AOS-CX 10.12 Security Guide

8100, 8360 Switch Series

a Hewlett Packard
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Chapter 1
About this document

This document describes features of the AOS-CX network operating system. It is intended for administrators responsible for installing, configuring, and managing Aruba switches on a network.

Applicable products

This document applies to the following products:

- Aruba 8100 Switch Series (R9W94A, R9W95A, R9W96A, R9W97A)
- Aruba 8360 Switch Series (JL700A, JL701A, JL702A, JL703A, JL706A, JL707A, JL708A, JL709A, JL710A, JL711A, JL700C, JL701C, JL702C, JL703C, JL706C, JL707C, JL708C, JL709C, JL710C, JL711C, JL704C, JL705C, JL719C, JL718C, JL717C, JL720C, JL722C, JL721C)

Latest version available online

Updates to this document can occur after initial publication. For the latest versions of product documentation, see the links provided in Support and Other Resources.

Command syntax notation conventions

Convention	Usage
`example-text`	Identifies commands and their options and operands, code examples, filenames, pathnames, and output displayed in a command window. Items that appear like the example text in the previous column are to be entered exactly as shown and are required unless enclosed in brackets (`[ ]`).
example-text	In code and screen examples, indicates text entered by a user.
Any of the following: ■ *<example-text>* ■ <example-text> ■ *example-text* ■ *example-text*	Identifies a placeholder—such as a parameter or a variable—that you must substitute with an actual value in a command or in code: ■ For output formats where italic text cannot be displayed, variables are enclosed in angle brackets (`< >`). Substitute the text—including the enclosing angle brackets—with an actual value. ■ For output formats where italic text can be displayed, variables might or might not be enclosed in angle brackets. Substitute the text including the enclosing angle brackets, if any, with an actual value.
|	Vertical bar. A logical OR that separates multiple items from which you can choose only one. Any spaces that are on either side of the vertical bar are included for readability and are not a required part of the command syntax.

Convention	Usage
{ }	Braces. Indicates that at least one of the enclosed items is required.
[ ]	Brackets. Indicates that the enclosed item or items are optional.
... or . . .	Ellipsis: ■ In code and screen examples, a vertical or horizontal ellipsis indicates an omission of information. ■ In syntax using brackets and braces, an ellipsis indicates items that can be repeated. When an item followed by ellipses is enclosed in brackets, zero or more items can be specified.

About the examples

Examples in this document are representative and might not match your particular switch or environment.

The slot and port numbers in this document are for illustration only and might be unavailable on your switch.

Understanding the CLI prompts

When illustrating the prompts in the command line interface (CLI), this document uses the generic term `switch`, instead of the host name of the switch. For example:

```
switch>
```

The CLI prompt indicates the current command context. For example:

```
switch>
```

Indicates the operator command context.

```
switch#
```

Indicates the manager command context.

```
switch(CONTEXT-NAME)#
```

Indicates the configuration context for a feature. For example:

```
switch(config-if)#
```

Identifies the `interface` context.

Variable information in CLI prompts

In certain configuration contexts, the prompt may include variable information. For example, when in the VLAN configuration context, a VLAN number appears in the prompt:

```
switch(config-vlan-100)#
```

When referring to this context, this document uses the syntax:

```
switch(config-vlan-<VLAN-ID>)#
```

Where *<VLAN-ID>* is a variable representing the VLAN number.

Identifying switch ports and interfaces

Physical ports on the switch and their corresponding logical software interfaces are identified using the format:

member/slot/port

On the 83xx, 9300, and 10000 Switch Series

- *member*: Always 1. VSF is not supported on this switch.
- *slot*: Always 1. This is not a modular switch, so there are no slots.
- *port*: Physical number of a port on the switch.

For example, the logical interface `1/1/4` in software is associated with physical port 4 on the switch.

If using breakout cables, the port designation changes to x:y, where x is the physical port and y is the lane when split to 4 x 10G or 4 x 25G. For example, the logical interface 1/1/4:2 in software is associated with lane 2 on physical port 4 in slot 1 on member 1.

This AOS-CX Switch provides the following security features:

- Local user and group management.
- Authentication, Authorization, and Accounting (AAA), either local (password or SSH public key-based), or remote password-based TACACS+ or RADIUS.
- SSH server. SSH is a cryptographic protocol that encrypts all communication between devices.
- Ability to use enhanced security as described in Configuring enhanced security .
- Making sensitive switch configuration information available for secure export/import between switches. For information, see `service export-password`.

About Authentication, Authorization, and Accounting (AAA)

- **Authentication:** identifies users, validates their credentials, and grants switch access.
- **Authorization:** controls authenticated users command execution and switch interaction privileges.
- **Accounting:** collects and manages user session activity logs for auditing and reporting purposes.

Local AAA on your Aruba switch provides:

- Authentication using local password or SSH public key.
- Authorization using role-based access control (RBAC), and optionally, using user-defined local user groups with command authorization rules defined per group.
- Accounting of user activity on the switch using accounting logs.

Remote AAA provides the following for your Aruba switch:

- Authentication using remote AAA servers with either TACACS+ or RADIUS.
- Authorization using remote AAA servers with TACACS+ fine-grained command authorization. Local RBAC or local rule-based authorization is also possible.
- Transmission of locally collected accounting information to remote TACACS+ and RADIUS servers.

TACACS+ (Terminal Access Controller Access-Control System Plus) and RADIUS (Remote Authentication Dial-In User Service) server software is readily available as either open source or from various vendors.

For switches that support multiple management modules such as the Aruba 8400, all AAA functionality discussed only applies to the active management module. See also *AAA on switches with multiple management modules* in the *High Availability Guide*.

Default user admin

A factory-default switch comes with a single user named `admin`.

The `admin` user:

- Has an empty password. Press **Enter** in response to the `admin` password prompt. At initial boot, you are prompted to define a password for the `admin` user. Although empty (blank) passwords are allowed, it is recommended that you use strong passwords for all production switches.
- Is a member of the `administrators` group.
- Cannot be removed from the switch.

The switch `admin` user is distinct from the Service OS `admin` user. The Service OS acts as the `bootloader` and recovery operating system. The Service OS has its own CLI.

Example of first login with password setting

```
switch login: admin
Password:

Please configure the 'admin' user account password.
Enter new password: ********
Confirm new password: ********
switch#
```

Built-in user groups and their privileges

The switch provides the following built-in user groups with corresponding roles. Each of these roles comes with a set of privileges.

Group/Role	Privileges
`administrators`	Administrators have full privileges, including: ■ Full CLI access. ■ Performing firmware upgrades. ■ Viewing switch configuration information, including sensitive information such as passwords which are displayed as ciphertext. ■ Performing switch configuration. ■ Adding/removing user accounts. ■ Configuring users accounts, including passwords. Once set, a password cannot be deleted or set to empty.

Group/Role	Privileges
	▪ REST API: All methods (GET, PUT, POST, DELETE) and switch resources are available. The privilege level for `administrators` is 15.
`operators`	Operators have no switch configuration privileges. Operators are restricted to: ▪ Basic display-only CLI access. ▪ Viewing of nonsensitive switch configuration information. ▪ REST API: Other than the `\login` and `\logout` resources, only the GET method is available. The privilege level for `operators` is 1.
`auditors`	Auditors are restricted to functions related to auditing only: ▪ CLI: Access to commands in the auditor context (`auditor>`) only. ▪ Web UI: Access to the **System > Log** page only. ▪ REST API: POST method available for the `\login` and `\logout` resources. GET method available for the following resources only: ◦ Audit log: `/logs/audit` ◦ Event log: `/logs/event` The privilege level for `auditors` is 19.

User-defined user groups

The switch enables you to create up to 29 user-defined local user groups, for the purpose of configuring local authorization. Each of the 29 user-defined groups support up to 1024 CLI command authorization rules that define what CLI commands can be executed by members of the group.

The local user groups with their command execution rules are useful for the following:

- Providing authorization for use with RADIUS servers.
- Providing fallback authorization for use with TACACS+ servers.
- Providing authorization when neither RADIUS or TACACS+ servers are used.

User name requirements

Specifies the user name. Requirements:

- Must start with a lowercase letter.
- Can contain numbers and lowercase letters.
- Can include only these three special characters: hyphens (-), dots (.), and underscores (_).
- Can have a maximum of 32 characters.
- Cannot be empty.
- Cannot contain uppercase letters.
- Cannot be: admin, `root`, or `remote_user`.
- Cannot be Linux reserved names such as:

  `daemon`, `bin`, `sys`, `sync`, `proxy`, `www-data`, `backup`, `list`, `irc`, `gnats`, `nobody`, `systemd-bus-proxy`, `sshd`, `messagebus`, `rpc`, `systemd-journal-gateway`, `systemd-journal-remote`, `systemd-journal-`

`upload`, `systemd-timesync`, `systemd-coredump`, `systemd-resolve`, `rpcuser`, `vagrant`, `opsd`, `rdanet`, `_lldpd`, `rdaadmin`, `rdaweb`, `docker_container`, `tss`.

Password requirements

Passwords must:

- Contain only ASCII characters from hexadecimal 21 to hexadecimal 7E [\x21-\x7E] (decimal 33 to 126). Spaces are not allowed. When the password is entered directly without prompting, the "?" symbol (hexadecimal 3F [\x3F] (decimal 63)) is not permitted.
- Contain at most 32 characters.
- Contain at least the number of characters configured (optionally) for minimum-password-length.

Although empty passwords are supported, it is recommended that you use strong passwords for all production switches.

Only an administrator can change the password of a user assigned to the `operators` role.

Per-user management interface enablement

By default, switch users are enabled for accessing the switch through all these available management interfaces: **`ssh`**, **`telnet`**, **`https-server`**, **`console`**.

Optionally, one or more of the management interfaces can be disabled for specific users.

User accounts can be local or managed on remote TACACS+ or RADIUS servers.

Local per-user management interface enablement

Local per-user management interface enablement is performed with CLI command **`user management-interface`**. CLI command **`show user-list management-interface`** is available for showing the current configuration.

Example of disabling the SSH management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface ssh
switch(config)# show user-list management-interface
USER                          ENABLED MANAGEMENT INTERFACE(S)
------------------------------------------------------------
admin                         ssh,telnet,https-server,console
admin1                        telnet,https-server,console
```

Example of disabling the telnet management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface telnet
switch(config)# show user-list management-interface
USER                          ENABLED MANAGEMENT INTERFACE(S)
------------------------------------------------------------
admin                         ssh,telnet,https-server,console
admin1                        https-server,console
```

Example of re-enabling the SSH management interface for local user `admin1`:

```
switch(config)# user admin1 management-interface ssh
switch(config)# show user-list management-interface
USER                          ENABLED MANAGEMENT INTERFACE(S)
------------------------------------------------------------
admin                         ssh,telnet,https-server,console
admin1                        ssh,https-server,console
```

Remote (TACACS+ or RADIUS) per-user management interface enablement

For remote TACACS+ and RADIUS servers, per-user management interface enablement is performed by configuring the Aruba VSA **`Aruba-User-Mgmt-Interface`**.

On the TACACS+ or RADIUS server, the Aruba VSA **`Aruba-User-Mgmt-Interface`** must be set to a comma-separated list of management interface names for which login is permitted by the associated user. Management interfaces omitted from the list are disabled for the associated user. A maximum of four management interface names are allowed, with each management interface name given once.

Permitted management interface names (always lowercase) are as follows:

- **`ssh`**
- **`telnet`**
- **`https-server`**
- **`console`**

The VSA has a maximum length of 32 characters. The VSA is ignored by the switch if longer than 32 characters.

When a user login fails because of an attempt to use a management interface that is not allowed, an event log is available indicating the enabled management interfaces as received in the TACACS+ or RADIUS VSA.

When using a RADIUS server other than ClearPass Policy Manager (CPPM), before setting the **`Aruba-User-Mgmt-Interface`** VSA, you must first define the VSA on the RADIUS server in file **`/usr/share/freeradius/dictionary.aruba`** as follows:

```
ATTRIBUTE  Aruba-User-Mgmt-Interface  69 string
```

Example RADIUS server VSA value that enables the two named management interfaces (**`ssh`**, **`telnet`**) while disabling the two unnamed management interfaces (**`https-server`**, **`console`**):

```
Aruba-User-Mgmt-Interface = "ssh,telnet"
```

Example RADIUS server VSA value that enables all four management interfaces:

```
Aruba-User-Mgmt-Interface = "ssh,telnet,https-server,console"
```

Example TACACS+ server configuration for user **`admin1`** with a VSA that enables management interfaces **`ssh`** and **`console`**:

```
key = test
group = admin {
        default service = permit
        service = exec {
        priv-lvl = 15
        Aruba-User-Mgmt-Interface = ssh,console
        }
}
user = admin1 {
member = admin
pap = cleartext testing
}
```

User and user group management tasks

User and user group management common tasks are as follows:

Task	Command or procedure	Example
Creating a user	`user`	`user jamie group administrators password`
Changing a user password	`user password`	`user jamie password`
Removing a user	`user`	`no user jamie`
Setting a user account password	`user password`	`user admin password`
Resetting the admin password using the Service OS	(procedure)	
Resetting the admin password by reverting the switch to factory defaults	(procedure)	`erase startup-config` `boot system`
Showing a list of all users	`show user-list`	`show user-list`
Showing information for the logged-in user	`show user information`	`show user information`
Creating a user group	`user-group`	`user-group admuser2`
Adding command authorization rules to a user group	`permit` or `deny` (within `user-group`)	`10 deny cli command "show aaa .*"` `20 permit cli command "show .*"`
Adding comments to rules in a user group	`comment` (within `user-group`)	`10 comment Deny all show aaa commands.` `20 comment Permit all other show commands.`
Resequencing rules in a user group	`resequence` (within `user-group`)	`resequence 100 20`

Task	Command or procedure	Example
Showing a list of all user groups	`show user-group`	`show user-group`

Resetting the switch admin password using the Service OS console

Perform this task only when the switch (Product OS) `admin` user password has been forgotten.

Prerequisites

- You are connected to the switch through the console port.
- You know the Service OS password (if configured).

If you forget the Service OS password, the only recourse is to zeroize the switch, reverting it to factory defaults. For more information, see *Zeroization* in the *Diagnostics and Supportability Guide*.

Procedure

1. Reboot the switch.
2. At the boot prompt, select `0. Service OS Console`.

```
0. Service OS Console
1. Primary Software Image [XL.01.01.0001]
2. Secondary Software Image [XL.01.01.0002]
```

3. At the `Switch Login` prompt, enter `admin` and press `Enter`. If prompted for a Service OS password, enter it and press `Enter`.

```
Switch login: admin

Password: **********

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SVOS>
```

4. At the `SVOS>` prompt, enter `password` and press `Enter`.
5. Enter the new switch (Product OS) password at both password prompts.

```
SVOS> password
Enter password: ************
Confirm password: ************

SVOS>
```

6. Enter `boot` and press `Enter`.

```
SVOS> boot

ServiceOS Information:
    Version: **.10.06.0001
    Build Date: 2020-12-01 14:52:31 PDT
    Build ID: ServiceOS:**.01.01.0001:461519208911:20180301452
    SHA: 46151920891195cdb2267ea6889a3c6cbc3d4193

Boot Profiles:
0. Service OS Console
1. Primary Software Image [**.10.06.0001]
2. Secondary Software Image [**.10.06.0001]

Select profile(primary):
```

7. To boot with the primary switch image press `1` and then `Enter`. To boot with the secondary switch image, press `2` and then `Enter`. If you make no selection for approximately 10 seconds, the switch boots the default image. The default is shown in parentheses to the right of `Select profile`, for example: `Select profile(primary):`.
8. Once in AOS-CX, save the configuration to make the `admin` login user account password setting persistent.

Resetting the admin password by reverting the switch to factory defaults

This task erases all switch configuration, reverting the switch to its factory default state. Consider using other less-impacting techniques for admin password reset. For example, another administrator user can reset the admin user password to a known value. See also Resetting the switch admin password using the Service OS console.

Prerequisites

If wanted, you have saved a copy of the switch configuration.

Procedure

1. At the manager command prompt, enter `erase startup-config`.

```
switch# erase startup-config
```

2. Enter `boot system`, responding `n` to the `Do you want to save the current configuration` prompt and then responding `y` to the `Continue` prompt.

```
switch# boot system
Do you want to save the current configuration (y/n)? n

This will reboot the entire switch and render it unavailable
```

```
until the process is complete.
Continue (y/n)? y
The system is going down for reboot.
```

3. At the login prompt, enter `admin` and press `Enter`. The admin password remains empty until it is set.

User and group commands

password complexity

```
password complexity
no password complexity
```

Description

Enters the password-complexity context (shown in the switch prompt as `config-pwd-cplx`) for the purpose of enabling and configuring password complexity. Password complexity enhances security by enforcing specific password complexity requirements. Password complexity is disabled by default and must be enabled by execution of the `enable` command.

Enabling or changing password complexity settings effects password creation or password change after the password complexity feature is enabled or changed. All existing passwords will continue to function as currently configured. When existing passwords are changed they will have to comply with whatever password complexity settings are enabled at the time of the change.

The `no` form of this command reverts all settings to their default values and disables password complexity enforcement.

To ensure that enhanced security is maintained, it is recommended that you do not set any values to less than their defaults.

Password complexity apples only to local authentication. For remote authentication, you may choose to set up an equivalent of password complexity according to whatever is supported on your particular TACACS+ or RADIUS server.

Subcommands

These subcommands are available within the password complexity context (shown in the switch prompt as `config-pwd-cplx`).

`enable`

Enables password complexity enforcement. The enforcement only applies to passwords created after this enabling. Existing passwords are not checked against password complexity.

`disable`

Disables password complexity enforcement.

`[no] history-count <COUNT>`

Specifies the number of previous passwords checked to prevent excessive reuse. Not applicable when adding new users. The `no` form of this subcommand resets the value to its default. Default: 5. Range: 1 to 5.

Previous passwords checked includes passwords used prior to enabling the password complexity feature.

`[no] minimum-length  <LENGTH>`

Specifies the minimum password length. The no form of this subcommand resets the value to its default. Default: 8. Range: 1 to 32.

`[no] position-changes <POSITIONS>`

Specifies the minimum number of characters that must change in the new password compared to the previous password. Not applicable if no previous password exists, including when adding new users. The no form of this subcommand resets the value to its default. Default: 8. Range: 1 to 32.

The number of password position changes is based on the number of simple character insertions, deletions, or replacements. For example:

Old password: abCD4$ New password: abCD$ Position changes=1 ("4" deleted) Old password: abCD4$ New password: abCDEF4$ Position changes=2 ("EF" inserted) Old password: abCD4$ New password: ebCD4Position changes=2 ("a" replaced with "e," "1" added) Old password: abCD4$ New password: abC$# Position changes=3 ("D4" deleted, "#" added)

`[no] lowercase-count <COUNT>`

Specifies the minimum lowercase character count for new passwords. The no form of this subcommand resets the value to its default. Default: 1. Range: 0 to 32.

`[no] uppercase-count <COUNT>`

Specifies the minimum uppercase character count for new passwords. The no form of this subcommand resets the value to its default. Default: 1. Range: 0 to 32.

