# AAA Authorization and Authentication Cache

The AAA Authorization and Authentication Cache feature allows you to cache authorization and authentication responses for a configured set of users or service profiles, providing performance improvements and an additional level of network reliability because user and service profiles that are returned from authorization and authentication responses can be queried from multiple sources and need not depend solely on an offload server. This feature also provides a failover mechanism so that if a network RADIUS or TACACS+ server is unable to provide authorization and authentication responses network users and administrators can still access the network.



# Prerequisites for Implementing Authorization and Authentication Profile Caching

The following prerequisites apply to implementing authorization and authentication profile caching:

- Understand how you would want to implement profile caching, that is, are profiles being cached to improve network performance or as a failover mechanism if your network authentication and authorization (RADIUS and TACACS+) servers become unavailable.
- RADIUS and TACACS+ server groups must already be configured.

# Information About Implementing Authorization and Authentication Profile Caching

## Network Performance Optimization Using Authorization and Authentication Profile Caching

RADIUS and TACACS+ clients run on Cisco routers and send authentication requests to a central RADIUS or TACACS+ server that contains all user authentication and network service access information. The router is required to communicate with an offload RADIUS or TACACS+ server to authenticate a given call and then apply a policy or service to that call. Unlike authentication, authorization, and accounting (AAA) accounting, AAA authentication and authorization is a blocking procedure, which means the call setup may not proceed while the call is being authenticated and authorized. Thus, the time required to process the call setup is directly impacted by the time required to process such an authentication or authorization request from the router to the offload RADIUS or TACACS+ server, and back again. Any communication problems in the transmission, offload server utilization, and numerous other factors cause significant degradation in a router's call setup performance due simply to the AAA authentication and authorization step. The problem is further highlighted when multiple AAA authentications and authorizations are needed for a single call or session.

A solution to this problem is to minimize the impact of such authentication requests by caching the authentication and authorization responses for given users on the router, thereby removing the need to send the requests to an offload server again and again. This profile caching adds significant performance improvements to call setup times. Profile caching also provides an additional level of network reliability because user and service profiles that are returned from authentication and authorization responses can be queried from multiple sources and need not depend solely on an offload server.

To take advantage of this performance optimization, you need to configure the authentication method list so that the AAA cache profile is queried first when a user attempts to authenticate to the router. See the Method Lists in Authorization and Authentication Profile Caching section for more information.

## Authorization and Authentication Profile Caching as a Failover Mechanism

If, for whatever reason, RADIUS or TACACS+ servers are unable to provide authentication and authorization responses, network users and administrators can be locked out of the network. The profile caching feature allows usernames to be authorized without having to complete the authentication phase. For example, a user by the name of user100@example.com with a password secretpassword1 could be stored in a profile cache using the regular expression ".*@example.com". Another user by the name of user101@example.com with a password of secretpassword2 could also be stored using the same regular expression, and so on. Because the number of users in the ".*@example.com" profile could number in the thousands, it is not feasible to authenticate each user with their personal password. Therefore authentication is disabled and each user simply accesses authorization profiles from a common Access Response stored in cache.

The same reasoning applies in cases where higher end security mechanisms such as Challenge Handshake Authentication Protocol (CHAP), Microsoft Challenge Handshake Authentication Protocol (MS-CHAP), or Extensible Authentication Protocol (EAP), which all use an encrypted password between the client and AAA offload server, are used. To allow these unique, secure username and password profiles to retrieve their authorization profiles, authentication is bypassed.

To take advantage of this failover capability, you need to configure the authentication and authorization method list so that the cache server group is queried last when a user attempts to authenticate to the router. See the Method Lists in Authorization and Authentication Profile Caching section for more information.

# Method Lists in Authorization and Authentication Profile Caching

A method list is a sequential list describing the authentication methods to be queried in order to authenticate a user. We support methods such as local (use the local database), none (do nothing), RADIUS server group, or TACACS+ server group. Typically, more than one method can be configured into a method list. Software uses the first listed method to authenticate users. If that method fails to respond, the software selects the next authentication method listed in the method list. This process continues until there is successful communication with a listed authentication method, or until all methods defined in the method list are exhausted.

To optimize network performance or provide failover capability using the profile caching feature you simply change the order of the authentication and authorization methods in the method list. To optimize network performance, make sure the cache server group appears first in the method list. For failover capability, the cache server group should appear last in the method list.

