Configuring Security Features on an External AAA Server

The authentication, authorization, and accounting (AAA) feature verifies the identity of, grants access to, and tracks the actions of users managing a switch. All Cisco MDS 9000 Family switches use Remote Access Dial-In User Service (RADIUS) or Terminal Access Controller Access Control device Plus (TACACS+) protocols to provide solutions using remote AAA servers.

Based on the user ID and password combination provided, switches perform local authentication or authorization using the local database or remote authentication or authorization using a AAA server. A preshared secret key provides security for communication between the switch and AAA servers. This secret key can be configured for all AAA servers or for only a specific AAA server. This security feature provides a central management capability for AAA servers.

This chapter includes the following sections:

Switch Management Security

Management security in any switch in the Cisco MDS 9000 Family provides security to all management access methods, including the command-line interface (CLI) or Simple Network Management Protocol (SNMP).

This section includes the following topics:

CLI Security Options

You can access the CLI using the console (serial connection), Telnet, or Secure Shell (SSH).

- Remote security control
    - Using RADIUS

      See the Configuring RADIUS Server Monitoring Parameters, on page 29
    - Using TACACS+

      See the Configuring TACACS+ Server Monitoring Parameters, on page 43
- Local security control

  See the Local AAA Services, on page 65

These security features can also be configured for the following scenarios:

- iSCSI authentication

  See the *Cisco MDS 9000 Family NX-OS IP Services Configuration Guide* and *Cisco Fabric Manager IP Services Configuration Guide*.
- Fibre Channel Security Protocol (FC-SP) authentication

  See Configuring FC-SP and DHCHAP.

SNMP Security Options

The SNMP agent supports security features for SNMPv1, SNMPv2c, and SNMPv3. Normal SNMP security features apply to all applications that use SNMP (for example, Cisco MDS 9000 Fabric Manager).

SNMP security options also apply to the Fabric Manager and Device Manager.

See the *Cisco MDS 9000 NX-OS Family System Management Configuration Guide* for more information on the SNMP security options.

Refer to the *Cisco Fabric Manager Fundamentals Configuration Guide* for information on Fabric Manager and Device Manager.

Switch AAA Functionalities

Using the CLI or Fabric Manager, or an SNMP application, you can configure AAA switch functionalities on any switch in the Cisco MDS 9000 Family.

This section includes the following topics:

Authentication

Authentication is the process of verifying the identity of the person or device accessing the switch. This identity verification is based on the user ID and password combination provided by the entity trying to access the switch. Cisco MDS 9000 Family switches allow you to perform local authentication (using the local lookup database) or remote authentication (using one or more RADIUS or TACACS+ servers).

Note Fabric Manager does not support AAA passwords with trailing white space, for example “passwordA.”

Authorization

The following authorization roles exist in all Cisco MDS switches:

- Network operator (network-operator)—Has permission to view the configuration only. The operator cannot make any configuration changes.
- Network administrator (network-admin)— Has permission to execute all commands and make configuration changes. The administrator can also create and customize up to 64 additional roles.
- Default-role—Has permission to use the GUI (Fabric Manager and Device Manager). This access is automatically granted to all users for accessing the GUI.

These roles cannot be changed or deleted. You can create additional roles and configure the following options:

- Configure role-based authorization by assigning user roles locally or using remote AAA servers.
- Configure user profiles on a remote AAA server to contain role information. This role information is automatically downloaded and used when the user is authenticated through the remote AAA server.

Note If a user belongs only to one of the newly created roles and that role is subsequently deleted, then the user immediately defaults to the network-operator role.

Accounting

The accounting feature tracks and maintains a log of every management configuration used to access the switch. This information can be used to generate reports for troubleshooting and auditing purposes. Accounting logs can be stored locally or sent to remote AAA servers.

Remote AAA Services

Remote AAA services provided through RADIUS and TACACS+ protocols have the following advantages over local AAA services:

- User password lists for each switch in the fabric can be managed more easily.
- AAA servers are already deployed widely across enterprises and can be easily adopted.
- The accounting log for all switches in the fabric can be centrally managed.
- User role mapping for each switch in the fabric can be managed more easily.

Remote Authentication Guidelines

If you prefer using remote AAA servers, follow these guidelines:

- A minimum of one AAA server should be IP reachable.
- Be sure to configure a desired local AAA policy as this policy is used if all AAA servers are not reachable.
- AAA servers are easily reachable if an overlay Ethernet LAN is attached to the switch (see the Cisco Fabric Manager IP Services Configuration Guide and the Cisco MDS 9000 Family NX-OS Configuration Guide). We recommend this method.
- SAN networks connected to the switch should have at least one gateway switch connected to the Ethernet LAN reaching the AAA servers.

Server Groups

You can specify remote AAA servers for authentication, authorization, and accounting using server groups. A server group is a set of remote AAA servers implementing the same AAA protocol. The purpose of a server group is to provide for failover servers in case a remote AAA server fails to respond. If the first remote server in the group fails to respond, the next remote server in the group is tried until one of the servers sends a response. If all the AAA servers in the server group fail to respond, then that server group option is considered a failure. If required, you can specify multiple server groups. If the Cisco MDS switch encounters errors from the servers in the first group, it tries the servers in the next server group.

AAA Service Configuration Options

AAA configuration in Cisco MDS 9000 Family switches is service based. You can have separate AAA configurations for the following services:

- Telnet or SSH login (Fabric Manager and Device Manager login)
- Console login
- iSCSI authentication (See the Cisco Fabric Manager IP Services Configuration Guide and the Cisco MDS 9000 Family NX-OS IP Services Configuration Guide)
- FC-SP authentication (See Configuring FC-SP and DHCHAP)
- Accounting

In general, server group, local, and none are the three options that can be specified for any service in an AAA configuration. Each option is tried in the order specified. If all the options fail, local is tried.

Caution Cisco MDS NX-OS supports user names that are created with alphanumeric characters or specific special characters (+ [plus], = [equal], _ [underscore], - [hyphen] , \ [backslash], and . [period]) whether created remotely (using TACACS+ or RADIUS) or locally, provided the user name starts with an alphabetical character. Local user names cannot be created with all numbers or with any special characters (apart from those specified). If a numeric-only user name or a non-supported special character user name exists on an AAA server, and is entered during login, then the user is denied access.

Note Even if local is not specified as one of the options, it is tried by default if all AAA servers configured for authentication are unreachable. User has the flexibility to disable this fallback.

When RADIUS times out, local login is attempted depending on the fallback configuration. For this local login to be successful, a local account for the user with the same password should exist, and the RADIUS timeout and retries should take less than 40 seconds. The user is authenticated if the username and password exist in the local authentication configuration.

The following table provides the related CLI command for each AAA service configuration option.

Table 1: AAA Service Configuration Commands

AAA Service Configuration Option	Related Command
Telnet or SSH login (Cisco Fabric Manager and Device Manager login)	**aaa authentication login default**
Console login	**aaa authentication login console**
iSCSI authentication	**aaa authentication iscsi default**
FC-SP authentication	**aaa authentication dhchap default**
Accounting	**aaa accounting default**

Note If we do not configure any authentication method for the console, the default authentication method will be applied for both console and Telnet or SSH.

Error-Enabled Status

When you log in, the login is processed by rolling over to local user database if the remote AAA servers do not respond. In this situation, the following message is displayed on your screen if you have enabled the error-enabled feature:

```
Remote AAA servers unreachable; local authentication done.
```

To enable this message display, use the **aaa authentication login error-enable** command.

To disable this message display, use the **no aaa authentication login error-enable** command.

To view the current display status, use the **show aaa authentication login error-enable** command (see the following example).

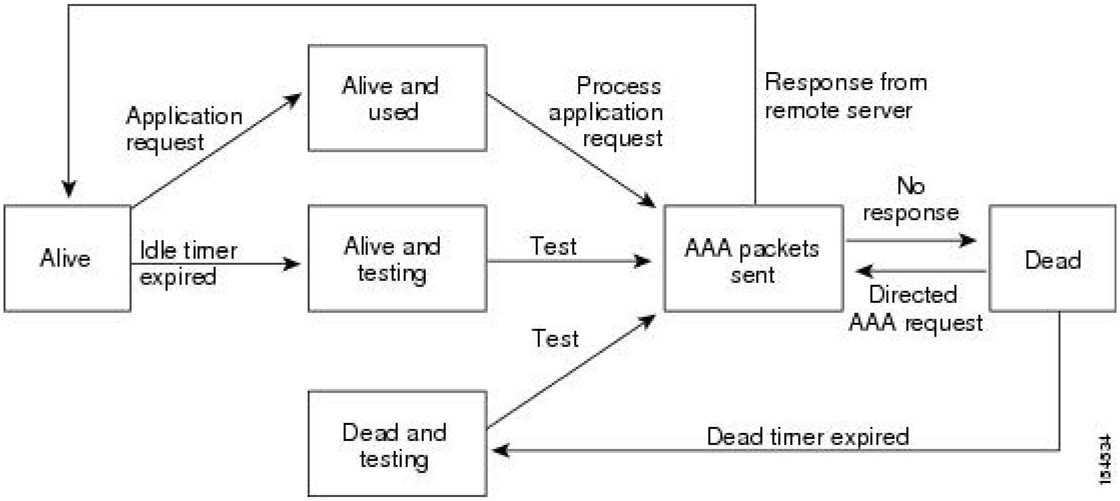
Displays AAA Authentication Login Information

```
switch# show aaa authentication login error-enable enabled
```

AAA Server Monitoring

An unresponsive AAA server introduces a delay in the processing of AAA requests. An MDS switch can periodically monitor an AAA server to check whether it is responding (or alive) to save time in processing AAA requests. The MDS switch marks unresponsive AAA servers as dead and does not send AAA requests to any dead AAA servers. An MDS switch periodically monitors dead AAA servers and brings them to the alive state once they are responding. This monitoring process verifies that an AAA server is in a working state before real AAA requests are sent its way. Whenever an AAA server changes to the dead or alive state, an SNMP trap is generated and the MDS switch warns the administrator that a failure is taking place before it can impact performance. See Figure 1: AAA Server States, on page 6 for AAA server states.

Figure 1: AAA Server States



Note The monitoring interval for alive servers and dead servers is different and can be configured by the user. The AAA server monitoring is performed by sending a test authentication request to the AAA server.

The user name and password to be used in the test packet can be configured.

See the Configuring RADIUS Server Monitoring Parameters, on page 29 and Displaying RADIUS Server Details, on page 39 sections.

Authentication and Authorization Process

Authentication is the process of verifying the identity of the person managing the switch. This identity verification is based on the user ID and password combination provided by the person managing the switch.

The Cisco MDS 9000 Family switches allow you to perform local authentication (using the lookup database) or remote authentication (using one or more RADIUS servers or TACACS+ servers).

Authorization provides access control. It is the process of assembling a set of attributes that describe what the user is authorized to perform. Based on the user ID and password combination, the user is authenticated and authorized to access the network as per the assigned role. You can configure parameters that can prevent unauthorized access by an user, provided the switches use the TACACS+ protocol.

AAA authorization is the process of assembling a set of attributes that describe what the user is authorized to perform. Authorization in the Cisco NX-OS software is provided by attributes that are downloaded from AAA servers. Remote security servers, such as RADIUS and TACACS+, authorize users for specific rights by associating attribute-value (AV) pairs, which define those rights with the appropriate user.

The following steps explain the authorization and authentication process:

Procedure

Step 1 Log in to the required switch in the Cisco MDS 9000 Family, using the Telnet, SSH, Fabric Manager or Device Manager, or console login options.

Step 2 When you have configured server groups using the server group authentication method, an authentication request is sent to the first AAA server in the group.

- If the AAA server fails to respond, then the next AAA server is contacted and so on until the remote server responds to the authentication request.
- If all AAA servers in the server group fail to respond, then the servers in the next server group are contacted.
- If all configured methods fail, then by default local database is used for authentication. The next section will describe the way to disable this fallback.

Step 3 When you are successfully authenticated through a remote AAA server, then the following possible actions are taken:

- If the AAA server protocol is RADIUS, then user roles specified in the **cisco-av-pair** attribute are downloaded with an authentication response.
- If the AAA server protocol is TACACS+, then another request is sent to the same server to get the user roles specified as custom attributes for the shell.
- If user roles are not successfully retrieved from the remote AAA server, then the user is assigned the network-operator role if the show aaa user default-role command is enabled. You are denied access if this command is disabled.

Step 4 When your user name and password are successfully authenticated locally, you are allowed to log in, and you are assigned the roles configured in the local database.

Enabling the Default User Role for AAA Authentication

You can allow remote users who do not have a user role to log in to the Cisco NX-OS device through a remote authentication server using a default user role. When you disable the AAA default user role feature, remote users (who do not have a matched user role locally in the device) cannot log in to the device.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**aaa user default-role** **Example:** `switch(config)# aaa user default-role`	Enables the default user role for AAA authentication. The default is enabled. You can disable the default user role feature by using the **no** form of this command.

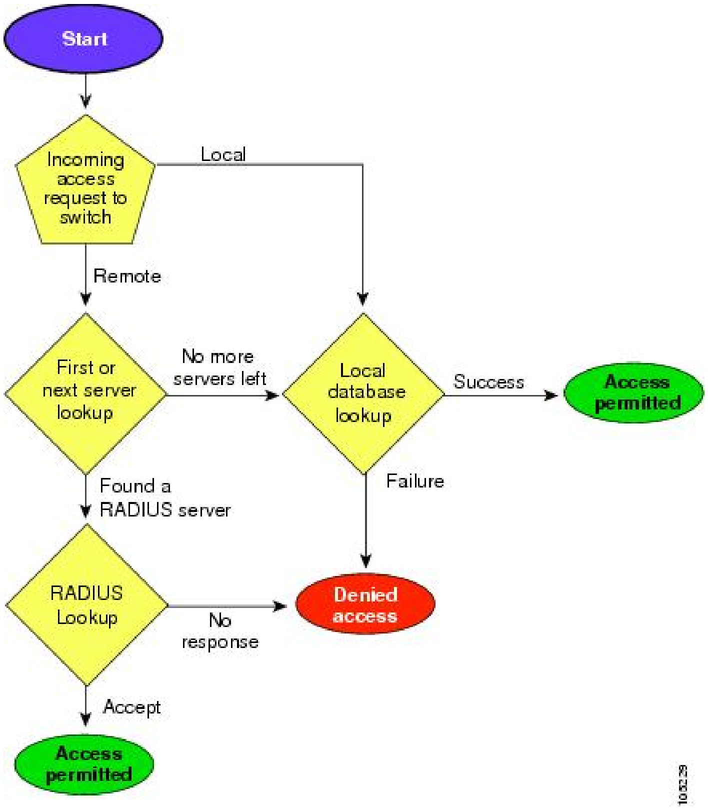
Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 4	(Optional) **show aaa user default-role** **Example:** `switch# show aaa user default-role`	Displays the AAA default user role configuration.