`[no] numeric-count <COUNT>`

Specifies the minimum numeric digit count for new passwords. The no form of this subcommand resets the value to its default. Default: 1. Range: 0 to 32.

`[no] special-char-count <COUNT>`

Specifies the minimum special character count for new passwords. The no form of this subcommand resets the value to its default. Default: 1. Range: 0 to 32.

`[no] adjacent-char-type-count`

Specifies the maximum number of adjacent characters from a character set allowed in a password. The different character sets are:

- Numbers
- Lowercase alphabets
- Uppercase alphabets
- Special characters

The number of adjacent characters from the character set in the password has to be less than or equal to the configured value. When set to 0, adjacent character type length check requirement is disabled. The no form of this subcommand resets the value to its default. Default: 0. Range: 0-31.

`list`

List the subcommands available within the password complexity context.

`exit`

Exits the password complexity context.

`end`

Exits the password complexity context and then the config context.

Usage

- Password complexity is only for use with plaintext passwords. With password complexity enabled, existing ciphertext passwords will continue working until a password is changed. All new passwords must be entered in plaintext form and be compliant with your password complexity configuration.
- The effective minimum password length may be larger than the configured `minimum-length` value. The effective minimum password length is calculated as follows:

```
LARGEST-of:(minimum-length, position-changes,(SUM-of:lowercase-count+uppercase-
count+numeric-count+special-char-count))
```

For example, with `minimum-length=8`, and `position-changes=10` (and the sum of the other four count settings `<=9`), the **effective minimum-length is `10`** (because `position-changes` is largest). Similarity, with a `minimum-length=12`, `position-changes=8`, `lowercase-count=8`, `uppercase-count=4`, `numeric-count=1`, `special-char-count=1`, the **effective minimum-length is `14`** (`8+4+1+1=14`) (because sum off the four counts is largest).

Examples

Configuring password complexity settings with an effective minimum length of 10 (because `position-changes` is 10):

```
switch(config)# password complexity
switch(config-pwd-cplx)# history-count 3
switch(config-pwd-cplx)# minimum-length 8
switch(config-pwd-cplx)# position-changes 10
switch(config-pwd-cplx)# lowercase-count 2
switch(config-pwd-cplx)# uppercase-count 2
switch(config-pwd-cplx)# numeric-count 2
switch(config-pwd-cplx)# special-char-count 2
switch(config-pwd-cplx)# adjacent-char-type-count 3
switch(config-pwd-cplx)# enable
switch# exit
```

Configuring password complexity settings with an effective minimum length of 14 (because the sum of the four count items is 14):

```
switch(config)# password complexity
switch(config-pwd-cplx)# history-count 4
switch(config-pwd-cplx)# minimum-length 12
switch(config-pwd-cplx)# position-changes 8
switch(config-pwd-cplx)# lowercase-count 8
switch(config-pwd-cplx)# uppercase-count 4
switch(config-pwd-cplx)# numeric-count 1
switch(config-pwd-cplx)# special-char-count 1
switch(config-pwd-cplx)# adjacent-char-type-count 3
switch(config-pwd-cplx)# enable
switch# exit
```

Enabling password complexity (with default settings) and changing a user (admin1) password successfully but failing to change another user (admin2) password due to not meeting complexity requirements:

```
switch(config)# password complexity
switch(config-pwd-cplx)# enable
switch(config-pwd-cplx)# exit
switch(config)#
switch(config)# user admin1 password
Changing password for user admin1
Enter old password:************
Enter new password:************
Confirm new password:************
switch(config)#
switch(config)# user admin2 password
Changing password for user admin2
Enter old password:************
Enter new password:************
Confirm new password:************
```

```
User password not changed.
The new password does not meet one or more of the following complexity
requirements:
Minimum length          : 8
Position changes        : 8
Numeric count           : 1
Lowercase count         : 1
Uppercase count         : 1
Special character count : 1
Adjacent character type count: 3
```

With password complexity already enabled, attempting to change an existing user password but failing because the new password is identical to a recently used one (`history-count`).

```
switch(config)# user admin1 password
Changing password for user admin1
Enter old password:************
Enter new password:************
Confirm new password:************
User password not changed.
The new password is the same as a recently used password.
```

With password complexity already enabled, creating a new admin user (admin3) with a plaintext password that meets complexity requirements.

```
switch(config)# user admin3 group administrators password
Adding user admin3
Enter password:************
Confirm password:************
```

With password complexity already enabled, attempting to create a new admin user (admin4) with a ciphertext password but failing because ciphertext passwords are not supported with password complexity enabled.

```
switch(config)# user admin4 group administrators password ciphertext AQBapPd...==
Ciphertext passwords cannot be used when password complexity is enabled.
switch(config)#
```

Command History

Release	Modification
10.11.1010	`adjacent-char-type-count` subcommand added.
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

service export-password

```
service export-password
no service export-password
```

Description

Configures a nondefault export password. The export password is used to transform critical security parameters (such as password hashes) into ciphertext suitable for exporting and showing by commands such as `show running-config`. This transformation enables safe switch configuration import and export.

The `no` form of this command reverts the export password to its factory default.

All factory-default switches have identical default export passwords. For security, it is recommended that you set the same nondefault export password on every switch in a group that will exchange configuration information. Only switches with identical export passwords can exchange configuration information.

Usage

Prompts you twice for the new export password.

The export password must:

- Contain only ASCII characters from hexadecimal 21 to hexadecimal 7E [\x21-\x7E] (decimal 33 to 126). Spaces are not allowed.
- Contain at most 32 characters.
- Not be blank.

Examples

Configuring a new export password:

```
switch(config)# service export-password
Enter password:************
Confirm password:************
```

Reverting the export password to its factory default:

```
switch(config)# no service export-password
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

show password-complexity

`show password-complexity`

Description

Shows user-configured or default password complexity checking criteria.

Examples

Showing the current password complexity checking criteria:

```
switch(config)# show password-complexity

Global password complexity checking criteria:
    Password complexity                : Enabled
    Previous passwords to check        : 3
    Minimum password length            : 12
    Minimum position changes           : 10
    Maximum adjacent characters count  : 3
    Password composition
         Minimum lowercase characters  : 3
         Minimum uppercase characters  : 1
         Minimum special characters    : 1
         Minimum numeric characters    : 3
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show user-group

`show user-group [<GROUP-NAME>] [vsx-peer]`

Description

Shows user group information for the built-in groups plus any user-defined local user groups. When entered without *<GROUP-NAME>*, summary information is shown for all groups.

Parameter	Description
<GROUP-NAME>	Narrows the `show` command output to that of the specified group, and for local user groups, adds the `User Group Rules` list.
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Show the list of all user groups, including built-in groups and local user groups.

```
switch# show user-group
GROUP NAME     GROUP TYPE     INCLUDED GROUP    NUMBER OF RULES
-------------- -------------- ----------------- -------------------
administrators built-in       n/a               n/a
admuser1       configuration  --                5
admuser2       configuration  admuser1          2
auditors       built-in       n/a               n/a
operators      built-in       n/a               n/a
```

Show detailed information for local user group `admuser2`.

```
switch(config-usr-grp-admuser2)# show user-group admuser2
User Group Summary
==================
Name             : admuser2
Type             : configuration
Included Group   : admuser1
Number of Rules : 2
User Group Rules
================
SEQUENCE NUM  ACTION     COMMAND                          COMMENT
------------ ---------- ------------------------------ --------------------------
-----
10            deny       show aaa .*                    Deny all show aaa commands.
20            permit     show .*                        Permit all other show
commands.
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show user-list

`show user-list [vsx-peer]`

Description

Shows all configured users and their corresponding group names.

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not

Parameter	Description
	have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Show the user list from a switch with only the admin user defined.

```
switch# show user-list

USER                          GROUP
--------------------------------------------
admin                         administrators
```

Show the user list after adding a user to the operators built-in group.

```
switch# show user-list

USER                          GROUP
--------------------------------------------
admin                         administrators
oper1                         operators
```

Show the user list after adding a user to the auditors built-in group.

```
switch# show user-list

USER                          GROUP
--------------------------------------------
admin                         administrators
oper1                         operators
audit1                        auditors
```

Show the user list after adding a total of three users to two user-defined user groups.

```
switch# show user-list

USER                          GROUP
--------------------------------------------
admin                         administrators
oper1                         operators
audit1                        auditors
adm1a                         admuser1
admin2-a                      admuser2
admin2-b                      admuser2
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show user-list management-interface

```
show user-list management-interface [vsx-peer]
```

Description

Shows a list of local users and the enabled management interfaces for each user.

Parameter	Description
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Disabling SSH and https-server for user **admin1**, disabling Telnet for **admin2**, then showing the configuration:

```
switch(config)# no user admin1 management-interface ssh
switch(config)# no user admin1 management-interface https-server
switch(config)# no user admin2 management-interface telnet
switch(config)# show user-list management-interface
USER                          ENABLED MANAGEMENT INTERFACE(S)
------------------------------------------------------------
admin                         ssh,telnet,https-server,console
admin1                        telnet,console
admin2                        ssh, https-server, console
```

Re-enabling https-server for user **admin1**, re-enabling Telnet for **admin2**, then showing the configuration:

```
switch(config)# user admin1 management-interface https-server
switch(config)# user admin2 management-interface telnet
switch(config)# show user-list management-interface
USER                          ENABLED MANAGEMENT INTERFACE(S)
------------------------------------------------------------
admin                         ssh,telnet,https-server,console
admin1                        telnet,https-server,console
admin2                        telnet,https-server,console
```

Command History

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show user information

```
show user information
```

Description

Shows the following information for the logged-in user:

- User name.
- User authentication type: `local`, `RADIUS`, or `TACACS+`.
- User group: `administrators`, `operators`, or *<GROUP-NAME>*. This field is not applicable for remote authenticated users who are mapped to administrators or operators based on their privilege level.
- User privilege level: For the built-in user groups and RADIUS or TACACS+, the role privilege level value is shown. For user-defined user groups, `N/A` is shown.
- User login session: `ssh`, `telnet`, `https-server`, or `console`.

Examples

Showing information for the `admin` user:

```
switch# show user information
Username              : admin
Authentication type   : Local
User group            : administrators
User privilege level : 15
User login session    : console
```

Showing information for a member of the user-defined local user group `admuser2`:

```
switch# show user information
Username              : admin2-b
Authentication type   : Local
User group            : admuser2
User privilege level : N/A
User login session    : telnet
```

Showing information for a member of `operators`:

```
switch# show user information
Username              : operator
Authentication type   : Local
User group            : operators
User privilege level : 1
User login session    : https-server
```

Showing information for remote RADIUS user `rad_user1` mapped to local user group `administrators`:

```
switch# show user information
Username              : rad_user1
Authentication type   : RADIUS
User group            : administrators
User privilege level : 15
User login session    : telnet
```

Showing information for remote RADIUS user `rad_user2` mapped to local user group `operators`:

```
switch# show user information
Username              : rad_user2
Authentication type   : RADIUS
User group            : operators
User privilege level : 1
User login session    : console
```

Showing information for remote TACACS+ `tac_user1` logged in with `priv-lvl` 15 (mapped to user group `administrators`):

```
switch# show user information
Username              : tac_user1
Authentication type   : TACACS+
User group            : administrators
User privilege level : 15
User login session    : ssh
```

Command History

Release	Modification
10.11	Command now includes `User login session` information in its output
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

user

```
user <USERNAME> group {administrators | operators | auditors | <USER-GROUP>}
     password [ciphertext <CIPHERTEXT-PASSWORD> | plaintext <PLAINTEXT-PASSWORD>]
no user <USERNAME>
```

Description

Creates a user and adds the user to one of the user groups. Users are given the privileges of their group. For the three built-in user groups (`administrators`, `operators`, `auditors`), the privileges are

fixed. For user-defined local user groups, the privileges are defined by the CLI command authorization rules of the group.

When entered without either optional `ciphertext` or `plaintext` parameters, the cleartext password is prompted for twice, with the characters entered masked with "*" symbols.

The `no` form of this command removes a user account from the switch. The administrator cannot delete the user account from which they are logged in. The `admin` user cannot be deleted.

Parameter	Description
<USERNAME>	Specifies the user name. Requirements: Must start with a lowercase letter. Can contain numbers and lowercase letters. Can include only these three special characters: hyphens (-), dots (.), and underscores (_). Can have a maximum of 32 characters. Cannot be empty. Cannot contain uppercase letters. Cannot be: admin, `root`, or `remote_user`. Cannot be Linux reserved names such as: `daemon`, `bin`, `sys`, `sync`, `proxy`, `www-data`, `backup`, `list`, `irc`, `gnats`, `nobody`, `systemd-bus-proxy`, `sshd`, `messagebus`, `rpc`, `systemd-journal-gateway`, `systemd-journal-remote`, `systemd-journal-upload`, `systemd-timesync`, `systemd-coredump`, `systemd-resolve`, `rpcuser`, `vagrant`, `opsd`, `rdanet`, `_lldpd`, `rdaadmin`, `rdaweb`, `docker_container`, `tss`.
`group`	Selects the local user group to which the new user will be assigned.
`administrators | operators | auditors`	Selects one of three built-in local user groups.
<USER-GROUP>	Specifies an existing user-defined local user group.
`ciphertext` *<CIPHERTEXT-PASSWORD>*	Specifies a ciphertext password. No password prompts are provided and the ciphertext password is validated before the configuration is applied for the user. The variable *<CIPHERTEXT-PASSWORD>* is Base64 and is typically copied from another switch using the `show running-config` command output and then pasted into this command. **NOTE:** The administrator cannot construct ciphertext passwords themselves. The ciphertext is only created by an AOS-CX switch. The ciphertext is created by setting a password for a user with the `user` command. The ciphertext is available for copying from the `show running-config` output and pasting into the configuration on any other AOS-CX switch. The target switch must have the same export password (default or otherwise) as the source switch.
`plaintext` *<PLAINTEXT-PASSWORD>*	Specifies the password without prompting. The password is visible as cleartext when entered but is encrypted thereafter. Command history does show the password as cleartext.

Usage

- Up to 63 local users can be added, for a total of 64 users including the default user `admin`. A user can belong to only one group.
- The switch ships with the `admin` user account and three built-in local user groups: `administrators`, `operators`, and `auditors`. The `admin` account belongs to the `administrators` group. The Service OS also includes the administrator user `admin`. The two admin users are entirely distinct.
- When a local user account is removed, the user loses all active login/SSH sessions. Any calls on the existing REST session with that local user account fail with a permissions issue as soon as the user is deleted. Soon afterwards, the existing REST sessions with the deleted local user account become invalidated. If a user is viewing the GUI while their account is deleted, the user is redirected to the login page within 60 seconds. The home directory associated with the user is also removed from the switch.
- Cleartext passwords (whether entered with prompting or entered directly) must:
  - Contain only ASCII characters from hexadecimal 21 to hexadecimal 7E [\x21-\x7E] (decimal 33 to 126). Spaces are not allowed. When the password is entered directly without prompting, the "`?`" symbol (hexadecimal 3F [\x3F] (decimal 63)) is not permitted.
  - Contain at most 32 characters.
  - Contain at least the number of characters configured (optionally) for `minimum-password-length`.

Although empty passwords are supported, it is recommended that you use strong passwords for all production switches.

Only an administrator can change the password of a user assigned to the `operators` role.

Examples

Creating local user `jamie` in the `administrators` group with a prompted password:

```
switch(config)# user jamie group administrators password
Adding user jamie
Enter password:************
Confirm password:************
```

Creating user `chris` in the existing user-defined local user group `admuser2` with a cleartext password, using direct entry without prompting:

```
switch(config)# user chris group admuser2 password plaintext passWORDxJ|989
```

Creating user `alex` in the `operators` group with a ciphertext password (the ciphertext shown is a placeholder that must be replaced with actual ciphertext):

```
switch(config)# user alex group operators password ciphertext NDcDI2...8igJfA=
```

Removing user `jamie`:

```
switch(config)# no user jamie
User jamie's home directory and active sessions will be deleted.
Do you want to continue [y/n]?y
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

user-group

```
user-group <GROUP-NAME>
no user-group <GROUP-NAME>
```

Description

If *<GROUP-NAME>* does not exist, this command creates a local user group and then enters its context. If *<GROUP-NAME>* exists, this command enters the context for the specified *<GROUP-NAME>*. Within the <GROUP-NAME> context, several subcommands are available for working with rules that specify what CLI commands are permitted or denied for all members of the local group.

In addition to the three built-in user groups `administrators`, `operators`, and `auditors`, up to 29 user-defined local user groups can be defined. All users can be members of only one of the up to 32 groups.

The no form of this command deletes the specified user group. All members of the deleted group lose all command authorization privilege.

Parameter	Description
<GROUP-NAME>	Specifies the user group name. A new group is created if the specified group does not exist and then the group context is entered. If the group name exists, its context is entered.

Do not causally delete user-defined local user groups without understanding the implications. Although user-defined local user groups can be deleted with the respective members losing all privileges, the three built-in groups `administrators`, `operators`, and `auditors` are always available and their privileges are unchangeable.

Subcommands

These subcommands are available within the user-defined local user group context (shown in the switch prompt as `config-usr-grp-`*<GROUP-NAME>*).

```
[<SEQ-NUM>] {permit | deny} cli command "<REGEX>"
no <SEQ-NUM>
```

Defines a CLI command privilege `permit` or `deny` rule. There is an implicit `"deny .*"` rule at the end of every user-defined group rule list. Members of a user-defined group without any `permit` rules have no CLI command privileges.

The no form of this subcommand deletes the specified (by sequence number) rule from the group.

Rule evaluation proceeds from lowest to highest sequence number until the first successful match, resulting in either CLI command permission or denial. Rule evaluation ceases upon first match. Therefore, rules for related CLI commands must be defined in most restrictive to least restrictive order.

<SEQ-NUM>

Specifies the CLI command rule sequence number. When omitted, a sequence number that is 10 greater the highest existing sequence number is auto-assigned. When no rules exist, the first auto-assigned sequence number is 10.

{permit | deny}

Sets the rule type as either `permit` or `deny`. Rule order is important. For example, these two related rules together authorize all `show` commands except for the `show aaa` commands.

```
switch(config-usr-grp-admuser2)#10 deny cli command "show aaa .*"
switch(config-usr-grp-admuser2)#20 permit cli command "show .*"
```

To achieve the wanted effect in this example, the `deny` rule must precede the `permit` rule. These two rules together achieve the following:

- All `show aaa` commands match on rule 10, triggering command denial, and the immediate cessation of further rule evaluation. Matching on rule 20 is never attempted.
- All other `show` commands (excluding `show aaa` commands) match on rule 20 and are therefore permitted.

<REGEX>

Specifies the CLI command matching criteria of the rule. The criteria can be expressed as `".*"` which matches all commands. Otherwise, the criteria is expressed as a POSIX-compliant regular expression (regex) string starting with an exact match command token (for example `show`) followed by a regex representing command arguments. The first word must be a string that contains only alphanumeric or hyphen characters.

For example, to allow all commands starting with the word `interface`, the regex must be `"interface .*"` or just `"interface"`. Using `"interface.*"` (without the space) is not supported. For example, `"show .*"` matches every `show` command. Consult the Extended regular expression information available at: https://pubs.opengroup.org/onlinepubs/9699919799/basedefs/V1_chap09.html#tag_09_04.

Sample matching criteria	Sample matched CLI command or specifier	Matches
`show .*`	`show accounting log`	All `show` commands
`bgp .*`	`bgp router-id 1.1.1.1`	All `bgp` commands
`interface .*`	`interface 1/1/1`	All interface specifiers
`vlan (3|4)`	`vlan 3`	VLAN 3 or 4

Sample matching criteria	Sample matched CLI command or specifier	Matches
`vlan [1-9]`	`vlan 5`	A single VLAN in the range 1 to 9
`vlan ([1-9]|1[0-9])`	`vlan 19`	A single VLAN in the range 1 to 19

`[<SEQ-NUM>] comment <TEXT-STRING>`
`no <SEQ-NUM> comment`

Adds a comment to an existing rule. The no form of this subcommand removes an existing comment.