# Authorization and Authentication Profile Caching Guidelines

Because the number of usernames and profiles that can request to be authenticated or authorized at a given router on a given point of presence (POP) can be quite extensive, it would not be feasible to cache all of them. Therefore, only usernames and profiles that are commonly used or that share a common authentication and authorization response should be configured to use caching. Commonly used usernames such as aolip and aolnet, which are used for America Online (AOL) calls, or preauthentication dialed number identification service (DNIS) numbers used to connect Public Switched Telephone Network (PSTN) calls to a network attached storage device, along with domain-based service profiles, are all examples of usernames and profiles that can benefit from authentication and authorization caching.

# General Configuration Procedure for Implementing Authorization and Authentication Profile Caching

To implement authorization and authentication profile caching, you would complete the following procedure:

1. Create cache profile groups and define the rules for what information is cached in each group.

Entries that match based on exact username, regular expressions, or specify that all authentication and authorization requests can be cached.

1. Update existing server groups to reference newly defined cache groups.
2. Update authentication or authorization method lists to use the cached information to optimize network performance or provide a failover mechanism.

# How to Implement Authorization and Authentication Profile Caching

## Creating Cache Profile Groups and Defining Caching Rules

Perform this task to create a cache profile group, define the rules for what information is cached in that group, and verify and manage cache profile entries.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa cache profile** *group-name*
5. **profile** *name* [**no-auth**]
6. Repeat Step 5 for each username you want to add to the profile group in Step 4.
7. **regexp** *matchexpression* {**any**| **only**}[**no-auth**]
8. Repeat Step 7 for each regular expression you want to add to the cache profile group defined in Step 4.
9. **all** [**no-auth**]
10. **end**
11. **show aaa cache group** *name*
12. **clear aaa cache group** *name* {**profile** *name*| **all**}
13. **debug aaa cache group**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **aaa new-model**<br>**Example:**<br>`Router(config)# aaa new-model` | Enables the AAA access control model. |
| **Step 4** | **aaa cache profile** *group-name*<br>**Example:** | Defines an authentication and authorization cache profile server group and enters profile map configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| | `Router(config)# aaa cache profile networkusers@companyname` | |
| **Step 5** | **profile** *name* [**no-auth**]<br>**Example:**<br>`Router(config-profile-map# profile networkuser1 no-auth` | Creates an individual authentication and authorization cache profile based on a username match.<br>• The *name* argument must be an exact match to a username being queried by an authentication or authorization service request.<br>• Use the **no-auth** keyword to bypass authentication for this user. |
| **Step 6** | Repeat Step 5 for each username you want to add to the profile group in Step 4. | -- |
| **Step 7** | **regexp** *matchexpression* {**any**\| **only**}[**no-auth**]<br>**Example:**<br>`Router(config-profile-map)# regexp .*@example.com any no-auth` | (Optional) Creates an entry in a cache profile group that matches based on a regular expression.<br>• If you use the **any** keyword, all unique usernames matching the regular expression are saved.<br>• If you use the **only** keyword, only one profile entry is cached for all usernames matching the regular expression.<br>• Use the **no-auth** keyword to bypass authentication for this user or set of users.<br>• Because the number of entries in a regular expression cache profile group could be in the thousands, and validating each request against a regular expression can be time consuming, we do not recommend using regular expression entries in cache profile groups. |
| **Step 8** | Repeat Step 7 for each regular expression you want to add to the cache profile group defined in Step 4. | -- |
| **Step 9** | **all** [**no-auth**]<br>**Example:**<br>`Router(config-profile-map)# all no-auth` | (Optional) Specifies that all authentication and authorization requests are cached.<br>• Use the **all** command for specific service authorization requests, but it should be avoided when dealing with authentication requests. |
| **Step 10** | **end**<br>**Example:**<br>`Router(config-profile-map)# end` | Returns to privileged EXEC mode. |
| **Step 11** | **show aaa cache group** *name*<br>**Example:** | (Optional) Displays all cache entries for a specified group. |

| | Command or Action | Purpose |
|---|---|---|
| | `Router# show aaa cache group networkusers@companyname` | |
| **Step 12** | **clear aaa cache group** *name* {**profile** *name*\| **all**}<br>**Example:**<br>`Router# clear aaa cache group networkusers@companyname profile networkuser1` | (Optional) Clears an individual entry or all entries in the cache. |
| **Step 13** | **debug aaa cache group**<br>**Example:**<br>`Router# debug aaa cache group` | (Optional) Displays debug information about cached entries. |

# Defining RADIUS and TACACS Server Groups That Use Cache Profile Group Information

Perform this task to define how RADIUS and TACACS+ server groups use the information stored in each cache profile group.

