "Scripting".

### *Important Points About Script Engine Security*

The following points should be considered when configuring the security settings within each script engine:

#### **The scripting engine only validates directly accessible classes.**

The security settings only apply to classes that the script *directly* accesses. If the script calls `Foo.a()` and then that method calls `Bar.b()`, the scripting engine will be unable to prevent it. You must consider the whole chain of accessible classes.

#### **Note**

*Access* includes actions such as:

- Importing or loading a class.
- Accessing any instance of that class. For example, passed as a parameter to the script.
- Calling a static method on that class.
- Calling a method on an instance of that class.
- Accessing a method or field that returns an instance of that class.

#### **Potentially dangerous Java classes are blacklisted by default.**

All Java reflection classes (`java.lang.Class`, `java.lang.reflect.*`) are blacklisted by default to avoid bypassing the security settings.

The `java.security.AccessController` class is also blacklisted by default to prevent access to the `doPrivileged()` methods.

#### **Caution**

You should not remove potentially dangerous Java classes from the blacklist.

#### **The whitelists and blacklists match class or package names only.**

The whitelist and blacklist patterns apply only to the exact class or package names involved. The script engine does not know anything about inheritance, so it is best to whitelist known, specific classes.



## B.1.2. Thread Pools

Each script is executed in an individual thread. Each scripting engine starts with an initial number of threads available for executing scripts. If no threads are available for execution, AM creates a new thread to execute the script, until the configured maximum number of threads is reached.

If the maximum number of threads is reached, pending script executions are queued in a number of buffer threads, until a thread becomes available for execution. If a created thread has completed script execution and has remained idle for a configured amount of time, AM terminates the thread, shrinking the pool.

For more information on configuring script engine thread pools, see "Scripting".

## B.2. Global Scripting API Functionality

This section covers functionality available to each of the server-side script types.

Global API functionality includes:

- Accessing HTTP Services
- Debug Logging

### B.2.1. Accessing HTTP Services

AM passes an HTTP client object, `httpClient`, to server-side scripts. Server-side scripts can call HTTP services with the `httpClient.send` method. The method returns an `HttpClientResponse` object.

Configure the parameters for the HTTP client object by using the `org.forgerock.http.protocol` package. This package contains the `Request` class, which has methods for setting the URI and type of request.

The following example, taken from the default server-side Scripted authentication module script, uses these methods to call an online API to determine the longitude and latitude of a user based on their postal address:

```
function getLongitudeLatitudeFromUserPostalAddress() {
    var request = new org.forgerock.http.protocol.Request();

    request.setUri("http://maps.googleapis.com/maps/api/geocode/json?address=" +
    encodeURIComponent(userPostalAddress));
    request.setMethod("GET");

    var response = httpClient.send(request).get();
    logResponse(response);

    var geocode = JSON.parse(response.getEntity());
    var i;

    for (i = 0; i < geocode.results.length; i++) {
        var result = geocode.results[i];
        latitude = result.geometry.location.lat;
        longitude = result.geometry.location.lng;

        logger.message("latitude:" + latitude + " longitude:" + longitude);
    }
}
```

HTTP client requests are synchronous and blocking until they return. You can, however, set a global timeout for server-side scripts. For details, see "Scripted Authentication Module Properties".

Server-side scripts can access response data by using the methods listed in the table below.

### HTTP Client Response Methods

Method	Parameters	Return Type	Description
<code>HttpClientResponse.getCookies</code>	Void	Map<String, String>	Get the cookies for the returned response, if any exist.
<code>HttpClientResponse.getEntity</code>	Void	String	Get the entity of the returned response.
<code>HttpClientResponse.getHeaders</code>	Void	Map<String, String>	Get the headers for the returned response, if any exist.
<code>HttpClientResponse.getReasonPhrase</code>	Void	String	Get the reason phrase of the returned response.
<code>HttpClientResponse.getStatusCode</code>	Void	Integer	Get the status code of the returned response.
<code>HttpClientResponse.hasCookies</code>	Void	Boolean	Indicate whether the returned response had any cookies.
<code>HttpClientResponse.hasHeaders</code>	Void	Boolean	Indicate whether the returned response had any headers.

## B.2.2. Debug Logging

Server-side scripts can write messages to AM debug logs by using the `logger` object.

AM does not log debug messages from scripts by default. You can configure AM to log such messages by setting the debug log level for the `amScript` service. For details, see "Debug Logging By Service" in the *Setup and Maintenance Guide*.

The following table lists the `logger` methods.