```
switch(config-usr-grp-admuser2)# 10 comment Deny all show aaa commands.
switch(config-usr-grp-admuser2)# 20 comment Permit all other show commands.
switch(config-usr-grp-admuser2)#
switch(config-usr-grp-admuser2)# show running-config current-context
user-group admuser2
    10 comment Deny all show aaa commands.
    10 deny cli command "show aaa .*"
    20 comment Permit all other show commands.
    20 permit cli command "show .*"
```

`include <GROUP-NAME> [no] include <GROUP-NAME>`

Include all rules from the specified user-defined *<GROUP-NAME>*. Only one group can be included in the definition of another group. The content of the included group is effectively placed at the top of the rules list in the current group. If the specified *<GROUP-NAME>* does not exist, it is created.

The no form of this subcommand removes the specified included group from the current group. The specified included group must exist and must be included in the current group or else an error message is shown.

The name of the included group is shown at the top of the `show user-group` command for the group with the `include`.

In this example, group `admuser1` is included in group `admuser2`. So the `admuser1` rules are evaluated first and then the rules in the `admuser2` group are only evaluated if no CLI command match occurs for the rules in group `admuser1`.

```
switch(config-usr-grp-admuser2)# include admuser1
switch(config-usr-grp-admuser2)# show user-group admuser2
User Group Summary
==================
Name            : admuser2
Type            : configuration
Included Group  : admuser1
Number of Rules : 2
User Group Rules
================
SEQUENCE NUM  ACTION     COMMAND                        COMMENT
------------ ---------- ------------------------------ ---------------------------
-----
10            deny       show aaa .*                    Deny all show aaa commands.
20            permit     show .*                        Permit all other show
commands.
```

`resequence [<STARTING-SEQ-NUM> <INCREMENT>]`

Resequences the CLI command authorization rules. When entered without the optional parameters the rules are resequenced with a *<STARTING-SEQ-NUM>* of 10 and an *<INCREMENT>* of 10.

<STARTING-SEQ-NUM>

Specifies the starting sequence number.

<INCREMENT>

Specifies the sequence number increment.

Resequencing the rules to start at 100 with an increment of 20:

```
switch(config-usr-grp-admuser2)# resequence 100 20
switch(config-usr-grp-admuser2)# show running-config current-context
user-group admuser2
    100 comment Deny all show aaa commands.
    100 deny cli command "show aaa .*"
    120 comment Permit all other show commands.
    120 permit cli command "show .*"
```

Resequencing the rules to the default of starting at 10 with an increment of 10:

```
switch(config-usr-grp-admuser2)# resequence
switch(config-usr-grp-admuser2)# show running-config current-context
user-group admuser2
    10 comment Deny all show aaa commands.
    10 deny cli command "show aaa .*"
    20 comment Permit all other show commands.
    20 permit cli command "show .*"
```

`show running-config current-context`

Shows all the commands used to configure the rules in the current group context.

```
switch(config-usr-grp-admuser2)# show running-config current-context
user-group admuser2
    10 comment Deny all show aaa commands.
    10 deny cli command "show aaa .*"
    20 comment Permit all other show commands.
    20 permit cli command "show .*"
```

`list`

List the subcommands available within the user-defined group context.

`exit`

Exits the user-defined group context.

`end`

Exits the user-defined group context and then the config context.

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

user management-interface

```
user <USERNAME> management-interface <MGMT-INTERFACE>
no user <USERNAME> management-interface <MGMT-INTERFACE>
```

Description

Enables a management interface for the specified local user. By default, all management interfaces are enabled for all local users.

The `no` form of this command disables the selected management interface for the specified local user.

Parameter	Description
<USERNAME>	Specifies the name of an existing local user.
<MGMT-INTERFACE>	Selects one of the management interfaces: **ssh**, **telnet**, **https-server**, **console**. Note that **https-server** corresponds to the Web UI and REST.

Examples

Enabling the SSH management interface for local user `admin1`:

```
switch(config)# user admin1 management-interface ssh
```

Disabling the SSH management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface ssh
```

Enabling the telnet management interface for local user `admin1`:

```
switch(config)# user admin1 management-interface telnet
```

Disabling the telnet management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface telnet
```

Enabling the https-server (Web UI) management interface for local user `admin1`:

```
switch(config)# user admin1 management-interface https-server
```

Disabling the https-server (Web UI) management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface https-server
```

Enabling the console management interface for local user `admin1`:

```
switch(config)# user admin1 management-interface console
```

Disabling the console management interface for local user `admin1`:

```
switch(config)# no user admin1 management-interface console
```

Command History

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

user password

`user <USERNAME> password [ciphertext <CIPHERTEXT-PASSWORD> | plaintext <PLAINTEXT-PASSWORD>]`

Description

Changes a password for an account or enables the password for the admin account. When entered without either optional `ciphertext` or `plaintext` parameters, the cleartext password is prompted for twice, with the characters entered masked with "*" symbols.

Parameter	Description
<USERNAME>	Specifies the corresponding user name for the password you want to change.
`ciphertext` *<CIPHERTEXT-PASSWORD>*	Specifies a ciphertext password. No password prompts are provided and the ciphertext password is validated before the configuration is applied for the user. The variable *<CIPHERTEXT-PASSWORD>* is Base64 and is typically copied from another switch using the `show running-config` command output and then pasted into this command. **NOTE:** The administrator cannot construct ciphertext passwords themselves. The ciphertext is only created by an AOS-CX switch. The ciphertext is created by setting a password for a user with the `user` command. The ciphertext is available for copying from the `show running-config` output and pasting into the configuration on any other AOS-CX switch. The target switch must have the same export password (default or otherwise) as the source switch.
`plaintext` *<PLAINTEXT-PASSWORD>*	Specifies the password without prompting. The password is visible as cleartext when entered but is encrypted thereafter. Command history does show the password as cleartext.

Usage

The admin account is available on the switch without a password by default.

Cleartext passwords (whether entered with prompting or entered directly) must:

- Contain only ASCII characters from hexadecimal 21 to hexadecimal 7E [\x21-\x7E] (decimal 33 to 126). Spaces are not allowed. When the password is entered directly without prompting, the "`?`" symbol (hexadecimal 3F [\x3F] (decimal 63)) is not permitted.
- Contain at most 32 characters.
- Contain at least the number of characters configured (optionally) for `minimum-password-length`.

Although empty passwords are supported, it is recommended that you use strong passwords for all production switches.

Only an administrator can change the password of a user assigned to the `operators` role.

Examples

Enabling (or changing) a cleartext password for `admin`:

```
switch(config)# user admin password
Changing password for user admin
Enter password:************
Confirm password:************
```

Changing the cleartext password for user `chris`, using direct entry without prompting:

```
switch(config)# user chris password plaintext PASSwordZQ#@67
```

Changing the ciphertext password for user `alex` (the ciphertext shown is a placeholder that must be replaced with actual ciphertext):

```
switch(config)# user alex password ciphertext XqYJ36...W83D4Y=
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

SSH (Secure Shell) is a cryptographic protocol that encrypts all communication between devices.

Each switch VRF includes an SSH server. The SSH server on the `mgmt` VRF is enabled by default in software version 10.02 and higher, and disabled in version 10.01 and lower. Only the SSH servers included in the switch are supported.

The SSH server provides SSH client to switch communications, enabling SSH clients (at least SSH v2.0) to connect to the switch for the purpose of managing it. The SSH server interfaces with the authentication service that provides local and/or remote AAA.

The SSH server will perform a rekey operation for all open SSH sessions at every hour or after 1 GB of data transferred, whichever occurs first. The rekey is performed to address a common security concern that encryption/decryption keys not be used for long periods of time. This limits the amount of data exposed in the unfortunate case where a key is exposed or refactored.

SSH public key authentication is separate from SSH server. Look for information on *SSH public key* under Local authentication.

SSH defaults

Setting	Default value
Maximum SSH password retries	3 password retries.
Password-based (with SSH client) authentication	Enabled.
SSH password-based login grace period timeout	120 seconds.
SSH public key authentication	Enabled.
SSH idle session timeout	60 seconds.

SSH server tasks

SSH server tasks are as follows:

Task	Command name	Example
Enabling the SSH server	`ssh server vrf`	`ssh server vrf default`

Task	Command name	Example
Disabling the SSH server	`no ssh server vrf`	`no ssh server vrf default`
Generating an SSH host-key pair	`ssh host-key`	`ssh host-key rsa bits 2048`
Clearing the list of trusted SSH servers for your user account	`ssh known-host remove`	`ssh known-host remove 1.1.1.1`
Configuring SSH to use a set of ciphers	`ssh ciphers`	`ssh ciphers chacha20-poly1305@openssh.com aes256-ctr aes256-cbc`
Configuring SSH to use a set of host key algorithms	`ssh host-key-algorithms`	`ssh host-key-algorithms ssh-rsa ssh-ed25519 ecdsa-sha2-nistp521`
Configuring SSH to use a set of MACs	`ssh macs`	`ssh macs hmac-sha2-256 hmac-sha2-512`
Configuring SSH to use a set of key exchange algorithms	`ssh key-exchange-algorithms`	`ssh key-exchange-algorithms ecdh-sha2-nistp256`
Configuring SSH to use a set of public key algorithms	`ssh public-key-algorithms`	`ssh public-key-algorithms x509v3-ssh-rsa ssh-rsa rsa-sha2-256`
Configuring SSH idle session timeout	`cli-session`	`switch(config)# cli-session` `switch(config-cli-session)# timeout 20`
Showing the SSH server configuration	`show ssh server`	`show ssh server all-vrfs`
Showing the active SSH sessions	`show ssh server sessions`	`show ssh server sessions all-vrfs`
Showing the SSH server host keys	`show ssh host-key`	`show ssh host-key ecdsa`

SSH server commands

show ssh host-key

```
show ssh host-key [ecdsa | ed25519 | rsa]
```

Description

Shows the public host keys for the SSH server. If the key type is not provided, all available host-keys are shown.

Parameter	Description
`ecdsa`	Selects the ECDSA host-key pair.
`ed25519`	Selects the ED25519 host-key pair.

Parameter	Description
`rsa`	Selects the RSA host-key pair.

Examples

Showing the ECDSA public host-key:

```
switch# show ssh host-key ecdsa

Key Type : ECDSA     Curve : ecdsa-sha2-nistp256

ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAhtuv5rABBBGs
...
O4mjVFGMVKZ87RWkyrxeQa2fAGZZEp1902K33/k3q17fA4EivRzC75YvjDu8=
```

Showing all public host keys:

```
switch# show ssh host-key
Key Type : ECDSA     Curve : ecdsa-sha2-nistp256
ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAhtuv5rABBBGs
...
O4mjVFGMVKZ87RWkyrxeQa2fAGZZEp1902K33/k3q17fA4EivRzC75YvjDu8=

Key Type : ED25519
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIGb6910Jwoe8Hkl9K5YhqijrWI3yovNbiJVq6tw4WjJr4

Key Type : RSA       Key Size : 2048
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDdVCXlw43h4n1bwg9jI6DSBMngymCdPD0JUG42Sn9IS
...
nGSXtrNy6OmlFDJTAy+zz5Kd8d21ZLuhf07IHNgF3pff65Xc8qNJBv
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show ssh server

`show ssh server [vrf <VRF-NAME> | all-vrfs] [vsx-peer]`

Description

Shows the SSH server configuration for the specified VRF. Administrators can show the server configuration of all VRFs by using the `all-vrfs` parameter. If no VRF name is provided in this command, the command shows the SSH server configuration on the default VRF.

Parameter	Description
`vrf <VRF-NAME>`	Specifies the VRF name.
`all-vrfs`	Selects all VRFs.
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Showing the SSH server configuration on the default VRF:

```
switch# show ssh server

SSH server configuration on VRF default :

   IP Version        :  IPv4 and IPv6        SSH Version          : 2.0
   TCP Port          :  22                   Grace Timeout (sec)  : 120
   Max Auth Attempts :         6
   Allow-list        : disabled


   Ciphers:
   chacha20-poly1305@openssh.com, aes128-ctr, aes192-cbc,
   aes128-cbc, aes192-ctr, aes256-gcm@openssh.com,
   aes128-gcm@openssh.com, aes256-ctr, aes256-cbc

   Host Key Algorithms:
   ecdsa-sha2-nistp256, ecdsa-sha2-nistp384, ecdsa-sha2-nistp521,
   ssh-ed25519, rsa-sha2-256, rsa-sha2-512, ssh-rsa

   Key Exchange Algorithms:
   curve25519-sha256, curve25519-sha256@libssh.org,
   ecdh-sha2-nistp256,ecdh-sha2-nistp384, ecdh-sha2-nistp521,
   diffie-hellman-group-exchange-sha256,diffie-hellman-group16-sha512,
   diffie-hellman-group18-sha512,diffie-hellman-group14-sha256,
   diffie-hellman-group14-sha1

   MACs:
   hmac-sha1-etm@openssh.com, umac-64@openssh.com,
   umac-128@openssh.com, hmac-sha2-256,hmac-sha2-512,hmac-sha1

   Public Key Algorithms:
   rsa-sha2-256, rsa-sha2-512ssh-rsa, ecdsa-sha2-nistp256,
   ecdsa-sha2-nistp384, ecdsa-sha2-nistp521, ssh-ed25519,
   x509v3-rsa2048-sha256, x509v3-ssh-rsa, x509v3-sign-rsa,
   x509v3-ecdsa-sha2-nistp256, x509v3-ecdsa-sha2-nistp384,
   x509v3-ecdsa-sha2-nistp521
```

Showing the SSH server configuration on the management VRF:

```
switch# show ssh server vrf mgmt

SSH server configuration on VRF mgmt :

    IP Version             : IPv4 and IPv6        SSH Version          : 2.0
```

```
    TCP Port               : 22                   Grace Timeout (sec)  : 120
    Max Auth Attempts      : 6

    Ciphers:
    chacha20-poly1305@openssh.com, aes128-ctr, aes192-cbc,
    aes128-cbc, aes192-ctr, aes256-gcm@openssh.com,
    aes128-gcm@openssh.com, aes256-ctr, aes256-cbc

    Host Key Algorithms:
    ecdsa-sha2-nistp256, ecdsa-sha2-nistp384, ecdsa-sha2-nistp521,
    ssh-ed25519, rsa-sha2-256, rsa-sha2-512, ssh-rsa

    Key Exchange Algorithms:
    curve25519-sha256, curve25519-sha256@libssh.org,
    ecdh-sha2-nistp256,ecdh-sha2-nistp384, ecdh-sha2-nistp521,
    diffie-hellman-group-exchange-sha256,diffie-hellman-group16-sha512,
    diffie-hellman-group18-sha512,diffie-hellman-group14-sha256,
    diffie-hellman-group14-sha1

    MACs:
    hmac-sha1-etm@openssh.com, umac-64@openssh.com,
    umac-128@openssh.com, hmac-sha2-256,hmac-sha2-512,hmac-sha1

    Public Key Algorithms:
    rsa-sha2-256, rsa-sha2-512ssh-rsa, ecdsa-sha2-nistp256,
    ecdsa-sha2-nistp384, ecdsa-sha2-nistp521, ssh-ed25519,
    x509v3-rsa2048-sha256, x509v3-ssh-rsa, x509v3-sign-rsa,
    x509v3-ecdsa-sha2-nistp256, x509v3-ecdsa-sha2-nistp384,
```

Showing the SSH server configuration for all VRFs:

```
switch# show ssh server all-vrfs

SSH server configuration on VRF default :

    IP Version             :  IPv4 and IPv6        SSH Version          : 2.0
    TCP Port               :  22                   Grace Timeout (sec)  : 120
    Max Auth Attempts      :  6

    Ciphers:
    chacha20-poly1305@openssh.com, aes128-ctr, aes192-cbc,
    aes128-cbc, aes192-ctr, aes256-gcm@openssh.com,
    aes128-gcm@openssh.com, aes256-ctr, aes256-cbc

    Host Key Algorithms:
    ecdsa-sha2-nistp256, ecdsa-sha2-nistp384, ecdsa-sha2-nistp521,
    ssh-ed25519, rsa-sha2-256, rsa-sha2-512, ssh-rsa

    Key Exchange Algorithms:
    curve25519-sha256, curve25519-sha256@libssh.org,
    ecdh-sha2-nistp256,ecdh-sha2-nistp384, ecdh-sha2-nistp521,
    diffie-hellman-group-exchange-sha256,diffie-hellman-group16-sha512,
    diffie-hellman-group18-sha512,diffie-hellman-group14-sha256,


    MACs:
    hmac-sha1-etm@openssh.com, umac-64@openssh.com,
    umac-128@openssh.com, hmac-sha2-256,hmac-sha2-512,hmac-sha1

    Public Key Algorithms:
```

```
    rsa-sha2-256, rsa-sha2-512ssh-rsa, ecdsa-sha2-nistp256,
    ecdsa-sha2-nistp384, ecdsa-sha2-nistp521, ssh-ed25519,
    x509v3-rsa2048-sha256, x509v3-ssh-rsa, x509v3-sign-rsa,
    x509v3-ecdsa-sha2-nistp256, x509v3-ecdsa-sha2-nistp384,
    x509v3-ecdsa-sha2-nistp521

SSH server configuration on VRF mgmt :

    IP Version              : IPv4 and IPv6        SSH Version          : 2.0
    TCP Port                : 22                   Grace Timeout (sec)  : 120
    Max Auth Attempts       : 6

    Ciphers:
    chacha20-poly1305@openssh.com, aes128-ctr, aes192-cbc,
    aes128-cbc, aes192-ctr, aes256-gcm@openssh.com,
    aes128-gcm@openssh.com, aes256-ctr, aes256-cbc

    Host Key Algorithms:
    ecdsa-sha2-nistp256, ecdsa-sha2-nistp384, ecdsa-sha2-nistp521,
    ssh-ed25519, rsa-sha2-256, rsa-sha2-512, ssh-rsa

    Key Exchange Algorithms:
    curve25519-sha256, curve25519-sha256@libssh.org,
    ecdh-sha2-nistp256,ecdh-sha2-nistp384, ecdh-sha2-nistp521,
    diffie-hellman-group-exchange-sha256,diffie-hellman-group16-sha512,
    diffie-hellman-group18-sha512,diffie-hellman-group14-sha256,
    diffie-hellman-group14-sha1

    MACs:
    hmac-sha1-etm@openssh.com, umac-64@openssh.com,
    umac-128@openssh.com, hmac-sha2-256,hmac-sha2-512,hmac-sha1

    Public Key Algorithms:
    rsa-sha2-256, rsa-sha2-512ssh-rsa, ecdsa-sha2-nistp256,
    ecdsa-sha2-nistp384, ecdsa-sha2-nistp521, ssh-ed25519,
    x509v3-rsa2048-sha256, x509v3-ssh-rsa, x509v3-sign-rsa,
    x509v3-ecdsa-sha2-nistp256, x509v3-ecdsa-sha2-nistp384,
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show ssh server sessions

`show ssh server sessions [vrf <VRF-NAME> | all-vrfs] [vsx-peer]`

Description

Shows the active SSH sessions on a specified VRF or on all VRFs. If no VRF is specified, the active sessions on the `default` VRF are shown.

Parameter	Description
`vrf <VRF-NAME>`	Specifies the VRF name.
`all-vrfs`	Selects all VRFs.
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Usage

If you provide the command with a VRF name, the command shows the active SSH session for the specified VRF. Any user can show sessions of all VRFs by using the `all-vrfs` parameter. The maximum number of sessions per VRF is five. The maximum SSH idle session timeout is 60 seconds.

Examples

Showing the active SSH sessions on the default VRF:

```
switch# show ssh server sessions

SSH sessions on VRF default
    IPv4 SSH Sessions
        Server IP        : 10.1.1.1
        Client IP        : 10.1.1.2
        Client Port      : 58835

    IPv6 SSH Sessions
        Server IP        : FF01:0:0:0:0:0:0:FB
        Client IP        : FF01:0:0:0:0:0:0:FC
        Client Port      : 58836
```

Showing the SSH server configuration for all VRFs:

```
switch# show ssh server sessions all-vrf

SSH sessions on VRF mgmt
    IPv4 SSH Sessions
        Server IP        : 10.1.1.1
        Client IP        : 10.1.1.2
        Client Port      : 58835

    IPv6 SSH Sessions
        Server IP        : FF01:0:0:0:0:0:0:FB
        Client IP        : FF01:0:0:0:0:0:0:FC
        Client Port      : 58836

SSH sessions on VRF default
    IPv4 SSH Sessions
        Server IP        : 20.1.1.1
        Client IP        : 20.1.1.2
        Client Port      : 58837
```

```
IPv6 SSH Sessions
    Server IP        : FF01:0:0:0:0:0:0:FD
    Client IP        : FF01:0:0:0:0:0:0:FE
    Client Port      : 58838
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

ssh ciphers

```
ssh ciphers <CIPHERS-LIST>
no ssh ciphers
```

Description

Configures SSH to use a set of ciphers in the specified priority order. Ciphers in SSH are used for privacy of data being transported over the connection. The first cipher type entered in the CLI is considered a first priority. Each option is an algorithm that is used to encrypt the link and each name indicates the algorithm and cryptographic parameters that are used. Only ciphers that are entered by the user are configured.