### Before you begin

RADIUS and TACACS+ server groups must be created.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa group server radius** *group-name* or**aaa group server tacacs+** *group-name*
5. **cache authorization profile** *name*
6. **cache authentication profile** *name*
7. **cache expiry** *hours* {**enforce failover**}
8. **end**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:** | Enters global configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| | `Router# configure terminal` | |
| **Step 3** | **aaa new-model**<br>**Example:**<br>`Router(config)# aaa new-model` | Enables the AAA access control model. |
| **Step 4** | **aaa group server radius** *group-name* or**aaa group server tacacs+** *group-name*<br>**Example:**<br>`Router(config)# aaa group server radius networkusers@companyname` | Enters RADIUS server group configuration mode.<br>• To enter TACACS+ server group configuration mode, use the **aaa group server tacacs+** *group-name* command. |
| **Step 5** | **cache authorization profile** *name*<br>**Example:**<br>`Router(config-sg-radius)# cache authorization profile networkusers@companyname` | Activates the authorization caching rules in the profile networkusers for this RADIUS or TACACS+ server group.<br>• The *name* argument in this command is a AAA cache profile group name. |
| **Step 6** | **cache authentication profile** *name*<br>**Example:**<br>`Router(config-sq-radius)# cache authentication profile networkusers@companyname` | Activates the authentication caching rules in the profile networkusers for this RADIUS or TACACS+ server group. |
| **Step 7** | **cache expiry** *hours* {**enforce** **failover**}<br>**Example:**<br>`Router(config-sq-radius)# cache expiry 240 failover` | (Optional) Sets the amount of time before a cache profile entry expires (becomes stale).<br>• Use the **enforce** keyword to specify that once a cache profile entry expires it is not used again.<br>• Use the **failover** keyword to specify that an expired cache profile entry can be used if all other methods to authenticate and authorize the user fail. |
| **Step 8** | **end**<br>**Example:**<br>`Router(config-sg-radius)# end` | Returns to privileged EXEC mode. |

# Updating Authorization and Authentication Method Lists to Specify How Cache Information is Used

Perform this task to update authorization and authentication method lists to use the authorization and authentication cache information.

### Before you begin

Method lists must already be defined.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authorization** {**network** | **exec** | **commands** *level* | **reverse-access**| **configuration**} {**default** | *list-name*} [*method1* [*method2...*]]
5. **aaa authentication ppp** {**default** | *list-name*} *method1* [*method2...*]
6. **aaa authentication login** {**default** | *list-name*} *method1* [*method2...*]
7. **end**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **aaa new-model**<br>**Example:**<br>`Router(config)# aaa new-model` | Enables the AAA access control model. |
| **Step 4** | **aaa authorization** {**network** | **exec** | **commands** *level* | **reverse-access**| **configuration**} {**default** | *list-name*} [*method1* [*method2...*]]<br>**Example:**<br>`Router(config)# aaa authorization network default cache networkusers@companyname group networkusers@companyname` | Enables AAA authorization and creates method lists, which define the authorization methods used when a user accesses a specified function. |
| **Step 5** | **aaa authentication ppp** {**default** | *list-name*} *method1* [*method2...*]<br>**Example:**<br>`Router(config)# aaa authentication ppp default cache networkusers@companyname group networkusers@companyname` | Specifies one or more authentication methods for use on serial interfaces that are running PPP. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **aaa authentication login** {**default** \| *list-name*} *method1* [*method2...*]<br>**Example:**<br>`Router(config)# aaa authentication login default cache adminusers group adminusers` | Sets the authentication at login. |
| **Step 7** | **end**<br>**Example:**<br>`Router(config)# end` | Returns to privileged EXEC mode. |