Configuring Role-based Authorization on TACACS+ Server

The following figure shows a flow chart of the authorization and authentication process.

Figure 2: Switch Authorization and Authentication Flow



Note No more server groups left = no response from any server in all server groups.No more servers left = no response from any server within this server group.

To configure role-based authorization on TACACS+ server, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa authorization**

Enables configuration of authorization methods.

Step 3 switch(config)# **aaa authorization config-commands**

Enables authorization for all commands under config mode Layer2 and Layer3.

Step 4 switch(config)# **aaa authorization config-commands default group tac1**

Enables specified TACACS+ server group authorization.

Step 5 switch(config)# **aaa authorization commands**

Enables AAA authorization for all EXEC mode commands.

Step 6 switch(config)# **aaa authorization commands default group tac1**

Enables specified TACACS+ server group authorization.

Step 7 switch(config)# **aaa authorization commands default group local**

Enables default TACACS+ server group authorization.Authorization is based on the local-user-database.

Step 8 switch(config)# **no aaa authorization command default group tac1**

Removes authorization for a specified function for the authenticated user.

Note

- Authorization configuration is provided only for authentication done using TACACS+ server.
- The 'none' option from aaa authorization methods has been deprecated. If you did an upgrade from 4.x image and 'none' was configured as one of the authorization methods, it is be replaced with local. The functionality remains the same.
- Command authorization disables user role-based authorization control (RBAC), including the default roles.

Displays aaa Authorization Information Details

You can use the show commands to display information on the AAA authorization and the default user roles assigned for remote authentication. (see the following examples)

```
switch# show aaa authorization all
AAA command authorization:
default authorization for config-commands: local
default authorization for commands: local
cts: group rad1
```

Displays Default User Role for Remote Authentication

```
switch# show aaa user default-role
enabled
```

Configuring Fallback Mechanism for Authentication

You can enable/disable fallback to local database in case the remote authentication is set and all AAA servers are unreachable (authentication error). The fallback is set to local by default in case of an authentication error. You can disable this fallback for both console and ssh/telnet login. Disabling this fallback will tighten the security of authentication.

The CLI syntax and behavior is as follows:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **show run aaa all**

```
aaa authentication login default fallback error local
aaa authentication login console fallback error local
```

Displays the default fallback behavior.

Step 3 switch(config)# **no aaa authentication login default fallback error local**

```
WARNING!!! Disabling fallback can lock your switch.
```

Disables the fallback to local database for authentication.

Note Replace default with console in this command to disable fallback to console.

Caution If fallback is disable for both default/console, remote authentication is enabled and servers are unreachable, then the switch will be locked.

Verifying Authorization Profile

You can verify the authorizing profile for different commands. When enabled, all commands are directed to the Access Control Server (ACS) for verification. The verification details are displayed once the verification is completed.

```
switch# terminal verify-only username sikander
switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# feature telnet
% Success
switch(config)# feature ssh
% Success
switch(config)# end
% Success
switch# exit
```

Note This command only verifies the commands and does not enable the configuration.

Testing Authorization

You can test the authorization settings for any command.

To test the authorization of a command, use the test aaa authorization command-type command.

```
switch(config)# test aaa authorization command-type commands user u1 command "feature dhcp"
% Success
```

Configuring Login Parameters

Use this task to configure your Cisco MDS 9000 device for login parameters that helps to detect suspected DoS attacks and slow down dictionary attacks.

All login parameters are disabled by default. You must enter the login block-for command, which enables default login functionality, before using any other login commands. After the login block-for command is enabled, the following default is enforced:

- All login attempts made through Telnet or SSH are denied during the quiet period; that is, no ACLs are exempt from the login period until the login quiet-mode access-class command is entered.

To configure the login parameter, follow these steps:

Procedure

Step 1 Enters configuration mode:

switch#**configure terminal**

Step 2 Configures your Cisco MDS 9000 device for login parameters that helps to provide DoS detection:

switch(config)# **login block-for 100 attempts 2 within 100**

Note This command must be issued before any other login command.

Step 3 (Optional) Although this command is optional, it is recommended that, it should be configured to specify an ACL that is to be applied to the device when the device switches to quiet mode. When the device is in quiet mode, all login requests are denied and the only available connection is through the console:

switch(config)# **login quiet-mode access-class myacl**

Step 4 Exits to privileged EXEC mode:

switch(config)#**exit**

Step 5 Display login parameters:

switch#**show login**

Step 6 Display information related only to failed login attempts:

switch#**show login failures**

Setting Login Parameters

Verifies no login parameters

Verifies login parameters

Displays information on failed login attempts

The following example shows how to configure your switch to enter into a 100 seconds quiet period if 15 failed login attempts is exceeded within 100 seconds. All login requests are denied during the quiet period except hosts from the ACL "myacl."

```
switch(config)# login block-for 100 attempts 15 within 100
switch(config)# login quiet-mode access-class myacl
```

The following sample output from the show login command verifies that no login parameters have been specified.

```
switch# show login

No Quiet-Mode access list has been configured, default ACL will be applied.
Switch is enabled to watch for login Attacks.
If more than 15 login failures occur in 100 seconds or less, logins will be disabled for
100 seconds.
Switch presently in Normal-Mode.
Current Watch Window remaining time 49 seconds.
Present login failure count 0.
```

The following sample output from the show login command verifies that login parameters have been specified:

```
switch# show login

Quiet-Mode access list myacl is applied.
Switch is enabled to watch for login Attacks.
If more than 15 login failures occur in 100 seconds or less, logins will be disabled for
100 seconds.

Switch presently in Normal-Mode.
Current Watch Window remaining time 49 seconds.
Present login failure count 0.
```

The following sample output from the show login failures command shows all failed login attempts on the switch:

```
switch# show login failures

Information about last 20 login failures with the device.
---------------------------------------------------------
Username   TimeStamp        Line    Source                Appname
admin    Wed Jun 10 04:56:16 2015     pts/0        10.10.10.1           login
admin    Wed Jun 10 04:56:19 2015        pts/0       10.10.10.2        login
```

The following sample output from the show login failures command verifies that no information is presently logged:

```
switch# show login failures

*** No logged failed login attempts with the device.***
```

Configuring AAA Server Monitoring Parameters Globally

The AAA server monitoring parameters can be configured globally for all servers or individually for a specific server. This section explains how the global configuration can be set. The global configurations will apply to all servers that do not have individual monitoring parameters defined. For any server, the individual test parameter defined for that particular server will always get precedence over the global settings.

Use the following commands to configure the global monitoring parameters for RADIUS servers:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **radius-server deadtime 10**

Sets global deadtime for RADIUS servers to 10 minutes.

Acceptable Range: 0 to 1440 minutes.

Step 3 switch(config)# **radius-server timeout 20f**

Sets global timeout for RADIUS servers to 20 seconds.

Acceptable Range: 1 to 60 seconds.

Step 4 switch(config)# **radius-server retransmit 2**

Sets global retransmit count for RADIUS servers to 2.

Acceptable Range 0 to 5

Step 5 switch(config)# **radius-server test username username password password idle-time time**

Globally configures test parameters for the RADIUS servers.

Step 6 switch(config)# **radius-server test username username password password no**

Disables global test parameters for the RADIUS servers.

Example

Note Replace “radius” with “tacacs” in the steps above to get equivalent commands for TACACS server global test parameter configurations.

The Global AAA Server Monitoring Parameters observe the following behavior:

- When a new AAA server is configured it is monitored using the global test parameters, if defined.

- When global test parameters are added or modified, all the AAA servers, which do not have any test parameters configured, start getting monitored using the new global test parameters.
- When the server test parameters are removed for a server or when the idle-time is set to zero (default value) it starts getting monitored using the global test parameters, if defined.
- If global test parameters are removed or global idle-time is set to zero, servers for which the server test parameters are present will not be affected. However monitoring will stop for all other servers which were previously being monitored using global parameters.
- If the server monitoring fails with the user specified server test parameters, the server monitoring does not fall back to global test parameters.

Configuring LDAP

The Lightweight Directory Access Protocol (LDAP) provides centralized validation of users attempting to gain access to a Cisco NX-OS device. LDAP services are maintained in a database on an LDAP daemon running, typically, on a UNIX or Windows NT workstation. You must have access to and must configure an LDAP server before the configured LDAP features on your Cisco NX-OS device are available.

LDAP provides for separate authentication and authorization facilities. LDAP allows for a single access control server (the LDAP daemon) to provide each service-authentication and authorization-independently. Each service can be tied into its own database to take advantage of other services available on that server or on the network, depending on the capabilities of the daemon.

The LDAP client/server protocol uses TCP (TCP port 389) for transport requirements. Cisco NX-OS devices provide centralized authentication using the LDAP protocol.

Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

This section includes the following topics:

LDAP Authentication and Authorization

Clients establish a TCP connection and authentication session with an LDAP server through a simple bind (username and password). As part of the authorization process, the LDAP server searches its database to retrieve the user profile and other information.

You can configure the bind operation to first bind and then search, where authentication is performed first and authorization next, or to first search and then bind. The default method is to first search and then bind.

The advantage of searching first and binding later is that the distinguished name (DN) received in the search result can be used as the user DN during binding rather than forming a DN by prepending the username (cn attribute) with the baseDN. This method is especially helpful when the user DN is different from the username plus the baseDN. For the user bind, the bindDN is constructed as baseDN + append-with-baseDN, where append-with-baseDN has a default value of cn=$userid.

Note As an alternative to the bind method, you can establish LDAP authentication using the compare method, which compares the attribute values of a user entry at the server. For example, the user password attribute can be compared for authentication. The default password attribute type is userPassword.

Guidelines and Limitations for LDAP

LDAP has the following guidelines and limitations:

- You can configure a maximum of 64 LDAP servers on the Cisco NX-OS device.
- Cisco NX-OS supports only LDAP version 3.
- Cisco NX-OS supports only these LDAP servers:
  - OpenLDAP
  - Microsoft Active Directory
- From Cisco MDS NX-OS Release 9.4(1) and later, LDAP over Secure Sockets Layer (SSL) supports SSL version 3 and Transport Layer Security (TLS) version 1.3.
- From Cisco MDS NX-OS Release 8.1(1) and later, LDAP over Secure Sockets Layer (SSL) supports SSL version 3 and Transport Layer Security (TLS) versions 1.0 and 1.2.
- Secure DNS lookup by DNSSEC is not supported.
- If you have a user account configured on the local Cisco NX-OS device that has the same name as a remote user account on an AAA server, the Cisco NX-OS software applies the user roles for the local user account to the remote user, not the user roles configured on the AAA server.
- A Cisco MDS switch will assign a local role to remote users when LDAP uses remote authentication protocol, if all the following conditions are met:
  - The remote username on the LDAP server has the same name as the local user on the Cisco MDS switch. (For example, “test” is the username on the AD server and “test” is the username created on the local Cisco MDS switch)
  - The LDAP server is configured as AAA authentication on the Cisco MDS switch.
  - The role assigned for the local user and the remote user is different.

  Consider the following example where the LDAP server has the username "test" which is a member of the AD group "testgroup". The Cisco MDS switch has a role configured with the name "testgroup" which has certain permit roles assigned to it. This role is created in the Cisco MDS switch for remote users who login into switch using LDAP. The Cisco MDS switch also has a local username "test" and it has "network-admin" as the assigned role. The Cisco MDS switch is configured for AAA authentication and uses LDAP as an authentication protocol. In this scenario, if a user logs into the Cisco MDS switch using the username "test", the switch authenticates the user using LDAP authentication (it uses the password of the user "test" created on the AD server). But, it assigns the role "network-admin", which is assigned to the local user "test", and not the "testgroup" role that is assinged to the remote authenticated user.

Prerequisites for LDAP

LDAP has the following prerequisites:

- Obtain the IPv4 or IPv6 addresses or hostnames for the LDAP servers.
- Ensure that the Cisco NX-OS device is configured as an LDAP client of the AAA servers.

Enabling LDAP

By default, the LDAP feature is disabled on the Cisco NX-OS device. You must explicitly enable the LDAP feature to access the configuration and verification commands for authentication.

To enable LDAP, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **feature ldap**

Enables LDAP.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring Remote LDAP Server Profiles

To access a remote LDAP server, first create a profile with the server IP address or hostname on the Cisco NX-OS device. Global LDAP server parameters are used unless overridden by the same parameter in a server's profile.

Configurable parameters are—The use of SSL transport, the target port number on the server, the request timeout period, the root Distinguished Name (the bind user) and password, and search referrals.

Up to 64 LDAP server profiles are supported.

Note By default, when you configure an LDAP server IP address or hostname on the Cisco NX-OS device, the LDAP server is added to the default LDAP server group. You can also add the LDAP server to another LDAP server group.

To configure a remote LDAP server, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server host 10.10.2.2**

Specifies the IPv4 or IPv6 address or hostname of an LDAP server.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the RootDN for an LDAP Server

You can configure the root designated name (DN) for the LDAP server database. The rootDN is used to bind to the LDAP server to verify its state.

To configure the RootDN for an LDAP server, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server host 10.10.1.1 rootDN cn=manager,dc=acme,dc=com password Ur2Gd2BH timeout 60**

Specifies the rootDN for the LDAP server database and the bind password for the root.

Optionally specifies the TCP port to use for LDAP messages to the server. The range is from 1 to 65535, and the default TCP port is the global value or 389 if a global value is not configured. Also specifies the timeout interval for the server. The range is from 1 to 60 seconds, and the default timeout is the global value or 5 seconds if a global value is not configured.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring LDAP Server Groups

You can specify one or more remote AAA servers to authenticate users using server groups. All members of a group must be configured to use LDAP. The servers are tried in the same order in which you configure them.

You can configure these server groups at any time, but they take effect only when you apply them to an AAA service.

Starting from Cisco MDS NX-OS Release 6.2(1), Cisco MDS 9000 Series switches support group-based user roles. In the LDAP server, ensure that the LDAP users belong to a group, which is same as the role name created (customized role) or in-built (network-admin or attribute-admin) in the switch.

Note

- A user can be part of only one group that is available on the switch.
- A user can be part of multiple groups, but only one group should be part of the switch role.
- A group name cannot have a space.

