



## CHAPTER 4

# Configuring Security Features on an External AAA Server

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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 topics:

- [Information About Switch Management Security, page 4-1](#)
- [Guidelines and Limitations, page 4-15](#)
- [Default Settings, page 4-16](#)
- [Configuring the RADIUS, TACACS+, and LDAP Server, page 4-16](#)
- [Verifying RADIUS and TACACS+ Configuration, page 4-34](#)
- [Feature History for RADIUS, TACACS+, and LDAP, page 4-36](#)

## Information About 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:

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## Security Options

You can access DCNM-SAN using TCP/UDP SNMP or HTTP traffic. For each management path (console, Telnet, and SSH), you can configure one or more of the following security control options: local, remote (RADIUS or TACACS+), or none.

- Remote security control
  - Using RADIUS  
[See the “Configuring the RADIUS, TACACS+, and LDAP Server” section on page 4-16](#)
  - Using TACACS+  
[See the “Configuring the RADIUS, TACACS+, and LDAP Server” section on page 4-16](#)
- Local security control.  
[See the “Local AAA Services” section on page 4-14.](#)

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

- iSCSI authentication  
[See the \*IP Services Configuration Guide, Cisco DCNM for SAN\*.](#)
- Fibre Channel Security Protocol (FC-SP) authentication  
[See Chapter 8, “Configuring FC-SP and DHCHAP.”](#)

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## 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 DCNM for SAN).

SNMP security options also apply to DCNM for SAN 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 DCNM Fundamentals Guide* for information on DCNM for SAN and Device Manager.

## Switch AAA Functionalities

Using the CLI or DCNM for SAN (DCNM-SAN), 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, page 4-3](#)
- [Authorization, page 4-4](#)
- [Accounting, page 4-4](#)
- [Remote AAA Services, page 4-4](#)
- [Remote Authentication Guidelines, page 4-15](#)
- [Server Groups, page 4-4](#)
- [Authentication and Authorization Process, page 4-6](#)

## 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

When you log in to a Cisco MDS switch successfully using DCNM-SAN 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.



### Note

DCNM-SAN does not support AAA passwords with trailing white space, for example “passwordA.”

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## 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 (DCNM-SAN 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.

## 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.

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## 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 (DCNM-SAN and Device Manager login)
- Console login
- iSCSI authentication (see the *IP Services Configuration Guide, Cisco DCNM for SAN*).
- FC-SP authentication (see [Chapter 8, “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 (See section [“Configuring Fallback Mechanism for Authentication”](#) section on page 4-18).

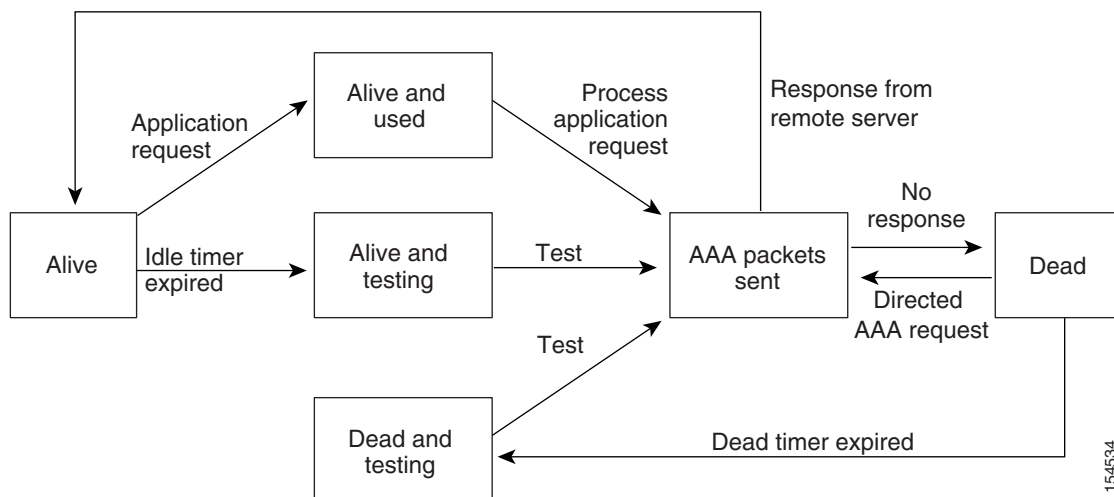
When RADIUS times out, local login is attempted depending on the fallback configuration. For this local login to be successful, a local account for the user with the same password should exist, and the RADIUS timeout and retries should take less than 40 seconds. The user is authenticated if the username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

## 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 4-1](#) for AAA server states.

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**Figure 4-1 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 the RADIUS, TACACS+, and LDAP Server”](#) section on page 4-16.

