Configuring AAA

This chapter describes how to configure authentication, authorization, and accounting (AAA) on Cisco NX-OS devices.

This chapter includes the following sections:

About AAA

This section includes information about AAA on Cisco NX-OS devices.

Prerequisites for AAA

Remote AAA servers have the following prerequisites:

- Ensure that at least one RADIUS, TACACS+, or LDAP server is reachable through IP.
- Ensure that the Cisco NX-OS device is configured as a client of the AAA servers.
- Ensure that the secret key is configured on the Cisco NX-OS device and the remote AAA servers.
- Ensure that the remote server responds to AAA requests from the Cisco NX-OS device.

Guidelines and Limitations for AAA

AAA has the following guidelines and limitations:

- 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.
- Cisco Nexus 3400-S Series switches support the **aaa authentication login ascii-authentication** command only for TACACS+ (and not for RADIUS).
- If you modify the default login authentication method (without using the **local** keyword), the configuration overrides the console login authentication method. To explicitly configure the console authentication method, use the **aaa authentication login console** {**group** *group-list* [**none**] | **local** | **none**} command.

Default Settings for AAA

This table lists the default settings for AAA parameters.

Table 1: Default AAA Parameter Settings

Parameters	Default
Console authentication method	local
Default authentication method	local
Login authentication failure messages	Disabled
CHAP authentication	Disabled
MSCHAP authentication	Disabled
Default accounting method	local
Accounting log display length	250 KB

Configuring AAA

This section describes the tasks for configuring AAA on Cisco NX-OS devices.

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.

Note Cisco Nexus3400-S Series switches support the aaa authentication login ascii-authentication,command only for TACAAS+, but not for RADIUS. Ensure that you have disabled aaa authentication login ascii-authentication command so that the default authentication, PAP is enabled. Otherwise, you will see syslog errors.

Process for Configuring AAA

Follow these steps to configure AAA authentication and accounting:

1. If you want to use remote RADIUS, TACACS+, or LDAP servers for authentication, configure the hosts on your Cisco NX-OS device.
2. Configure console login authentication methods.
3. Configure default login authentication methods for user logins.
4. Configure default AAA accounting default methods.

Configuring Console Login Authentication Methods

This section describes how to configure the authentication methods for the console login.

The authentication methods include the following:

- Global pool of RADIUS servers
- Named subset of RADIUS, TACACS+, or LDAP servers
- Local database on the Cisco NX-OS device
- Username only (none)

The default method is local, but you have the option to disable it.

Note The **group radius** and **group** *server-name* forms of the **aaa authentication** command refer to a set of previously defined RADIUS servers. Use the **radius-server host** command to configure the host servers. Use the **aaa group server radius** command to create a named group of servers.

Note If you perform a password recovery when remote authentication is enabled, local authentication becomes enabled for console login as soon as the password recovery is done. As a result, you can log into the Cisco NX-OS device through the console port using the new password. After login, you can continue to use local authentication, or you can enable remote authentication after resetting the admin password configured at the AAA servers. For more information about the password recovery process, see the *Cisco Nexus 3400-S NX-OS Troubleshooting Guide.*

Before you begin

Configure RADIUS, TACACS+, or LDAP server groups, as needed.

Procedure

	Command or Action	Purpose

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

Step 2	**aaa authentication login console** {**group** *group-list* [**none**] | **local** | **none**} **Example:** `switch(config)# aaa authentication login console group radius`	Configures login authentication methods for the console. The *group-list* argument consists of a space-delimited list of group names. The group names are the following: **radius** Uses the global pool of RADIUS servers for authentication. ***named-group*** Uses a named subset of RADIUS, TACACS+, or LDAP servers for authentication. The **local** method uses the local database for authentication, and the **none** method specifies that no AAA authentication be used. The default console login method is **local**, which is used when no methods are configured or when all the configured methods fail to respond, unless fallback to local is disabled for the console login.