To configure the LDAP server groups, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **aaa group server ldap LDAPServer1**

switch(config-ldap)#

Creates an LDAP server group and enters the LDAP server group configuration mode for that group.

Step 3 switch(config-ldap)# **server 10.10.2.2**

Configures the LDAP server as a member of the LDAP server group.

If the specified LDAP server is not found, configure it using the ldap-server host command and retry this command.

Step 4 switch(config-ldap)# **authentication compare password-attribute TyuL8r**

(Optional) Performs LDAP authentication using the bind or compare method. The default LDAP authentication method is the bind method using first search and then bind.

Step 5 switch(config-ldap)# **enable user-server-group**

(Optional) Enables group validation. The group name should be configured in the LDAP server. Users can log in through public-key authentication only if the username is listed as a member of this configured group in the LDAP server.

Step 6 switch(config-ldap)# **enable Cert-DN-matc**h

(Optional) Enables users to login only if the user profile lists the subject-DN of the user certificate as authorized for login.

Step 7 switch(config)# **exit**

switch#

Exits configuration mode.

Step 8 switch# **show ldap-server groups**

(Optional) Displays the LDAP server group configuration.

Step 9 switch# **show run ldap**

(Optional) Displays the LDAP configuration.

Step 10 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the Global LDAP Timeout Interval

You can configure the maximum period the Cisco NX-OS LDAP client waits for the LDAP server to respond before declaring a timeout failure for it. If other LDAP servers exist in the LDAP server group the next server is tried after the timeout. If there are no other LDAP servers the request fails. By default, Cisco NX-OS LDAP client uses the global timeout period of 5 seconds for each LDAP server to respond. The global timeout value can be overridden in each LDAP server profile.

To configure the global LDAP timeout interval, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server timeout 10**

Specifies the timeout interval for LDAP servers. The default timeout interval is 5 seconds. The range is from 1 to 60 seconds.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the Connection Timeout for an LDAP Server

The timeout interval specified in an LDAP server profile overrides the global LDAP server timeout interval value for the specified server.

To configure the connection timeout period for an LDAP server, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server host 10.10.2.2 timeout 3**

Specifies the timeout interval for the server. The range is from 1 to 60 seconds.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the Global LDAP Server Port

You can configure a global LDAP server destination port to which clients initiate TCP connections. By default, Cisco NX-OS devices use port 389 for all LDAP requests.

To configure the global LDAP server port, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server port 789**

Specifies the global TCP port to use for LDAP messages to the server. The default TCP port is 389. The range is from 1 to 65535.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the Destination Port of an LDAP Server

The destination port specified in an LDAP server profile overrides the global LDAP server destination port value for the specified server.

To configure the destination TCP port, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server host 10.10.2.2 port 200**

Specifies the TCP port to use for LDAP messages to the server. The default TCP port is 389. The range is from 1 to 65535.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring SSL Transport for an LDAP Server

Using Secure Sockets Layer (SSL) as the transport between the LDAP client and server ensures the integrity and confidentiality of transferred data, such as user passwords. The Cisco NX-OS LDAP client supports negotiating an SSL connection prior to sending any bind or search request. To use SSL as the transport to a remote LDAP server, enable the SSL option in the LDAP server profile on the Cisco NX-OS device. Ensure the remote LDAP server also supports this functionality before enabling it in the Cisco NX-OS device.

Connectivity to remote LDAP servers over TLS (via SSL) is RFC4513 compliant. This requires that the identity presented by the server during secure transport negotiation must exactly match both the server profile name and the certificate on the switch. Matching may be by IP address or hostname in the certificate 'Subject Alternative Name'. This is the preferred method. If there is no match, then the Common Name (CN) in the certificate 'Subject' is checked, although this method is deprecated by RFC4513. Server certificates are installed separately on the Cisco NX-OS devices. See the Configuring Certificate Authorities and Digital Certificates chapter for more information.

Note Starting from Cisco MDS NX-OS Release 8.2(1), when the destination TCP port is configured to be 636, the LDAP client automatically starts the session with SSL or TLS negotiation. When using other destination ports, SSL transport must be manually enabled by using the **enable-ssl** option.

To configure SSL transport to a remote LDAP server, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap-server host 10.10.2.2 enable-ssl**

Enables SSL transport for bind and search requests to the remote LDAP server.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring LDAP Search Maps

You can configure LDAP search maps to send a search query to the LDAP server. The server searches its database for data meeting the criteria specified in the search map.

To configure the LDAP search maps, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)# **ldap search-map map1**

switch(config-ldap-search-map)#

Configures an LDAP search map.

Step 3 Example 1

```
switch(config-ldap-search-map)# userprofile attribute-name description search-filter
 "(&(objectClass=inetOrgPerson)(cn=$userid))" base-DN dc=acme,dc=com
```

Example 2

```
switch(config-ldap-search-map)# userprofile attribute-name "memberOf" search-filter
"(&(objectClass=inetOrgPerson)(cn=$userid))" base-DN dc=acme,dc=com
```

(Optional) Configures the attribute name, search filter, and base-DN for the user profile, trusted certificate, CRL, certificate DN match, public key match, or user-switchgroup lookup search operation. These values are used to send a search query to the LDAP server.

Note

- The LDAP search filter string is limited to a maximum of 128 characters for releases prior to Cisco MDS NX-OS 9.3(2a).
- The LDAP search filter string, rootDN, and baseDN is limited to a maximum of 512 characters starting from release Cisco MDS NX-OS 9.3(2a) and later.

Specifies the groups to which the user is a member of.

Step 4 switch(config-ldap-search-map)# **exit**

switch(config)#

Exits LDAP search map configuration mode.

Step 5 switch(config)# **show ldap-search-map**

(Optional) Displays the configured LDAP search maps.

Step 6 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring the LDAP Dead-Time Interval

You can configure the dead-time interval for all LDAP servers. The dead-time interval specifies the time that the Cisco NX-OS device waits, after declaring that an LDAP server is dead, before sending out a test packet to determine if the server is now alive.

Note When the dead-time interval is 0 minutes, LDAP servers are not marked as dead even if they are not responding. You can configure the dead-time interval per group.

To configure the LDAP dead-time interval, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)#**ldap-server deadtime 5**

Configures the global dead-time interval. The default value is 0 minutes. The range is from 1 to 60 minutes.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **show ldap-server**

(Optional) Displays the LDAP server configuration.

Step 5 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Configuring AAA Authorization on LDAP Servers

You can configure the default AAA authorization method for LDAP servers.

To configure AAA authorization by LDAP servers, follow these steps:

Before you begin

Ensure that you have configured the SSH public and private keys on the LDAP server.

Procedure

Step 1 Enter global configuration mode:

switch# **configure terminal**

Step 2 Configure SSH public key and SSH certificate:

SSH Public Key

a. Configure the default AAA authorization method for the LDAP servers:

switch(config)# **aaa authorization ssh-publickey default** {**group** *group-list* | **local**}

The **ssh-publickey** keyword configures LDAP or local authorization with the SSH public key. The default authorization is local authorization, which is the list of authorized commands for the user's assigned role.

The *group-list* argument consists of a space delimited list of LDAP server group names. Servers that belong to this group are contacted for AAA authorization. The **local** method uses the local database for authorization.

b. Specify the rootDN for the LDAP server database and the bind password for the root:

switch(config)# **ldap-server host** {*ipv4-address* | *ipv6-address* | *hostname*} **rootDN** *root-name* [**password** *password* [**port** *tcp-port* [**timeout** *seconds*] | **timeout** *seconds*]]

c. Configure an LDAP search map:

switch(config)# **ldap search-map** *map-name*

d. Specify the public key matching:

switch(config-ldap-search-map)# **user-pubkey-match attribute-name** *attribute-name* **search-filter** *search-filter* **base-dn**

e. Configure the attribute name, search filter, and base-DN for the user profile, trusted certificate, CRL, certificate DN match, public key match, or user-switchgroup lookup search operation. These values are used to send a search query to the LDAP server.

switch(config-ldap-search-map)# **userprofile attribute-name "memberOf" search-filter "(&(objectClass=inetOrgPerson)(cn=$userid))" base-DN dc=acme,dc=com**

f. Create an LDAP server group and enters the LDAP server group configuration mode for that group:

switch(config-ldap-search-map)# **aaa group server ldap** *group-name*

g. Configure the LDAP server as a member of the LDAP server group:

switch(config-ldap)# **server** {*ipv4-address* | *ipv6-address* | *host-name*}

SSH Certificate

a. Configure the default AAA authorization method for the LDAP servers:

switch(config)# **aaa authorization ssh-certificate default group LDAPServer1 LDAPServer2**

The ssh-certificate keyword configures LDAP or local authorization with certificate authentication. The default authorization is local authorization, which is the list of authorized commands for the user's assigned role.

The group-list argument consists of a space-delimited list of LDAP server group names. Servers that belong to this group are contacted for AAA authorization. The **local** method uses the local database for authorization.

b. Specify the rootDN for the LDAP server database and the bind password for the root:

switch(config)# **ldap-server host** {*ipv4-address* | *ipv6-address* | *hostname*} **rootDN** *root-name* [**password** *password* [**port** *tcp-port* [**timeout** *seconds*] | **timeout** *seconds*]]

c. Configure an LDAP search map:

switch(config)# **ldap search-map** *map-name*

d. Specify the certificate matching:

switch(config-ldap-search-map)# **user-certdn-match attribute-name** *attribute-name* **search-filter** *search-filter* **base-dn**

e. Configure the attribute name, search filter, and base-DN for the user profile, trusted certificate, CRL, certificate DN match, public key match, or user-switchgroup lookup search operation. These values are used to send a search query to the LDAP server.

switch(config-ldap-search-map)# **userprofile attribute-name "memberOf" search-filter "(&(objectClass=inetOrgPerson)(cn=$userid))" base-DN dc=acme,dc=com**

f. Create an LDAP server group and enters the LDAP server group configuration mode for that group:

switch(config-ldap-search-map)# **aaa group server ldap** *group-name*

g. Configure the LDAP server as a member of the LDAP server group:

switch(config-ldap)# **server** {*ipv4-address* | *ipv6-address* | *host-name*}

What to do next

For SSH certificates, configure the following features:

1. Configuring the Host Name and IP Domain Name. See Configuring the Host Name and IP Domain Name.
2. Creating a Trust Point Certificate Authority Association. See Creating a Trust Point Certificate Authority Association.
3. Authenticating a Trust Point Certificate Authority. See Authenticating a Trust Point Certificate Authority.

Disabling LDAP

When you disable LDAP, all related configurations are automatically discarded.

To disable LDAP, follow these steps:

Procedure

Step 1 switch# **configure terminal**

switch(config)#

Enters global configuration mode.

Step 2 switch(config)#**no feature ldap**

Disables LDAP.

Step 3 switch(config)# **exit**

switch#

Exits configuration mode.

Step 4 switch# **copy running-config startup-config**

(Optional) Copies the running configuration to the startup configuration.

Example

For detailed information about the fields in the output from this command, see the Cisco MDS 9000 Family Command Reference, Release 5.0(1a).

Configuration Examples for LDAP

The following example shows how to configure an LDAP server host and server group:

```
feature ldap
ldap-server host 10.10.2.2 enable-ssl
aaa group server ldap LdapServer
server 10.10.2.2
exit
show ldap-server
show ldap-server groups
```

The following example shows how to configure an LDAP search map:

```
ldap search-map s0
userprofile attribute-name description search-filter
(&(objectClass=inetOrgPerson)(cn=$userid)) base-DN dc=acme,dc=com
exit
show ldap-search-map
```

The following example shows how to configure AAA authorization with certificate authentication for an LDAP server:

```
aaa authorization ssh-certificate default group LDAPServer1 LDAPServer2
exit
show aaa authorization
```

Default Settings

The following table lists the default settings for LDAP parameters.

Table 2: Default LDAP Parameter Settings

Parameters	Default
LDAP	Disabled
LDAP authentication method	First search and then bind
LDAP authentication mechanism	Plain
Dead-interval time	0 minutes
Timeout interval	5 seconds
Idle timer interval	60 minutes
Periodic server monitoring username	test
Periodic server monitoring password	Cisco

Configuring RADIUS Server Monitoring Parameters

Cisco MDS 9000 Family switches can use the RADIUS protocol to communicate with remote AAA servers. You can configure multiple RADIUS servers and server groups and set timeout and retry counts.

RADIUS is a distributed client/server protocol that secures networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco MDS 9000 Family switches and send authentication requests to a central RADIUS server that contains all user authentication and network service access information.

This section defines the RADIUS operation, identifies its network environments, and describes its configuration possibilities.

This section includes the following topics:

About RADIUS Server Default Configuration

Fabric Manager allows you to set up a default configuration that can be used for any RADIUS server that you configure the switch to communicate with. The default configuration includes:

- Encryption type
- Timeout value
- Number of retransmission attempts
- Allowing the user to specify a RADIUS server at login

Setting the RADIUS Server IPv4 Address

You can add up to 64 RADIUS servers. RADIUS keys are always stored in encrypted form in persistent storage. The running configuration also displays encrypted keys.

To specify the host RADIUS server IPv4 address and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server host 10.10.0.0 key HostKey**

Specifies the preshared key for the selected RADIUS server. This key overrides the key assigned using the **radius-server key** command. In this example, the host is 10.10.0.0 and the key is HostKey.

Step 3 switch(config)# **radius-server host 10.10.0.0 auth-port 2003**

Specifies the destination UDP port number to which the RADIUS authentication messages should be sent. In this example, the host is 10.10.0.0 and the authentication port is 2003. The default authentication port is 1812, and the valid range is 0 to 65366.

Step 4 switch(config)# **radius-server host 10.10.0.0 acct-port 2004**

Specifies the destination UDP port number to which RADIUS accounting messages should be sent. The default accounting port is 1813, and the valid range is 0 to 65366.

Step 5 switch(config)# **radius-server host 10.10.0.0 accounting**

Specifies this server to be used only for accounting purposes.

Note If neither the **authentication** nor the **accounting** options are specified, the server is used for both accounting and authentication purposes.

Step 6 switch(config)# **radius-server host 10.10.0.0 key 0 abcd**

Specifies a clear text key for the specified server. The key is restricted to 64 characters.

Step 7 switch(config)# **radius-server host 10.10.0.0 key 4 da3Asda2ioyuoiuH**

Specifies an encrypted key for the specified server. The key is restricted to 64 characters.