The `no` form of this command removes the configuration of ciphers and reverts SSH to use the default set of ciphers.

Parameter	Description
<CIPHERS-LIST>	Valid ciphers: ■ `aes128-cbc` ■ `aes192-cbc` ■ `aes256-cbc` ■ `aes128-ctr` ■ `aes192-ctr` ■ `aes256-ctr` ■ `aes128-gcm@openssh.com` ■ `aes256-gcm@openssh.com` ■ `chacha20-poly1305@openssh.com` Default set of ciphers in priority order (highest at top): ■ `chacha20-1305@openssh.com` ■ `aes128-ctr` ■ `aes192-ctr` ■ `aes256-ctr`

Parameter	Description
	■ aes128-gcm@openssh.com ■ aes256-gcUm@openssh.com

Examples

Configuring SSH to use only specified ciphers in the priority order:

```
switch(config)# ssh ciphers chacha20-poly1305@openssh.com aes256-ctr aes256-cbc
```

Reverting SSH to use the default set of ciphers:

```
switch(config)# no ssh ciphers
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

ssh host-key

```
ssh host-key {ecdsa [ecdsa-sha2-nistp256 | ecdsa-sha2-nistp384 | ecdsa-sha2-nistp521] |
    ed25519 | rsa [bits {2048 | 4096}] }
```

Description

Generates an SSH host-key pair.

Parameter	Description
ecdsa	Selects the ECDSA host-key pair type as ecdsa-sha2-nistp256 (the default), ecdsa-sha2-nistp384, or ecdsa-sha2-nistp521.
ed25519	Selects the ED25519 host-key pair.
rsa	Selects the RSA host-key pair. Optionally, the key bit length is selected with either bits 2048 (the default) or bits 4096.

Usage

When an SSH server is enabled on a VRF for the first time, host-keys are generated.

If the host-key of the given type exists, a warning message is displayed with a request to overwrite the previous host-key with the new key.

Examples

Overwriting an old ECDSA host-key with a new ecdsa-sha2-nistp384 host-key:

```
switch(config)# ssh host-key ecdsa ecdsa-sha2-nistp384
ecdsa host-key will be overwritten.
Do you want to continue (y/n)?
```

Overwriting an old RSA host-key with a new RSA host-key with 2048 bits:

```
switch(config)# ssh host-key rsa bits 2048
rsa host-key will be overwritten.
Do you want to continue (y/n)?
```

Overwriting an ECDSA host-key with an ED25519 host-key pair:

```
switch(config)# ssh host-key ed25519
ed25519 host-key will be overwritten.
Do you want to continue (y/n)?
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh host-key-algorithms

```
ssh host-key-algorithms <HOST-KEY-ALGORITHMS-LIST>
no ssh host-key-algorithms
```

Description

Configures SSH to use a set of host key algorithms in the specified priority order. Host key algorithms specify which host key types are allowed to be used for the SSH connection. The first host key entered in the CLI is considered a first priority. Each option represents a type of key that can be used. Host keys are used to verify the host that you are connecting to. This configuration allows you to control which host key types are presented to incoming clients, or which host key types to receive first from hosts. Only the host key algorithms that are specified by the user are configured.

The `no` form of this command removes the configuration of host key algorithms and reverts SSH to use the default set of algorithms.

Parameter	Description
<HOST-KEY-ALGORITHMS-LIST>	Default set of public key algorithms in priority order (highest at top), comprised of all possible valid algorithms: ■ ecdsa-sha2-nistp256 ■ ecdsa-sha2-nistp384 ■ ecdsa-sha2-nistp521 ■ ssh-ed25519 ■ rsa-sha2-256 ■ rsa-sha2-512 ■ ssh-rsa

Examples

Configuring SSH to use only specified host key algorithms:

```
switch(config)# ssh host-key-algorithms ssh-rsa ssh-ed25519 ecdsa-sha2-nistp521
```

Reverting SSH to use the default set of host key algorithms:

```
switch(config)# no host-key-algorithms
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

ssh key-exchange-algorithms

```
ssh key-exchange-algorithms <KEY-EXCHANGE-ALGORITHMS-LIST>
no ssh key-exchange-algorithms
```

Description

Configures SSH to use a set of key exchange algorithm types in the specified priority order. The first key exchange type entered in the CLI is considered a first priority. Key exchange algorithms are used to exchange a shared session key with a peer securely. Each option represents an algorithm that is used to distribute a shared key in a way that prevents outside interference, manipulation, or recovery. Only the key exchange algorithms that are specified by the user are configured.

The no form of this command removes the configuration of key exchange algorithms and reverts SSH to use the default set of algorithms.

Parameter	Description
<KEY-EXCHANGE-ALGORITHMS-LIST>	Valid key exchange algorithms: ■ curve25519-sha256 ■ curve25519-sha256@libssh.org ■ diffie-hellman-group-exchange-sha1 ■ diffie-hellman-group-exchange-sha256 ■ diffie-hellman-group14-sha1 ■ diffie-hellman-group14-sha256 ■ diffie-hellman-group16-sha512 ■ diffie-hellman-group18-sha512 ■ ecdh-sha2-nistp256 ■ ecdh-sha2-nistp384 ■ ecdh-sha2-nistp521 Default set of key exchange algorithms in priority order (highest at top): ■ curve25519-sha256 ■ curve25519-sha256@libssh.org ■ ecdh-sha2-nistp256 ■ ecdh-sha2-nistp384 ■ ecdh-sha2-nistp521 ■ diffie-hellman-group-exchange-sha256 ■ diffie-hellman-group16-sha512 ■ diffie-hellman-group18-sha512 ■ diffie-hellman-group14-sha256 ■ diffie-hellman-group-exchange-sha1

Examples

Configuring SSH to use a set of specified key exchange algorithms:

```
switch(config)# ssh key-exchange-algorithms ecdh-sha2-nistp256 curve25519-sha256
 diffie-hellman-group-exchange-sha256
```

Reverting SSH to use the default set of key-exchange-algorithms:

```
switch(config)# no key-exchange-algorithms
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

ssh known-host remove

```
ssh known-host remove {all | {<IPv4-ADDRESS> | <HOSTNAME> | <IPv6-ADDRESS>} }
```

Description

Clears the list of trusted SSH servers for your user account. When you download or upload a file to or from a server using SFTP, you establish a trusted SSH relationship with that server. Each user account maintains its own set of SSH server host-keys for every server to which the user previously connected.

Parameter	Description
`all`	Clears the trusted servers list.
<IPv4-ADDRESS>	Specifies the IPv4 address of the remote device.
<HOSTNAME>	Specifies the host name of the remote device. Range: up to 255 characters.
<IPv6-ADDRESS>	Specifies the IPv6 address of the remote device.

Examples

Clearing the trusted server list:

```
switch(config)# ssh known-host remove all
```

Removing a specified server from the trusted server list:

```
switch(config)# ssh known-host remove 1.1.1.1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh macs

```
ssh macs <MACS-LIST>
no ssh macs
```

Description

Configures SSH to use a set of message authentication codes (MACs) in the specified priority order. The first MAC entered in the CLI is considered a first priority. MACs maintain the integrity of each message

sent across an SSH connection. Each option represents an algorithm that can be used to provide integrity between peers. Only the MAC types that are specified by the user are configured.

The `no` form of this command removes the configuration of MACs and reverts SSH to use the default set of MACs.

Parameter	Description
<MACS-LIST>	Valid MACs: ■ `hmac-sha1` ■ `hmac-sha1-96` ■ `hmac-sha1-etm@openssh.com` ■ `hmac-sha2-256` ■ `hmac-sha2-512` ■ `hmac-sha2-256-etm@openssh.com` ■ `hmac-sha2-512-etm@openssh.com` Default set of MACs in priority order (highest at top): ■ `hmac-sha2-256-etm@openssh.com` ■ `hmac-sha2-512-etm@openssh.com` ■ `hmac-sha1-etm@openssh.com` ■ `hmac-sha2-256` ■ `hmac-sha2-512` ■ `hmac-sha1`

Examples

Configuring SSH to use a set of specified MACs:

```
switch(config)# ssh macs hmac-sha2-256 hmac-sha2-512
```

Reverting SSH to use the default set of MACs:

```
switch(config)# no ssh macs
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh maximum-auth-attempts

```
ssh maximum-auth-attempts <ATTEMPTS>
no maximum-auth-attempts
```

Description

Sets the SSH maximum number of authentication attempts.

The `no` form of the command resets the maximum to its default of 6.

Parameter	Description
<ATTEMPTS>	Specifies the maximum number of SSH authentication attempts. Range: 1 to 10. Default: 6.

Examples

Setting the maximum number of authentication attempts:

```
switch(config)# ssh maximum-auth-attempts 3
```

Resetting the maximum number of authentication attempts to its default of 6:

```
switch(config)# no maximum-auth-attempts
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh public-key-algorithms

```
ssh public-key-algorithms <PUBLIC-KEY-ALGORITHMS-LIST>
no ssh public-key-algorithms
```

Description

Configures SSH to use a set of public key algorithms in the specified priority order. The first public key type entered in the CLI is considered a first priority. Public key algorithms specify which public key types can be used for public key authentication in SSH. Each option represents a public key type that the SSH server can accept or that the SSH client can present to a server. Only the public key algorithms that are chosen by the user are configured.

The `no` form of this command removes the configuration of public key algorithms and reverts SSH to use the default set.

Parameter	Description
<PUBLIC-KEY-ALGORITHMS-LIST>	Default set of public key algorithms in priority order (highest at

Parameter	Description
	top), comprised of all possible valid algorithms: ■ rsa-sha2-256 ■ rsa-sha2-512 ■ ssh-rsa ■ ecdsa-sha2-nistp256 ■ ecdsa-sha2-nistp384 ■ ecdsa-sha2-nistp521 ■ ssh-ed25519 ■ x509v3-rsa2048-sha256 ■ x509v3-ssh-rsa ■ x509v3-sign-rsa ■ x509v3-ecdsa-sha2-nistp256 ■ x509v3-ecdsa-sha2-nistp384 ■ x509v3-ecdsa-sha2-nistp521

Examples

Configuring SSH to use a set of specified public key algorithms:

```
switch(config)# ssh public-key-algorithms x509v3-ssh-rsa ssh-rsa rsa-sha2-256
```

Reverting SSH to use the default set of public key algorithms:

```
switch(config)# no ssh public-key-algorithms
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

ssh server allow-list

```
ssh server allow-list
   ip <ipv4-addr>[mask]
   ipv6 <ipv6-addr>[mask]
   enable
   no
```

Description

Configure a list of addresses that will be the only hosts allowed to connect to the SSH servers running on all VRFs of the switch. By default, the allow-list is disabled and any host is allowed to connect given

the correct authentication criteria. When the allow-list is enabled, only the hosts that fall under one of the entries may connect with the correct authentication criteria, all other hosts will be denied to attempt authentication.

Parameter	Description
ip <ipv4-addr>[mask]	An allowed host IP address and (optional) subnet in any of the following formats: ▪ **A.B.C.D**: An allowed IPv4 address ▪ **A.B.C.D/M**: An allowed IPv4 subnet with prefix length ▪ **A.B.C.D W.X.Y.Z**: An allowed IPv4 address with network mask ▪ **A.B.C.D/W.X.Y.Z**: An allowed IPv4 address with network mask
ipv6 <iv6p-addr>[mask]	An allowed host IPv6 address and (optional) subnet in any of the following formats: ▪ **X:X::X:X**: An allowed IPv6 address ▪ **X:X::X:X/M**: An allowed IPv6 subnet
enable	Enable the allow-list.
no ...	Negate a command or set its default.

Usage

The allow-list can contain up to 20 entries of IPv4 or IPv6 addresses, including entire subnets. The order in which the entries are added to the list does not matter. The configuration will only take effect once the allow-list is enabled by issuing the **enable** command in the the *config-ssh-al* (**ssh server allow-list**) context.

When the allow-list is enabled, SSH servers on all VRFs will restart and all active SSH sessions will be terminated. The enabled allow-list may be modified to remove existing entries or add new entries, and each of those modifications will trigger an SSH server restart for all VRFs and will terminate all active SSH sessions, which may include the current user if they are connected via SSH. If you disable the allow-list before making changes and enabling the allow-list again once the changes are made, any host will be allowed to connect during the modification period before the allow-list is re-enabled. When the allow-list is disabled, the SSH servers on all VRFs will restart and active SSH sessions will persist.

Every SSH allow-list ends with an implicit **deny all** rule. When you add entries to an allow list, take care to avoid blocking connectivity to the SSH server. If an SSH allow-list is enabled with no entries configured, the **deny all** functionality will block all addresses, and the SSH server will be unusable.

Examples

Configuring and enabling an SSH server allow list

```
switch(config)# ssh server allow-list
switch(config-ssh-al)# 1.1.1.1
switch(config-ssh-al)# enable
Active SSH sessions will be terminated.
Do you want to continue (y/n)?
```

Command History

Release	Modification
10.12	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config and config-ssh-al contexts`	Administrators or local user group members with execution rights for this command.

ssh server port

```
ssh server port <PORT-NUMBER>
no ssh server port [<PORT-NUMBER>]
```

Description

Configures SSH server to listen on a particular TCP port number. The default value is 22.

This port will be used for all VRFs that have SSH server enabled.

Configuring the TCP port number restarts the SSH server and terminates all active SSH sessions. It may take a few seconds for the SSH sessions to reach the running state on some VRFs.

The `no` form of the command resets the TCP port number to the default, 22.

Parameter	Description
<PORT-NUMBER>	Specifies the TCP port number. Range: 1 to 65535. Default: 22.

Examples

Configuring TCP port number `19222`:

```
switch(config)# ssh server port 19222
```

Resetting the TCP port number to the default, `22`:

```
switch(config)# no ssh server port
```

Command History

Release	Modification
10.11.1000	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh server vrf

```
ssh server vrf <VRF-NAME>
no ssh server vrf <VRF-NAME>
```

Description

Enables the SSH server on the specified VRF. SSH is disabled by default and will not be operational till the admin password is set on the switch. Note that the admin password is considered set even if it is configured to be empty.

The `no` form of the command disables the SSH server on the specified VRF. If no VRF is specified, by default the SSH server will be enabled on the **default** or **mgmt** VRF, depending on the switch model.

Parameter	Description
`vrf <VRF-NAME>`	Specifies the VRF name.

Examples

Enabling the SSH server on the management VRF:

```
switch(config)# ssh server vrf mgmt
```

Disabling the SSH server on the management VRF:

```
switch(config)# no ssh server vrf mgmt
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

The switch provides an SSH client that enables the switch to log in to an SSH server such as another switch, typically for command execution purposes. The SSH client provides secure encrypted communications between the switch and the SSH server over any network.

SSH client commands

ssh (client login)

```
ssh [<USERNAME>@]{<IPV4> | <HOSTNAME>} [vrf <VRF-NAME>] [port <PORT-NUMBER>]
```

Description

Establishes a client session with an SSH server which is typically another switch.

username, vrf and port number are optional parameters. If a source ip address or source interface is configured for the ssh client protocol, the configuration values are used for establishing the client session with the SSH server.

The source interface can be configured using the IP source interface configuration commands described in the Fundamentals Guide.

Parameter	Description
<USERNAME>	Specifies the username that the client uses to log in to an SSH server. When omitted, the username of the current session is used.
<IPV4>	Specifies the SSH server to which the SSH client will connect as an IPv4 address.
<HOSTNAME>	Specifies the SSH server to which the SSH client will connect as a host name.
`vrf` *<VRF-NAME>*	Specifies the VRF to be used for the SSH client session. When omitted, the default VRF named `default` is used.
`port` *<PORT-NUMBER>*	Specifies the SSH server TCP port number. When omitted, the default TCP port 22 is used.

Examples

Establishing an SSH client session (using the management VRF) with an SSH server:

```
switch# ssh admin@10.0.11.180 vrf mgmt
```

Establishing an SSH client session (using the default VRF and a specific port) with an SSH server:

```
switch# ssh admin@10.0.11.175 port 223
```

Configuring a test user on switch 1 and then connecting to switch 1 from switch 2 using the SSH client on the mgmt VRF:

```
** Configuring a test user on switch 1 **
switch(config)# user-group test
switch(config-usr-grp-test)# permit cli command ".*"
switch(config)# exit
switch(config)# user test-user group test password plaintext tst#9J

** On switch 2, connecting to switch 1 using the SSH client **
switch# ssh test-user@10.0.11.177 vrf mgmt
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

Local AAA on your Aruba CX switch provides:

- Authentication using local password or SSH public key.
- Authorization using local role-based access control (RBAC). Optional per-command authorization is possible through configuration of user-defined local user groups, with command authorization rules applied to respective group members.
- Accounting of user activity on the switch using accounting logs.