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

Step 4	(Optional) **show aaa authentication** **Example:** `switch# show aaa authentication`	Displays the configuration of the console login authentication methods.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring Default Login Authentication Methods

The authentication methods include the following:

- Global pool of RADIUS servers
- Named subset of RADIUS, TACACS+, or LDAP servers
- Local database on the Cisco NX-OS device
- Username only

The default method is local, but you have the option to disable it.

Before you begin

Configure RADIUS, TACACS+, or LDAP server groups, as needed.

Procedure

	Command or Action	Purpose

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

Step 2	**aaa authentication login default** {**group** *group-list* [**none**] | **local** | **none**} **Example:** `switch(config)# aaa authentication login default group radius`	Configures the default authentication methods. The *group-list* argument consists of a space-delimited list of group names. The group names are the following: • **radius**—Uses the global pool of RADIUS servers for authentication. • *named-group*—Uses a named subset of RADIUS, TACACS+, or LDAP servers for authentication. The **local** method uses the local database for authentication, and the **none** method specifies that no AAA authentication be used. The default login method is **local**, which is used when no methods are configured or when all the configured methods fail to respond, unless fallback to local is disabled for the console login. You can configure one of the following: • AAA authentication groups • AAA authentication groups with no authentication

	Command or Action	Purpose
		• Local authentication • No authentication **Note** The **local** keyword is not supported (and is not required) when configuring AAA authentication groups because local authentication is the default if remote servers are unreachable. For example, if you configure **aaa authentication login default group g1**, local authentication is tried if you are unable to authenticate using AAA group g1. In contrast, if you configure **aaa authentication login default group g1 none**, no authentication is performed if you are unable to authenticate using AAA group g1.

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

Step 4	(Optional) **show aaa authentication** **Example:** `switch# show aaa authentication`	Displays the configuration of the default login authentication methods.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Disabling Fallback to Local Authentication

By default, if remote authentication is configured for console or default login and all AAA servers are unreachable (resulting in an authentication error), the Cisco NX-OS device falls back to local authentication to ensure that users are not locked out of the device. However, you can disable fallback to local authentication in order to increase security.

Caution Disabling fallback to local authentication can lock your Cisco NX-OS device, forcing you to perform a password recovery in order to gain access. To prevent being locked out of the device, we recommend that you disable fallback to local authentication for only the default login or the console login, not both.

Before you begin

Configure remote authentication for the console or default login.

Procedure

	Command or Action	Purpose

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

Step 2	**no aaa authentication login** {**console** | **default**} **fallback error local** **Example:** `switch(config)# no aaa authentication login console fallback error local`	Disables fallback to local authentication for the console or default login if remote authentication is configured and all AAA servers are unreachable. The following message appears when you disable fallback to local authentication: `"WARNING!!! Disabling fallback can lock your switch."`

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

Step 4	(Optional) **show aaa authentication** **Example:** `switch# show aaa authentication`	Displays the configuration of the console and default login authentication methods.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

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 RADIUS or TACACS+ remote authentication server using a default user role. When you disable the AAA default user role feature, remote users who do not have a user role 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.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Enabling Login Authentication Failure Messages

When you log in, the login is processed by rolling over to the local user database if the remote AAA servers do not respond. In such cases, the following messages display on the user's terminal if you have enabled login failure messages:

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

Procedure

	Command or Action	Purpose

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

Step 2	**aaa authentication login error-enable** **Example:**	Enables login authentication failure messages. The default is disabled.