## 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).

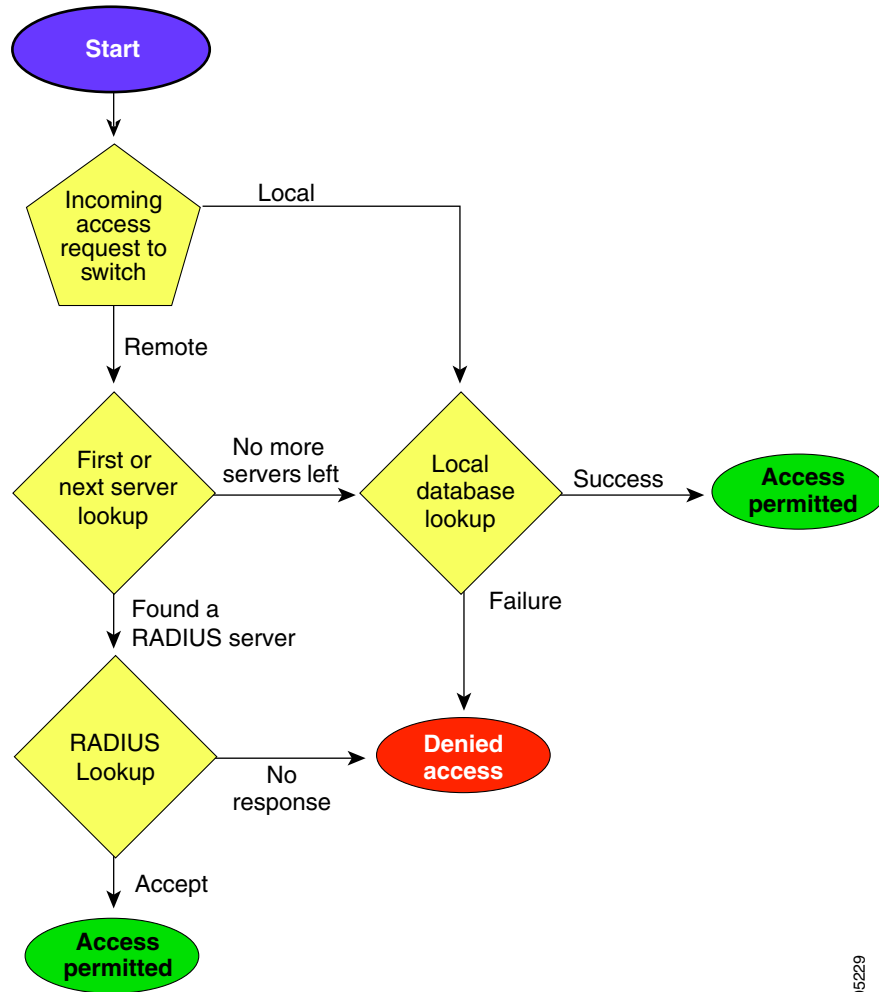
Authorization provides access control. It is the process of assembling a set of attributes that describe what the user is authorized to perform. Based on the user ID and password combination, the user is authenticated and authorized to access the network as per the assigned role. You can configure parameters 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.

Figure 4-2 shows a flow chart of the authorization and authentication process.

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**Figure 4-2 Switch Authorization and Authentication Flow**



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**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.

## Global AAA Server Monitoring Parameters

The global AAA server monitoring parameters function as follows:

- 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) the server 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 are not affected. However, monitoring stops for all other servers that were previously being monitored using global parameters.

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- If the server monitoring fails with the user-specified server test parameters, the server monitoring does not fall back to global test parameters.

## About RADIUS Server Default Configuration

DCNM-SAN 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

## 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.

## 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 an LDAP Server” section on page 4-19](#).

## 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).



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**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 an LDAP Server” section on page 4-19](#).