For switches that support multiple management modules such as the Aruba 8400, all AAA functionality discussed only applies to the active management module. See also *AAA on switches with multiple management modules* in the *High Availability Guide*.

Local AAA defaults and limits

Setting	Default value / limit
Local authentication	Enabled by default for all connection types: console, SSH, and REST.
Local role-based access control (RBAC) authorization	Enabled by default for all connection types: console, SSH, and REST.
Local accounting	Enabled.
Maximum number of local users	64 users, including the default `admin` user.
Maximum number of user-defined local user groups	32 groups, including the three built-in groups `administrators`, `operators`, `auditors`.
Password for default admin account	The password is empty by default.
SSH public key authentication	Enabled.

Supported platforms and standards

Local AAA is supported on the 4100i, 6000, 6100, 6200, 6300, 6400, 8320, 8325, 8360, 8400, 9300, and 10000 Switch Series.

Scale

Setting	Default value / limit
Local authentication	Enabled by default for all connection types: console, SSH, and REST.
Local role-based access control (RBAC) authorization	Enabled by default for all connection types: console, SSH, and REST.
Local accounting	Enabled.
Maximum number of local users	64 users, including the default `admin` user.
Maximum number of user-defined local user groups	32 groups, including the three built-in groups `administrators`, `operators`, `auditors`.
Password for default admin account	The password is empty by default.
SSH public key authentication	Enabled.

Local authentication

Authentication identifies users, validates their credentials, and grants switch access. Local authentication is either password-based or SSH public key-based.

Password-based local authentication

- Validates users with local user name and password credentials
- Is supported on all interfaces/channels (SSH, WebUI, Console, REST)
- Is enabled by default but can be superseded by remote authentication or with SSH client using SSH public key authentication

SSH public key-based local authentication

- Validates users identified with SSH public keys stored in the local user database
- Is supported on the SSH interface/channel with SSH client
- Takes precedence over password-based authentication whether local or remote
- Is enabled by default (also requires key configuration to work)

Local authentication tasks

The local authentication (local password and SSH public key) tasks are as follows:

Task	Command name	Example

Enable authentication as local for the specified connection types	`aaa authentication login`	Enable local authentication for the default and console connection types:
		`aaa authentication login default local`
		`aaa authentication login console local`

Task	Command name	Example
Show authentication configuration	`show aaa authentication`	`show aaa authentication`
Enable password-based authentication minimum password length checking	`aaa authentication minimum-password-length`	`aaa authentication minimum-password-length 12`
Disable password-based authentication minimum password length checking	`aaa authentication minimum-password-length`	`no aaa authentication minimum-password-length`
Enable local password-based authentication login attempt limiting	`aaa authentication limit-login-attempts`	`aaa authentication limit-login-attempts 4 lockout-time 20`
Disable local password-based authentication login attempt limiting	`aaa authentication limit-login-attempts`	`no aaa authentication limit-login-attempts`
Enable local password-based authentication for use with SSH clients (enabled by default)	`ssh password-authentication`	`ssh password-authentication`
Disable local password-based authentication for use with SSH clients	`ssh password-authentication`	`no ssh password-authentication`

Task	Command name	Example
Enable SSH public key authentication (enabled by default)	`ssh public-key-authentication`	`ssh public-key-authentication`
Disable SSH public key authentication	`ssh public-key-authentication`	`no ssh public-key-authentication`
Show state of local password-based (for SSH) and SSH public key authentication	`show ssh authentication-method`	`show ssh authentication-method`
Copying the client SSH public key into the key list	`user authorized-key`	`user admin authorized-key ecdsa-sha2-nistp256 E2VjZH...QUiCAk= root@switch`
Removing SSH public keys from the key list	`user authorized-key`	`no user admin authorized-key 2`
Showing the SSH client public key list	`show user`	`show user admin authorized-key`

Local authorization

Authorization controls authenticated users command execution and switch interaction privileges. Local authorization uses role-based access control (RBAC) to provide role-based privilege levels plus optional user-defined local user groups with command execution rules. Authorization occurs only after successful authentication.

- **Administrators** have full command execution and switch interaction privilege.
- **Operators** are limited to the use of several nonsensitive `show` commands.
- **Auditors** are limited to a few auditing-related commands.

Optional per-command authorization is available through configuration of user-defined local user groups with command authorization rules applied to respective group members. see User-defined user groups .

Local authorization tasks

The local authorization tasks are as follows:

Task	Command name	Example

Enable authorization as local RBAC for the specified connection types	`aaa authorization commands`	Enable local authorization for the default and console connection types:
		`aaa authorization commands default local`
		`aaa authorization commands console local`

Show authorization configuration	`show aaa authorization`	`show aaa authorization`

Local accounting

Local accounting is always active. It cannot be turned off.

This accounting information is captured and made available locally (using `show accounting log`) and, if desired, for sending to remote AAA servers:

- Exec Accounting: user login/logout events.
- Command accounting: commands executed by users.
- System accounting: remote accounting On/Off events.
- CLI show commands.
- Interactions on the non-CLI interfaces: REST and WebUI.

The following is not captured or made available as accounting information:

- CLI commands that reboot the switch.
- Interactions in the bash shell.

See also the `show accounting log` command.

Local accounting tasks

The local accounting tasks are as follows:

Task	Command name	Example

Enable accounting as local for the specified connection types	`aaa accounting all-mgmt`	Enable local accounting for the default and console connection types:
		`aaa accounting all-mgmt default start-stop local`
		`aaa accounting all-mgmt console start-stop local`

Show accounting configuration	`show aaa accounting`	`show aaa accounting`
Show local accounting log contents	`show accounting log`	`show accounting log last 10`

aaa accounting all-mgmt

```
aaa accounting all-mgmt <CONNECTION-TYPE> start-stop {local | group <GROUP-LIST>}
no aaa accounting all-mgmt <CONNECTION-TYPE>
```

Description

Defines accounting as being local (with the name `local`) (the default). Or defines a sequence of remote AAA server groups to be accessed for accounting purposes.

For remote accounting, the information is sent to the first reachable remote server that was configured with this command for remote accounting. If no remote server is reachable, local accounting remains available. Each available connection type (channel) can be configured individually as either local or using remote AAA server groups. All server groups named in your command, must exist. This command can be issued multiple times, once for each connection type. Local is always available for any connection type not configured for remote accounting.

The system accounting log is not associated with any connection type (channel) and is therefore sent to the accounting method configured on the default connection type (channel) only.

The `no` form of this command removes for the specified connection type, any defined remote AAA server group accounting sequence. Local accounting is available for connection types without a configured remote AAA server group list (whether default or for the specific connection type).

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Defines a list of accounting server groups to be used for the `default` connection type. This configuration applies to all other connection types (`console`, `https-server`, `ssh`) that are not explicitly configured with this command. For example, if you do not use `aaa accounting all-mgmt console...` to define the console accounting list, then this default configuration is used for console.
	`console`
	Defines a list of accounting server groups to be used for the `console` connection type.
	`https-server`
	Defines a list of accounting server groups to be used for the `https-server` (REST, Web UI) connection type.
	`ssh`
	Defines a list of accounting server groups to be used for the `ssh` connection type.

`start-stop`	Selects accounting information capture at both the beginning and

Parameter	Description
	end of a process.
`local`	Selects local-only accounting when used without the `group` parameter.
`group <GROUP-LIST>`	Specifies the list of remote AAA server group names. Each name can be specified one time. Predefined remote AAA group names `tacacs` and `radius` are available. Although not a group name, predefined name `local` is available. User-defined TACACS+ and RADIUS server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa group server` and servers are added to a server group with the command `server`. If the AAA server(s) in the group are not reachable, or the if there is a key mismatch error between the server and the switch, the next accounting method is attempted.

Usage

Local accounting is always active. It cannot be turned off.

Examples

Setting local accounting for the default connection type:

```
switch(config)# aaa accounting all-mgmt default start-stop local
```

Setting local accounting for the console connection type:

```
switch(config)# aaa accounting all-mgmt console start-stop local
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication console-login-attempts

`aaa authentication console-login-attempts <ATTEMPTS> console-lockout-time <LOCKOUT-TIME>`

```
no aaa authentication console-login-attempts
```

Description

For the console interface (channel) only, enables console login attempt limiting. If the number of failed console login attempts equals the configured threshold, the user is locked out for the configured duration.

The `no` form of this command disables console login attempt limits.

Important: If you enable the lockout using this command and also enable the SSH, REST, and Telnet lockout using command `aaa authentication limit-login-attempts`, and then enter too many consecutive wrong passwords, you may become locked out, and will have to wait for the configured lockout time to elapse before logging in on any interface.

This console login attempt limiting feature is only available when not using remote authentication through AAA servers (TACACS+ or RADIUS) on any interface. Remote authentication through AAA servers (TACACS+ or RADIUS) is not possible when limit login attempts is configured on any interface.

Parameter	Description
<ATTEMPTS>	Specifies the threshold of failed console login attempts that triggers user lockout. Range: 1 to 10. For example, if *<ATTEMPTS>* is set to `1`, a single failed login attempt triggers immediate user lockout.
<LOCKOUT-TIME>	Specifies the amount of time a user is locked out. Range: 1 to 3600 seconds.

Examples

Enabling console login attempt failure limiting with a 60 second lockout being triggered upon the third consecutive login attempt failure.

```
switch(config)# aaa authentication console-login-attempts 3 console-lockout-time
60
```

Disabling console login attempt failure limiting:

```
switch(config)# no aaa authentication console-login-attempts
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication limit-login-attempts

```
aaa authentication limit-login-attempts <ATTEMPTS> lockout-time <LOCKOUT-TIME>
no aaa authentication limit-login-attempts <ATTEMPTS> lockout-time <LOCKOUT-TIME>
```

Description

For the SSH, REST, and Telnet interface (channel), enables local login attempt limiting. If the number of failed local login attempts equals the configured threshold, the user is locked out for the configured duration.

The `no` form of this command disables local login attempt limits.

Important: If you enable the lockout using this command and also enable the console lockout using command `aaa authentication console-login-attempts`, and then enter too many consecutive wrong passwords, you may become locked out, and will have to wait for the configured lockout time to elapse before logging in on any interface.

This local login attempt limiting feature is only available when not using remote authentication through AAA servers (TACACS+ or RADIUS) on any interface. Remote authentication through AAA servers (TACACS+ or RADIUS) is not possible when limit login attempts is configured on any interface.

Parameter	Description
<ATTEMPTS>	Specifies the threshold of failed local login attempts that triggers user lockout. Range: 1 to 10. For example, if *<ATTEMPTS>* is set to `1`, a single failed login attempt triggers immediate user lockout.
<LOCKOUT-TIME>	Specifies the amount of time a user is locked out. Range: 1 to 3600 seconds.

Examples

Enabling local login attempt failure limiting with a 20 second lockout being triggered upon the fourth consecutive login attempt failure.

```
switch(config)# aaa authentication limit-login-attempts 4 lockout-time 20
```

Disabling login attempt failure limiting:

```
switch(config)# no aaa authentication limit-login-attempts
```

Command History

Release	Modification
10.11	Added Telnet support on the 10000, 9300, 83xx, 6100, 6000 and 4100i Switch Series.
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication login

```
aaa authentication login <CONNECTION-TYPE> {local | group <GROUP-LIST>}
no aaa authentication login <CONNECTION-TYPE> {local | group <GROUP-LIST>}
```

Description

Defines authentication as being local (with the name `local`) (the default). Or defines a sequence of remote AAA server groups to be accessed for authentication purposes. Each available connection type (channel) can be configured individually as either local or using remote AAA server groups. All server groups named in your command, must exist. This command can be issued multiple times, once for each connection type. Local is always available for any connection type not configured for remote AAA authentication.

The `no` form of this command removes for the specified connection type, any defined remote AAA server group authentication sequence. Local authentication is available for connection types without a configured remote AAA server group list (whether default or for the specific connection type).

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Defines a list of accounting server groups to be used for the `default` connection type. This configuration applies to all other connection types (`console`, `https-server`, `ssh`) that are not explicitly configured with this command. For example, if you do not use `aaa accounting all-mgmt console...` to define the console accounting list, then this default configuration is used for console.
	`console`
	Defines a list of accounting server groups to be used for the `console` connection type.
	`https-server`
	Defines a list of accounting server groups to be used for the `https-server` (REST, Web UI) connection type.
	`ssh`
	Defines a list of accounting server groups to be used for the `ssh` connection type.

Parameter	Description
`local`	Selects local-only accounting when used without the `group` parameter.
`group <GROUP-LIST>`	Specifies the list of remote AAA server group names. Each name can be specified one time. Predefined remote AAA group names `tacacs` and `radius` are available. Although not a group name, predefined name `local` is available. User-defined TACACS+ and RADIUS server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa group server` and servers are added to a server group with the command `server`. If no AAA server(s) in the group are reachable, or if there is a key mismatch error between the server and the switch, the next authentication method is attempted.

Examples

Setting local authentication for the default connection type:

```
switch(config)# aaa authentication login default local
```

Setting local authentication for the console connection type:

```
switch(config)# aaa authentication login console local
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication minimum-password-length

```
aaa authentication minimum-password-length <LENGTH>
no aaa authentication minimum-password-length <LENGTH>
```

Description

Enables minimum password length checking. Existing passwords shorter than the minimum length are unaffected. Length checking does not apply to ciphertext passwords. Length checking applies both to local and remote authentication.

The `no` form of this command disables minimum password length checking.

Parameter	Description
<LENGTH>	Specifies the minimum password length. Range: 1 to 32.

Examples

Enabling password length checking, with a minimum length of 12.

```
switch(config)# aaa authentication minimum-password-length 12
```

Disabling minimum password length checking:

```
switch(config)# no aaa authentication minimum-password-length
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authorization commands (local)

```
aaa authorization commands <CONNECTION-TYPE> {local | none}
no aaa authorization commands <CONNECTION-TYPE> {local | none}
aaa authorization commands <CONNECTION-TYPE> group <GROUP-LIST>
no aaa authorization commands <CONNECTION-TYPE> group <GROUP-LIST>
```

Description

Defines authorization as being basic local RBAC (specified as `none`), or as full-fledged local RBAC specified as `local` (the default), or as remote TACACS+ (specified with `group` *<GROUP-LIST>*). Each available connection type (channel) can be configured individually. All server groups named in the command, must exist. This command can be issued multiple times, once for each connection type.

The `no` form of this command unconfigures authorization for the specified connection type, reverting to the default of `local`.

Although only TACACS+ servers are supported for remote authorization, local authorization (basic or full-fledged) can be used with remote RADIUS authentication. If your switch uses command authorization, best practices is to configure authorization fail-through before configuring authentication fail-through. If not, the switch may fall into an unusable state where authorization will fail for all commands.

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Selects the `default` connection type for configuration. This configuration applies to all other connection types (`console`, `ssh`) that are not explicitly configured with this command. For example, if you do not use `aaa authorization commands console...` to define the console authorization list, then this default configuration is used for console.
	`console`
	Selects the `console` connection type for configuration.
	`ssh`
	Selects the `ssh` connection type for configuration.

`local`	When used alone without `group` *<GROUP-LIST>*, selects local authorization which can be used to provide authorization for a purely local setup without any remote AAA servers and also for when RADIUS is used for remote Authentication and Accounting but Authorization is local. When used after `group`, provides for fallback (to full-fledged local authorization) when every server in every specified TACACS+ server group cannot be reached. **NOTE:** If any TACACS+ server in the specified groups is reachable, but the command fails to be authorized by that server, the command is rejected and local authorization is never attempted. Local authorization is only attempted if every TACACS+ server cannot be reached.
`none`	When used alone without `group` *<GROUP-LIST>*, selects basic local RBAC authorization, for use with the built-in user groups (`administrators`, `operators`, `auditors`). When used after `group`, provides for fallback (to basic local RBAC authorization) when every server in every specified TACACS+ server group cannot be reached. **NOTE:** With `none`, for users belonging to user-defined user groups, all commands can be executed regardless of what authorization rules are defined in such groups. For per-command local authorization, use `local` instead.
`group` *<GROUP-LIST>*	Specifies the list of remote AAA server group names. Predefined remote AAA group name `tacacs` is available. User-defined TACACS+ server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa server group` and servers are added to a server group using command `server`. It is recommended to always include either the special name `local` or `none` as the last name in the group list. If both `local` and `none` are omitted, and no remote AAA server is reachable (or the first reachable server cannot authorize the command), command execution for the current user will not be possible.

Parameter	Description
	If no AAA server(s) in the group are reachable, o rif there is a key mismatch error between the server and the switch, the next authorization method is attempted.

Examples

Setting the authorization for default to `local`:

```
switch(config)# aaa authorization commands default local
```

Setting the authorization for the SSH interface to `none`:

```
switch(config)# aaa authorization commands ssh none
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

show aaa accounting

```
show aaa accounting [vsx-peer]
```

Description

Shows the accounting configuration per connection type (channel).

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Configuring and then showing local accounting for the default and console connection types:

```
switch(config)# aaa accounting all default start-stop local
switch(config)# aaa accounting all console start-stop local
switch(config)# exit
```

```
switch# show aaa accounting
AAA Accounting:
  Accounting Type                                 : all
  Accounting Mode                                 : start-stop

Accounting for default channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

Accounting for console channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication

```
show aaa authentication [vsx-peer]
```

Description

Shows the authentication configuration per connection type (channel).

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Configuring and then showing local authentication for the default and console connection types (channels):

```
switch(config)# aaa authentication login default local
switch(config)# aaa authentication login console local
switch(config)# exit
switch# show aaa authentication

AAA Authentication:
  Fail-through                          : Disabled
  Limit Login Attempts                  : Not set
  Lockout Time                          : 300
  Minimum Password Length               : Not set

Authentication for default channel:
------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------------
local                           | 0
------------------------------------------------------------------------------

Authentication for console channel:
------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------------
local                           | 0
------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authorization

```
show aaa authorization [vsx-peer]
```

Description

Shows the authorization configuration per connection type (channel).

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Configuring and then showing full-fledged local RBAC authorization for the default and console connection types (channels):

```
switch(config)# aaa authorization commands default none
switch(config)#
switch(config)# aaa authorization commands console none
switch(config)# exit
switch#
switch# show aaa authorization
Authorization for default channel:
-------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
-------------------------------------------------------------------------------
none                            | 0
-------------------------------------------------------------------------------

Authorization for console channel:
-------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
-------------------------------------------------------------------------------
none                            | 0
-------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show authentication locked-out-users

```
show authentication locked-out-users
```

Description

Shows a list of users currently locked out due to excessive failed login attempts. This applies to console, REST, SSH, WebUI, and telnet logins.

Example

Showing locked-out users.

```
switch# show authentication locked-out-users
 USER                              GROUP
 ----------------------------------------
 admin                             administrators
 admin-1                           administrators
```

Command History

Release	Modification
10.11	The output of this command now also includes information for users locked out due to excessive REST login attempts.
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show ssh authentication-method

```
show ssh authentication-method
```

Description

Shows the status of the SSH public key method and the local password-based (through SSH client) authentication method.