	Command or Action	Purpose
	`switch(config)# aaa authentication login error-enable`	

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

Step 4	(Optional) **show aaa authentication** **Example:** `switch# show aaa authentication`	Displays the login failure message configuration.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Logging Successful and Failed Login Attempts

You can configure the switch to log all successful and failed login attempts to the configured syslog server.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	Required: [**no**] **login on-failure log** **Example:** `switch(config)# login on-failure log`	Logs all failed authentication messages to the configured syslog server. With this configuration, the following syslog message appears after the failed login: AUTHPRIV-3-SYSTEM_MSG: pam_aaa:Authentication failed for user admin from 172.22.00.00 **Note** When logging level authpriv is 6, additional Linux kernel authentication messages appear along with the previous message. If these additional messages need to be ignored, the authpriv value should be set to 3.
Step 3	Required: [**no**] **login on-success log** **Example:**	Logs all successful authentication messages to the configured syslog server. With this

	Command or Action	Purpose
	`switch(config)# login on-success log`	configuration, the following syslog message appears after the successful login: AUTHPRIV-6-SYSTEM_MSG: pam_aaa:Authentication success for user admin from 172.22.00.00 **Note** When logging level authpriv is 6, additional Linux kernel authentication messages appear along with the previous message.
Step 4	(Optional) **show login on-failure log** **Example:** `switch(config)# show login on-failure log`	Displays whether the switch is configured to log failed authentication messages to the syslog server.
Step 5	(Optional) **show login on-successful log** **Example:** `switch(config)# show login on-successful log`	Displays whether the switch is configured to log successful authentication messages to the syslog server.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Enabling CHAP Authentication

The Cisco NX-OS software supports the Challenge Handshake Authentication Protocol (CHAP), a challenge-response authentication protocol that uses the industry-standard Message Digest (MD5) hashing scheme to encrypt responses. You can use CHAP for user logins to a Cisco NX-OS device through a remote authentication server (RADIUS or TACACS+).

By default, the Cisco NX-OS device uses Password Authentication Protocol (PAP) authentication between the Cisco NX-OS device and the remote server. If you enable CHAP, you need to configure your RADIUS or TACACS+ server to recognize the CHAP vendor-specific attributes (VSAs).

This table shows the RADIUS and TACACS+ VSAs required for CHAP.

Table 2: CHAP RADIUS and TACACS+ VSAs

Vendor-ID Number	Vendor-Type Number	VSA	Description
311	11	CHAP-Challenge	Contains the challenge sent by an AAA server to a CHAP user. It can be used in both Access-Request and Access-Challenge packets.

Vendor-ID Number	Vendor-Type Number	VSA	Description
211	11	CHAP-Response	Contains the response value provided by a CHAP user in response to the challenge. It is used only in Access-Request packets.

Before you begin

Disable AAA ASCII authentication for logins.

Procedure

	Command or Action	Purpose

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

Step 2	**no aaa authentication login ascii-authentication** **Example:** `switch(config)# no aaa authentication login ascii-authentication`	Disables ASCII authentication.
Step 3	**aaa authentication login chap enable** **Example:** `switch(config)# aaa authentication login chap enable`	Enables CHAP authentication. The default is disabled. **Note** You cannot enable both CHAP and MSCHAP or MSCHAP V2 on your Cisco NX-OS device.

Step 4	(Optional) **exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 5	(Optional) **show aaa authentication login chap** **Example:** `switch# show aaa authentication login chap`	Displays the CHAP configuration.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Enabling MSCHAP or MSCHAP V2 Authentication

Microsoft Challenge Handshake Authentication Protocol (MSCHAP) is the Microsoft version of CHAP. The Cisco NX-OS software also supports MSCHAP Version 2 (MSCHAP V2). You can use MSCHAP for user logins to a Cisco NX-OS device through a remote authentication server (RADIUS or TACACS+). MSCHAP V2 only supports user logins to a Cisco NX-OS device through remote authentication RADIUS servers. If you configure a TACACS+ group with MSCHAP V2, the AAA default login authentication uses the next configured method, or the local method, if no other server group is configured.

Note The Cisco NX-OS software may display the following message:

" Warning: MSCHAP V2 is supported only with Radius."

This warning message is informational only and does not affect MSCHAP V2 operation with RADIUS.