## 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 only test.

## 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.

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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 ..."
```

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.

## 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 shortcomings that are associated with usual (static) passwords. The most vital shortcoming that is addressed by OTPs is that, in contrast to static passwords, 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 because it is no longer valid.

One-time password applies only to RADIUS and TACACS protocol daemons. In the case of the RADIUS protocol daemon, there is no configuration required from the switch side. In the case of the TACACS protocol, ASCII authentication mode needs to be enabled.

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## 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

DCNM-SAN 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 an individual TACACS+ server.

## About TACACS+ Servers

By default, the TACACS+ feature is disabled in all switches in the Cisco MDS 9000 Family. DCNM-SAN 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.

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**Note**

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

## 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, RADIUS generates a SYSLOG message and authentication falls 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.

## 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 DCNM-SAN, see the [“Configuring the RADIUS, TACACS+, and LDAP Server”](#) section on page 4-16.

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## 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.

## 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 *System Management Configuration Guide, Cisco DCNM for SAN*).

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.

**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).

## Starting a Distribution Session on a Switch

A distribution session starts the moment you begin a RADIUS or 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.

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## CHAP Authentication

Challenge Handshake Authentication Protocol (CHAP) 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.

## 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” section on page 4-9](#). [Table 4-1](#) shows the RADIUS vendor-specific attributes required for MSCHAP.

**Table 4-1 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.

## 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.

## 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.

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**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.

## Guidelines and Limitations

This section has the following topics:

- [Remote Authentication Guidelines, page 4-15](#)
- [Merge Guidelines for RADIUS and TACACS+ Configurations, page 4-15](#)

## 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 *IP Services Configuration Guide, Cisco DCNM for SAN*). 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.

## 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.

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**Note**

Test parameter will be distributed via CFS for TACACS+ Daemon only. If the fabric contains only Cisco NX-OS Release 5.0 devices, then the test parameters will be distributed. If the fabric contains devices running Release 5.0 and some running Release 4.x, the test parameters are not distributed.

**Caution**

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

## Default Settings

Table 4-2 lists the default settings for all switch security features in any switch.

**Table 4-2 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
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

## Configuring the RADIUS, TACACS+, and LDAP Server

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.



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

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:

- [Authorizing and Authenticating the Switch, page 4-17](#)
- [Configuring Fallback Mechanism for Authentication, page 4-18](#)
- [Configuring the Default RADIUS Server Encryption Type and Preshared Key, page 4-18](#)
- [Setting the Default RADIUS Server Timeout Interval and Retransmits, page 4-19](#)
- [Configuring an LDAP Server, page 4-19](#)
- [Validating a RADIUS Server, page 4-23](#)
- [Allowing Users to Specify a RADIUS Server at Login, page 4-23](#)
- [Setting the Default TACACS+ Server Encryption Type and Preshared Key, page 4-24](#)
- [Setting the Default TACACS+ Server Timeout Interval and Retransmits, page 4-24](#)
- [Configuring a TACACS+ Server, page 4-24](#)
- [Allowing Users to Specify a TACACS+ Server at Login, page 4-26](#)
- [Configuring Server Groups, page 4-26](#)
- [Enabling AAA Server Distribution, page 4-27](#)
- [Committing the Distribution, page 4-28](#)
- [Discarding the Distribution Session, page 4-28](#)
- [Clearing Sessions, page 4-29](#)
- [Enabling MSCHAP Authentication, page 4-29](#)
- [Configuring Cisco Access Control Servers, page 4-30](#)

## Authorizing and Authenticating the Switch

### Detailed Steps

To authorize and authenticate the switch, follow these steps:

- 
- |               |   |
|---------------|---|