*Logger Methods*

Method	Parameters	Return Type	Description
<code>logger.error</code>	<i>Error Message</i> (type: <code>String</code> )	<code>Void</code>	Write <i>Error Message</i> to AM debug logs if ERROR level logging is enabled.
<code>logger.errorEnabled</code>	<code>Void</code>	<code>Boolean</code>	Return <code>true</code> when ERROR level debug messages are enabled.
<code>logger.message</code>	<i>Message</i> (type: <code>String</code> )	<code>Void</code>	Write <i>Message</i> to AM debug logs if MESSAGE level logging is enabled.
<code>logger.messageEnabled</code>	<code>Void</code>	<code>Boolean</code>	Return <code>true</code> when MESSAGE level debug messages are enabled.
<code>logger.warning</code>	<i>Warning Message</i> (type: <code>String</code> )	<code>Void</code>	Write <i>Warning Message</i> to AM debug logs if WARNING level logging is enabled.
<code>logger.warningEnabled</code>	<code>Void</code>	<code>Boolean</code>	Return <code>true</code> when WARNING level debug messages are enabled.

## B.3. Managing Scripts

This section shows you how to manage scripts used for client-side and server-side scripted authentication, custom policy conditions, and handling OpenID Connect claims using the AM console, the `ssoadm` command, and the REST API.

### B.3.1. Managing Scripts With the AM Console

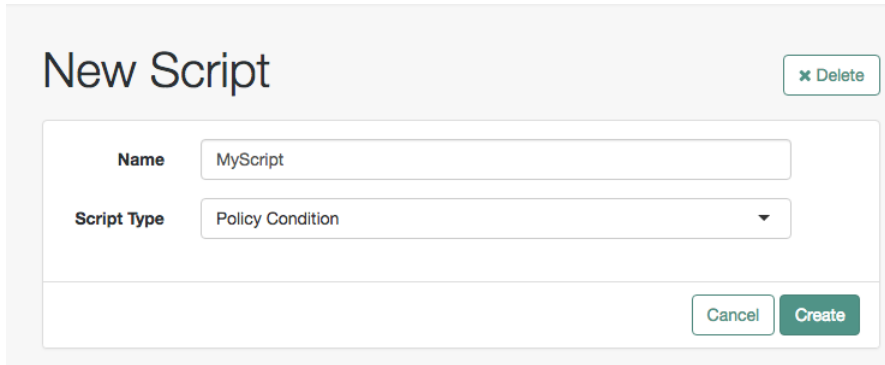
The following procedures describe how to create, modify, and delete scripts using the AM console:

- "To Create Scripts by Using the AM Console"
- "To Modify Scripts by Using the AM Console"
- "To Delete Scripts by Using the AM Console"

## To Create Scripts by Using the AM Console

1. Log in to the AM console as an AM administrator, for example, `amadmin`.
2. Navigate to Realms > *Realm Name* > Scripts.
3. Click New Script.


The New Script page appears:



The screenshot shows a web form titled "New Script". In the top right corner, there is a "Delete" button with a small 'x' icon. The form contains two input fields: "Name" with the text "MyScript" and "Script Type" with a dropdown menu currently showing "Policy Condition". At the bottom right of the form, there are two buttons: "Cancel" and "Create".

4. Specify a name for the script.
5. Select the type of script from the Script Type drop-down list.
6. Click Create.

The *Script Name* page appears:



SCRIPT

## MyScript

✕ Delete

**Name**

**Description**

**Script Type** Policy Condition ⚙️ Change

**Language**  JavaScript  Groovy

**Script**

```

1  /**
2  * This is a Policy Condition example script. It demon
3  * use that information in external HTTP calls and mak
4  */
5
6  var userAddress, userIP, resourceHost;
7
8  if (validateAndInitializeParameters()) {
9
10     var countryFromUserAddress = getCountryFromUserAdd
11     logger.message("Country retrieved from user's addr
12     var countryFromUserIP = getCountryFromUserIP();
13     logger.message("Country retrieved from user's IP:
14     var countryFromResourceURI = getCountryFromResourc
15     logger.message("Country retrieved from resource UR
16
17     if (countryFromUserAddress === countryFromUserIP &
18         logger.message("Authorization Succeeded");
19         responseAttributes.put("countryOfOrigin", {cou
20         authorized = true;
21     } else {

```

Upload
Validate
🖥️ Edit Fullscreen

Save Changes

7. Enter values on the *Script Name* page as follows:

- a. Enter a description of the script.
- b. Choose the script language, either JavaScript or Groovy. Note that not every script type supports both languages.
- c. Enter the source code in the Script field.