Example

Showing the authentication methods.

```
switch# show ssh authentication-method
SSH publickey authentication : Enabled
SSH password authentication : Enabled
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show user

```
show user <USERNAME> authorized-key
```

Description

Shows the SSH client public key list for a specified user.

Parameter	Description
<USERNAME>	Specifies the username for which you want to show the SSH client public key list.

Usage

Any user can show their own public key list; however, administrators can also show a public key list of other users.

Examples

Showing a client public key:

```
switch# show user admin authorized-key

1. Key Type : RSA     Key size : 2048
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDMtyMBmmAaF6r1zxf3DZNHSYVHBJhlbBlyAIqQ8DSHK
...
U+aE14UW/ifIukmK67sIHwK+FhhRYwPztQc5pjyOPk128a4pgKQaHCcOF169Z admin@switch
```

Showing two client public keys:

```
switch# show user admin authorized-key
1. Key Type : ECDSA     Curve : nistp256
ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBEqEFevZ0
...
l76V+D0svdCJ9Wo32zqI9OeAdTJw/eZYp5qknhNgS81HjAI6J/4/kAqdZAjbqQUiCAk= admin@switch

2. Key Type : RSA     Key size : 2048
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDXQHrqV7+/GcMdOhr//IRjJkX7TQKupW89j80bL7xq8
...
j8qKuHWSN0/h/HxjzQJuYDVmZN5vG3DhpXbBZUlZNnchVod13QLCesqA3VLKN admin@switch
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

ssh password-authentication

```
ssh password-authentication

no ssh password-authentication
```

Description

Enables the password-based authentication method for use with SSH clients.

The `no` form of this command disables the password-based authentication method for use with SSH clients.

Usage

The switch ships with password-based authentication (for SSH clients) enabled. The maximum number of password retries is three.

Examples

Enabling password authentication for use with SSH clients:

```
switch(config)# ssh password-authentication
```

Disabling password authentication for use with SSH clients:

```
switch(config)# no ssh password-authentication
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh public-key-authentication

```
ssh public-key-authentication
no ssh public-key-authentication
```

Description

Enables the SSH public key authentication method. The switch ships with SSH public key authentication enabled.

The `no` form of this command disables the SSH public key authentication method.

Although SSH public key authentication is enabled by default, it cannot be used until SSH public keys are added with the `user authorized-key` command.

Examples

Enabling SSH public key authentication:

```
switch(config)# ssh public-key-authentication
```

Disabling SSH public key authentication:

```
switch(config)# no ssh public-key-authentication
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

user authorized-key

```
user <USERNAME> authorized-key <PUBKEY>
no user <USERNAME> authorized-key [<KEYNUM>]
```

Description

Copies an SSH client public key into the key list. If the key list and the public key do not exist, it creates a list with the public key. If the SSH client public key exists, the command appends the new key to the existing list. The client public key list holds a maximum of 32 client keys.

The `no` form of the command removes either one or all SSH public keys from the key list.

Parameter	Description
<USERNAME>	Specifies the name of the user.
<PUBKEY>	Specifies the SSH client public key to be copied into the key list.
<KEYNUM>	Specifies the key number. The range is 1 to 32. Use the `show user <USERNAME> authorized-key` command to find the key number associated with the key.

Usage

Each key on the key list has a key identifier. The `show user <USERNAME> authorized-key` command displays the key identifier associated with the key.

Administrators can add and remove the public keys of themselves and other users. Operators can add and remove only their own public keys. If the public key authentication method is enabled, the client public key present is used by the SSH server to authenticate the client. The authentication method reverts to the password authentication method and prompts for a client password when one of the following occurs:

- The client public keys are not present.
- The server does not have the keys enabled.
- The public key method is disabled.

You can either remove all keys or a specific key. Each key on the key list has a key identifier. If you provide the key identifier in this command, the command removes the corresponding key from the list. If you provide no key identifier, the command removes all keys from the key list.

Examples

Adding a public key:

```
switch(config)#user admin authorized-key ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTIt
bmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBEqEFevZ0176V+D0svdCJ9Wo32zqI9OeAIdTJwT/eZYp50qkA
nhZNgS81HBjAI6QJ/4/kAyqdZ9oAjbiqQUiCAk= root@switch
```

Removing all SSH public keys from the list:

```
switch(config)# no user admin authorized-key
```

Removing the specified SSH public key from the list:

```
switch(config)# no user admin authorized-key 2
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Remote AAA with TACACS+ provides the following for your Aruba CX switch:

- Authentication using remote TACACS+ AAA servers.
- Authorization using remote TACACS+ AAA servers, providing fine-grained command authorization. Optional user-defined local user groups with configured command authorization rules can be used to provide authorization fallback protection for when TACACS+ servers become temporarily unavailable.
- Transmission of locally collected accounting information to remote TACACS+ servers.

For switches that support multiple management modules such as the Aruba 8400, all AAA functionality discussed only applies to the active management module. See also *AAA on switches with multiple management modules* in the *High Availability Guide*.

Parameters for TACACS+ server

When creating a TACACS+ server for AAA, you must configure the following parameters using the `tacacs-server host` command:

Parameter	Description
`{<FQDN> | <IPV4> | <IPv6>}`	Specifies the TACACS+ server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
`key [plaintext <PASSKEY> | ciphertext <PASSKEY>]`	Selects either a plaintext or an encrypted local shared-secret passkey for the server. As per RFC 2865, shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `key` is entered without either sub-parameter, plaintext passkey prompting occurs upon pressing Enter. Enter must be pressed immediately after the `key` parameter without entering other parameters. The entered passkey characters are masked with asterisks. When `key` is omitted, the server uses the global passkey. This command requires either the global or local passkey to be set; otherwise the server will not be contacted. Command `tacacs-server key` is available for setting the global passkey.
`timeout <TIMEOUT-SECONDS>`	Specifies the timeout. Range: 1 to 60 seconds. Default : 5 seconds.
`port <PORT-NUMBER>`	Specifies the TCP authentication port number. Range: 1 to 65535. Default: 49.

Parameter	Description
`auth-type {pap | chap}`	Selects either the PAP (the default) or CHAP authentication types. If this parameter is not specified, the TACACS+ global default is used.
`tracking {enable | disable}`	Enables or disables server tracking for the RADIUS server. Tracked servers are probed at the start of each server tracking interval to check if they are reachable. Use command `tacacs-server tracking` to configure TACACS+ server tracking globally.
`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.

Default server groups

The switch always has these four default groups:

- `tacacs`: for remote AAA, always contains every configured TACACS+ server.
- `radius`: for remote AAA, always contains every configured RADIUS server.
- `local`: for local authentication.
- `none`: for local (RBAC) authorization.

User-defined AAA servers are always added to the matching default group, either `tacacs` or `radius`. A maximum of 28 user-defined groups can be created.

- On the 4100i, 6000, 6100, 6200, 6300, 6400, 8100, 8325, 8360, and 10000 Switch Series, a RADIUS server can be associated with a maximum of four different user-defined server groups.
- On the 8320, 8400, and 9300 Switch Series, a RADIUS server can be associated with only one user-defined server group.

The order in which servers are added to a group is important. The server added first is accessed first, and if necessary, the second server is accessed second, and so on.

Supported platforms and standards

Remote AAA with TACACS+ is supported on the 4100i, 6000, 6100, 6200, 6300, 6400, 8100, 8320, 8325, 8360, 8400, 9300, and 10000 Switch Series.

TACACS VxLAN overlay (IPv4 and IPv6) is supported on the following platforms only: 6300, 6400, 8100, and 8360.

TACACS Static VxLAN underlay (IPv4) is supported on the 6200 platform.

Setting	Default value / limit
Authentication of REST sessions with TACACS+	Disabled

Setting	Default value / limit
Maximum number of TACACS+ servers in an AAA group	16
Maximum number of TACACS+ servers that can be configured	16
Maximum number of user-defined AAA server groups that can be configured	28
TACACS+ authentication	Disabled
TACACS+ authentication global timeout	5 seconds
TACACS+ authentication passkey (shared secret)	None
TACACS+ authentication tcp-port	49
TACACS+ global authentication protocol	PAP
TACACS+ server tracking default interval	300 seconds
TACACS+ server access through the default VRF	default*

*The default value is `default`, unless another VRF is specified during the server configuration.

About global versus per-TACACS+ server passkeys (shared secrets)

To communicate with a TACACS+ AAA server, the switch must have a passkey (shared secret) configured that matches what is configured on the server. Use one of these commands to achieve the desired configuration:

- For a global passkey common to every TACACS+ server, use `tacacs-server key`.
- For a per-TACACS+ server passkey, use `tacacs-server host` with the `key` parameter.

If both passkeys are configured on the switch, the per-TACACS+ server passkey is used.

Remote AAA TACACS+ server configuration requirements

The user-supplied TACACS+ server must:

- Have an IPv4/IPv6 address or fully qualified domain name (FQDN) that is visible to the switch.
- Have a passkey (shared secret) that matches what is configured on the switch.
- Provide username and password definitions for every switch user. Remote users do not require definition on the switch.
- Configure user role assignment using TACACS+ attributes.
- Have any needed command authorization configured to control what commands (per user or user role) will be executable on the switch.

Consult your TACACS+ server documentation for installation and general configuration details.

If SSH public key authentication is used, the key information is stored locally on the switch, making username and password definition on the TACACS+ server unnecessary.

User role assignment using TACACS+ attributes

User role assignment is configured on the TACACS+ server using VSAs (vendor-specific attributes) and TACACS+ specified attributes.

TACACS+ servers can return multiple attribute value pairs (AVPs) in response to an authentication request. The attributes are processed in this order of precedence to determine the user role assigned:

- If the `Aruba-Admin-Role` VSA is present, map the user to the matching corresponding local user-group name.
  - Else if the `priv-lvl` TACACS+ specified attribute is present, extract the privilege level (1, 15, or 19) and map the user to the local user-group corresponding to this privilege level (`1=operators`, `15=administrators`, `19=auditors`). Privilege levels 2 to 14 may also be used with matching local user groups named 2 to 14.
    - Otherwise, the user role cannot be determined, and authentication fails.

Aruba-Admin-Role	priv-lvl	User role assigned
<GROUP-NAME>	Do not care	Matching local user *<GROUP-NAME>*
Not present	1	Operators
Not present	15	Administrators
Not present	19	Auditors
Not present	2 to 14	Matching local user groups named 2 to 14
Not present	Not present	None (not authenticated)

TACACS+ server redundancy and access sequence

To prevent authentication and authorization interruption, it is common practice to configure more than one TACACS+ server. When identifying TACACS+ servers to the switch, server group order (and server order within the group), determines server access order.

When defining the server access sequence for authentication with `aaa authentication login default`, there is an implied `local` included as the last item in the list. If no TACACS+ server can be reached, local authentication will be attempted.

When defining the server access sequence for authorization with `aaa authorization commands`, it is recommended to always include either `local` or `none` as the last item in the list.

Single source IP address for consistent source identification to AAA servers

If applicable to your installation, it is recommended that you perform the optional configuration mentioned in this section.

If your topology allows the AAA server to be reached through multiple paths, the server interprets the incoming packets to be from different switches even though they are all coming from the same switch. Having a switch associated with multiple IP addresses makes it more difficult to interpret system logs and accounting data.

To ensure that all traffic sent from the switch to the AAA server uses the same source IP address, use `ip source-interface` or `ipv6 source-interface`. These two commands plus the related commands `show ip source-interface` and `show ipv6 source-interface` are described under *Layer 2/3 Interface commands* in the *Command-Line Interface Guide*.

TACACS+ general tasks

General TACACS+ tasks, not specific to authentication, authorization, or accounting, are as follows:

Task	Command name	Example
Configuring a TACACS+ server	`tacacs-server host`	`tacacs-server host 1.1.1.1 vrf default` `no tacacs-server host 1.1.1.1 vrf default`
Showing global and TACACS+ server configurations	`show tacacs-server`	`show tacacs-server detail`
Configuring a TACACS+ server group	`aaa group server`	`aaa group server tacacs sg1` `no aaa group server tacacs sg1`
Showing server groups	`show aaa server-groups`	`show aaa server-groups`
Adding a TACACS server to a server-group	`server`	`aaa group server tacacs sg1` `server 1.1.1.2 port 32 vrf default`
Deleting a TACACS server from a server-group	`server`	`aaa group server tacacs sg1` `no server 1.1.1.2 port 32 vrf default`
Configuring a TACACS+ global passkey	`tacacs-server key`	`tacacs-server key plaintext mypasskey123`
Configuring PAP or CHAP for TACACS+	`tacacs-server auth-type`	`tacacs-server auth-type chap` `no tacacs-server auth-type`
Configuring the TACACS+ global timeout	`tacacs-server timeout`	`tacacs-server timeout 20` `no tacacs-server timeout`

TACACS+ authentication

TACACS+ authentication occurs as follows:

- User credentials are sent from the switch to TACACS+ server using the PAP or CHAP authentication protocol.

- If a user is authenticated, their role is communicated to the switch as Administrator, Operator, or Auditor.
- An unknown user or a user who entered an invalid password is identified as such to the switch, which then rejects user login.

About authentication fail-through

Normally, authentication is performed by the first AAA server reached. A rarely needed feature named "Authentication fail-through" is available. If authentication fail-through is enabled and authentication fails on the first reachable AAA server, authentication is attempted on the second AAA server, and so on, until successful authentication or the server list is exhausted.

Enabling Authentication fail-through is typically unnecessary because the user credential databases should be consistent across all AAA servers. Authentication fail-through might be helpful if your AAA user credential databases are not quickly synchronized across all AAA servers.

Authentication fail-through, authorization fail-through, and accounting fail-through must each be configured separately.

TACACS+ authentication tasks

The TACACS+ authentication-related tasks are as follows:

Task	Command name	Example
Configuring the authentication sequence for the default connection type	`aaa authentication login`	`aaa authentication login default group tg1 tg2 tacacs local`
Configuring the authentication sequence for the console connection type	`aaa authentication login`	`aaa authentication login console group tg2 tg3 tacacs local`
Configuring the authentication sequence for the ssh connection type	`aaa authentication login`	`aaa authentication login ssh group tg2 tacacs local`
Removing remote AAA for the default connection type	`aaa authentication login`	`no aaa authentication login default`
Configuring authentication fail-through	`aaa authentication allow-fail-`	`aaa authentication allow-fail-through` `no aaa authentication allow-fail-through`

Task	Command name	Example
	`through`	
Showing the authentication sequence	`show aaa authentication`	`show aaa authentication`

TACACS+ authorization

Upon successful user authentication, the user is assigned their role by the TACACS+ server. See also User role assignment using TACACS+ attributes .

TACACS+ authorization provides command filtering to allow/disallow individual command or command set execution. Each command is sent to the TACACS+ server for approval, and the switch then allows/disallows command execution according to the server response.

TACACS+ authorization applies only to the CLI interface.

Using local authorization as fallback from TACACS+ authorization

Local authorization can be used for the situation in which communication is lost with all TACACS+ servers after a successful authentication. Users that are members of the built-in local user groups (`administrators`, `operators`, or `auditors`) are authorized according to the fixed roles and privilege levels of those groups. Optionally, local user-defined user groups can be configured with specific command execution rules per group. Users that are members of such groups, are authorized according to the command execution rules of the group to which they belong. For configuring local user groups, see `user-group`.

About authentication fail-through and authorization

Rare potential out-of-synchronization situation when using authentication fail-through: Successful authentication on one server can be followed by authorization denial on another. The user is known on the server doing the authentication but unknown on the server attempting the authorization. This situation typically arises only during brief periods in which user credential databases are not synchronized across all TACACS+ servers. See also TACACS+ server authorization considerations in aaa authorization commands .

TACACS+ authorization tasks

The TACACS+ authorization-related tasks are as follows:

Task	Command name	Example
Configuring the authorization sequence for the default connection	`aaa authorization commands`	`aaa authorization commands default group tg1 tacacs local`

Task	Command name	Example
type		
Configuring the authorization sequence for the console connection type	`aaa authorization commands`	`aaa authorization commands console group tg1 tg2 tacacs none`
Removing remote AAA for the default connection type	`aaa authorization commands`	`no aaa authorization commands default`
Showing the TACACS+ authorization sequence	`show aaa authorization`	`show aaa authorization`

TACACS+ accounting

This accounting information is captured and made available for sending to remote accounting servers:

- Exec Accounting: user login/logout events.
- Command accounting: commands executed by users.
- System accounting: remote accounting On/Off events.
- CLI show commands.
- Interactions on the non-CLI interfaces: REST and WebUI.

The following is not captured or made available as accounting information:

- CLI commands that reboot the switch.
- Interactions in the bash shell.

Local accounting (always enabled) must be functioning properly for remote Accounting to work.

The accounting information is sent to the first reachable remote TACACS+ AAA server (configured for remote accounting). If no remote TACACS+ server is reachable, local accounting remains available.

Sample accounting information on a TACACS+ server

```
Mon May 9 17:52:32 10.10.11.1 UNKNOWN tty 0.0.0.0 start task_id=1525899775430
timezone=UTC  start_time=1525913552.428  service=system  event=sys_acct
reason="System-accounting-ON"  result=success
Mon May 9 17:52:48 10.10.11.1 admin  tty 192.168.1.20  start task_id=1525899775431
 timezone=UTC  start_time=1525913567.611 service=shell priv_lvl=15  result=success
Mon May 9 17:52:48 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775432
```

```
 timezone=UTC  stop_time=1525913567.614  service=shell priv_lvl=15  cmd="enable"
result=success
Mon May 9 17:52:51 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775433
 timezone=UTC  stop_time=1525913570.851  service=shell priv_lvl=15
cmd="configure"  result=success
Mon May 9 17:52:53 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775434
 timezone=UTC  stop_time=1525913573.427  service=shell priv_lvl=15  cmd="interface
1/1/3"  result=success
Mon May 9 17:52:54 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775435
 timezone=UTC  stop_time=1525913574.447  service=shell priv_lvl=15  cmd="no
shutdown"  result=success
Mon May 9 17:52:58 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775436
 timezone=UTC  stop_time=1525913578.131  service=shell priv_lvl=15  cmd="ip
address 10.10.13.1/24"  result=success
Mon May 9 17:52:59 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775437
 timezone=UTC  stop_time=1525913579.468  service=shell priv_lvl=15  cmd="exit"
result=success
Mon May 9 17:53:10 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775442
 timezone=UTC  stop_time=1525913590.204  service=shell priv_lvl=15  cmd="exit"
result=success
Mon May 9 17:53:10 10.10.11.1 admin  tty 192.168.1.20  stop  task_id=1525899775431
 timezone=UTC  stop_time=1525913590.205  service=shell priv_lvl=15  result=success
Mon May 9 17:53:44 10.10.11.1 UNKNOWN tty 0.0.0.0 stop  task_id=1525899775430
timezone=UTC  stop_time=1525913624.473  service=system  event=sys_acct
reason="System-accounting-OFF"  result=success
```

This sample is representative and not from any particular TACACS+ server implementation.

Sample REST accounting information on a TACACS+ server

```
Oct 30 16:31:56 10.10.10.1 admin  tty 127.0.0.1  start  task_id=1540942055868
timezone=UTC  start_time=1540942316.36  service=https-server  priv_lvl=15
cmd="http-method=POST http-uri=/rest/v1/login"  result=success
```

This sample is representative and not from any particular TACACS+ server implementation.

TACACS+ accounting tasks

The TACACS+ accounting-related tasks are as follows:

Task	Command name	Example
Configuring the accounting sequence for the default connection type	`aaa accounting all-mgmt`	`aaa accounting all-mgmt default start-stop group tg1 tg2 tacacs local`
Configuring	`aaa`	`aaa accounting all-mgmt console start-stop group tg2 tg3`

Task	Command name	Example
the accounting sequence for the console connection type	`accounting all-mgmt`	`tacacs local`
Configuring the accounting sequence for the ssh connection type	`aaa accounting all-mgmt`	`aaa accounting all-mgmt ssh start-stop group tg2 tacacs local`
Removing remote AAA for the default connection type	`aaa accounting all-mgmt`	`no aaa accounting all-mgmt default start-stop`
Showing the accounting configuration	`show aaa accounting`	`show aaa accounting`

Example: Configuring the switch for Remote AAA with TACACS+

Prerequisites

- TACACS+ servers configured in general according to the information in Remote AAA TACACS+ server configuration requirements . The exact settings appropriate to your environment will vary.
- Logged in to the switch with Administrator privilege and in the `config` context.

Procedure

1. Configure the global TACACS+ passkey (shared secret) as "xjkW74932qX3j_$"

```
switch(config)# tacacs-server key plaintext xjkW74932qX3j_$
switch(config)#
```

2. Add these configuration details for two remote TACACS+ servers:
   - Server 1 with IPv4 address 10.0.0.2, on the management interface (belonging to VRF “mgmt”), using the default PAP protocol.
   - Server 2 with IPv4 address 4.0.0.2, on the data interface (belonging to VRF “default”), using the CHAP protocol.