| <b>Step 1</b> | Log in to the required switch in the Cisco MDS 9000 Family, using the Telnet, SSH, DCNM-SAN or Device Manager, or console login options.  |
| <b>Step 2</b> | 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. <ul style="list-style-type: none"><li>• 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.</li><li>• If all AAA servers in the server group fail to respond, then the servers in the next server group are contacted.</li><li>• 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.</li></ul> |

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- 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.
- 

## Configuring Fallback Mechanism for Authentication

You can enable or disable fallback to the local database in case the remote authentication is set and all of the 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 or Telnet login. Disabling this fallback tightens the authentication security.

### Detailed Steps

To configure the fallback mechanism, follow this step:

- Step 1** Enter the **show run aaa all** command to verify that the default fallback is enabled for both the default and console login.
- Disabling fallback will print a warning message.
- 



#### Caution

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

---

## Configuring the Default RADIUS Server Encryption Type and Preshared Key

### Detailed Steps

To configure the default RADIUS server encryption type and preshared key, follow these steps:

- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS**.  
You see the RADIUS configuration in the Information pane.
- Step 2** Click the **Defaults** tab.
- Step 3** Select **plain** or **encrypted** from the AuthType drop-down menu.
- Step 4** Set the key in the Auth Key field.

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**Step 5** Click the **Apply Changes** icon to save the changes.

---

## 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.

### Detailed Steps

To configure the number of retransmissions and the time between retransmissions to the RADIUS servers, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS**.  
You see the RADIUS configuration in the Information pane.
- Step 2** Choose the **Defaults** tab.  
You see the RADIUS default settings.
- Step 3** Fill in the Timeout and Retransmits fields for authentication attempts.
- Step 4** Click the **Apply Changes** icon to save the changes.
- 

## Configuring an LDAP Server

### Detailed Steps

To configure an LDAP server and all of its options, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **LDAP**.  
You see the LDAP configuration in the Information pane.
- Step 2** Click the **Servers** tab.  
You see any existing RADIUS servers.
- Step 3** Click **Create Row** to add a new LDAP server.  
You see the Create LDAP Server dialog box.

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**Figure 4-3 LDAP Server Creation**

The screenshot shows the 'LDAP Server Creation' dialog box. It has a title bar with the path '/SAN/Fabric\_sw172-22-46-223/Switches/Security/A...'. The main area contains several sections: a 'Switches' list with five entries (sw172-22-46-174, sw172-22-46-220, sw172-22-47-133, mchinn-n5k, sw172-22-47-167) each with a checked checkbox; an 'Index' text field; 'IP Address Type' with radio buttons for 'ipv4' (selected), 'ipv6', and 'dns'; a 'Name or IP Address' text field; 'AuthPort' (1812) and 'AcctPort' (1813) with spinners and a range of 0..65535; an 'Override Defaults' section with 'KeyType' radio buttons for 'plain' (selected), 'encrypted', and 'notConfigured'; a 'Key' text field; 'TimeOut' (0) with a spinner and range 0..60 (s); 'Retransmits' (0) with a spinner and range 0..5 (0=default); 'IdleTime' (0) with a spinner and range 0..1440 (m); 'TestUser', 'TestPassword', 'RootDN', and 'RootDNPassword' text fields; and an 'SSLMode' checkbox. At the bottom right are 'Create' and 'Close' buttons. A vertical label '310172' is on the right edge of the dialog.

- Step 4** Select the switches that you want to assign as LDAP servers.
- Step 5** Assign an index number to identify the LDAP server.
- Step 6** Select the IP address type for the LDAP server.
- Step 7** Fill in the IP address or name for the LDAP server.
- Step 8** (Optional) Modify the authentication and accounting ports used by this LDAP server.
- Step 9** Select the appropriate key type for the LDAP server.
- Step 10** Select the TimeOut value in seconds. The valid range is 0 to 60 seconds.
- Step 11** Select the number of times the switch tries to connect to an LDAP server(s) before reverting to local authentication.
- Step 12** Enter the test idle time interval value in minutes. The valid range is 1 to 1440 minutes.
- Step 13** Enter the test user with the default password. The default username is test.
- Step 14** Click **Create** to save these changes.

## Creating LDAP Search Map

To create an LDAP search map, follow these steps:

- Step 1** Expand **Switches > Security > AAA**, and then select **LDAP**.

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You see the LDAP configuration in the Information pane.

- Step 2** Click the **Search Map** tab.
  - Step 3** Click **Create Row** to add a new LDAP search map.
  - Step 4** Enter the LDAP search map name for the **Name** field.
  - Step 5** Select the appropriate search type for the **Type** field.
  - Step 6** Enter the base domain name for the **BaseDN** field.