On supported browsers, you can click Upload, navigate to the script file, and then click Open to upload the contents to the Script field.

- d. Click Validate to check for compilation errors in the script.

Correct any compilation errors, and revalidate the script until all errors have been fixed.

- e. Save your changes.

### To Modify Scripts by Using the AM Console

1. Log in to the AM console as an AM administrator, for example, `amadmin`.
2. Navigate to Realms > *Realm Name* > Scripts.
3. Select the script you want to modify from the list of scripts.

The *Script Name* page appears.

4. Modify values on the *Script Name* page as needed. Note that if you change the Script Type, existing code in the script is replaced.
5. If you modified the code in the script, click Validate to check for compilation errors.

Correct any compilation errors, and revalidate the script until all errors have been fixed.

6. Save your changes.

### To Delete Scripts by Using the AM Console

1. Log in to the AM console as an AM administrator, for example, `amadmin`.
2. Navigate to Realms > *Realm Name* > Scripts.
3. Choose one or more scripts to delete by activating the checkboxes in the relevant rows. Note that you can only delete user-created scripts—you cannot delete the global sample scripts provided with AM.
4. Click Delete.

## B.3.2. Managing Scripts With the `ssoadm` Command

Use the `ssoadm` command's `create-sub-cfg`, `get-sub-cfg`, and `delete-sub-cfg` subcommands to manage AM scripts.

Create an AM script as follows:

1. Create a script configuration file as follows:

```
script-file=/path/to/script-file
language=JAVASCRIPT|GROOVY
name=myScript
context=AUTHENTICATION_SERVER_SIDE|AUTHENTICATION_CLIENT_SIDE|POLICY_CONDITION|OIDC_CLAIMS
```

2. Run the **ssoadm create-sub-cfg** command. The **--datafile** argument references the script configuration file you created in the previous step:

```
$ ssoadm \  
  create-sub-cfg \  
  --realm /myRealm \  
  --adminid amadmin \  
  --password-file /tmp/pwd.txt \  
  --servicename ScriptingService \  
  --subconfigname scriptConfigurations/scriptConfiguration \  
  --subconfigid myScript \  
  --datafile /path/to/myScriptConfigurationFile  
Sub Configuration scriptConfigurations/scriptConfiguration was added to realm /myRealm
```

- To list the properties of a script, run the **ssoadm get-sub-cfg** command:

```
$ ssoadm \  
  get-sub-cfg \  
  --realm /myRealm \  
  --adminid amadmin \  
  --password-file /tmp/pwd.txt \  
  --servicename ScriptingService \  
  --subconfigname scriptConfigurations/myScript  
createdBy=  
lastModifiedDate=  
lastModifiedBy=  
name=myScript  
context=POLICY_CONDITION  
description=  
language=JAVASCRIPT  
creationDate=  
script=...Script output follows...
```

- To delete a script, run the **ssoadm delete-sub-cfg** command:

```
$ ssoadm \  
  delete-sub-cfg \  
  --realm /myRealm \  
  --adminid amadmin \  
  --password-file /tmp/pwd.txt \  
  --servicename ScriptingService \  
  --subconfigname scriptConfigurations/myScript  
Sub Configuration scriptConfigurations/myScript was deleted from realm /myRealm
```

### B.3.3. Managing Scripts With the REST API

This section shows you how to manage scripts used for client-side and server-side scripted authentication, custom policy conditions, and handling OpenID Connect claims by using the REST API.

AM provides the **scripts** REST endpoint for the following:

- "Querying Scripts"
- "Reading a Script"

- "Validating a Script"
- "Creating a Script"
- "Updating a Script"
- "Deleting a Script"

User-created scripts are realm-specific, hence the URI for the scripts' API can contain a realm component, such as `/json{/realm}/scripts`. If the realm is not specified in the URI, the top level realm is used.

### Tip

AM includes some global example scripts that can be used in any realm.

Scripts are represented in JSON and take the following form. Scripts are built from standard JSON objects and values (strings, numbers, objects, sets, arrays, `true`, `false`, and `null`). Each script has a system-generated *universally unique identifier* (UUID), which must be used when modifying existing scripts. Renaming a script will not affect the UUID:

```
{
  "_id": "7e3d7067-d50f-4674-8c76-a3e13a810c33",
  "name": "Scripted Module - Server Side",
  "description": "Default global script for server side Scripted Authentication Module",
  "script": "dmFyIFNlbnVJUX1R...",
  "language": "JAVASCRIPT",
  "context": "AUTHENTICATION_SERVER_SIDE",
  "createdBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
  "creationDate": 1433147666269,
  "lastModifiedBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
  "lastModifiedDate": 1433147666269
}
```

The values for the fields shown in the example above are explained below:

#### **`_id`**

The UUID that AM generates for the script.