```
switch(config)# tacacs-server host 10.0.0.2 vrf mgmt
```

```
switch(config)# tacacs-server host 4.0.0.2 auth-type chap
switch(config)#
```

3. Create a TACACS+ group named `tac_grp1`, assign TACACS+ server 10.0.0.2 to the group, show the group information.

The default TACACS+ group named `tacacs` includes every TACACS+ server regardless of whether any TACACS+ servers are also assigned to a user-defined TACACS+ group.

```
switch(config)# aaa group server tacacs tac_grp1
switch(config-sg)# server 10.0.0.2 vrf mgmt
switch(config-sg)# exit
switch(config)#
switch(config)# do show aaa server-groups tacacs

******* AAA Mechanism TACACS+ *******
------------------------------------------------------------------------
GROUP NAME       | SERVER NAME                | PORT | VRF     | PRIORITY
------------------------------------------------------------------------
tac_grp1         | 10.0.0.2                   | 49   | mgmt    | 1
------------------------------------------------------------------------
tacacs (default) | 10.0.0.2                   | 49   | mgmt    | 1
tacacs (default) | 4.0.0.2                    | 49   | default | 2
------------------------------------------------------------------------
switch(config)#
```

4. Define the authentication sequence list so that the new TACACS+ group is first, the default TACACS+ group is second, and local is third. Show the authentication sequence.

```
switch(config)# aaa authentication login default group tac_grp1 tacacs local
switch(config)#
switch(config)# do show aaa authentication
AAA Authentication:
  Fail-through                          : Disabled
  Limit Login Attempts                  : Not set
  Lockout Time                          : 300
  Minimum Password Length               : Not set

Default Authentication for All Channels:
------------------------------------------------------------------------
-----
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------
-----
tac_grp1                        | 0
tacacs                          | 1
local                           | 2
------------------------------------------------------------------------
-----
switch(config)#
```

5. Define the authorization sequence list with two TACACS+ server groups plus local RBAC. Show the authorization sequence.

```
switch(config)# aaa authorization commands default group tac_grp1 tacacs
local
switch(config)#
switch(config)# do show aaa authorization

Default command Authorization for All Channels:
-------------------------------------------------------------------------------
-----
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
-----
tac_grp1                          | 0
tacacs                            | 1
local                             | 2
-------------------------------------------------------------------------------
-----
switch(config)#
```

6. Define the accounting sequence list with two TACACS+ server groups. Show the accounting sequence.

```
switch(config)# aaa accounting all default start-stop group tac_grp1 tacacs
switch(config)#
switch(config)# do show aaa accounting
AAA Accounting:
  Accounting Type                              : all
  Accounting Mode                              : start-stop

Default Accounting for All Channels:
-------------------------------------------------------------------------------
-----
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
-----
tac_grp1                          | 0
tacas                             | 1
-------------------------------------------------------------------------------
-----
```

Remote AAA with RADIUS is supported on the 4100i, 6000, 6100, 6200, 6300, 6400, 8320, 8325, 8360, 8400, 9300, and 10000 Switch Series.

Remote AAA with RADIUS provides the following for your Aruba CX switch:

- Authentication using remote RADIUS AAA servers. For added security, two-factor authentication may be used. In two-factor authentication, X.509 certificate-based authentication is combined with RADIUS authentication.
- Command authorization is not supported by RADIUS servers, however, user-defined local user groups can be configured with command-authorization rules, providing locally configured per-command authorization for members of such groups. See User-defined user groups.

  In the switch default state (without user-defined local groups), basic role-based authorization is available with the three built-in roles (`administrators`, `operators`, `auditors`).
- Transmission of locally collected accounting information to remote RADIUS servers.

AOS-CX supports IPv4 and IPv6 Radius over the VXLAN overlay network without additional configuration from the user.

Parameters for RADIUS server

When creating a RADIUS server for AAA, you must configure the following parameters using the **radius-server host** command:

Parameter	Description
{*<FQDN>* | *<IPV4>* | *<IPv6>*}	Specifies the RADIUS server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
key [plaintext *<PASSKEY>* | ciphertext *<PASSKEY>*]	Selects either a plaintext or an encrypted local shared-secret passkey for the server. As per RFC 2865, shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `key` is entered without either sub-parameter, plaintext passkey prompting occurs upon pressing Enter. Enter must be pressed immediately after the `key` parameter without entering other parameters. The entered passkey characters are masked with asterisks. When `key` is omitted, the server uses the global passkey. This command requires either the global or local passkey to be set; otherwise the server will not be contacted. Command `radius-server key` is available for setting the global passkey.
timeout *<TIMEOUT-SECONDS>*	Specifies the timeout. Range: 1 to 60 seconds. If a timeout is not

Parameter	Description
	specified, the value from the global timeout for RADIUS is used.
`port <PORT-NUMBER>`	Specifies the authentication port number. Range: 1 to 65535. Default: 1812.
`auth-type {pap | chap}`	Selects either the PAP (the default) or CHAP authentication types. If this parameter is not specified, the RADIUS global default is used.
`acct-port <ACCT-PORT>`	Specifies the UDP accounting port number. Range: 1 to 65535. Default: 1813.
`retries <RETRY-COUNT>`	Specifies the number of retry attempts for contacting the specified RADIUS server. Range is 0 to 5 attempts. If no retry value is provided, the default value of 1 is used.
`tracking {enable | disable}`	Enables or disables server tracking for the RADIUS server. Tracked servers are probed at the start of each server tracking interval to check if they are reachable. Use command `radius-server tracking` to configure RADIUS server tracking globally. **NOTE:** Server tracking uses authentication request and response packets to determine server reachability status. The server tracking user name and password are used to form the request packet which is sent to the server with tracking enabled. Upon receiving a response to the request packet, the server is considered to be reachable.

`tracking-mode {any | dead-only}`	Configures tracking mode for the RADIUS server that has tracking enabled with the server. The tracking mode is used to monitor the status of RADIUS server reachability The default tracking mode is `any`.
	`any`
	Track the RADIUS server irrespective of its server reachability.
	`dead-only`
	Track the RADIUS server only when the server is marked as unreachable.

`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.

Default server groups

The switch always has these four default groups:

- `tacacs`: for remote AAA, always contains every configured TACACS+ server.
- `radius`: for remote AAA, always contains every configured RADIUS server.
- `local`: for local authentication.
- `none`: for local (RBAC) authorization.

User-defined AAA servers are always added to the matching default group, either `tacacs` or `radius`. A maximum of 28 user-defined groups can be created.

- On the 4100i, 6000, 6100, 6200, 6300, 6400, 8100, 8325, 8360, and 10000 Switch Series, a RADIUS server can be associated with a maximum of four different user-defined server groups.
- On the 8320, 8400, and 9300 Switch Series, a RADIUS server can be associated with only one user-defined server group.

The order in which servers are added to a group is important. The server added first is accessed first, and if necessary, the second server is accessed second, and so on.

Supported platforms and standards

Remote AAA with TACACS+ is supported on the 4100i, 6000, 6100, 6200, 6300, 6400, 8320, 8325, 8360, 8400, 9300, and 10000 Switch Series.

Setting	Default value / limit
Maximum number of RADIUS servers in a AAA group	16
Maximum number of RADIUS servers that can be configured	16
Maximum number of user-defined AAA server groups that can be configured	28
RADIUS authentication	Disabled
RADIUS authentication global timeout	5 seconds
RADIUS authentication passkey (shared secret)	None
RADIUS authentication udp-port	1812
RADIUS global authentication protocol	PAP
RADIUS global retries	1 retry
RADIUS server tracking default interval	300 seconds
RADIUS server access through the default VRF	default*

*The default value is `default`, unless another VRF is specified during the server configuration.

About global versus per-RADIUS server passkeys (shared secrets)

To communicate with a RADIUS AAA server, the switch must have a passkey (shared secret) configured that matches what is configured on the server. Use one of these commands to achieve the desired configuration:

- For a global passkey common to every RADIUS server, use `radius-server key`.
- For a per-RADIUS server passkey, use `radius-server host` with the `key` parameter.

If both passkeys are configured on the switch, the per-RADIUS server passkey is used.

Remote AAA RADIUS server configuration requirements

The user-supplied RADIUS server must:

- Have an IPv4/IPv6 address or fully qualified domain name (FQDN) that is visible to the switch.
- Have a passkey (shared secret) that matches what is configured on the switch.
- Provide username and password definitions for every switch user. Remote users do not require definition on the switch.
- Configure user role assignment using RADIUS attributes.

Consult your RADIUS server documentation for installation and general configuration details.

If SSH public key authentication is used, the key information is stored locally on the switch, making username and password definition on the RADIUS server unnecessary.

User role assignment using RADIUS attributes

User role assignment is configured on the RADIUS server using VSAs (vendor-specific attributes).

RADIUS servers can return multiple attribute value pairs (AVPs) in response to an authentication request. The attributes are processed in this order of precedence to determine the user role assigned:

- If the `Aruba-Admin-Role` VSA is present, map the user to the matching local user-group name.
- Else, if the `Aruba-Priv-Admin-User` VSA is present, extract the privilege level (1, 15, or 19) and map the user to the local user-group corresponding to this privilege level (`1=operators`, `15=administrators`, `19=auditors`). Privilege levels 2 to 14 may also be used with matching local user groups named 2 to 14.
- Else, If Service-Type AVP is present, map `Administrative-User(6)` to `administrators` and map `NAS-Prompt-User(7)` to `operators`.
- Otherwise, the user role cannot be determined, and the authentication fails.

Aruba-Admin-Role	Aruba-Priv-Admin-User	service-type	User role assigned
<GROUP-NAME>	Do not care	Do not care	Matching local user *<GROUP-NAME>*
Not present	privilege level =1	Do not care	Operators
Not present	privilege level =15	Do not care	Administrators

Aruba-Admin-Role	Aruba-Priv-Admin-User	service-type	User role assigned
Not present	privilege level =19	Do not care	Auditors
Not present	privilege level =2 to 14	Do not care	Matching local user groups named 2 to 14
Not present	Not present	`Administrative-User(6)`	Administrators
Not present	Not present	`NAS-Prompt-User (7)`	Operators
Not present	Not present	Not present (or = any other value)	None (not authenticated)

The `Service-Type` attribute is retained only for backward compatibility. It is recommended that you instead use the `Aruba-Admin-Role` or `Aruba-Priv-Admin-User` VSA.

RADIUS server redundancy and access sequence

To prevent authentication interruption, it is common practice to configure more than one RADIUS server. When identifying RADIUS servers to the switch, server group order (and server order within the group), determines server access order.

When defining the server access sequence for authentication with `aaa authentication login default`, there is an implied `local` included as the last item in the list. If no RADIUS server can be reached, local authentication will be attempted.

Configuration task list

Steps	Example	Comments

Step 1: Configure the UBT mode	Local VLAN (Reserved VLAN) mode :
	`ubt-client-vlan 4000`
	VLAN extend mode:
	`ubt-mode vlan-extend`
		In the local VLAN mode, the UBT client VLAN on the switch will be a reserved UBT VLAN. The default UBT mode is Local VLAN. For the Local VLAN mode, UBT client VLAN needs to be configured.

Steps	Example	Comments

Step 2: Configure the source IP address	`interface vlan 10`
	`  no shutdown`
	`  ip address 192.168.10.1/24`
	`ip source-interface ubt interface vlan10`
		UBT source IP address can be a loopback interface, ROP, or SVI.

Step 3: Configure the UBT zones	`ubt zone zone1 vrf default`
	`  primary-controller ip 192.168.10.8`
	`  backup-controller ip 192.168.10.18`
	`  enable`	

Step 4: Configure the UBT client role	VLAN extend mode configuration:
	`port-access role ubt-switch-role`
	`  gateway-zone zone zone1 gateway-role ubt-controller-role`
	`  vlan access 20`
	Local VLAN mode configuration:
	`port-access role ubt-switch-role`
	`  gateway-zone zone zone1 gateway-role ubt-controller-role`
		UBT supports both LUR and DUR roles for the UBT client. In the case of LUR, the UBT client role needs to be configured on the switch. In case of DUR, UBT client role needs to be configured on the CPPM server.
		NOTE: In the case of Local VLAN UBT mode, UBT client primary/switch role VLAN configuration is not needed.

Step 5: Configure the secondary role on the gateway	`user-role ubt-controller-role`
	`  access-list session allowall`
	`  access-list session v6-allowall`
	`  vlan 20`
		VLAN 20 is the secondary role VLAN on the controller for the UBT client.

Single source IP address for consistent source identification to AAA servers

If applicable to your installation, it is recommended that you perform the optional configuration mentioned in this section.

If your topology allows the AAA server to be reached through multiple paths, the server interprets the incoming packets to be from different switches even though they are all coming from the same switch.

Having a switch associated with multiple IP addresses makes it more difficult to interpret system logs and accounting data.

To ensure that all traffic sent from the switch to the AAA server uses the same source IP address, use `ip source-interface` or `ipv6 source-interface`. These two commands plus the related commands `show ip source-interface` and `show ipv6 source-interface` are described under *Layer 2/3 Interface commands* in the *Command-Line Interface Guide*.

RADIUS general tasks

General RADIUS tasks, not specific to authentication, are as follows:

Task	Command name	Example
Configuring a RADIUS server	`radius-server host`	`radius-server host 1.1.1.1 vrf default` `no radius-server host 1.1.1.1 vrf default`
Showing global and RADIUS server configurations	`show radius-server`	`show radius-server detail`
Configuring a RADIUS server group	`aaa group server`	`aaa group server radius sg3` `no aaa group server radius sg3`
Showing server groups	`show aaa server-groups`	`show aaa server-groups`
Adding a RADIUS server to a server-group	`server`	`aaa group server radius sg3` `server 1.1.1.4 port 32 vrf default`
Deleting a RADIUS server from a server-group	`server`	`aaa group server tacacs sg3` `no server 1.1.1.4 port 32 vrf default`
Configuring a RADIUS global passkey	`radius-server key`	`radius-server key plaintext mypasskey123`
Configuring PAP or CHAP for RADIUS	`radius-server auth-type`	`radius-server auth-type chap` `no radius-server auth-type`
Configuring the RADIUS global timeout	`radius-server timeout`	`radius-server timeout 15` `no radius-server timeout`
Configuring the RADIUS global retries	`radius-server retries`	`radius-server retries 3` `no radius-server retries`
Overriding the global retries for a RADIUS server	`radius-server host`	`radius-server host 1.1.1.1 retries 2`

Per-port RADIUS server group configuration

RADIUS server groups can be configured for MAC and 802.1X authentication mechanisms on a port. This port-specific server group configuration overrides any global server group configured for the authentication mechanisms.

In the absence of a port-specific configuration, clients authenticated on a port will be associated with the globally configured RADIUS server group. When a RADIUS server group is configured on a port, any existing clients already authenticated on that port, using the previous group, will be associated with the new port-specific server group during the subsequent reauthentication cycle.

- On the 4100i, 6000, 6100, 6200, 6300, 6400, 8100, 8325, 8360, and 10000 Switch Series, a RADIUS server can be associated with a maximum of four different user-defined RADIUS server groups.
- On the 8320, 8400, and 9300 Switch Series, a RADIUS server can be associated with only one user-defined server group.

Different NAS-IDs can be sent to the same RADIUS server as a RADIUS server can be associated with four user-defined server groups.

- For more details on NAS-IDs configuration, refer to Configurable RADIUS attributes (port access).
- Dynamic authentication is not affected by this port configuration, because only the authentication server will be determined by this configuration. Any COA or disconnect requests from any of the reachable server will be successful.

To configure per-port or global RADIUS server groups for MAC and 802.1X authentication mechanisms, see:

- aaa authentication port-access dot1x authenticator radius server-group
- aaa authentication port-access mac-auth radius server-group

RADIUS authentication

RADIUS authentication occurs as follows:

- User credentials are sent from the switch to RADIUS server using the PAP or CHAP authentication protocol.
- If a user is authenticated, their role is communicated to the switch as Administrator, Operator, or Auditor.
- An unknown user or a user who entered an invalid password is identified as such to the switch, which then rejects user login.

About authentication fail-through

Normally, authentication is performed by the first AAA server reached. A rarely needed feature named "Authentication fail-through" is available. If authentication fail-through is enabled and authentication fails on the first reachable AAA server, authentication is attempted on the second AAA server, and so on, until successful authentication or the server list is exhausted.

Enabling Authentication fail-through is typically unnecessary because the user credential databases should be consistent across all AAA servers. Authentication fail-through might be helpful if your AAA user credential databases are not quickly synchronized across all AAA servers.

Authentication fail-through, authorization fail-through, and accounting fail-through must each be configured separately.

RADIUS authentication tasks

The RADIUS authentication-related tasks are as follows:

Task	Command name	Example
Configuring the authentication sequence for the default connection type	`aaa authentication login`	`aaa authentication login default group rg1 rg2 radius local`
Configuring the authentication sequence for the https-server connection type	`aaa authentication login`	`aaa authentication login https-server group rg1 radius local`
Removing remote AAA for the default connection type	`aaa authentication login`	`no aaa authentication login default`
Configuring authentication fail-through	`aaa authentication allow-fail-through`	`aaa authentication allow-fail-through` `no aaa authentication allow-fail-through`
Configuring authorization fail-through	`aaa authorization allow-fail-through`	`aaa authorization allow-fail-through` `no aaa authorization allow-fail-through`
Configuring accounting fail-through	`aaa accounting allow-fail-through`	`aaa accounting allow-fail-through` `no aaa accounting allow-fail-through`
Showing the authentication sequence	`show aaa authentication`	`show aaa authentication`

Two-factor authentication

Two-factor authentication is available for added security. In two-factor authentication, X.509 certificate-based authentication is combined with RADIUS authentication.

Two-factor authentication can be performed with local or remote (on RADIUS server) users.

Configuring two-factor authentication (for local users)

Two-factor authentication is available for added security. In two-factor authentication, X.509 certificate-based authentication is combined with RADIUS authentication. When a user establishes an SSH connection to the switch, two factor-authentication occurs as follows:

- The username in the user's X.509 certificate is validated against the local user accounts on the switch.
- The username and password are validated against the accounts on the RADIUS server and the configured trust anchors.

Prerequisites

- The switch SSH server is enabled.
- Your switch management computer, though its SSH client, is connected to the switch.
- A remote RADIUS server is available to authenticate switch users and is configured on the switch.
- Every user that will use two-factor authentication is configured both on the RADIUS server and locally on the switch using identical usernames. Users are added locally on the switch with the `user` command. These usernames must precisely match the usernames identified by the X.509 user certificates.
- The X.509 CA certificate is both installed on your switch management computer and is also visible to your computer's SSH client. The X.509 CA certificate is the root of trust for the client certificate being used.
- One X.509 certificate per user is available on your switch management computer and is visible to your computer's SSH client. The usernames identified by these user certificates must be the same as the usernames already defined on the RADIUS server and locally on the switch.

Procedure

1. Create a TA profile with the command `crypto pki ta-profile`. This command switches to the TA configuration context. The TA profile is where the switch stores the root certificate of the CA that is used to validate the certificates of clients communicating with the SSH server.
2. Although optional, it is recommended that you enable certificate revocation checking with the command `revocation-check ocsp`.
3. Import the root certificate of the CA with the command `ta-certificate`.
4. Exit the TA configuration context with the command `exit`.
5. For each user that will be using two-factor authentication, import the public key from the individual X.509 user certificate with the command `user <USERNAME> authorized-key <PUBKEY>`. Each user identified by `<USERNAME>` must exist locally on the switch and on the RADIUS authentication server.
6. Enable two-factor authentication with the command `ssh two-factor-authentication`.

Example

This example shows the above steps being executed:

```
--- step 1 ---
switch(config)# crypto pki ta-profile root-cert

--- step 2 ---
switch(config-ta-root-cert)# revocation-check ocsp

--- step 3 ---
switch(config-ta-root-cert)# ta-certificate
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer:  C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=site.com/emailAddress=test.ca@site.com
Subject: C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=8400/emailAddress=test.ca@site.com
Serial Number: 12121221634631568498 (0xaea51217d5945772)

Do you want to accept this certificate (y/n)? y
TA certificate accepted.