  - Step 7** Enter the filter value for the **Filter** field.
  - Step 8** Enter the attribute value for the **Attribute** field.
  - Step 9** Click **Create** to save the changes.
- 

## Configuring a RADIUS Server

### Detailed Steps

To configure a RADIUS server and all its options, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS**.  
You see the RADIUS configuration in the Information pane.
  - Step 2** Click the **Servers** tab.  
You see any existing RADIUS servers.
  - Step 3** Click **Create Row** to add a new RADIUS server.  
You see the Create RADIUS Server dialog box shown in [Figure 4-4](#).

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**Figure 4-4 Create RADIUS Server**

The screenshot shows a dialog box titled "/SAN/Fabric v\_185/Switches/Security/AAA/RADIUS/S...". It contains the following fields and options:

- Switches:** A list box containing "v\_185" with a green checkmark.
- Index:** An empty text field.
- IP Address Type:** Radio buttons for "ipv4" (selected), "ipv6", and "dns".
- Name or IP Address:** An empty text field.
- AuthPort:** A spin box set to 1812, with a range of 0..65535.
- AcctPort:** A spin box set to 1813, with a range of 0..65535.
- Override Defaults:** A section with:
  - KeyType:** Radio buttons for "plain" (selected), "encrypted", and "notConfigured".
  - Key:** An empty text field.
  - TimeOut (s):** A spin box set to 0, with a range of 0..60 sec.
  - Retransmits:** A spin box set to 0, with a range of 0..5 (0=default).
  - IdleTime (m):** A spin box set to 0.
  - TestUser:** An empty text field.
  - TestPassword:** An empty text field.
- Buttons:** "Create" and "Close" buttons at the bottom right.

- Step 4** Select the switches that you want to assign as RADIUS servers.
- Step 5** Assign an index number to identify the RADIUS server.
- Step 6** Select the IP address type for the RADIUS server.
- Step 7** Fill in the IP address or name for the RADIUS server.
- Step 8** (Optional) Modify the authentication and accounting ports used by this RADIUS server.
- Step 9** Select the appropriate key type for the RADIUS server.
- Step 10** Select the TimeOut value in seconds. The valid range is 0 to 60 seconds.
- Step 11** Select the number of times the switch tries to connect to a RADIUS server(s) before reverting to local authentication.
- Step 12** Enter the test idle time interval value in minutes. The valid range is 1 to 1440 minutes.
- Step 13** Enter the test user with the default password. The default username is test.
- Step 14** Click **Create** to save these changes.

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## Validating a RADIUS Server

### Detailed Steps

To configure the switch to periodically test a RADIUS server, follow these steps:

- 
- |               |  |
|---------------|--|
| <b>Step 1</b> | Expand <b>Switches &gt; Security &gt; AAA</b> , and then select <b>RADIUS</b> .<br>You see the RADIUS configuration in the Information pane. |
| <b>Step 2</b> | Click the <b>Servers</b> tab.<br>You see any existing RADIUS servers.  |
| <b>Step 3</b> | Click <b>Create Row</b> to add a new RADIUS server.<br>You see the Create RADIUS Server dialog box (see <a href="#">Figure 4-4</a> ).        |
| <b>Step 4</b> | Fill in the IP address.  |
| <b>Step 5</b> | Modify the authentication and accounting ports used by this RADIUS server.   |
| <b>Step 6</b> | Fill in the TestUser field and, optionally, the TestPassword field. The default password for the test is <b>Cisco</b> .                      |
| <b>Step 7</b> | Set the IdleTime field for the time that the server is idle before you send a test authentication.   |
| <b>Step 8</b> | Click <b>Create</b> to save these changes.   |
- 

## 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.

### Detailed Steps

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

- 
- |               |  |
|---------------|--|
| <b>Step 1</b> | Expand <b>Switches &gt; Security &gt; AAA</b> , and then select <b>RADIUS</b> .<br>You see the RADIUS configuration in the Information pane. |
| <b>Step 2</b> | Click the <b>Defaults</b> tab.<br>You see the RADIUS default settings.   |
| <b>Step 3</b> | Check the <b>DirectedReq</b> check box for the RADIUS server.  |
| <b>Step 4</b> | Click the <b>Apply Changes</b> icon to save the changes.   |
-

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## Setting the Default TACACS+ Server Encryption Type and Preshared Key

### Detailed Steps

To configure the default TACACS+ server encryption type and preshared key, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
  - Step 2** If the Defaults tab is dimmed, click the **CFS** tab.
  - Step 3** Click the **Defaults** tab.  
You see the TACACS+ default settings.
  - Step 4** Select **plain** or **encrypted** from the AuthType drop-down menu and set the key in the Auth Key field.
  - Step 5** Click the **Apply Changes** icon to save the changes.
- 

## 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.

### Detailed Steps

To configure the number of retransmissions and the time between retransmissions to the TACACS+ servers, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
  - Step 2** Click the **Defaults** tab. (If the **Defaults** tab is disabled, click the **CFS** tab first).  
You see the TACACS+ default settings.
  - Step 3** Supply values for the Timeout and Retransmits fields for authentication attempts.
  - Step 4** Click the **Apply Changes** icon to save the changes.