#### **`name`**

The name provided for the script.

#### **`description`**

An optional text string to help identify the script.

#### **`script`**

The source code of the script. The source code is in UTF-8 format and encoded into Base64.



For example, a script such as the following:

```
var a = 123;  
var b = 456;
```

When encoded into Base64 becomes:

```
dmFyIGVgPSAxMjM7IA0KdmFyIGIgaSA0NTY7
```

## Language

The language the script is written in - **JAVASCRIPT** or **GROOVY**.

### *Language Support per Context*

Script Context	Supported Languages
<b>POLICY_CONDITION</b>	JAVASCRIPT, GROOVY
<b>AUTHENTICATION_SERVER_SIDE</b>	JAVASCRIPT, GROOVY
<b>AUTHENTICATION_CLIENT_SIDE</b>	JAVASCRIPT
<b>OIDC_CLAIMS</b>	JAVASCRIPT, GROOVY

## context

The context type of the script.

Supported values are:

### **POLICY\_CONDITION**

Policy Condition

### **AUTHENTICATION\_SERVER\_SIDE**

Server-side Authentication

### **AUTHENTICATION\_CLIENT\_SIDE**

Client-side Authentication

#### Note

Client-side scripts must be written in JavaScript.

### **OIDC\_CLAIMS**

OIDC Claims

#### createdBy

A string containing the universal identifier DN of the subject that created the script.

#### creationDate

An integer containing the creation date and time, in ISO 8601 format.

#### LastModifiedBy

A string containing the universal identifier DN of the subject that most recently updated the resource type.

If the script has not been modified since it was created, this property will have the same value as `createdBy`.

#### LastModifiedDate

A string containing the last modified date and time, in ISO 8601 format.

If the script has not been modified since it was created, this property will have the same value as `creationDate`.

### B.3.4. Querying Scripts

To list all the scripts in a realm, as well as any global scripts, perform an HTTP GET to the `/json/{realm}/scripts` endpoint with a `_queryFilter` parameter set to `true`.

#### Note

If the realm is not specified in the URL, AM returns scripts in the top level realm, as well as any global scripts.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```
$ curl \
--header "iPlanetDirectoryPro: AQIC5..." \
https://openam.example.com:8443/openam/json/realm/root/realm/myrealm/scripts?_queryFilter=true
{
  "result": [
    {
      "_id": "9de3eb62-f131-4fac-a294-7bd170fd4acb",
      "name": "Scripted Policy Condition",
      "description": "Default global script for Scripted Policy Conditions",
      "script": "Ly0qCiAqIFRoaxMg...",
      "language": "JAVASCRIPT",
      "context": "POLICY_CONDITION",
      "createdBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
      "creationDate": 1433147666269,
```

```

    "lastModifiedBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
    "lastModifiedDate": 1433147666269
  },
  {
    "_id": "7e3d7067-d50f-4674-8c76-a3e13a810c33",
    "name": "Scripted Module - Server Side",
    "description": "Default global script for server side Scripted Authentication Module",
    "script": "dmFyIFNUNUQVJUX1RJ...",
    "language": "JAVASCRIPT",
    "context": "AUTHENTICATION_SERVER_SIDE",
    "createdBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
    "creationDate": 1433147666269,
    "lastModifiedBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
    "lastModifiedDate": 1433147666269
  }
],
"resultCount": 2,
"pagedResultsCookie": null,
"remainingPagedResults": -1
}

```

### Supported `_queryFilter` Fields and Operators

Field	Supported Operators
<code>_id</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )
<code>name</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )
<code>description</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )
<code>script</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )
<code>language</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )
<code>context</code>	Equals ( <code>eq</code> ), Contains ( <code>co</code> ), Starts with ( <code>sw</code> )

### B.3.5. Reading a Script

To read an individual script in a realm, perform an HTTP GET using the `/json{/realm}/scripts` endpoint, specifying the UUID in the URL.

#### Tip

To read a script in the top-level realm, or to read a built-in global script, do not specify a realm in the URL.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```
$ curl \
--header "iPlanetDirectoryPro: AQIC5..." \
https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/9de3eb62-f131-4fac-a294-7bd170fd4acb
{
  "_id": "9de3eb62-f131-4fac-a294-7bd170fd4acb",
  "name": "Scripted Policy Condition",
  "description": "Default global script for Scripted Policy Conditions",
  "script": "LyoqCiAqIFRoaxMg...",
  "language": "JAVASCRIPT",
  "context": "POLICY_CONDITION",
  "createdBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
  "creationDate": 1433147666269,
  "lastModifiedBy": "id=dsameuser,ou=user,dc=openam,dc=forgerock,dc=org",
  "lastModifiedDate": 1433147666269
}
```

### B.3.6. Validating a Script

To validate a script, perform an HTTP POST using the `/json{/realm}/scripts` endpoint, with an `_action` parameter set to `validate`. Include a JSON representation of the script and the script language, `JAVASCRIPT` or `GR00VY`, in the POST data.