# Configuration Examples for Implementing Authorization and Authentication Profile Caching

## Implementing Authorization and Authentication Profile Caching for Network Optimization Example

The following configuration example shows how to:

- Define a cache profile group adminusers that contains all administrator names on the network and sets it as the default list that is used for all login and exec sessions.
- Activate the new caching rules for a RADIUS server group.
- Add the new cache profile group in the authentication and authorization method list and change the method order so that the cache profile group is queried first.

```
configure terminal

 aaa new-model

 ! Define aaa cache profile groups and the rules for what information is saved to cache.

 aaa cache profile admin_users

 profile adminuser1

 profile adminuser2

 profile adminuser3

 profile adminuser4
```

```
 profile adminuser5

 exit

 ! Define server groups that use the cache information in each profile group.

 aaa group server radius admins@companyname.com

 cache authorization profile admin_users

 cache authentication profile admin_users

 ! Update authentication and authorization method lists to specify how profile groups and
server groups are used.

 aaa authentication login default cache admins@companyname.com group admins@companyname.com

 aaa authorization exec default cache admins@companyname.com group admins@companyname.com

 end
```

# Implementing Authorization and Authentication Profile Caching as a Failover Mechanism Example

The following configuration example shows how to:

- Create a cache profile group admin_users that contains all of the administrators on the network so that if the RADIUS or TACACS+ server should become unavailable the administrators can still access the network.
- Create a cache profile group abc_users that contains all of the ABC company users on the network so that if the RADIUS or TACACS+ server should become unavailable these users will be authorized to use the network.
- Activate the new caching rules for each profile group on a RADIUS server.
- Add the new cache profile group in the authentication and authorization method list and change the method order so that the cache profile group is queried last.

```
configure terminal

 aaa new-model

 ! Define aaa cache profile groups and the rules for what information is saved to cache.

 aaa cache profile admin_users

 profile admin1
```

```
profile admin2
profile admin3
exit
aaa cache profile abcusers
profile .*@example.com only no-auth
exit
! Define server groups that use the cache information in each cache profile group.
aaa group server tacacs+ admins@companyname.com
server 10.1.1.1
server 10.20.1.1
cache authentication profile admin_users
cache authorization profile admin_users
exit
aaa group server radius abcusers@example.com
server 172.16.1.1
server 172.20.1.1
cache authentication profile abcusers
cache authorization profile abcusers
exit
! Update authentication and authorization method lists to specify how cache is used.
aaa authentication login default cache admins@companyname.com group admins@companyname.com
aaa authorization exec default cache admins@companyname.com group admins@companyname.com
aaa authentication ppp default group abcusers@example.com cache abcusers@example.com
aaa authorization network default group abcusers@example.com cache abcusers@example.com
```

```
end
```

# Additional References for RADIUS Change of Authorization

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Cisco IOS Master Command List, All Releases |
| Security commands | • Security Command Reference: Commands A to C<br>• Security Command Reference: Commands D to L<br>• Security Command Reference: Commands M to R<br>• Security Command Reference: Commands S to Z |
| Configuring AAA | *Authentication, Authorization, and Accounting Configuration Guide* |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| RFC 2903 | *Generic AAA Architecture* |
| RFC 5176 | *Dynamic Authorization Extensions to Remote Authentication Dial In User Service(RADIUS)* |

### Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | http://www.cisco.com/cisco/web/support/index.html |

# Feature Information for Implementing Authorization and Authentication Profile Caching

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

***Table 1: Feature Information for Implementing Authentication and Authorization Profile Caching***

| Feature Name | Release | Feature Information |
|---|---|---|
| AAA Authorization and Authentication Cache | Cisco IOS XE Release 2.3 | This feature optimizes network performance and provides a failover mechanism in the event a network RADIUS or TACACS+ server becomes unavailable for any reason.<br><br>In Cisco IOS XE Release 2.3, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.<br><br>The following commands were introduced or modified: **aaa authentication login**, **aaa authentication ppp**, **aaa authorization**, **aaa cache profile**, **all (profile map configuration)**, **cache authentication profile (server group configuration)**, **cache authorization profile (server group configuration)**, **cache expiry (server group configuration)**, **clear aaa cache group**, **debug aaa cache group**, **profile (profile map configuration)**, **regexp (profile map configuration)**, **show aaa cache group**. |