Setting the RADIUS Server IPv6 Address

To specify the host RADIUS server IPv6 address and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server host 2001:0DB8:800:200C::417A Key HostKey**

Specifies the preshared key for the selected RADIUS server. This key overrides the key assigned using the **radius-server key** command. In this example, the host is 2001:0DB8:800:200C::417A and the key is HostKey.

Step 3 switch(config)# **radius-server host 2001:0DB8:800:200C::417A auth-port 2003**

Specifies the destination UDP port number to which the RADIUS authentication messages should be sent. In this example, the host is 2001:0DB8:800:200C::417A and the authentication port is 2003. The default authentication port is 1812, and the valid range is 0 to 65366.

Step 4 switch(config)# **radius-server host 2001:0DB8:800:200C::417A acct-port 2004**

Specifies the destination UDP port number to which RADIUS accounting messages should be sent. The default accounting port is 1813, and the valid range is 0 to 65366.

Step 5 switch(config)# **radius-server host 2001:0DB8:800:200C::417A accounting**

Specifies this server to be used only for accounting purposes.

Note If neither the **authentication** nor the **accounting** options are specified, the server is used for both accounting and authentication purposes.

Step 6 switch(config)# **radius-server host 2001:0DB8:800:200C::417A key 0 abcd**

Specifies a clear text key for the specified server. The key is restricted to 64 characters.

Step 7 switch(config)# **radius-server host 2001:0DB8:800:200C::417A key 4 da3Asda2ioyuoiuH**

Specifies an encrypted key for the specified server. The key is restricted to 64 characters.

Setting the RADIUS Server DNS name

To specify the host RADIUS server DNS name and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server host radius2 key HostKey**

Specifies the preshared key for the selected RADIUS server. This key overrides the key assigned using the **radius-server key** command. In this example, the host is radius2 and the key is HostKey.

Step 3 switch(config)# **radius-server host radius2 auth-port 2003**

Specifies the destination UDP port number to which the RADIUS authentication messages should be sent. In this example, the host is radius2 and the authentication port is 2003. The default authentication port is 1812, and the valid range is 0 to 65366.

Step 4 switch(config)# **radius-server host radius2 acct-port 2004**

Specifies the destination UDP port number to which RADIUS accounting messages should be sent. The default accounting port is 1813, and the valid range is 0 to 65366.

Step 5 switch(config)# **radius-server host radius2 accounting**

Specifies this server to be used only for accounting purposes.

Note If neither the **authentication** nor the **accounting** options are specified, the server is used for both accounting and authentication purposes.

Step 6 switch(config)# **radius-server host radius2 key 0 abcd**

Specifies a clear text key for the specified server. The key is restricted to 64 characters.

Step 7 switch(config)# **radius-server host radius2 key 4 da3Asda2ioyuoiuH**

Specifies an encrypted key for the specified server. The key is restricted to 64 characters.

About the Default RADIUS Server Encryption Type and Preshared Key

You need to configure the RADIUS preshared key to authenticate the switch to the RADIUS server. The length of the key is restricted to 64 characters and can include any printable ASCII characters (white spaces are not allowed). You can configure a global key to be used for all RADIUS server configurations on the switch.

You can override this global key assignment by explicitly using the **key** option when configuring an individual RADIUS server in the **radius-server host** command.

Configuring the Default RADIUS Server Encryption Type and Preshared Key

To configure the RADIUS preshared key, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server key AnyWord**

Configures a preshared key (AnyWord) to authenticate communication between the RADIUS client and server. The default is clear text.

Step 3 switch(config)# **radius-server key 0 AnyWord**

Configures a preshared key (AnyWord) specified in clear text (indicated by 0) to authenticate communication between the RADIUS client and server.

Step 4 switch(config)# **radius-server key 7 abe4DFeeweo00o**

Configures a preshared key (specified in encrypted text) specified in encrypted text (indicated by 7) to authenticate communication between the RADIUS client and server.

Setting the RADIUS Server Timeout Interval

You can configure a global timeout value between transmissions for all RADIUS servers.

Note If timeout values are configured for individual servers, those values override the globally configured values.

To specify the timeout values between retransmissions to the RADIUS servers, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server timeout 30**

Configures the global timeout period in seconds for the switch to wait for a response from all RADIUS+ servers before the switch declares a timeout failure. The time ranges from 1 to 1440 seconds.

Step 3 switch(config)# **no radius-server timeout 30**

Reverts the transmission time to the default value (1 second).

Setting the Default RADIUS Server Timeout Interval and Retransmits

By default, a switch retries transmission to a RADIUS server only once before reverting to local authentication. You can increase this number up to a maximum of five retries per server. You can also configure the timeout value for the RADIUS server.

To specify the number of times that RADIUS servers should try to authenticate a user, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server retransmit 3**

Configures the number of times (3) the switch tries to connect to a RADIUS server(s) before reverting to local authentication.

Step 3 switch(config)# **no radius-server retransmit**

Reverts to the default retry count (1).

Configuring RADIUS Server Monitoring Parameters

You can configure parameters for monitoring RADIUS servers. You can configure this option to test the server periodically, or you can run a one-time only test.

This section includes the following topics:

Configuring the Test Idle Timer

The test idle timer specifies the interval during which a RADIUS server receives no requests before the MDS switch sends out a test packet.

Note The default idle timer value is 0 minutes. When the idle time interval is 0 minutes, periodic RADIUS server monitoring is not performed.

To configure the idle timer, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server host 10.1.1.1 test idle-time 20**

Configures the test idle time interval value in minutes. The valid range is 1 to 1440 minutes.

Step 3 switch(config)# **no radius-server host 10.1.1.1 test idle-time 20**

Reverts to the default value (0 minutes).

Configuring Test User Name

You can configure a username and password for periodic RADIUS server status testing. You do not need to configure the test username and password to issue test messages to monitor RADIUS servers. You can use the default test username (test) and default password (test).

Note We recommend that the test username not be the same as an existing username in the RADIUS database for security reasons.

To configure the optional username and password for periodic RADIUS server status testing, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server host 10.1.1.1 test username testuser**

Configures the test user (testuser) with the default password (test). The default user name is test.

Step 3

```
switch(config)# no radius-server host 10.1.1.1 test username testuser
```

Removes the test user name (testuser).

Step 4

```
switch(config)# radius-server host 10.1.1.1 test username testuser password Ur2Gd2BH
```

Configures the test user (testuser) and assigns a strong password.

Configuring the Dead Timer

The dead timer specifies the interval that the MDS switch waits, after declaring that a RADIUS server is dead, before sending out a test packet to determine if the server is now alive.

Note The default dead timer value is 0 minutes. When the dead timer interval is 0 minutes, RADIUS server monitoring is not performed unless the RADIUS server is part of a server group and the dead-time interval for the group is greater than 0 minutes. (See the Server Groups, on page 4).

Note If the dead timer of a dead RADIUS server expires before it is sent a RADIUS test message, that server is marked as alive again even if it is still not responding. To avoid this scenario, configure a test user with a shorter idle time than the dead timer time.

To configure the dead timer, follow these steps:

Procedure

Step 1

```
switch# configure terminal
```

Enters configuration mode.

Step 2

```
switch(config)# radius-server deadtime 30
```

Configures the dead timer interval value in minutes. The valid range is 1 to 1440 minutes.

Step 3

```
switch(config)# no radius-server deadtime 30
```

Reverts to the default value (0 minutes).

About RADIUS Servers

You can add up to 64 RADIUS servers. RADIUS keys are always stored in encrypted form in persistent storage. The running configuration also displays encrypted keys. When you configure a new RADIUS server, you can use the default configuration or modify any of the parameters to override the default RADIUS configuration.

Configuring the Test Idle Timer

The test idle timer specifies the interval during which a RADIUS server receives no requests before the MDS switch sends out a test packet.

Note The default idle timer value is 0 minutes. When the idle time interval is 0 minutes, periodic RADIUS server monitoring is not performed.

To configure the test idle timer, see Configuring RADIUS Server Monitoring Parameters, on page 29.

Configuring Test User Name

You can configure a username and password for periodic RADIUS server status testing. You do not need to configure the test username and password to issue test messages to monitor RADIUS servers. You can use the default test username (test) and default password (test).

Note We recommend that the test username not be the same as an existing username in the RADIUS database for security reasons.

To configure the optional username and password for periodic RADIUS server status testing, see Configuring RADIUS Server Monitoring Parameters, on page 29.

About Validating a RADIUS Server

As of Cisco SAN-OS Release 3.0(1), you can periodically validate a RADIUS server. The switch sends a test authentication to the server using the username and password that you configure. If the server does not respond to the test authentication, then the server is considered non responding.

Note For security reasons we recommend that you do not use a username that is configured on your RADIUS server as a test username.

You can configure this option to test the server periodically, or you can run a one-time test.

Sending RADIUS Test Messages for Monitoring

You can manually send test messages to monitor a RADIUS server.

To send the test message to the RADIUS server, follow this step:

Procedure

Step 1 switch# **test aaa server radius 10.10.1.1 test test**

Sends a test message to a RADIUS server using the default username (test) and password (test).

Step 2 switch# **test aaa server radius 10.10.1.1 testuser Ur2Gd2BH**

Sends a test message to a RADIUS server using a configured test username (testuser) and password (Ur2Gd2BH).

Note A configured username and password is optional (see the Configuring Test Username, on page 49 section).

Allowing Users to Specify a RADIUS Server at Login

By default, an MDS switch forwards an authentication request to the first server in the RADIUS server group. You can configure the switch to allow the user to specify which RADIUS server to send the authenticate request by enabling the directed request option. If you enable this option, the user can log in as *username@hostname* , where the *hostname* is the name of a configured RADIUS server.

Note User specified logins are supported only for Telnet sessions.

To allow users logging into an MDS switch to select a RADIUS server for authentication, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius-server directed-request**

Allows users to specify a RADIUS server to send the authentication request when logging in.

Step 3 switch(config)# **no radius-server directed-request**

Reverts to sending the authentication request to the first server in the server group (default).

Example

You can use the **show tacacs-server directed-request** command to display the RADIUS directed request configuration.

```
switch# show radius-server directed-request

disabled
```

About Vendor-Specific Attributes

The Internet Engineering Task Force (IETF) draft standard specifies a method for communicating vendor-specific attributes (VSAs) between the network access server and the RADIUS server. The IETF uses attribute 26. VSAs allow vendors to support their own extended attributes that are not suitable for general use. The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. The Cisco vendor ID is 9, and the supported option is vendor type 1, which is named **cisco-avpair.** The value is a string with the following format:

```
protocol : attribute separator value *
```

Where **protocol** is a Cisco attribute for a particular type of authorization, **separator** is = (equal sign) for mandatory attributes, and * (asterisk) is for optional attributes.

When you use RADIUS servers to authenticate yourself to a Cisco MDS 9000 Family switch, the RADIUS protocol directs the RADIUS server to return user attributes, such as authorization information, along with authentication results. This authorization information is specified through VSAs.

VSA Format

The following VSA protocol options are supported by the Cisco NX-OS software:

- **Shell** protocol—Used in Access-Accept packets to provide user profile information.
- **Accounting** protocol—Used in Accounting-Request packets. If a value contains any white spaces, it should be put within double quotation marks.

The following attributes are supported by the Cisco NX-OS software:

- **roles**—This attribute lists all the roles to which the user belongs. The value field is a string storing the list of group names delimited by white space. For example, if you belong to roles **vsan-admin** and **storage-admin**, the value field would be "**vsan-admin storage-admin"**. This subattribute is sent in the VSA portion of the Access-Accept frames from the RADIUS server, and it can only be used with the shell protocol value. These are two examples using the roles attribute:

  shell:roles="network-admin vsan-admin"

  shell:roles*"network-admin vsan-admin"

  When an VSA is specified as **shell:roles*"network-admin vsan-admin"**, this VSA is flagged as an optional attribute, and other Cisco devices ignore this attribute.

- **accountinginfo**—This attribute stores additional accounting information besides the attributes covered by a standard RADIUS accounting protocol. This attribute is only sent in the VSA portion of the Account-Request frames from the RADIUS client on the switch, and it can only be used with the accounting protocol-related PDUs.

Specifying SNMPv3 on AAA Servers

The vendor/custom attribute **cisco-av-pair** can be used to specify user's role mapping using the format:

```
shell:roles="roleA roleB ..."
```

Note When you log in to a Cisco MDS switch successfully using the Fabric Manager or Device Manager through Telnet or SSH and if that switch is configured for AAA server-based authentication, a temporary SNMP user entry is automatically created with an expiry time of one day. The switch authenticates the SNMPv3 protocol data units (PDUs) with your Telnet or SSH login name as the SNMPv3 user. The management station can temporarily use the Telnet or SSH login name as the SNMPv3 **auth** and **priv** passphrase. This temporary SNMP login is only allowed if you have one or more active MDS shell sessions. If you do not have an active session at any given time, your login is deleted and you will not be allowed to perform SNMPv3 operations.

If the role option in the **cisco-av-pair** attribute is not set, the default user role is network-operator.

The VSA format optionally specifies your SNMPv3 authentication and privacy protocol attributes also as follows:

```
shell:roles="roleA roleB..." snmpv3:auth=SHA priv=AES-128
```

The SNMPv3 authentication protocol options are SHA and MD5. The privacy protocol options are AES-128 and DES. If these options are not specified in the **cisco-av-pair** attribute on the ACS server, MD5 and DES are used by default.

From Cisco MDS NX-OS Release 8.5(1), the SNMPv3 authentication protocol options are SHA and MD5. The privacy protocol options are AES-128 and DES. If these options are not specified in the **cisco-av-pair** attribute on the ACS server, MD5 and AES-128 are used by default.

Displaying RADIUS Server Details

Use the **show radius-server** command to display configured RADIUS parameters as shown in the following example.

Displays Configured RADIUS Information

```
switch# show radius-server
Global RADIUS shared secret:*******
retransmission count:5
timeout value:10
following RADIUS servers are configured:
        myradius.cisco.users.com:
                available for authentication on port:1812
                available for accounting on port:1813
        172.22.91.37:
                available for authentication on port:1812
                available for accounting on port:1813
                RADIUS shared secret:******
        10.10.0.0:
                available for authentication on port:1812
                available for accounting on port:1813
                RADIUS shared secret:******
```

Displays Configured RADIUS Server-Group Order

```
switch# show radius-server groups
total number of groups:4
following RADIUS server groups are configured:
        group radius:
                server: all configured radius servers
        group Group1:
                server: Server3 on auth-port 1812, acct-port 1813
                server: Server5 on auth-port 1812, acct-port 1813
        group Group5:
```

Displaying RADIUS Server Statistics

You can display RADIUS server statistics using the **show radius-server statistics** command.