The value for `script` must be in UTF-8 format and then encoded into Base64.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```
$ curl \
--request POST \
--header "Content-Type: application/json" \
--header "iPlanetDirectoryPro: AQIC5..." \
--data '{
  "script": "dmFyIGEGPSAxMjM7dmFyIGIGPSA0NTY7Cg==",
  "language": "JAVASCRIPT"
}' \
https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/?_action=validate
{
  "success": true
}
```

If the script is valid the JSON response contains a `success` key with a value of `true`.

If the script is invalid the JSON response contains a `success` key with a value of `false`, and an indication of the problem and where it occurs, as shown below:

```
$ curl \
  --request POST \
  --header "Content-Type: application/json" \
  --header "iPlanetDirectoryPro: AQIC5..." \
  --data '{
    "script": "dmFyIGEGPSAxMjM7dmFyIGIgPSA0NTY7ID1WQUxJREFUSU90IFNIT1VMRCBGQU1MPQo=",
    "language": "JAVASCRIPT"
  }' \
  https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/?_action=validate
{
  "success": false,
  "errors": [
    {
      "line": 1,
      "column": 27,
      "message": "syntax error"
    }
  ]
}
```

### B.3.7. Creating a Script

To create a script in a realm, perform an HTTP POST using the `/json{/realm}/scripts` endpoint, with an `_action` parameter set to `create`. Include a JSON representation of the script in the POST data.

The value for `script` must be in UTF-8 format and then encoded into Base64.

#### Note

If the realm is not specified in the URL, AM creates the script in the top level realm.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```

$ curl \
  --request POST \
  --header "Content-Type: application/json" \
  --header "iPlanetDirectoryPro: AQIC5..." \
  --data '{
    "name": "MyJavaScript",
    "script": "dmFyIGEGPSAxMjM7CnZhciBiID0gNDU2Ow==",
    "language": "JAVASCRIPT",
    "context": "POLICY_CONDITION",
    "description": "An example script"
  }' \
  https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/?_action
=create
{
  "_id": "0168d494-015a-420f-ae5a-6a2a5c1126af",
  "name": "MyJavaScript",
  "description": "An example script",
  "script": "dmFyIGEGPSAxMjM7CnZhciBiID0gNDU2Ow==",
  "language": "JAVASCRIPT",
  "context": "POLICY_CONDITION",
  "createdBy": "id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org",
  "creationDate": 1436807766258,
  "lastModifiedBy": "id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org",
  "lastModifiedDate": 1436807766258
}

```

### B.3.8. Updating a Script

To update an individual script in a realm, perform an HTTP PUT using the `/json{/realm}/scripts` endpoint, specifying the UUID in both the URL and the PUT body. Include a JSON representation of the updated script in the PUT data, alongside the UUID.

#### Note

If the realm is not specified in the URL, AM uses the top level realm.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```
$ curl \
  --header "iPlanetDirectoryPro: AQIC5..." \
  --header "Content-Type: application/json" \
  --request PUT \
  --data '{
    "name": "MyUpdatedJavaScript",
    "script": "dmFyIGEGPSAxMjM7CnZhciBiID0gNDU2Ow==",
    "language": "JAVASCRIPT",
    "context": "POLICY_CONDITION",
    "description": "An updated example script configuration"
  }' \
  https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/0168d494-015a-420f-ae5a-6a2a5c1126af
{
  "_id": "0168d494-015a-420f-ae5a-6a2a5c1126af",
  "name": "MyUpdatedJavaScript",
  "description": "An updated example script configuration",
  "script": "dmFyIGEGPSAxMjM7CnZhciBiID0gNDU2Ow==",
  "language": "JAVASCRIPT",
  "context": "POLICY_CONDITION",
  "createdBy": "id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org",
  "creationDate": 1436807766258,
  "lastModifiedBy": "id=amadmin,ou=user,dc=openam,dc=forgerock,dc=org",
  "lastModifiedDate": 1436808364681
}
```

### B.3.9. Deleting a Script

To delete an individual script in a realm, perform an HTTP DELETE using the `/json{/realm}/scripts` endpoint, specifying the UUID in the URL.

#### Note

If the realm is not specified in the URL, AM uses the top level realm.

The `iPlanetDirectoryPro` header is required and should contain the SSO token of an administrative user, such as `amAdmin`, who has access to perform the operation.