By default, the Cisco NX-OS device uses Password Authentication Protocol (PAP) authentication between the Cisco NX-OS device and the remote server. If you enable MSCHAP or MSCHAP V2, you need to configure your RADIUS server to recognize the MSCHAP and MSCHAP V2 vendor-specific attributes (VSAs).

This table shows the RADIUS VSAs required for MSCHAP.

Table 3: MSCHAP and MSCHAP V2 RADIUS VSAs

Vendor-ID Number	Vendor-Type Number	VSA	Description
311	11	MSCHAP-Challenge	Contains the challenge sent by an AAA server to an MSCHAP or MSCHAP V2 user. It can be used in both Access-Request and Access-Challenge packets.
211	11	MSCHAP-Response	Contains the response value provided by an MSCHAP or MSCHAP V2 user in response to the challenge. It is only used in Access-Request packets.

Before you begin

Disable AAA ASCII authentication for logins.

Procedure

	Command or Action	Purpose

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

Step 2	**no aaa authentication login ascii-authentication** **Example:**	Disables ASCII authentication.

	Command or Action	Purpose
	`switch(config)# no aaa authentication login ascii-authentication`	
Step 3	**aaa authentication login** {**mschap** | **mschapv2**} **enable** **Example:** `switch(config)# aaa authentication login mschap enable`	Enables MSCHAP or MSCHAP V2 authentication. The default is disabled. **Note** You cannot enable both MSCHAP and MSCHAP V2 on your Cisco NX-OS device.

Step 4	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 5	(Optional) **show aaa authentication login** {**mschap** | **mschapv2**} **Example:** `switch# show aaa authentication login mschap`	Displays the MSCHAP or MSCHAP V2 configuration.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring AAA Accounting Default Methods

Cisco NX-OS software supports TACACS+ and RADIUS methods for accounting. Cisco NX-OS devices report user activity to TACACS+ or RADIUS security servers in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the AAA server.

When you activate AAA accounting, the Cisco NX-OS device reports these attributes as accounting records, which are then stored in an accounting log on the security server.

You can create default method lists defining specific accounting methods, which include the following:

RADIUS server group
Uses the global pool of RADIUS servers for accounting.

Specified server group
Uses a specified RADIUS or TACACS+ server group for accounting.

Local
Uses the local username or password database for accounting.

Note If you have configured server groups and the server groups do not respond, by default, the local database is used for authentication.

Before you begin

Configure RADIUS or TACACS+ server groups, as needed.

Procedure

	Command or Action	Purpose

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

Step 2	**aaa accounting default** {**group** *group-list* | **local**} **Example:** `switch(config)# aaa accounting default group radius`	Configures the default accounting method. The *group-list* argument consists of a space-delimited list of group names. The group names are the following: • **radius**—Uses the global pool of RADIUS servers for accounting. • *named-group*—Uses a named subset of TACACS+ or RADIUS servers for accounting. The **local** method uses the local database for accounting. The default method is **local**, which is used when no server groups are configured or when all the configured server groups fail to respond.

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

Step 4	(Optional) **show aaa accounting** **Example:** `switch# show aaa accounting`	Displays the configuration AAA accounting default methods.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Using AAA Server VSAs with Cisco NX-OS Devices

You can use vendor-specific attributes (VSAs) to specify Cisco NX-OS user roles and SNMPv3 parameters on AAA servers.

Configuring Secure Login Features

Monitoring and Clearing the Local AAA Accounting Log

The Cisco NX-OS device maintains a local log for the AAA accounting activity. You can monitor this log and clear it.

Procedure

	Command or Action	Purpose
Step 1	**show accounting log** [*size* | **last-index** | **start-seqnum** *number* | **start-time** *year month day hh*:*mm*:*ss*] **Example:** `switch# show accounting log`	Displays the accounting log contents. By default, the command output contains up to 250,000 bytes of the accounting log. You can use the *size* argument to limit command output. The range is from 0 to 250000 bytes. You can also specify a starting sequence number or a starting time for the log output.The range of the starting index is from 1 to 1000000. Use the **last-index** keyword to display the value of the last index number in the accounting log file.
Step 2	(Optional) **clear accounting log** [**logflash**] **Example:** `switch# clear aaa accounting log`	Clears the accounting log contents. The **logflash** keyword clears the accounting log stored in the logflash.