You can clear RADIUS server statistics using the clear radius-server statistics 10.1.3.2 command.

Displays RADIUS Server Statistics

```
switch# show radius-server statistics 10.1.3.2
Server is not monitored
Authentication Statistics
        failed transactions: 0
        sucessful transactions: 0
        requests sent: 0
        requests timed out: 0
        responses with no matching requests: 0
        responses not processed: 0
        responses containing errors: 0
Accounting Statistics
        failed transactions: 0
        successful transactions: 0
        requests sent: 0
        requests timed out: 0
        responses with no matching requests: 0
        responses not processed: 0
        responses containing errors:
```

You can clear RADIUS server statistics using the clear radius-server statistics 10.1.3.2 command.

One-Time Password Support

A one-time password (OTP) is a password that is valid for a single login session or transaction. OTPs avoid a number of disadvantages that are associated with usual (static) passwords. The most vital disadvantage that is addressed by OTPs is that, they are not at risk to replay attacks. If an intruder manages to record an OTP that was already used to log into a service or to conduct an operation, it will not be misused as it will no longer be valid.

One Time Password is applicable only to RADIUS and TACACS protocol daemons. With a RADIUS protocol daemon, there is no configuration required from the switch side. With a TACACS protocol, ascii authentication mode needs to be enabled, which can be done by the following command:

```
aaa authentication login ascii-authentication
```

Recovering the Administrator Password

You can recover the administrator password using one of two methods:

- From the CLI with a user name that has network-admin privileges.
- Power cycling the switch.

The following topics included in this section:

Using the CLI with Network-Admin Privileges

If you are logged in to, or can log into, switch with a user name that has network-admin privileges and then recover the administrator password, follow these steps:

Procedure

Step 1 Use the **show user-accounts** command to verify that your user name has network-admin privileges.

Example:

```
switch# show user-account

user:admin
this user account has no expiry date
roles:network-admin
user:dbgusr
this user account has no expiry date
roles:network-admin network-operator
```

Step 2 If your user name has network-admin privileges, issue the **username** command to assign a new administrator password.

Example:

```
switch# configure terminal
switch(config)# username admin password  <new password>
switch(config)# exit
switch#
```

Step 3 Save the software configuration.

Example:

```
switch# copy running-config startup-config
```

Power Cycling the Switch

If you cannot start a session on the switch that has network-admin privileges, you must recover the administrator password by power cycling the switch.

Caution This procedure disrupts all traffic on the switch. All connections to the switch will be lost for 2 to 3 minutes.

Note You cannot recover the administrator password from a Telnet or SSH session. You must have access to the local console connection. See the Cisco MDS 9000 Series Fundamentals Configuration Guide for information on setting up the console connection.

To recover an administrator password by power cycling the switch, follow these steps:

Procedure

Step 1 Remove any standby supervisor module from the chassis.

Step 2 Power cycle the switch.

Step 3 Press the **Ctrl-]** key sequence when the switch begins its Cisco NX-OS software boot sequence to enter the switch(boot)# prompt mode.

Ctrl-]

```
switch(boot)#
```

Step 4 Change to configuration mode.

```
switch(boot)# configure terminal
```

Step 5 Issue the admin-password command to reset the administrator password. This will disable remote authentication for login through console, if enabled. This is done to ensure that admin is able to login through console with new password after password recovery. Telnet/SSH authentication will not be affected by this.

```
switch(boot-config)# admin-password <new password>
WARNING! Remote Authentication for login through console will be disabled#
```

For information on strong passwords, see the Checking Password Strength section.

Step 6 Exit to the EXEC mode.

```
switch(boot-config)# admin-password <new password>
```

Step 7 Issue the **load** command to load the Cisco NX-OS software.

```
switch(boot)# load bootflash:m9700-sf4ek9-mz.8.4.1.bin
```

Caution If you boot a system image that is older than the image you used to store the configuration and do not use the **install all** command to boot the system, the switch erases the binary configuration and uses the ASCII configuration. When this occurs, you must use the **init system** command to recover your password.

Step 8 Log in to the switch using the new administrator password.

```
switch login: admin
Password:<newpassword>
```

Step 9 Reset the new password to ensure that is it is also the SNMP password for Fabric Manager.

```
switch# configure terminal
switch(config)# username admin password<new password>
switch(config)# exit
switch#
```

Step 10 Save the software configuration.

```
switch# copy running-config startup-config
```

Step 11 Insert the previously removed supervisor module into slot 6 in the chassis.

Configuring TACACS+ Server Monitoring Parameters

A Cisco MDS switch uses the Terminal Access Controller Access Control System Plus (TACACS+) protocol to communicate with remote AAA servers. You can configure multiple TACACS+ servers and set timeout values.

This section includes the following topics:

About TACACS+

TACACS+ is a client/server protocol that uses TCP (TCP port 49) for transport requirements. All switches in the Cisco MDS 9000 Family provide centralized authentication using the TACACS+ protocol. The TACACS+ has the following advantages over RADIUS authentication:

- Provides independent, modular AAA facilities. Authorization can be done without authentication.
- Uses the TCP transport protocol to send data between the AAA client and server, making reliable transfers with a connection-oriented protocol.
- Encrypts the entire protocol payload between the switch and the AAA server to ensure higher data confidentiality. The RADIUS protocol only encrypts passwords.

About TACACS+ Server Default Configuration

Fabric Manager allows you to set up a default configuration that can be used for any TACACS+ server that you configure the switch to communicate with. The default configuration includes:

- Encryption type
- Preshared key
- Timeout value
- Number of retransmission attempts
- Allowing the user to specify a TACACS+ server at login

About the Default TACACS+ Server Encryption Type and Preshared Key

You need to configure the TACACS+ preshared key to authenticate the switch to the TACACS+ server. The length of the key is restricted to 64 characters and can include any printable ASCII characters (white spaces are not allowed). You can configure a global key to be used for all TACACS+ server configurations on the switch.

You can override this global key assignment by explicitly using the **key** option when configuring and individual TACACS+ server.

Enabling TACACS+

By default, the TACACS+ feature is disabled in all switches in the Cisco MDS 9000 Family. You must explicitly enable the TACACS+ feature to access the configuration and verification commands for fabric authentication. When you disable this feature, all related configurations are automatically discarded.

To enable TACACS+ for a Cisco MDS switch, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **feature tacacs+**

Enables the TACACS+ in this switch.

Step 3 switch(config)# **no feature tacacs+**

(Optional) Disables (default) the TACACS+ in this switch.

Setting the TACACS+ Server IPv4 Address

If a secret key is not configured for a configured server, a warning message is issued if a global key is not configured. If a server key is not configured, the global key (if configured) is used for that server (see the Setting the Default TACACS+ Server Timeout Interval and Retransmits, on page 47 section).

Note You can use the dollar sign ($) and the percent sign (%) in global secret keys.

To configure the TACACS+ server IPv4 address and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server host 171.71.58.91**

Configures the TACACS+ server identified by the specified IPv4 address.

Step 3 switch(config)# **no tacacs-server host 171.71.58.91**

(Optional) Deletes the specified TACACS+ server identified by the IPv4 address. By default, no server is configured.

Step 4 switch(config)# **tacacs-server host 171.71.58.91 port 2**

Configures the TCP port for all TACACS+ requests.

Step 5 switch(config)# **no tacacs-server host 171.71.58.91 port 2**

(Optional) Reverts to the factory default of using port 49 for server access.

Step 6 switch(config)# **tacacs-server host 171.71.58.91 key MyKey**

Configures the TACACS+ server identified by the specified domain name and assigns the secret key.

Step 7 switch(config)# **tacacs-server host 171.71.58.91 timeout 25**

Configures the timeout period for the switch to wait for a response from the specified server before it declares a timeout failure.

Setting the TACACS+ Server IPv6 Address

To configure the TACACS+ server IPv6 address and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server host 2001:0DB8:800:200C::417A**

```
warning: no key is configured for the host
```

Configures the TACACS+ server identified by the specified IPv6 address.

Step 3 switch(config)# **no tacacs-server host 2001:0DB8:800:200C::417A**

(Optional) Deletes the specified TACACS+ server identified by the IPv6 address. By default, no server is configured.

Step 4 switch(config)# **tacacs-server host 2001:0DB8:800:200C::417A port 2**

Configures the TCP port for all TACACS+ requests.

Step 5 switch(config)# **no tacacs-server host 2001:0DB8:800:200C::417A port 2**

(Optional) Reverts to the factory default of using port 49 for server access.

Step 6 switch(config)# **tacacs-server host 2001:0DB8:800:200C::417A key MyKey**

Configures the TACACS+ server identified by the specified domain name and assigns the secret key.

Step 7 switch(config)# **tacacs-server host 2001:0DB8:800:200C::417A timeout 25**

Configures the timeout period for the switch to wait for a response from the specified server before it declares a timeout failure.

Setting the TACACS+ Server DNS name

To configure the TACACS+ server DNS name and other options, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server host host1.cisco.com**

```
warning: no key is configured for the host
```

Configures the TACACS+ server identified by the specified DNS name.

Step 3 switch(config)# **no tacacs-server host host1.cisco.com**

(Optional) Deletes the specified TACACS+ server identified by the DNS name. By default, no server is configured.

Step 4 switch(config)# **tacacs-server host host1.cisco.com port 2**

Configures the TCP port for all TACACS+ requests.

Step 5 switch(config)# **no tacacs-server host host1.cisco.com port 2**

(Optional) Reverts to the factory default of using port 49 for server access.

Step 6 switch(config)# **tacacs-server host host1.cisco.com key MyKey**

Configures the TACACS+ server identified by the specified domain name and assigns the secret key.

Step 7 switch(config)# **tacacs-server host host1.cisco.com timeout 25**

Configures the timeout period for the switch to wait for a response from the specified server before it declares a timeout failure.

Setting the Global Secret Key

You can configure global values for the secret key for all TACACS+ servers.

Note

- If secret keys are configured for individual servers, those keys override the globally configured key.
- You can use the dollar sign ($) and the percent sign (%) in global secret keys.

To set the secret key for TACACS+ servers, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server key 7 3sdaA3daKUngd**

Assigns the global secret key (in encrypted format) to access the TACACS+ server. This example specifies **7** to indicate the encrypted format being used. If this global key and the individual server keys are not configured, clear text messages are sent to the TACACS+ server(s).

Step 3 switch(config)# **no tacacs-server key oldPword**

(Optional) Deletes the configured global secret key to access the TACACS+ server and reverts to the factory default of allowing access to all configured servers.

Setting the Default TACACS+ Server Timeout Interval and Retransmits

By default, a switch retries a TACACS+ server only once. This number can be configured. The maximum is five retries per server. You can also configure the timeout value for the TACACS+ server.

Setting the Timeout Value

You can configure a global timeout value between transmissions for all TACACS+ servers.

Note If timeout values are configured for individual servers, those values override the globally configured values.

To set the global timeout value for TACACS+ servers, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server timeout 30**

Configures the global timeout period in seconds for the switch to wait for a response from all TACACS+ servers before the switch declares a timeout failure. The time ranges from 1 to 1440 seconds.

Step 3 switch(config)# **no tacacs-server timeout 30**

(Optional) Deletes the configured timeout period and reverts to the factory default of 5 seconds.

About TACACS+ Servers

By default, the TACACS+ feature is disabled in all switches in the Cisco MDS 9000 Family. Fabric Manager or Device Manager enables the TACACS+ feature automatically when you configure a TACACS+ server.

If a secret key is not configured for a configured server, a warning message is issued if a global key is not configured. If a server key is not configured, the global key (if configured) is used for that server.

Note Prior to Cisco MDS SAN-OS Release 2.1(2), you can use the dollar sign ($) in the key but the key must be enclosed in double quotes, for example "k$". The percent sign (%) is not allowed. In Cisco MDS SAN-OS Release 2.1(2) and later, you can use the dollar sign ($) without double quotes and the percent sign (%) in global secret keys.

You can configure global values for the secret key for all TACACS+ servers.

Note If secret keys are configured for individual servers, those keys override the globally configured key.

Configuring TACACS+ Server Monitoring Parameters

You can configure parameters for monitoring TACACS+ servers.

This section includes the following topics:

Configuring the TACACS+ Test Idle Timer

The test idle timer specifies the interval during which a TACACS+ server receives no requests before the MDS switch sends out a test packet.

Note The default idle timer value is 0 minutes. When the idle time interval is 0 minutes, periodic TACACS+ server monitoring is not performed.

To configure the idle timer, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server host 10.1.1.1 test idle-time 20**

Configures the test idle time interval value in minutes. The valid range is 1 to 1440 minutes.

Step 3 switch(config)# **no tacacs-server host 10.1.1.1 test idle-time 20**

(Optional) Reverts to the default value (0 minutes).

Configuring Test Username

You can configure a username and password for periodic TACACS+ server status testing. You do not need to configure the user name and password to monitor TACACS+ servers. You can use the default test username (test) and default password (test).

To configure the optional username and password for periodic TACACS+ server status testing, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server host 10.1.1.1 test username testuser**

Configures the test user (testuser) with the default password (test). The default username is test.

Step 3 switch(config)# **no tacacs-server host 10.1.1.1 test username testuser**

(Optional) Removes the test user (testuser).

Step 4 switch(config)# **tacacs-server host 10.1.1.1 test username testuser password Ur2Gd2BH**

Configures the test user (testuser) and assigns a strong password.

Configuring the Dead Timer

The dead timer specifies the interval that the MDS switch waits, after declaring a TACACS+ server is dead, before sending out a test packet to determine if the server is now alive.

Note

- The default dead timer value is 0 minutes. TACACS+ server monitoring is not performed if the dead timer interval is 0 minutes, unless the TACACS+ server is a part of a bigger group with the dead-time interval greater than 0 minutes. (See Configuring RADIUS Server Monitoring Parameters, on page 29).
- If the dead timer of a dead TACACS+ server expires before it is sent a TACACS+ test message, that server is marked as alive again even if it is still not responding. To avoid this scenario, configure a test user with a shorter idle time than the dead timer time.

To configure the dead timer, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server deadtime 30**

Configures the dead-time interval value in minutes. The valid range is 1 to 1440 minutes.

Step 3 switch(config)# **no tacacs-server deadtime 30**

(Optional) Reverts to the default value (0 minutes).

Note When the dead-time interval is 0 minutes, TACACS+ server monitoring is not performed unless the TACACS+ server is part of a server group and the dead-time interval for the group is greater than 0 minutes. (See the Configuring RADIUS Server Monitoring Parameters, on page 29 section).