```
$ curl \
  --request DELETE \
  --header "iPlanetDirectoryPro: AQIC5..." \
  https://openam.example.com:8443/openam/json/realms/root/realms/myrealm/scripts/0168d494-015a-420f-ae5a-6a2a5c1126af
{}
```

## B.4. Scripting

`amster` type ID: `scripting`

## B.4.1. Configuration

The following settings appear on the **Configuration** tab:

### Default Script Type

The default script context type when creating a new script.

The possible values for this property are:

```
POLICY_CONDITION
AUTHENTICATION_SERVER_SIDE
AUTHENTICATION_CLIENT_SIDE
OIDC_CLAIMS
```

Default value: **POLICY\_CONDITION**

**amster** data attribute: **defaultContext**

## B.4.2. Secondary Configurations

This service has the following Secondary Configurations.

### B.4.2.1. Engine Configuration

The following properties are available for Scripting Service secondary configuration instances:

#### Engine Configuration

Configure script engine parameters for running a particular script type in OpenAM.

**amster** data attribute: **engineConfiguration**

To access a secondary configuration instance using the **ssoadm** command, use: **--subconfigname [primary configuration]/[secondary configuration]** For example:

```
$ ssoadm set-sub-cfg \
--adminid amAdmin \
--password-file admin_pwd_file \
--servicename ScriptingService \
--subconfigname OIDC_CLAIMS/engineConfiguration \
--operation set \
--attributevalues maxThreads=300 queueSize=-1
```

#### Note

Supports server-side scripts only. OpenAM cannot configure engine settings for client-side scripts.

The configurable engine settings are as follows:



### Server-side Script Timeout

The maximum execution time any individual script should take on the server (in seconds). OpenAM terminates scripts which take longer to run than this value.

**amster** data attribute: `serverTimeout`

### Core thread pool size

The initial number of threads in the thread pool from which scripts operate. OpenAM will ensure the pool contains at least this many threads.

**amster** data attribute: `coreThreads`

### Maximum thread pool size

The maximum number of threads in the thread pool from which scripts operate. If no free thread is available in the pool, OpenAM creates new threads in the pool for script execution up to the configured maximum.

**amster** data attribute: `maxThreads`

### Thread pool queue size

The number of threads to use for buffering script execution requests when the maximum thread pool size is reached.

**amster** data attribute: `queueSize`

### Thread idle timeout (seconds)

Length of time (in seconds) for a thread to be idle before OpenAM terminates created threads. If the current pool size contains the number of threads set in `Core thread pool size` idle threads will not be terminated, to maintain the initial pool size.

**amster** data attribute: `idleTimeout`

### Java class whitelist

Specifies the list of class-name patterns allowed to be invoked by the script. Every class accessed by the script must match at least one of these patterns.

You can specify the class name as-is or use a regular expression.

**amster** data attribute: `whitelList`

### Java class blacklist

Specifies the list of class-name patterns that are NOT allowed to be invoked by the script. The blacklist is applied AFTER the whitelist to exclude those classes - access to a class specified in both the whitelist and the blacklist will be denied.

You can specify the class name to exclude as-is or use a regular expression.

**amster** data attribute: `blackList`

### Use system SecurityManager

If enabled, OpenAM will make a call to `System.getSecurityManager().checkPackageAccess(...)` for each class that is accessed. The method throws `SecurityException` if the calling thread is not allowed to access the package.

#### Note

This feature only takes effect if the security manager is enabled for the JVM.

**amster** data attribute: `useSecurityManager`

### Scripting languages

Select the languages available for scripts on the chosen type. Either `GROOVY` or `JAVASCRIPT`.

**amster** data attribute: `languages`

### Default Script

The source code that is presented as the default when creating a new script of this type.

**amster** data attribute: `defaultScript`

## Appendix C. Getting Support

For more information or resources about AM and ForgeRock Support, see the following sections:

### C.1. Accessing Documentation Online

ForgeRock publishes comprehensive documentation online:

- The [ForgeRock Knowledge Base](#) offers a large and increasing number of up-to-date, practical articles that help you deploy and manage ForgeRock software.

While many articles are visible to community members, ForgeRock customers have access to much more, including advanced information for customers using ForgeRock software in a mission-critical capacity.

- ForgeRock product documentation, such as this document, aims to be technically accurate and complete with respect to the software documented. It is visible to everyone and covers all product features and examples of how to use them.

### C.2. Using the ForgeRock.org Site

The [ForgeRock.org](#) site has links to source code for ForgeRock open source software, as well as links to the ForgeRock forums and technical blogs.

If you are a *ForgeRock customer*, raise a support ticket instead of using the forums. ForgeRock support professionals will get in touch to help you.

## C.3. Getting Support and Contacting ForgeRock

ForgeRock provides support services, professional services, training through ForgeRock University, and partner services to assist you in setting up and maintaining your deployments. For a general overview of these services, see <https://www.forgerock.com>.