Verifying the AAA Configuration

To display AAA configuration information, perform one of the following tasks:

Command	Purpose
show aaa accounting	Displays AAA accounting configuration.
show aaa authentication [**login** {**ascii-authentication** | **chap** | **error-enable** | **mschap** | **mschapv2**}]	Displays AAA authentication login configuration information.
show aaa groups	Displays the AAA server group configuration.
show running-config aaa [**all**]	Displays the AAA configuration in the running configuration.
show startup-config aaa	Displays the AAA configuration in the startup configuration.

Configuration Examples for AAA

The following example shows how to configure AAA:

```
aaa authentication login default group radius
aaa authentication login console group radius
aaa accounting default group radius
```

Configuration Examples for Login Parameters

The following example shows how to configure the switch to enter a 100-second quiet period if 3 failed login attempts is exceeded within 60 seconds. This example shows no login failures.

```
switch# configure terminal
switch(config)# login block-for 100 attempts 3 within 60
switch(config)# 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 3 login failures occur in 60 seconds or less,
 logins will be disabled for 100 seconds.

 Switch presently in Normal-Mode.
 Current Watch Window remaining time 45 seconds.
 Present login failure count 0.

switch(config)# show login failures
*** No logged failed login attempts with the device.***
```

The following example shows how to configure a quiet-mode ACL. All login requests are denied during the quiet period except hosts from the myacl ACL. This example also shows a login failure.

```
switch# configure terminal
switch(config)# login block-for 100 attempts 3 within 60
switch(config)# login quiet-mode access-class myacl

switch(config)# show login

 Switch is enabled to watch for login Attacks.
 If more than 3 login failures occur in 60 seconds or less,
 logins will be disabled for 100 seconds.

 Switch presently in Quiet-Mode.
 Will remain in Quiet-Mode for 98 seconds.
 Denying logins from all sources.

switch(config)# show login failures
Information about last 20 login failure's with the device.
--------------------------------------------------------------------------------
Username      Line          SourceIPAddr    Appname    TimeStamp
--------------------------------------------------------------------------------
asd           /dev/pts/0    171.70.55.158   login      Mon Aug  3 18:18:54 2015
qweq          /dev/pts/0    171.70.55.158   login      Mon Aug  3 18:19:02 2015
qwe           /dev/pts/0    171.70.55.158   login      Mon Aug  3 18:19:08 2015
```

```
--------------------------------------------------------------------------------
```

Configuration Examples for the Password Prompt Feature

The following example shows how to configure the switch to prompt the user to enter a password after she enters the **username** command and the error message that displays if she does not enter a password.

```
switch# configure terminal
switch(config)# password prompt username
Password prompt username is enabled.
After providing the required options in the username command, press enter.
User will be prompted for the username password and password will be hidden.
Note: Choosing password key in the same line while configuring user account, password will
 not be hidden.


switch(config)# username user1
Enter password:
Confirm password:
warning: password for user:user1 not set. S/he may not be able to login
```

The following example shows how to configure the switch to prompt the user to enter a password after she enters the **snmp-server user** command and the prompts that then display to the user.

```
switch# configure terminal
switch(config)# password prompt username
Password prompt username is enabled.
After providing the required options in the username command, press enter.
User will be prompted for the username password and password will be hidden.
Note: Choosing password key in the same line while configuring user account, password will
 not be hidden.


N9K-1(config)# snmp-server user user1
Enter auth md5 password (Press Enter to Skip):
Enter auth sha password (Press Enter to Skip):
```

Additional References for AAA

This section includes additional information related to implementing AAA.

Related Documents

Related Topic	Document Title
Cisco NX-OS Licensing	*Cisco NX-OS Licensing Guide*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—