Sending TACACS+ Test Messages for Monitoring

You can manually send test messages to monitor a TACACS+ server.

To send the test message to the TACACS+ server, follow these steps:

Procedure

Step 1 switch# **test aaa server tacacs+ 10.10.1.1 test**

Sends a test message to a TACACS+ server using the default username (test) and password (test).

Step 2 switch# **test aaa server tacacs+ 10.10.1.1 testuser Ur2Gd2BH**

Sends a test message to a TACACS+ server using a configured test username and password. A configured username and password is optional (see the Configuring Test Username, on page 49 section).

Password Aging Notification through TACACS+ Server

Password aging notification is initiated when the user authenticates to a Cisco MDS 9000 switch via a TACACS+ account. The user is notified when a password is about to expire or has expired. If the password has expired, user is prompted to change the password.

Note As of Cisco MDS SAN-OS Release 3.2(1), only TACACS+ supports password aging notification. If you try to use RADIUS servers by enabling this feature, RADIUSs will generate a SYSLOG message and authentication will fall back to the local database.

Password aging notification facilitates the following:

- Password change—You can change your password by entering a blank password.
- Password aging notification—Notifies password aging. Notification happens only if the AAA server is configured and MSCHAP and MSCHAPv2 is disabled.
- Password change after expiration—Initiates password change after the old password expires. Initiation happens from the AAA server.

Note Password aging notification fails if you do not disable MSCHAP and MSCHAPv2 authentication.

To enable the password aging option in the AAA server, enter the following command:

```
aaa authentication login ascii-authentication
```

To determine whether or not password aging notification is enabled or disabled in the AAA server, enter the following command:

```
show aaa authentication login ascii-authentication
```

About Validating a TACACS+ Server

As of Cisco SAN-OS Release 3.0(1), you can periodically validate a TACACS+ server. The switch sends a test authentication to the server using the test username and test password that you configure. If the server does not respond to the test authentication, then the server is considered nonresponding.

Note We recommend that you do not configure the test user on your TACACS+ server for security reasons.

You can configure this option to test the server periodically, or you can run a one-time only test.

Periodically Validating a TACACS+ Server

To configure the switch to periodically test a TACACS+ server using Fabric Manager, see the Configuring TACACS+ Server Monitoring Parameters, on page 43 section.

About Users Specifying a TACACS+ Server at Login

By default, an MDS switch forwards an authentication request to the first server in the TACACS+ server group. You can configure the switch to allow the user to specify which TACACS+ server to send the authenticate request. If you enable this feature, the user can log in as *username@hostname* , where the *hostname* is the name of a configured TACACS+ server.

Note User specified logins are supported only for Telnet sessions

Allowing Users to Specify a TACACS+ Server at Login

To allow users logging into an MDS switch to select a TACACS+ server for authentication, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs-server directed-request**

Allows users to specify a TACACS+ server to send the authentication request when logging in.

Step 3 switch(config)# **no tacacs-server directed-request**

Reverts to sending the authentication request to the first server in the server group (default).

Example

You can use the **show tacacs-server directed-request** command to display the TACACS+ directed request configuration.

```
switch# show tacacs-server directed-request

disabled
```

Defining Roles on the Cisco Secure ACS 5.x GUI

Enter the following in the GUI under Policy Elements:

Table 3: Role Definitions

Attribute	Requirement	Value
shell:roles	Optional	network-admin

Defining Custom Attributes for Roles

Cisco MDS 9000 Family switches use the TACACS+ custom attribute for service shells to configure roles to which a user belongs. TACACS+ attributes are specified in**name=value** format. The attribute name for this custom attribute is**cisco-av-pair**. The following example illustrates how to specify roles using this attribute:

```
cisco-av-pair=shell:roles=”network-admin vsan-admin”
```

You can also configure optional custom attributes to avoid conflicts with non-MDS Cisco switches using the same AAA servers.

```
cisco-av-pair*shell:roles="network-admin vsan-admin"
```

Additional custom attribute shell:roles are also supported:

```
shell:roles="network-admin vsan-admin"
OR
shell:roles*"network-admin vsan-admin”
```

Note TACACS+ custom attributes can be defined on an Access Control Server (ACS) for various services (for example, shell). Cisco MDS 9000 Family switches require the TACACS+ custom attribute for the service shell to be used for defining roles.

Supported TACACS+ Server Parameters

The Cisco NX-OS software currently supports the following parameters for the listed TACACS+ servers:

- TACACS+

```
cisco-av-pair=shell:roles="network-admin"
```

- Cisco ACS TACACS+

```
shell:roles="network-admin"
shell:roles*"network-admin"
cisco-av-pair*shell:roles="network-admin"
cisco-av-pair*shell:roles*"network-admin"
cisco-av-pair=shell:roles*"network-admin"
```

- Open TACACS+

```
cisco-av-pair*shell:roles="network-admin"
cisco-av-pair=shell:roles*"network-admin"
```

Displaying TACACS+ Server Details

Use the **show aaa** and **show tacacs-server** commands to display information about TACACS+ server configuration in all switches in the Cisco MDS 9000 Family as shown in the following examples.

Displays Configured TACACS+ Server Information

```
switch# show tacacs-server

Global TACACS+ shared secret:***********
timeout value:30
total number of servers:3
following TACACS+ servers are configured:
        171.71.58.91:
                available on port:2
        cisco.com:
                available on port:49
        171.71.22.95:
                available on port:49
                TACACS+ shared secret:*****
```

Displays AAA Authentication Information

```
switch# show aaa authentication

         default: group TacServer local none
         console: local
         iscsi: local
         dhchap: local
```

Displays AAA Authentication Login Information

```
switch# show aaa authentication login error-enable

enabled
```

Displays Configured TACACS+ Server Groups

```
switch# show tacacs-server groups

total number of groups:2
following TACACS+ server groups are configured:
        group TacServer:
                server 171.71.58.91 on port 2
        group TacacsServer1:
                server ServerA on port 49
                server ServerB on port 49:
```

Displays All AAA Server Groups

```
switch# show aaa groups

radius
TacServer
```

Displays TACACS+ Server Statistics

```
switch# show tacacs-server statistics 10.1.2.3

Server is not monitored
Authentication Statistics
        failed transactions: 0
        successful transactions: 0
        requests sent: 0
        requests timed out: 0
        responses with no matching requests: 0
        responses not processed: 0
        responses containing errors: 0
Authorization Statistics
        failed transactions: 0
        sucessfull transactions: 0
        requests sent: 0
        requests timed out: 0
        responses with no matching requests: 0
        responses not processed: 0
        responses containing errors: 0
Accounting Statistics
        failed transactions: 0
        successful transactions: 0
        requests sent: 0
        requests timed out: 0
        responses with no matching requests: 0
responses not processed: 0
responses containing errors: 0
```

Clearing TACACS+ Server Statistics

You can clear all the TACACS+ server statistics using the **clear tacacs-server statistics 10.1.2.3** command.

Configuring Server Groups

You can specify one or more remote AAA servers to authenticate users using server groups. All members of a group must belong to the same protocol, either RADIUS or TACACS+. The servers are tried in the same order in which you configure them.

The AAA server monitoring feature can mark an AAA server as dead. You can configure a period of time in minutes to elapse before the switch sends requests to a dead AAA server. (See the AAA Server Monitoring, on page 6 section).

This section includes the following topics:

About Configuring Radius Server Groups

You can configure these server groups at any time but they only take effect when you apply them to an AAA service. You configure AAA policies for CLI users or Fabric Manager or Device Manager users.

To configure a RADIUS server group, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa group server radius RadServer**

switch(config-radius)#

Creates a server group named RadServer and enters the RADIUS server group configuration submode for that group.

Step 3 switch(config)# **no aaa group server radius RadServer**

(Optional) Deletes the server group called RadServer from the authentication list.

Step 4 switch(config-radius)# **server 10.71.58.91**

Configures the RADIUS server at IPv4 address 10.71.58.91 to be tried first within the server group RadServer.

Tip If the specified RADIUS server is not found, configure it using the **radius-server host** command and retry this command.

Step 5 switch(config-radius)# **server 2001:0DB8:800:200C::417A**

Configures the RADIUS server at IPv6 address 2001:0DB8:800:200C::417A to be tried first within the server group RadServer.

Step 6 switch(config-radius)# **no server 2001:0DB8:800:200C::417A**

(Optional) Removes the RADIUS server at IPv6 address 2001:0DB8:800:200C::417A from the server group RadServer.

Step 7 switch(config-radius)# **exit**

Returns to configuration mode.

Step 8 switch(config)# **aaa group server radius RadiusServer**

switch(config-radius)#

Creates a server group named RadiusServer and enters the RADIUS server group configuration submode for that group.

Step 9 switch(config-radius)# **server ServerA**

Configures ServerA to be tried first within the server group called the RadiusServer1.

Tip If the specified RADIUS server is not found, configure it using the **radius-server host** command and retry this command.

Step 10 switch(config-radius)# **server ServerB**

Configures ServerB to be tried second within the server group RadiusServer1.

Step 11 switch(config-radius)# **deadtime 30**

Configures the monitoring dead time to 30 minutes. The range is 0 through 1440.

Note If the dead-time interval for an individual RADIUS server is greater than 0, that value takes precedence over the value set for the server group.

Step 12 switch(config-radius)# **no deadtime 30**

(Optional) Reverts to the default value (0 minutes).

Note If the dead-time interval for both the RADIUS server group and an individual TACACS+ server in the RADIUS server group is set to 0, the switch does not mark the RADIUS server as dead when it is found to be unresponsive by periodic monitoring. Also, the switch does not perform dead server monitoring for that RADIUS server. (See the Configuring RADIUS Server Monitoring Parameters, on page 33 section).

Example

To verify the configured server group order, use the**show radius-server groups** command:

```
switch# show radius-server groups
total number of groups:2
following RAIDUS server groups are configured:
        group RadServer:
                server 10.71.58.91 on port 2
        group RadiusServer1:
```

```
server ServerA on port 49
server ServerB on port 49:
```

About Configuring TACACS+ Server Groups

To configure a TACACS+ server group, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa group server tacacs+ TacacsServer1**

switch(config-tacacs+)#

Creates a server group named TacacsServer1 and enters the submode for that group.

Step 3 switch(config)# **no aaa group server tacacs+ TacacsServer1**

(Optional) Deletes the server group called TacacsServer1 from the authentication list.

Step 4 switch(config-tacacs+)# **server ServerA**

Configures ServerA to be tried first within the server group called the TacacsServer1.

Tip If the specified TACACS+ server is not found, configure it using the **tacacs-server host** command and retry this command.

Step 5 switch(config-tacacs+)# **server ServerB**

Configures ServerB to be tried second within the server group TacacsServer1.

Step 6 switch(config-tacacs+)# **no server ServerB**

(Optional) Deletes ServerB within the TacacsServer1 list of servers.

Step 7 switch(config-tacacs+)# **deadtime 30**

Configures the monitoring dead time to 30 minutes. The range is 0 through 1440.

Note If the dead-time interval for an individual TACACS+ server is greater than 0, that value takes precedence over the value set for the server group.

Step 8 switch(config-tacacs+)# **no deadtime 30**

(Optional) Reverts to the default value (0 minutes).

Note If the dead-time interval for both the TACACS+ server group and an individual TACACS+ server in the TACACS+ server group is set to 0, the switch does not mark the TACACS+ server as dead when it is found to be unresponsive by periodic monitoring. Also, the switch does not perform dead server monitoring for that TACACS+ server. (See the Configuring TACACS+ Server Monitoring Parameters, on page 43 section).

About Bypassing a Nonresponsive Server

As of Cisco SAN-OS Release 3.0(1), you can bypass a nonresponsive AAA server within a server group. If the switch detects a nonresponsive server, it will bypass that server when authenticating users. Use this feature to minimize login delays caused by a faulty server. Instead of sending a request to a nonresponsive server and waiting for the authentication request to timeout, the switch sends the authentication request to the next server in the server group. If there are no other responding servers in the server group, the switch continues to attempt authentications against the nonresponsive server.

AAA Server Distribution

Configuration for RADIUS and TACACS+ AAA on an MDS switch can be distributed using the Cisco Fabric Services (CFS). The distribution is disabled by default (see the Cisco MDS 9000 Family NX-OS System Management Configuration Guide and the Cisco Fabric Manager System Management Configuration Guide).

After enabling the distribution, the first server or global configuration starts an implicit session. All server configuration commands entered thereafter are stored in a temporary database and applied to all switches in the fabric (including the originating one) when you explicitly commit the database. The various server and global parameters are distributed, except the server and global keys. These keys are unique secrets to a switch and should not be shared with other switches.

Note Server group configurations are not distributed.

This section includes the following topics:

Note For an MDS switch to participate in AAA server configuration distribution, it must be running Cisco MDS SAN-OS Release 2.0(1b) or later, or Cisco NX-OS Release 4.1(1).

Enabling AAA RADIUS Server Distribution

Only switches where distribution is enabled can participate in the distribution activity.

To enable RADIUS server distribution, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius distribute**

Enables RADIUS configuration distribution in this switch.

Step 3 switch(config)# **no radius distribute**

(Optional) Disables RADIUS configuration distribution in this switch (default).

Enabling AAA TACACS+ Server Distribution

To enable TACACS+ server distribution, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs+ distribute**

Enables TACACS+ configuration distribution in this switch.

Step 3 switch(config)# **no tacacs+ distribute**

(Optional) Disables TACACS+ configuration distribution in this switch (default).

Starting a Distribution Session on a Switch

A distribution session starts the moment you begin a RADIUS/TACACS+ server or global configuration. For example, the following tasks start an implicit session:

- Specifying the global timeout for RADIUS servers.
- Specifying the global timeout for TACACS+ servers.

Note After you issue the first configuration command related to AAA servers, all server and global configurations that are created (including the configuration that caused the distribution session start) are stored in a temporary buffer, not in the running configuration.

Displaying the Session Status

Once the implicit distribution session has started, you can check the session status from Fabric Manager by expanding Switches > Security > AAA, and selecting RADIUS or TACACS+.