ForgeRock has staff members around the globe who support our international customers and partners. For details on ForgeRock's support offering, including support plans and service level agreements (SLAs), visit <https://www.forgerock.com/support>.

# Glossary

Access control	Control to grant or to deny access to a resource.
Account lockout	The act of making an account temporarily or permanently inactive after successive authentication failures.
Actions	Defined as part of policies, these verbs indicate what authorized subjects can do to resources.
Advice	In the context of a policy decision denying access, a hint to the policy enforcement point about remedial action to take that could result in a decision allowing access.
Agent administrator	User having privileges only to read and write policy agent profile configuration information, typically created to delegate policy agent profile creation to the user installing a policy agent.
Agent authenticator	Entity with read-only access to multiple agent profiles defined in the same realm; allows an agent to read web service profiles.
Application	<p>In general terms, a service exposing protected resources.</p> <p>In the context of AM policies, the application is a template that constrains the policies that govern access to protected resources. An application can have zero or more policies.</p>
Application type	<p>Application types act as templates for creating policy applications.</p> <p>Application types define a preset list of actions and functional logic, such as policy lookup and resource comparator logic.</p>

---

	Application types also define the internal normalization, indexing logic, and comparator logic for applications.
Attribute-based access control (ABAC)	Access control that is based on attributes of a user, such as how old a user is or whether the user is a paying customer.
Authentication	The act of confirming the identity of a principal.
Authentication chaining	A series of authentication modules configured together which a principal must negotiate as configured in order to authenticate successfully.
Authentication level	Positive integer associated with an authentication module, usually used to require success with more stringent authentication measures when requesting resources requiring special protection.
Authentication module	AM authentication unit that handles one way of obtaining and verifying credentials.
Authorization	The act of determining whether to grant or to deny a principal access to a resource.
Authorization Server	In OAuth 2.0, issues access tokens to the client after authenticating a resource owner and confirming that the owner authorizes the client to access the protected resource. AM can play this role in the OAuth 2.0 authorization framework.
Auto-federation	Arrangement to federate a principal's identity automatically based on a common attribute value shared across the principal's profiles at different providers.
Bulk federation	Batch job permanently federating user profiles between a service provider and an identity provider based on a list of matched user identifiers that exist on both providers.
Circle of trust	Group of providers, including at least one identity provider, who have agreed to trust each other to participate in a SAML v2.0 provider federation.
Client	In OAuth 2.0, requests protected web resources on behalf of the resource owner given the owner's authorization. AM can play this role in the OAuth 2.0 authorization framework.
Conditions	Defined as part of policies, these determine the circumstances under which which a policy applies.  Environmental conditions reflect circumstances like the client IP address, time of day, how the subject authenticated, or the authentication level achieved.

---

	Subject conditions reflect characteristics of the subject like whether the subject authenticated, the identity of the subject, or claims in the subject's JWT.
Configuration datastore	LDAP directory service holding AM configuration data.
Cross-domain single sign-on (CDSSO)	AM capability allowing single sign-on across different DNS domains.
Delegation	Granting users administrative privileges with AM.
Entitlement	Decision that defines which resource names can and cannot be accessed for a given subject in the context of a particular application, which actions are allowed and which are denied, and any related advice and attributes.
Extended metadata	Federation configuration information specific to AM.
Extensible Access Control Markup Language (XACML)	Standard, XML-based access control policy language, including a processing model for making authorization decisions based on policies.
Federation	Standardized means for aggregating identities, sharing authentication and authorization data information between trusted providers, and allowing principals to access services across different providers without authenticating repeatedly.
Fedlet	Service provider application capable of participating in a circle of trust and allowing federation without installing all of AM on the service provider side; AM lets you create Java Fedlets.
Hot swappable	Refers to configuration properties for which changes can take effect without restarting the container where AM runs.
Identity	Set of data that uniquely describes a person or a thing such as a device or an application.
Identity federation	Linking of a principal's identity across multiple providers.
Identity provider (IdP)	Entity that produces assertions about a principal (such as how and when a principal authenticated, or that the principal's profile has a specified attribute value).
Identity repository	Data store holding user profiles and group information; different identity repositories can be defined for different realms.