- 

## Configuring a TACACS+ Server

### Detailed Steps

To configure a TACACS+ server and all its options using DCNM-SAN, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
  - Step 2** Click the **Servers** tab.



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You see any existing TACACS+ servers.

**Step 3** Click **Create Row** to add a new TACACS+ server.

You see the Create TACACS+ Server dialog box as shown in Figure 4-5.

**Figure 4-5 Create TACACS+ Server Dialog Box**

**Step 4** Select the switches that you want to assign as TACACS servers.

**Step 5** Assign an index number to identify the TACACS server.

**Step 6** Select the IP address type for the TACACS server.

**Step 7** Fill in the IP address or name for the TACACS server.

**Step 8** Modify the authentication and accounting ports used by this TACACS server.

**Step 9** Select the appropriate key type for the TACACS server.

**Step 10** Select the TimeOut value in seconds. The valid range is 0 to 60 seconds.

**Step 11** Select the number of times the switch tries to connect to a TACACS server(s) before reverting to local authentication.

**Step 12** Enter the test idle time interval value in minutes. The valid range is 1 to 1440 minutes.

**Step 13** Enter the test user with the default password. The default username is test.

**Step 14** Click **Create** to save these changes.

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## Allowing Users to Specify a TACACS+ Server at Login

### Detailed Steps

To configure the switch to allow users to specify a TACACS+ server at login using DCNM-SAN, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
  - Step 2** Click the **Defaults** tab.  
You see the TACACS+ default settings.
  - Step 3** Check the **DirectedReq** check box.
  - Step 4** Click the **Apply Changes** icon to save the changes.
- 

## 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” section on page 4-5](#)).

### Restrictions

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 DCNM-SAN or Device Manager users.



#### Note

Configuration of a TACACS+ group fails if MSCHPv2 authentication is not disabled.

### Detailed Steps

To configure a RADIUS, TACACS+, or LDAP server group using DCNM-SAN, follow these steps:

- 
- Step 1** Expand **Switches > Security**, and then select **AAA**.  
You see the AAA configuration in the Information pane. If you do not see the screen, click the **Server Groups** tab.  
You see the RADIUS, TACACS+, or LDAP server groups configured.
  - Step 2** Click **Create Row** to create a server group.  
You see the Create Server dialog box.
  - Step 3** Click the **radius** radio button to add a RADIUS server group, the **tacacs+** radio button to add a TACACS+ server group, and the **ldap** radio button to add a LDAP server group.

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- Step 4** Supply server names for the **ServerIdList** field.
- Step 5** When you chose LDAP, enter the LDAP search map name for the **LDAPSearchMapName**.
- **LDAPSSLMODE**—Specifies if the TLS tunnel should be setup before binding with the LDAP server.
  - **LDAPBindFirst**—Specifies if the user bind should be completed before the search.
- Step 6** Click the **plain** radio button to select the plain authentication method, click the **kerberos** button to select the kerberos authentication method, and click **md5digest** to select the md5digest authentication method.
- Step 7** Enter the password for the **LDAPComparePasswd** field:
- **LDAPCertDNBind**—Specifies if the User Certification Bind needs to be checked while doing PKI SSH certificate authorization.
  - **LDAPUserServerBind**—Specifies if the User Server Bind should be checked as part of SSH PKI authorization.
- Step 8** Set the **DeadTime** field for the number of minutes that a server can be nonresponsive before it is marked as bypassed. See the [“About Bypassing a Nonresponsive Server”](#) section on page 4-13.
- Step 9** Click **Create** to create this server group.
- The LDAP Server Group displays LDAP-specific parameters.
- Step 10** Click the **Applications** tab to assign this server group to an application.
- You can associate a server group with all applications or you can specify specific applications.
- Step 11** Click the **General** tab to assign the type of authentication to this server group.
- Check either the **MSCHAP** or **MSCHAPv2** check box based on the type of server group.
- Step 12** Click the **Apply Changes** icon to save the changes.
- Once the LDAP Server group is created, the configuration information is displayed in two tabs:
- **Server Groups**—Displays common data shared by all AAA protocols (RADIUS, TACACS+, and LDAP).
  - **LDAP Server Group**—Displays only LDAP-specific protocols.
- 

## Enabling AAA Server Distribution

### Restrictions

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

### Detailed Steps

To enable RADIUS server distribution, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS**.
- You see the RADIUS configuration in the Information pane.
- Step 2** Click the **CFS** tab. You see the RADIUS CFS configuration.
- Step 3** Choose **enable** from the Admin drop-down list for all switches that you want to enable CFS for RADIUS.

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- Step 4** Click **Apply Changes** to distribute these changes through the fabric.
- 