Use the **show radius** command to see the **distribution status** on the CFS tab.

```
switch# show radius distribution status

distribution : enabled
session ongoing: yes
session owner: admin
session db: exists
merge protocol status: merge activation done
last operation: enable
last operation status: success
```

Once the implicit distribution session has started, you can check the session status using the **show tacacs+ distribution status** command.

```
switch# show tacacs+ distribution status

distribution : enabled
session ongoing: yes
session owner: admin
session db: exists
merge protocol status: merge activation done
last operation: enable
last operation status: success
```

Displaying the Pending Configuration to be Distributed

To display the RADIUS or TACACS+ global and/or server configuration stored in the temporary buffer use the **show radius pending** command, follow these steps:

```
switch(config)# show radius pending-diff

   +radius-server host testhost1 authentication accounting
   +radius-server host testhost2 authentication accounting
```

To display the TACACS+ global and/or server configuration stored in the temporary buffer, use the **show tacacs+ pending** command.

```
switch(config)# show tacacs+ pending-diff

   +tacacs-server host testhost3
   +tacacs-server host testhost4
```

Committing the RADIUS Distribution

The RADIUS or TACACS+ global and/or server configuration stored in the temporary buffer can be applied to the running configuration across all switches in the fabric (including the originating switch).

To commit RADIUS configuration changes, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius commit**

Commits the RADIUS configuration changes to the running configuration.

Committing the TACACS+ Distribution

To commit TACACS+ configuration changes, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs+ commit**

Commits the TACACS+ configuration changes to the running configuration.

Discarding the RADIUS Distribution Session

Discarding the distribution of a session in progress causes the configuration in the temporary buffer to be dropped. The distribution is not applied.

To discard the RADIUS session in-progress distribution, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **radius abort**

Discards the RADIUS configuration changes to the running configuration.

Discarding the TACACS+ Distribution Session

To discard the TACACS+ session in-progress distribution, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **tacacs+ abort**

Discards the TACACS+ configuration changes to the running configuration.

Clearing Sessions

To clear the ongoing CFS distribution session (if any) and to unlock the fabric for the RADIUS feature, enter the **clear radius session** command from any switch in the fabric.

```
switch# clear radius session
```

To clear the ongoing CFS distribution session (if any) and to unlock the fabric for the TACACS+ feature, enter the **clear tacacs+ session** command from any switch in the fabric.

```
switch# clear tacacs+ session
```

Merge Guidelines for RADIUS and TACACS+ Configurations

The RADIUS and TACACS+ server and global configuration are merged when two fabrics merge. The merged configuration is applied to CFS distribution-enabled switches.

When merging the fabric, be aware of the following conditions:

- The server groups are not merged.
- The server and global keys are not changed during the merge.
- The merged configuration contains all servers found on all CFS enabled switches.
- The timeout and retransmit parameters of the merged configuration are the largest values found per server and global configuration.

Note The test parameter will be distributed through CFS for TACACS+ Daemon only. If the fabric contains only NX-OS Release 5.0 switches, then the test parameters will be distributed. If the fabric contains switches running 5.0 versions and some running NX-OS 4.x release, the test parameters will be not distributed.

Caution If there is a conflict between two switches in the server ports configured, the merge fails.

Use the **show radius distribution status** command to view the status of the RADIUS fabric merge as shown in the following example.

Displays the RADIUS Fabric Merge Status

```
switch# show radius distribution status

distribution : enabled
session ongoing: no
session db: does not exist
merge protocol status: merge response received
merge error: conflict: server dmtest2 has auth-port 1812 on this switch and 1999
on remote
last operation: enable
last operation status: success
```

Displays the TACACS+ Fabric Merge Status

Use the **show tacacs+ distribution status** command to view the status of the TACACS+ fabric merge as shown in the following example.

```
switch# show tacacs+ distribution status

distribution : enabled
session ongoing: no
session db: does not exist
merge protocol status: merge activation done
last operation: enable
last operation status: success
```

CHAP Authentication

CHAP (Challenge Handshake Authentication Protocol) is a challenge-response authentication protocol that uses the industry-standard Message Digest 5 (MD5) hashing scheme to encrypt the response. CHAP is used by various vendors of network access servers and clients. A server running routing and Remote Access supports CHAP so that remote access clients that require CHAP are authenticated. CHAP is supported as an authentication method in this release.

Enabling CHAP Authentication

To enable CHAP authentication, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa authentication login chap enable**

Enables CHAP login authentication.

Step 3 switch# **no aaa authentication login chap enable**

(Optional) Disables CHAP login authentication.

Example

You can use the **show aaa authentication login chap** command to display the CHAP authentication configuration.

```
switch# show aaa authentication login chap

chap is disabled
```

MSCHAP Authentication

Microsoft Challenge Handshake Authentication Protocol (MSCHAP) is the Microsoft version of CHAP.

Cisco MDS 9000 Family switches allow user logins to perform remote authentication using different versions of MSCHAP. MSCHAP is used for authentication on a RADIUS or TACACS+ server, while MSCHAPv2 is used for authentication on a RADIUS server.

About Enabling MSCHAP

By default, the switch uses Password Authentication Protocol (PAP) authentication between the switch and the remote server. If you enable MSCHAP, you need to configure your RADIUS server to recognize the MSCHAP vendor-specific attributes. See the About Vendor-Specific Attributes, on page 38. The following table shows the RADIUS vendor-specific attributes required for MSCHAP.

Table 4: MSCHAP RADIUS Vendor-Specific Attributes

Vendor-ID Number	Vendor-Type Number	Vendor-Specific Attribute	Description
311	11	MSCHAP-Challenge	Contains the challenge sent by an AAA server to an MSCHAP user. It can be used in both Access-Request and Access-Challenge packets.
211	11	MSCHAP-Response	Contains the response value provided by an MS-CHAP user in response to the challenge. It is only used in Access-Request packets.

Enabling MSCHAP Authentication

To enable MSCHAP authentication, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa authentication login mschap enable**

Enables MSCHAP login authentication.

Step 3 switch# **no aaa authentication login mschap enable**

(Optional) Disables MSCHAP login authentication.

Enabling MSCHAPv2 Authentication

To enable MSCHAPv2 authentication, follow these steps:

Procedure

Step 1 switch# **configure terminal**

Enters configuration mode.

Step 2 switch(config)# **aaa authentication login mschapv2 enable**

Enables MSCHAPv2 login authentication.

Step 3 switch# **no aaa authentication login mschapv2 enable**

(Optional) Disables MSCHAPv2 login authentication.

Example

Note

- Password aging, MSCHAPv2 and MSCHAP authentication can fail if one of these authentication is not disabled.
- A warning message is issued when you execute a command to enable MSCHAPv2 authentication on the TACACS+ server, and the configuration fails.

You can use the **show aaa authentication login mschap** command to display the MSCHAP authentication configuration.

```
switch# show aaa authentication login mschap

mschap is disabled
```

You can use the **show aaa authentication login mschapv2** command to display the MSCHAPv2 authentication configuration.

```
switch# show aaa authentication login mschapv2

mschapv2 is enabled
```

Local AAA Services

The system maintains the username and password locally and stores the password information in encrypted form. You are authenticated based on the locally stored user information.

Use the **username** command to configure local users and their roles.

Use the **show accounting log** command to view the local accounting log as shown in the following example.

Displays the Accounting Log Information

```
switch# show accounting log

Thu Dec 10 06:19:21 2009:type=update:id=console0:user=root:cmd=enabled telnet
Thu Dec 10 06:19:21 2009:type=update:id=console0:user=root:cmd=configure terminal ; feature
 telnet
(SUCCESS)
Thu Dec 10 06:19:35 2009:type=start:id=171.69.16.56@pts/1:user=admin:cmd=
Thu Dec 10 06:20:16 2009:type=stop:id=171.69.16.56@pts/1:user=admin:cmd=shell te
rminated gracefully
Thu Dec 10 06:20:20 2009:type=stop:id=console0:user=root:cmd=shell terminated gr
acefully
Thu Dec 10 06:29:37 2009:type=start:id=72.163.177.168@pts/1:user=admin:cmd=
Thu Dec 10 06:29:42 2009:type=update:id=72.163.177.168@pts/1:user=admin:cmd=pwd
(SUCCESS)
Thu Dec 10 06:32:49 2009:type=start:id=72.163.190.8@pts/2:user=admin:cmd=
```

Disabling AAA Authentication

You can turn off password verification using the **none** option. If you configure this option, users can log in without giving a valid password. But the user should at least exist locally on the Cisco MDS 9000 Family switch.

⚠ **Caution** Use this option cautiously. If configured, any user can access the switch at any time.

Refer to the*Cisco MDS 9000 Family NX-OS Security Configuration Guide* to configure this option.

Use the **none** option in the **aaa authentication login** command to disable password verification.

A user created by entering the **username** command will exist locally on the Cisco MDS 9000 Family switch.

Displaying AAA Authentication

The **show aaa authentication** command displays the configured authentication methods as shown in the following example.

Displays Authentication Information

```
switch# show aaa authentication

    No AAA Authentication
    default: group TacServer local none
    console: local none
    iscsi: local
    dhchap: local
```

Configuring Accounting Services

Accounting refers to the log information that is kept for each management session in a switch. This information may be used to generate reports for troubleshooting and auditing purposes. Accounting can be implemented locally or remotely (using RADIUS). The default maximum size of the accounting log is 250,000 bytes and cannot be changed.

Tip The Cisco MDS 9000 Family switch uses interim-update RADIUS accounting-request packets to communicate accounting log information to the RADIUS server. The RADIUS server must be appropriately configured to log the information communicated in these packets. Several servers typically have log update/watchdog packets flags in the AAA client configuration. Turn on this flag to ensure proper RADIUS accounting.

Note Configuration operations are automatically recorded in the accounting log if they are performed in configuration mode. Additionally, important system events (for example, configuration save and system switchover) are also recorded in the accounting log.

Displaying Accounting Configuration

To display configured accounting information use **show accounting** command. See the following examples. To specify the size of the local accounting log to be displayed, use the **show accounting log** command. By default approximately 250 KB of the accounting log is displayed.

Displays Two Samples of Configured Accounting Parameters

```
switch# show accounting config

show aaa accounting
default: local

switch# show aaa accounting

default: group rad1
```

Displays 60,000 Bytes of the Accounting Log

```
switch# show accounting log 60000

Fri Jan 16 15:28:21 1981:stop:snmp_348506901_64.104.131.208:admin:
Fri Jan 16 21:17:04 1981:start:/dev/pts/0_348527824:admin:
Fri Jan 16 21:35:45 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
Fri Jan 16 21:35:51 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
Fri Jan 16 21:35:51 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group5
Fri Jan 16 21:35:55 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group5
Fri Jan 16 21:35:55 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group3
```

```
Fri Jan 16 21:58:17 1981:start:snmp_348530297_171.71.150.105:admin:
...
```

Displays the Entire Log File

```
switch# show accounting log

Fri Jan 16 15:28:21 1981:stop:snmp_348506901_64.104.131.208:admin:
Fri Jan 16 21:17:04 1981:start:/dev/pts/0_348527824:admin:
Fri Jan 16 21:35:45 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
Fri Jan 16 21:35:51 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
Fri Jan 16 21:35:51 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group5
Fri Jan 16 21:35:55 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group5
Fri Jan 16 21:35:55 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group3
Fri Jan 16 21:58:17 1981:start:snmp_348530297_171.71.150.105:admin:
Fri Jan 16 21:58:17 1981:stop:snmp_348530297_171.71.150.105:admin:
Fri Jan 16 21:58:18 1981:start:snmp_348530298_171.71.150.105:admin:
Fri Jan 16 21:58:18 1981:stop:snmp_348530298_171.71.150.105:admin:
...
Fri Jan 16 23:37:02 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group3
Fri Jan 16 23:37:26 1981:update:/dev/pts/0_348527824:admin:updated TACACS+ parameters for
group:TacacsServer1
Fri Jan 16 23:45:19 1981:update:/dev/pts/0_348527824:admin:updated TACACS+ parameters for
group:TacacsServer1
Fri Jan 16 23:45:19 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
...
Fri Jan 16 23:53:51 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
server:Server3
Fri Jan 16 23:54:00 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
server:Server5
Fri Jan 16 23:54:22 1981:update:/dev/pts/0_348527824:admin:updated TACACS+ parameters for
server:ServerA
Fri Jan 16 23:54:25 1981:update:/dev/pts/0_348527824:admin:updated TACACS+ parameters for
server:ServerB
Fri Jan 16 23:55:03 1981:update:/dev/pts/0_348527824:admin:updated RADIUS parameters for
group:Group1
...
Sat Jan 17 00:01:41 1981:start:snmp_348537701_171.71.58.100:admin:
Sat Jan 17 00:01:41 1981:stop:snmp_348537701_171.71.58.100:admin:
Sat Jan 17 00:01:42 1981:start:snmp_348537702_171.71.58.100:admin:
Sat Jan 17 00:01:42 1981:stop:snmp_348537702_171.71.58.100:admin:
...
```

Clearing Accounting Logs

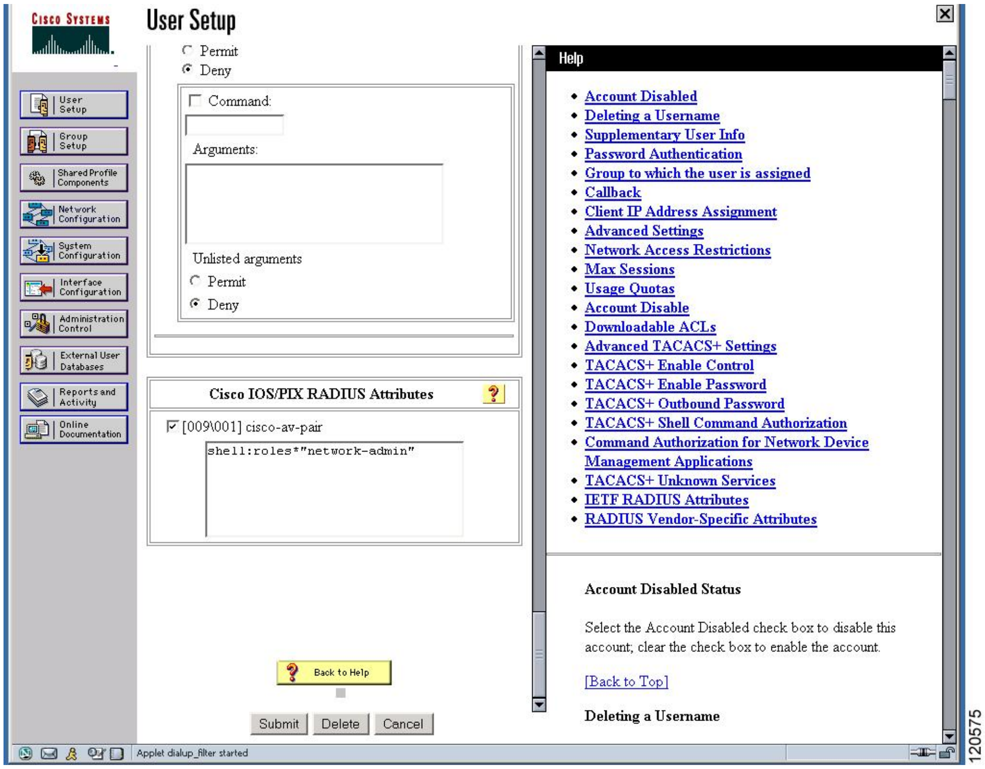
To clear out the contents of the current log, use the **clear accounting log** command.

```
switch# clear accounting log
```

Configuring Cisco Access Control Servers

The Cisco Access Control Server (ACS) uses TACACS+ and RADIUS protocols to provide AAA services that ensure a secure environment.When using the AAA server, user management is normally done using Cisco ACS. Figure 3: Configuring the network-admin Role When Using RADIUS, on page 69, Figure 4: Configuring Multiple Roles with SNMPv3 Attributes When Using RADIUS, on page 70, Figure 5: Configuring the network-admin Role with SNMPv3 Attributes When Using TACACS+, on page 71, and Figure 6: Configuring Multiple Roles with SNMPv3 Attributes When Using TACACS+, on page 72 display ACS server user setup configurations for network-admin roles and multiple roles using either RADIUS or TACACS+.