Java EE policy agent	Java web application installed in a web container that acts as a policy agent, filtering requests to other applications in the container with policies based on application resource URLs.

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Metadata	Federation configuration information for a provider.
Policy	Set of rules that define who is granted access to a protected resource when, how, and under what conditions.
Policy Agent	Agent that intercepts requests for resources, directs principals to AM for authentication, and enforces policy decisions from AM.
Policy Administration Point (PAP)	Entity that manages and stores policy definitions.
Policy Decision Point (PDP)	Entity that evaluates access rights and then issues authorization decisions.
Policy Enforcement Point (PEP)	Entity that intercepts a request for a resource and then enforces policy decisions from a PDP.
Policy Information Point (PIP)	Entity that provides extra information, such as user profile attributes that a PDP needs in order to make a decision.
Principal	<p>Represents an entity that has been authenticated (such as a user, a device, or an application), and thus is distinguished from other entities.</p> <p>When a <b>Subject</b> successfully authenticates, AM associates the <b>Subject</b> with the <b>Principal</b>.</p>
Privilege	In the context of delegated administration, a set of administrative tasks that can be performed by specified subjects in a given realm.
Provider federation	Agreement among providers to participate in a circle of trust.
Realm	<p>AM unit for organizing configuration and identity information.</p> <p>Realms can be used for example when different parts of an organization have different applications and user data stores, and when different organizations use the same AM deployment.</p> <p>Administrators can delegate realm administration. The administrator assigns administrative privileges to users, allowing them to perform administrative tasks within the realm.</p>
Resource	<p>Something a user can access over the network such as a web page.</p> <p>Defined as part of policies, these can include wildcards in order to match multiple actual resources.</p>
Resource owner	In OAuth 2.0, entity who can authorize access to protected web resources, such as an end user.



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Resource server	In OAuth 2.0, server hosting protected web resources, capable of handling access tokens to respond to requests for such resources.
Response attributes	Defined as part of policies, these allow AM to return additional information in the form of "attributes" with the response to a policy decision.
Role based access control (RBAC)	Access control that is based on whether a user has been granted a set of permissions (a role).
Security Assertion Markup Language (SAML)	Standard, XML-based language for exchanging authentication and authorization data between identity providers and service providers.
Service provider (SP)	Entity that consumes assertions about a principal (and provides a service that the principal is trying to access).
Session	The interval that starts with the user authenticating through AM and ends when the user logs out, or when their session is terminated. For browser-based clients, AM manages user sessions across one or more applications by setting a session cookie. See also <i>Stateful session</i> and <i>Stateless session</i> .
Session high availability	Capability that lets any AM server in a clustered deployment access shared, persistent information about users' sessions from the CTS token store. The user does not need to log in again unless the entire deployment goes down.
Session token	Unique identifier issued by AM after successful authentication. For a <i>Stateful session</i> , the session token is used to track a principal's session.
Single log out (SLO)	Capability allowing a principal to end a session once, thereby ending her session across multiple applications.
Single sign-on (SSO)	Capability allowing a principal to authenticate once and gain access to multiple applications without authenticating again.
Site	Group of AM servers configured the same way, accessed through a load balancer layer.  The load balancer handles failover to provide service-level availability. Use sticky load balancing based on <code>amlbcookie</code> values to improve site performance.  The load balancer can also be used to protect AM services.
Standard metadata	Standard federation configuration information that you can share with other access management software.
Stateful session	An AM session that resides in the Core Token Service's token store. Stateful sessions might also be cached in memory on one or more

AM servers. AM tracks stateful sessions in order to handle events like logout and timeout, to permit session constraints, and to notify applications involved in SSO when a session ends.

Stateless session

An AM session for which state information is encoded in AM and stored on the client. The information from the session is not retained in the CTS token store. For browser-based clients, AM sets a cookie in the browser that contains the session information.

Subject

Entity that requests access to a resource

When a subject successfully authenticates, AM associates the subject with the **Principal** that distinguishes it from other subjects. A subject can be associated with multiple principals.

User data store

Data storage service holding principals' profiles; underlying storage can be an LDAP directory service or a custom **IdRepo** implementation.

Web policy agent

Native library installed in a web server that acts as a policy agent with policies based on web page URLs.