To enable TACACS+ server distribution, follow these steps:

- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
- Step 2** Click the **CFS** tab.  
You see the TACACS+ CFS configuration.
- Step 3** Choose **enable** from the Admin drop-down list for all switches that you want to enable CFS on for TACACS+.
- Step 4** Click **Apply Changes** to distribute these changes through the fabric.
- 

## Committing the 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).

### Detailed Steps

To distribute a RADIUS or TACACS+ configuration, follow these steps:

- Step 1** Expand **Switches > Security > AAA**, and then select either **RADIUS** or **TACACS+**. You see the RADIUS or TACACS+ configuration in the Information pane.
- Step 2** Click the **CFS** tab. You see the RADIUS or TACACS+ CFS configuration.
- Step 3** Choose **commitChanges** in the Config Action drop-down list for all switches that you want to enable CFS for RADIUS or TACACS+.
- Step 4** Click **Apply Changes** to distribute the changes through the fabric.
- 

## Discarding the 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.

### Detailed Steps

To discard RADIUS or TACACS+ distribution, follow these steps:

- Step 1** Expand **Switches > Security > AAA**, and then select either **RADIUS** or **TACACS+**. You see either the RADIUS or TACACS+ configuration in the Information pane.
- Step 2** Click the **CFS** tab. You see either the RADIUS or TACACS+ CFS configuration.

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- Step 3** Choose **abort** from the Config Action drop-down list for each switch that should discard the pending RADIUS or TACACS+ distribution.
- Step 4** Click **Apply Changes**.
- 

## Clearing Sessions

### Detailed Steps

To clear a RADIUS or TACACS+ distribution, follow these steps:

- Step 1** Expand **Switches > Security > AAA** and then select either **RADIUS** or **TACACS+**.  
You see either the RADIUS or TACACS+ configuration in the Information pane.
- Step 2** Choose the **CFS** tab. You see either the RADIUS or TACACS+ CFS configuration.
- Step 3** Choose **clear** from the Config Action drop-down list for each switch that should clear the pending RADIUS or TACACS+ distribution.
- Step 4** Click **Apply Changes**.
- 

## Enabling MSCHAP Authentication

### Detailed Steps



**Note**

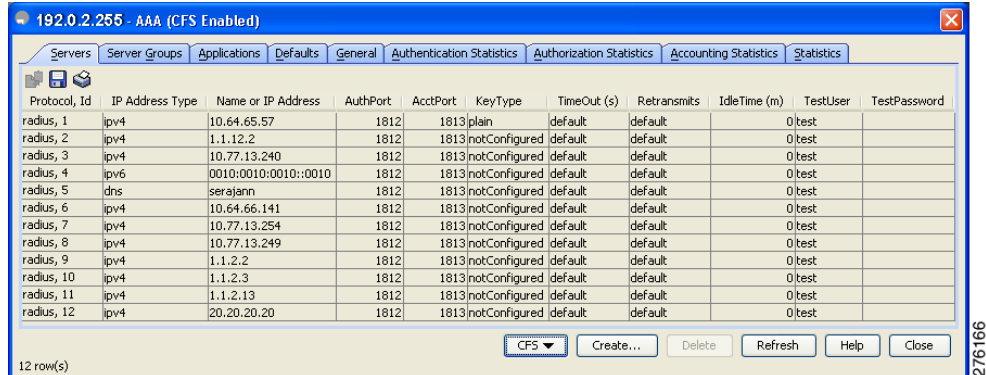
Password aging, MSCHAPv2, and MSCHAP authentication can fail if one of these authentication is not disabled.

To enable MSCHAP authentication using Device Manager, follow these steps:

- Step 1** Click **Security > AAA**.  
You see the AAA configuration in the Information pane (see [Figure 4-6](#)).

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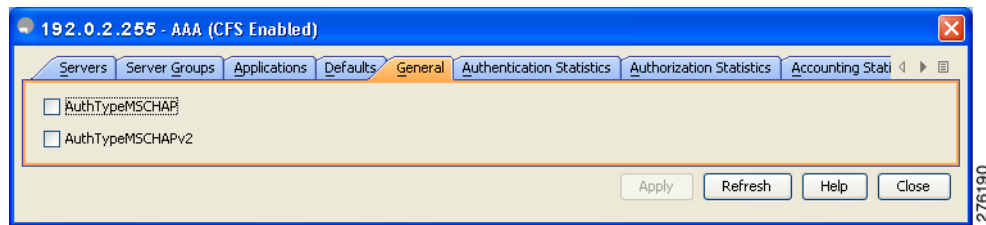
**Figure 4-6 AAA Configuration in Device Manager**



**Step 2** Click the **General** tab.

You see the MSCHAP configuration (see [Figure 4-7](#)).

**Figure 4-7 MSCHAP Configuration**



**Step 3** Check the **AuthTypeMSCHAP** or **AuthTypeMSCHAPv2** check box to use MSCHAP or MSCHAPv2 to authenticate users on the switch.

**Step 4** Click **Apply Changes** to save the changes.

## 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 4-8](#), [Figure 4-9](#), [Figure 4-10](#), and [Figure 4-11](#) display ACS server user setup configurations for network-admin roles and multiple roles using either RADIUS or TACACS+.

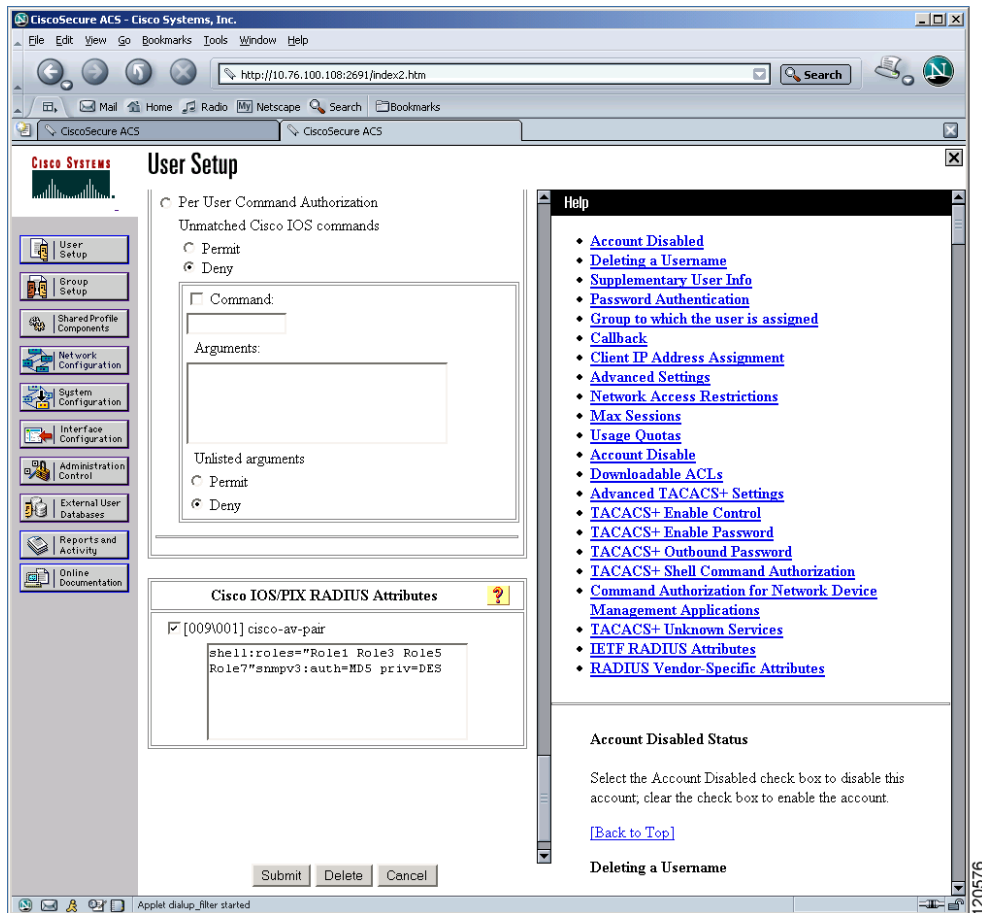
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**Figure 4-8** Configuring the network-admin Role When Using RADIUS

The screenshot displays the Cisco Systems User Setup web interface. The sidebar on the left contains the following navigation links: User Setup, Group Setup, Shared Profile Components, Network Configuration, System Configuration, Interface Configuration, Administration Control, External User Databases, Reports and Activity, and Online Documentation. The main content area is titled "User Setup" and includes radio buttons for "Permit" and "Deny" (selected). Below these are fields for "Command:" and "Arguments:". A section titled "Cisco IOS/PIX RADIUS Attributes" contains a checked checkbox for "[009\001] cisco-av-pair" and a text box with the value "shell:roles\*\*network-admin". At the bottom of the main area are "Submit", "Delete", and "Cancel" buttons. A "Back to Help" button is also present. The right-hand "Help" panel lists various links: 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, and RADIUS Vendor-Specific Attributes. Below the links, the "Account Disabled Status" section explains that selecting the checkbox disables the account, while clearing it enables the account, with a "Back to Top" link. The "Deleting a Username" section is partially visible at the bottom.

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**Figure 4-9** Configuring Multiple Roles with SNMPv3 Attributes When Using RADIUS





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**Figure 4-10** Configuring the network-admin Role with SNMPv3 Attributes When Using TACACS+