Figure 3: Configuring the network-admin Role When Using RADIUS



○ Permit
● Deny

☐ Command:

Arguments:

Unlisted arguments
○ Permit
● Deny

Cisco IOS/PIX RADIUS Attributes

☑ [009\001] cisco-av-pair

```
shell:roles*"network-admin"
```

Account Disabled Status

Select the Account Disabled check box to disable this account; clear the check box to enable the account.

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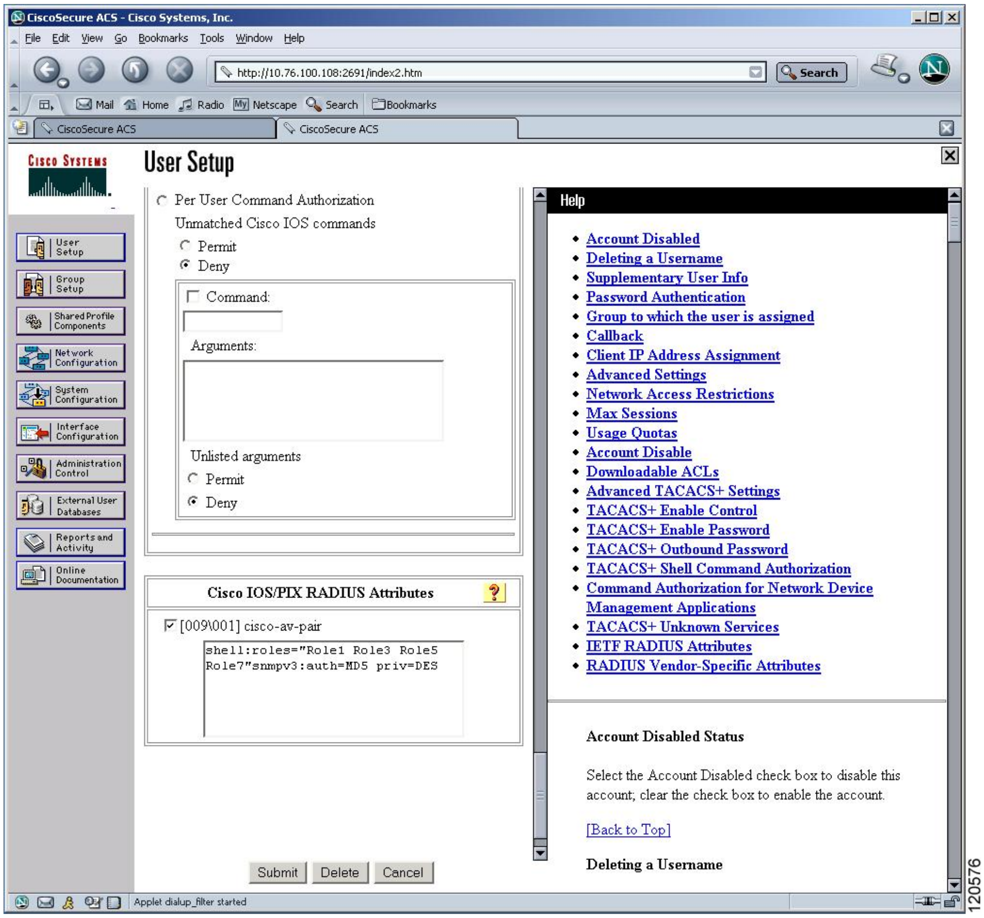
Deleting a Username

Figure 4: Configuring Multiple Roles with SNMPv3 Attributes When Using RADIUS



User Setup

○ Per User Command Authorization

Unmatched Cisco IOS commands

○ Permit

● Deny

□ Command:

Arguments:

Unlisted arguments

○ Permit

● Deny

Cisco IOS/PIX RADIUS Attributes

☑ [009\001] cisco-av-pair

```
shell:roles="Role1 Role3 Role5
Role7"snmpv3:auth=MD5 priv=DES
```

- Account Disabled
- Deleting a Username
- Supplementary User Info
- Password Authentication
- Group to which the user is assigned
- Callback
- Client IP Address Assignment
- Advanced Settings
- Network Access Restrictions
- Max Sessions
- Usage Quotas
- Account Disable
- Downloadable ACLs
- Advanced TACACS+ Settings
- TACACS+ Enable Control
- TACACS+ Enable Password
- TACACS+ Outbound Password
- TACACS+ Shell Command Authorization
- Command Authorization for Network Device Management Applications
- TACACS+ Unknown Services
- IETF RADIUS Attributes
- RADIUS Vendor-Specific Attributes

Account Disabled Status

Select the Account Disabled check box to disable this account; clear the check box to enable the account.

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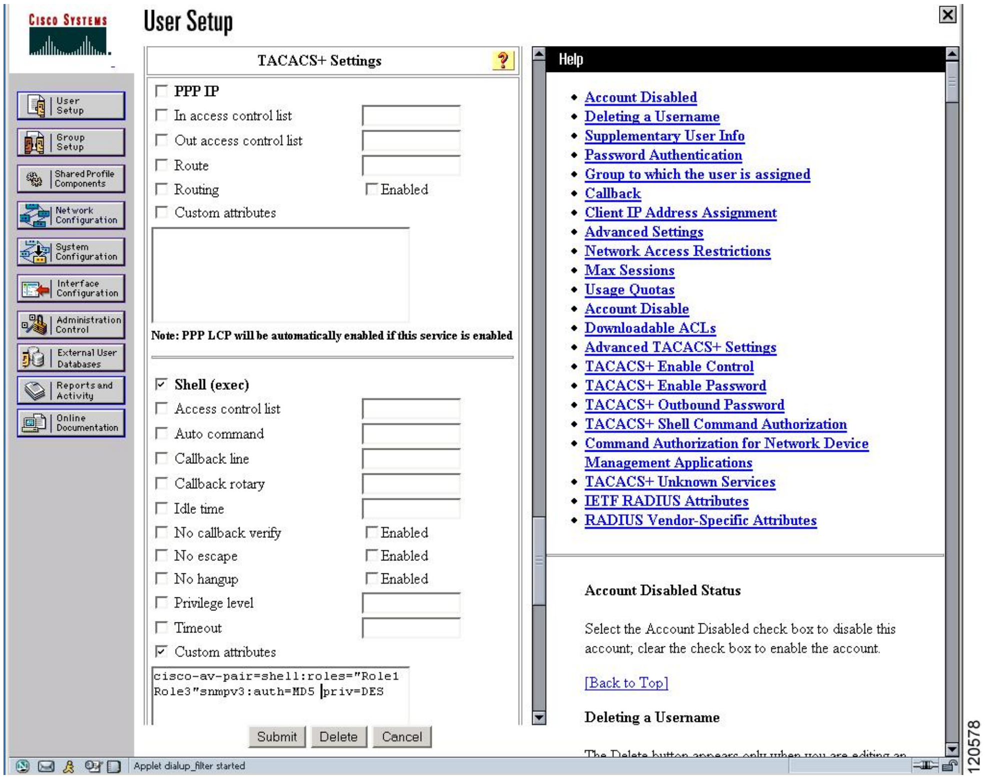
Deleting a Username

Figure 5: Configuring the network-admin Role with SNMPv3 Attributes When Using TACACS+



TACACS+ Settings

□ PPP IP

□ In access control list

□ Out access control list

□ Route

□ Routing □ Enabled

□ Custom attributes

Note: PPP LCP will be automatically enabled if this service is enabled

☑ Shell (exec)

□ Access control list

□ Auto command

□ Callback line

□ Callback rotary

□ Idle time

□ No callback verify □ Enabled

□ No escape □ Enabled

□ No hangup □ Enabled

□ Privilege level

□ Timeout

☑ Custom attributes

```
cisco-av-pair=shell:roles="Role1
Role3"snmpv3:auth=MD5 priv=DES
```

Help

- Account Disabled
- Deleting a Username
- Supplementary User Info
- Password Authentication
- Group to which the user is assigned
- Callback
- Client IP Address Assignment
- Advanced Settings
- Network Access Restrictions
- Max Sessions
- Usage Quotas
- Account Disable
- Downloadable ACLs
- Advanced TACACS+ Settings
- TACACS+ Enable Control
- TACACS+ Enable Password
- TACACS+ Outbound Password
- TACACS+ Shell Command Authorization
- Command Authorization for Network Device Management Applications
- TACACS+ Unknown Services
- IETF RADIUS Attributes
- RADIUS Vendor-Specific Attributes

Account Disabled Status

Select the Account Disabled check box to disable this account; clear the check box to enable the account.

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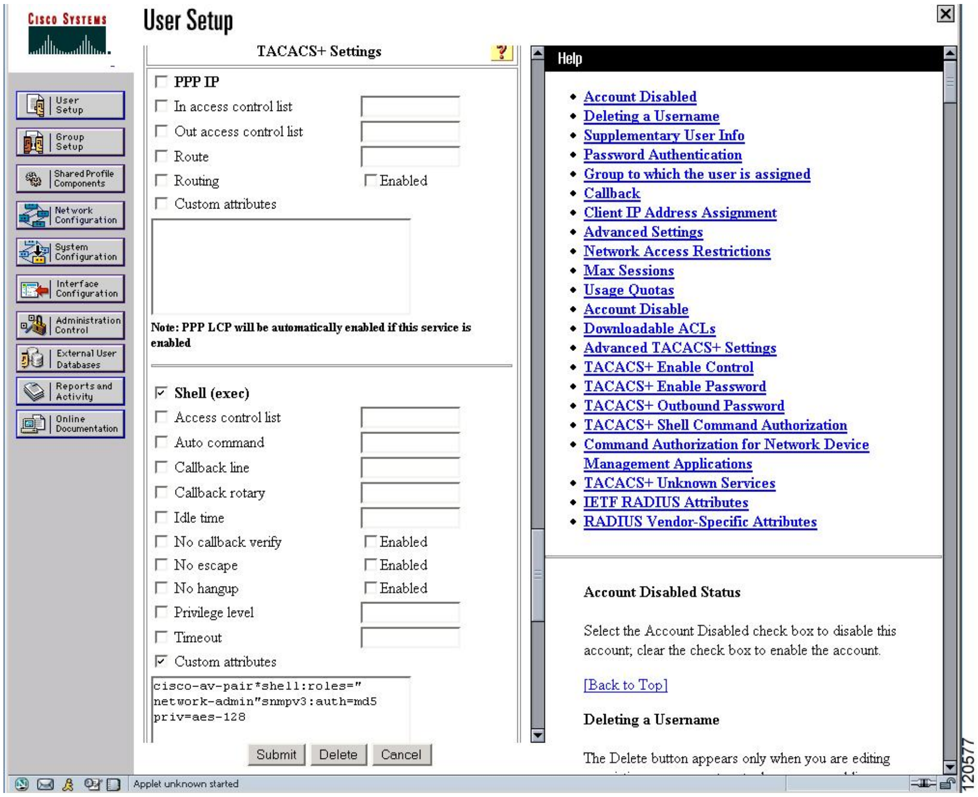
Deleting a Username

The Delete button appears only when you are editing an

Figure 6: Configuring Multiple Roles with SNMPv3 Attributes When Using TACACS+



TACACS+ Settings

□ PPP IP

□ In access control list

□ Out access control list

□ Route

□ Routing □ Enabled

□ Custom attributes

Note: PPP LCP will be automatically enabled if this service is enabled

☑ Shell (exec)

□ Access control list

□ Auto command

□ Callback line

□ Callback rotary

□ Idle time

□ No callback verify □ Enabled

□ No escape □ Enabled

□ No hangup □ Enabled

□ Privilege level

□ Timeout

☑ Custom attributes

```
cisco-av-pair*shell:roles="
network-admin"snmpv3:auth=md5
priv=aes-128
```

Help

- Account Disabled
- Deleting a Username
- Supplementary User Info
- Password Authentication
- Group to which the user is assigned
- Callback
- Client IP Address Assignment
- Advanced Settings
- Network Access Restrictions
- Max Sessions
- Usage Quotas
- Account Disable
- Downloadable ACLs
- Advanced TACACS+ Settings
- TACACS+ Enable Control
- TACACS+ Enable Password
- TACACS+ Outbound Password
- TACACS+ Shell Command Authorization
- Command Authorization for Network Device Management Applications
- TACACS+ Unknown Services
- IETF RADIUS Attributes
- RADIUS Vendor-Specific Attributes

Account Disabled Status

Select the Account Disabled check box to disable this account; clear the check box to enable the account.

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Deleting a Username

The Delete button appears only when you are editing

Default Settings

The following table lists the default settings for all switch security features in any switch.

Table 5: Default Switch Security Settings

Parameters	Default
Roles in Cisco MDS switches	Network operator (network-operator)
AAA configuration services	Local
Authentication port	1812
Accounting port	1813
Preshared key communication	Clear text
RADIUS server timeout	1 (one) second
RADIUS server retries	Once
Authorization	Disabled

Parameters	Default
aaa user default role	enabled
RADIUS server directed requests	Disabled
TACACS+	Disabled
TACACS+ servers	None configured
TACACS+ server timeout	5 seconds
TACACS+ server directed requests	Disabled
AAA server distribution	Disabled
Accounting log size	250 KB