The screenshot shows the 'User Setup' window in the Cisco DCNM interface. The left sidebar contains navigation links: User Setup, Group Setup, Shared Profile Components, Network Configuration, System Configuration, Interface Configuration, Administration Control, External User Databases, Reports and Activity, and Online Documentation. The main area is titled 'User Setup' and contains a 'TACACS+ Settings' section. This section includes checkboxes for 'PPP IP', 'In access control list', 'Out access control list', 'Route', 'Routing', and 'Custom attributes'. The 'Custom attributes' checkbox is checked, and a text box below it contains the configuration: 'cisco-av-pair=shell:roles="Role1 Role3"snmpv3:auth=MDS |priv=DES'. A note states: 'Note: PPP LCP will be automatically enabled if this service is enabled'. Below the TACACS+ settings is a 'Shell (exec)' section with checkboxes for 'Access control list', 'Auto command', 'Callback line', 'Callback rotary', 'Idle time', 'No callback verify', 'No escape', 'No hangup', 'Privilege level', and 'Timeout'. The 'Custom attributes' checkbox is also checked in this section. At the bottom of the main area are 'Submit', 'Delete', and 'Cancel' buttons. On the right side of the window is a 'Help' pane with a list of links: 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, and RADIUS Vendor-Specific Attributes. Below the links are sections for 'Account Disabled Status' and 'Deleting a Username'.

**User Setup**

**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=MDS |priv=DES

Submit Delete Cancel

**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.

[\[Back to Top\]](#)

**Deleting a Username**

The Delete button appears only when you are editing an

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**Figure 4-11** Configuring Multiple Roles with SNMPv3 Attributes When Using TACACS+

The screenshot shows the 'User Setup' web interface. The main panel is titled 'TACACS+ Settings' and contains two sections of configuration options. The first section includes checkboxes for 'PPP IP', 'In access control list', 'Out access control list', 'Route', 'Routing', and 'Custom attributes'. The 'Routing' checkbox is checked, and there is an 'Enabled' checkbox next to it. Below these is a text area with a note: 'Note: PPP LCP will be automatically enabled if this service is enabled'. The second section includes checkboxes for 'Shell (exec)', 'Access control list', 'Auto command', 'Callback line', 'Callback rotary', 'Idle time', 'No callback verify', 'No escape', 'No hangup', 'Privilege level', 'Timeout', and 'Custom attributes'. The 'Shell (exec)' and 'Custom attributes' checkboxes are checked. Below these is a text area containing the following configuration: `cisco-av-pair*shell:roles="network-admin"snmpv3:auth=md5priv=aes-128`. At the bottom of the main panel are 'Submit', 'Delete', and 'Cancel' buttons. On the right side, there is a 'Help' sidebar with a list of links: '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', and 'RADIUS Vendor-Specific Attributes'. Below the links, there is a section titled 'Account Disabled Status' with a paragraph: 'Select the Account Disabled check box to disable this account; clear the check box to enable the account.' and a link '[Back to Top]'. Below that is a section titled 'Deleting a Username' with a paragraph: 'The Delete button appears only when you are editing'.

## Verifying RADIUS and TACACS+ Configuration

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

- [Displaying RADIUS Server Statistics, page 4-35](#)
- [Displaying TACACS+ Server Statistics, page 4-35](#)
- [Displaying the Pending Configuration to be Distributed, page 4-35](#)

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## Displaying RADIUS Server Statistics

To display RADIUS server statistics, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS**.  
You see the RADIUS configuration in the Information pane.
- Step 2** Click the **Statistics** tab.  
You see the RADIUS server statistics.
- 

## Displaying TACACS+ Server Statistics

To display TACACS+ server statistics, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **TACACS+**.  
You see the TACACS+ configuration in the Information pane.
- Step 2** Choose the **Statistics** tab.  
You see the TACACS+ server statistics.
- 

## Displaying the Pending Configuration to be Distributed

To display the RADIUS or TACACS+ global and/or server configuration stored in the temporary buffer, follow these steps:

- 
- Step 1** Expand **Switches > Security > AAA**, and then select **RADIUS** or select **TACACS+**.
- Step 2** Click the **CFS** tab.  
You see the distribution status on the CFS tab.
- Step 3** Click the **pending** or **running** radio button.
- Step 4** Click **Apply Changes** to save the changes.
- Step 5** Click the **Servers** tab to view the pending or running configuration.
-

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## Feature History for RADIUS, TACACS+, and LDAP

Table 4-3 lists the release history for this feature. Only features that were introduced or modified in Cisco NX-OS Release 5.x or a later release appear in the table.

**Table 4-3 Feature History for RADIUS, TACACS+, and LDAP**

Feature Name	Releases	Feature Information
Configuring LDAP	5.2	Added LDAP server and server groups configuration.
Switch AAA Functionalities	5.0(1a)	Added configuring fallback mechanism for authentication, configuring AAA server monitoring parameters globally.
Configuring TACACS+ Server Monitoring Parameters	5.0(1a)	Added CHAP authentication.
OTP Authentication	5.0(1a)	Added one-time password support
Merge Guidelines for RADIUS and TACACS+ Configurations	5.0(1a)	TACACS test parameters have to be distributed via CFS; a note has been changed.
AAA Service Configuration Options	5.0(1a)	Note has been changed.