--- step 4 ---
switch(config-ta-root-cert)# exit
switch(config)#

--- step 5 ---
switch(config)# user admin authorized-key ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAACAQC6krLTrFTnzg3YjLiZKTZEYnh4cUiuOK+cjduxFnZUa
...
iAfcGvqvWtWWBSoWd011DeEZNKnOO8uEKeTEcAjfrnRHeOk2QJmw== "sv1@site.net"
switch(config)#

--- step 6 ---
switch(config)# ssh two-factor-authentication
```

Configuring two-factor authentication with SSH (for remote-only users)

Two-factor authentication is available for added security. In two-factor authentication, X.509 certificate-based authentication is combined with RADIUS authorization.

In circumstances where it is desirable to have no local users, when a user establishes an SSH connection to the switch, two factor-authentication occurs as follows:

- The certificate is validated by the switch using the set of customer-configured trusted TA profiles. If validated, the switch then sends a RADIUS Authorize-Only request to the RADIUS server using the username found in the certificate. The username is chosen from either the certificate UserPrincipalName (UPN) or CommonName (CN).
- A password is not required at time of authentication.

Prerequisites

- The switch SSH server is enabled.
- The remote RADIUS server providing authentication supports the "authorize-only" Service-Type. This includes RADIUS servers such as Aruba's ClearPass Policy Manager, Windows 2019 NPS, or FreeRADIUS.
- The RADIUS server is configured using a TLS (RadSec) connection. This requires the provisioning of a RadSec tunnel between the Switch and a RadSec proxy server, which then forwards the request to the RADIUS server. For information, see *Secure RADIUS (RadSec)* in the Security Guide for your switch.
- An appropriate set of Certificate Authority (CA) and leaf certificates for mutual TLS communication has been created for the switch-to-RADIUS server connection.
- Your switch management computer, through its SSH client, is connected to the switch. Typical supported clients are VanDyke SecureCRT and Pragma Fortress SSH Client Suite.
- Your SSH client is configured to get the username from the certificate.
- For the user being authenticated, an X.509 certificate is installed on your switch management computer and is visible to your computer SSH client. The username identified in the certificate matches a username already defined on the remote RADIUS server.

Procedure

1. Create a TA profile with the command `crypto pki ta-profile`. This command switches to the TA configuration context. The TA profile is where the switch stores the root certificate of the CA that is used to validate the certificates of clients communicating with the SSH server.
2. Although optional, it is recommended that you enable certificate revocation checking with the command `revocation-check ocsp`.
3. Import the root certificate of the CA with the command `ta-certificate`.
4. Exit the TA configuration context with the command `exit`.
5. Repeat steps 1 to 4 for the root certificate authority used for the RADIUS server.
6. Create a leaf certificate profile for the RADIUS client certificate, using the command `crypto pki certificate`. This command switches to the certificate configuration context.
7. Import the leaf certificate with the command i`mport terminal ta-profle`. Paste the leaf certificate in PEM format, followed by the corresponding private key.
8. Set the certificate for usage with RADIUS communication. Do this with the command `crypto pki application radsec-client certificate`.
9. Configure SSH to enforce the requirement to have the username defined in the X.509 certificate, within any of these two certificate fields: UserPrincipalName (UPN) or Common Name (CN). Do this with command `ssh certificate-as-authorized-key`.
10. Enable two-factor authentication with authorization performed by the RADIUS server. Do this with command `ssh two-factor-authentication authorization radius`.
11. Add the radius server connection to the switch. Do this with the command `radius-server host tls`.
12. Enable authorization by any RADIUS server (in default group `radius`) configured for Authorize-Only with command `aaa authorization radius ssh group radius`. Note also that user-defined RADIUS groups can be used in addition to or instead of the default RADIUS group.

Example

This example shows the above steps being executed:

```
--- step 1 ---
switch(config)# crypto pki ta-profile root-cert

--- step 2 ---
switch(config-ta-root-cert)# revocation-check ocsp

--- steps 3, 4 ---
switch(config-ta-root-cert)# ta-certificate
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer:  C=XX, ST=XX, L=Xxxx, O=Company, OU=Site,
         CN=9999/emailAddress=test.ca@site.com
Subject: C=XX, ST=XX, L=Xxxx, O=Company, OU=Site,
         CN=9999/emailAddress=test.ca@site.com
Serial Number: 99999999999999999999 (0xffffffffffffffff)

Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-root-cert)# exit

--- step 5 ---
switch(config)# crypto pki ta-profile radius-root-cert
switch(config-ta-root-cert)# ta-certificate
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer: C=XX, ST=XX, L=Xxxx, O=Company, OU=Site,
CN=9999/emailAddress=test.ca@site.com Subject: C=XX, ST=XX, L=Xxxx, O=Company,
OU=Site,
CN=9999/emailAddress=test.ca@site.com
Serial Number: 99999999999999999999 (0xffffffffffffffff)

Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-radius-root-cert)# exit

--- step 6 ---
switch(config)# crypto pki certificate radius-client-cert

--- step 7 ---
switch(config-cert-radius-client-cert)# import terminal ta-profile radius-root-
cert
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-cert-import)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-cert-import)# -----END CERTIFICATE-----
```

```
switch(config-cert-import)#
Leaf certificate is validated with radius-root-cert and imported successfully.
Certificate is installed and ready to use.
switch(config-cert-radius-client-cert)# exit

--- step 8 ---
switch(config)# crypto pki application radsec-client certificate radius-client-
cert

--- step 9 ---
switch(config)# ssh certificate-as-authorized-key

--- step 10 ---
switch(config)# ssh two-factor-authentication authorization radius

--- step 11 ---
switch(config)# radius-server host 999.99.9.9 tls

--- step 12 ---
switch(config)# aaa authorization radius ssh group radius
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y
```

Configuring two-factor authentication with HTTPS server and REST (for remote-only users)

Two-factor authentication is available for added security. In two-factor authentication, X.509 certificate-based authentication is combined with RADIUS authorization.

In circumstances where it is desirable to have no local users, when a user establishes an HTTPS connection to the switch, two factor-authentication occurs as follows:

- The certificate is validated by the switch using the set of customer-configured trusted TA profiles. If validated, the switch then sends a RADIUS Authorize-Only request to the RADIUS server using the username found in the certificate. The username is chosen from either the certificate User Principal Name (UPN) or Common Name (CN).
- A password is not required at time of authentication.

Prerequisites

- The switch HTTPS REST server is enabled in the desired VRF.
- The remote RADIUS server providing authentication supports the "authorize-only" Service-Type. This includes RADIUS servers such as Aruba's ClearPass Policy Manager, Windows 2019 NPS, or FreeRADIUS.
- The RADIUS server is configured using a TLS (RadSec) connection. This requires the provisioning of a RadSec tunnel between the Switch and a RadSec proxy server, which then forwards the request to the RADIUS server. For information, see *Secure RADIUS (RadSec)* in the Security Guide for your switch.
- An appropriate set of Certificate Authority (CA) and leaf certificates for mutual TLS communication has been created for the switch-to-RADIUS server connection.
- Your switch management computer has access to the REST API using an appropriate HTTPS client. This can be done with a web browser, using the WebUI, or other HTTP request tools such as Postman. Usage of Firefox is not recommended, as it requires additional configuration to work with this feature.

- For the user being authenticated, an X.509 certificate is installed on your switch management computer and loaded to your preferred HTTPS client. The username identified in the certificate (whether in the User Principal Name (UPN) or Common Name (CN) fields) matches a username already defined on the remote RADIUS server.

Procedure

1. Create a TA profile with the command `crypto pki ta-profile`. This command switches to the TA configuration context. The TA profile is where the switch stores the root certificate of the CA that is used to validate the certificates of clients logging in to the HTTPS REST server.
2. Although optional, it is recommended that you enable certificate revocation checking with the command `revocation-check ocsp`.
3. Import the root certificate of the CA with the command `ta-certificate`.
4. Exit the TA configuration context with the command `exit`.
5. Repeat steps 1 to 4 for the root certificate authority used for the RADIUS server.
6. Create a leaf certificate profile for the RADIUS client certificate, using the command `crypto pki certificate`. This command switches to the certificate configuration context.
7. Import the leaf certificate with the command i`mport terminal ta-profle`. Paste the leaf certificate in PEM format, followed by the corresponding private key.
8. Set the certificate for usage with RADIUS communication. Do this with the command `crypto pki application radsec-client certificate`.
9. Enable certificate authentication for the HTTPS server. Configure it with authorization performed by the RADIUS server and enforce the requirement to have the username defined in the X.509 certificate, within any of these two certificate fields: User Principal Name (UPN) or Common Name (CN). Do this with command `https-server authentication certificate authorization radius`.
10. Respond with **`y`** (yes) to the prompt indicating that HTTP authentication with certificate will be enabled and that password authentication will be disabled .
11. Add the radius server connection to the switch. Do this with the command `radius-server host tls`.
12. Enable authorization by any RADIUS server (in default group `radius`) configured for Authorize-Only with command `aaa authorization radius ssh group radius`. Note also that user-defined RADIUS groups can be used in addition to or instead of the default RADIUS group.
13. At this point you can send a POST request to the `/certificate_login` endpoint in the REST API, including the corresponding user certificate. Alternatively you can access the login page of the WebUI, where a login button is presented. Upon pressing the login button, the browser prompts you to select a certificate.

Example

This example shows the above steps being executed:

```
--- step 1 ---
switch(config)# crypto pki ta-profile https-root-cert

--- step 2 ---
switch(config-ta-root-cert)# revocation-check ocsp

--- steps 3, 4 ---
switch(config-ta-root-cert)# ta-certificate
```

```
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer: C=XX, ST=XX, L=Xxxx, O=Company, OU=Site,
CN=9999/emailAddress=test.ca@site.com Subject: C=XX, ST=XX, L=Xxxx, O=Company,
OU=Site,
CN=9999/emailAddress=test.ca@site.com
Serial Number: 99999999999999999999 (0xffffffffffffffff)

Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-root-cert)# exit

--- step 5 ---
switch(config)# crypto pki ta-profile radius-root-cert
switch(config-ta-root-cert)# ta-certificate
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer: C=XX, ST=XX, L=Xxxx, O=Company, OU=Site,
CN=9999/emailAddress=test.ca@site.com Subject: C=XX, ST=XX, L=Xxxx, O=Company,
OU=Site,
CN=9999/emailAddress=test.ca@site.com
Serial Number: 99999999999999999999 (0xffffffffffffffff)

Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-radius-root-cert)# exit

--- step 6 ---
switch(config)# crypto pki certificate radius-client-cert

--- step 7 ---
switch(config-cert-radius-client-cert)# import terminal ta-profile radius-root-
cert
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBq
...
switch(config-cert-import)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYoCD/TMsAW0nG7yY
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)#
Leaf certificate is validated with radius-root-cert and imported successfully.
Certificate is installed and ready to use.
switch(config-cert-radius-client-cert)# exit

--- step 8 ---
switch(config)# crypto pki application radsec-client certificate radius-client-
cert

--- steps 9, 10 ---
switch(config)# https-server authentication certificate authorization radius
```

```
username common_name
This will enable HTTPS authentication with certificate and disable password
authentication
Continue (y/n)? y

--- step 11 ---
switch(config)# radius-server host 999.99.9.9 tls

--- step 12 ---
switch(config)# aaa authorization radius ssh group radius
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y
```

Two-factor authentication commands

aaa authorization radius

```
aaa authorization radius {ssh | https-server} group <GROUP-LIST>
no aaa authorization radius {ssh | https-server} group <GROUP-LIST>
```

Description

Enables RADIUS authorize-only for use with two-factor authentication. By default RADIUS authenticates and authorizes a client that is configured for AAA based access. This command causes the RADIUS server to instead be used only for authorization and not for authentication.

Authorization requests are sent over TLS and therefore RADIUS authorize-only requires a RadSec RADIUS server.

If command authorization is also configured it is given priority over RADIUS authorize-only and therefore command authorization is done on the basis of command authorization configuration and not the user role and privilege level assigned by the RADIUS server.

The `no` form of this command disables RADIUS authorize-only, causing RADIUS to be again used for both authentication and authorization.

Parameter	Description
`ssh`	Selects the SSH authorization list.
`https-server`	Selects the HTTPS server authorization list.
`group <GROUP-LIST>`	Specifies the list of remote RADIUS server group names. Each name can be specified one time. Predefined remote RADIUS group name `radius` is available. The remote RADIUS server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa group server` and servers are added to a server group with the command `server`.

Examples

Enabling RADIUS authorize only for SSH with the default RADIUS group:

```
switch(config)# aaa authorization radius ssh group radius
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y
```

Disabling RADIUS authorize only for SSH with the default RADIUS group, causing RADIUS to be again used for both authentication and authorization:

```
switch(config)# no aaa authorization radius ssh group radius
```

Enabling RADIUS authorize only for HTTPS server with the default RADIUS group:

```
switch(config)# aaa authorization radius https-server group radius
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y
```

Disabling RADIUS authorize only for HTTPS server with the default RADIUS group, causing RADIUS to be again used for both authentication and authorization:

```
switch(config)# no aaa authorization radius https-server group radius
```

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

https-server authentication certificate

`https-server authentication certificate [authorization radius] [username {<CERT-FIELD>}]`

Description

Enables certificate-based authentication where the HTTPS server uses an X.509 certificate for authentication and a RADIUS server for authorization.

Enabling password authentication is the only way of disabling certificate authentication.

Parameter	Description
`authorization radius`	Specifies that after certificate authentication succeeds, instead of prompting for a password, the HTTPS server checks the RADIUS server only for authorization. A local user is not required. By default, the username found in the certificate field UserPrincipalName (UPN) is used for authorization on the RADIUS serer.

Parameter	Description
	When this parameter is omitted, **`authorization radius`** is still the assumed active setting.
<CERT-FIELD>	Selects which certificate username field is to be used for authorization. ▪ Specify **`user_pincipal_name`** to use the certificate UserPrincipalName (UPN) field. This is the default. ▪ Specify **`common_name`** to use the certificate CommonName (CN) field. When this parameter is omitted, **`user_pincipal_name`** is assumed.

Examples

Enabling HTTPS server authentication with authorization on a RADIUS server with the username in certificate field UserPrincipalName (UPN):

```
switch(config)# https-server authentication certificate authorization radius
```

Enabling HTTPS server authentication with authorization on a RADIUS server with the username in certificate field UserPrincipalName (UPN) (**`authorization radius`** is still implied even though not specified):

```
switch(config)# https-server authentication certificate
```

Enabling HTTPS server authentication with authorization on a RADIUS server with the username in certificate field CommonName (CN):

```
switch(config)# https-server authentication certificate authorization radius
username common_name
```

Command History

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh certificate-as-authorized-key

```
ssh certificate-as-authorized-key
no ssh certificate-as-authorized-key
```

Description

Enables SSH enforcement that the username must be present in the certificate that is being used for authorization. This configuration alters how certificate-based authentication maps to a user account.

When this is enabled, SSH will not require local user association with an authorized-key and instead enforces that the username used to log in is present within the certificate.

The SSH server will check for the username in certificate fields `Common Name` or `User Principle Name` for a match. If a certificate is not used for authentication then this configuration has no effect on SSH authentication.

The `no` form of this command disables the SSH enforcement of username in the certificate.

Examples

Enabling SSH enforcement of username in the certificate:

```
switch(config)# ssh certificate-as-authorized-key
```

Disabling SSH enforcement of username in the certificate:

```
switch(config)# no ssh certificate-as-authorized-key
```

Command History

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

ssh two-factor-authentication

```
ssh two-factor-authentication [authorization radius]
no ssh two-factor-authentication [authorization radius]
```

Description

Enables the selected SSH Two Factor authentication method. Two-factor authentication uses an X.509 certificate and possibly a password. First the X.509 certificate presented by the user is authenticated.

Then, if successful, (when the **`authorization-radius`** parameter is not specified) the (locally-defined) user is prompted for a password. When the **`authorization radius`** parameter is specified, instead of prompting for a password, SSH checks only for authorization with the remote RADIUS server. A local user is not required.

The `no` form of the command disables SSH two-factor authentication.

Parameter	Description
`authorization radius`	Specifies that after certificate authentication succeeds, SSH checks the RADIUS server only for authorization.

Examples

Enabling two-factor authentication for local user with password prompting:

```
switch(config)# ssh two-factor-authentication
```

Disabling two-factor authentication for local user with password prompting:

```
switch(config)# no ssh two-factor-authentication
```

Enabling two-factor authentication for remote-only RADIUS-defined users without password prompting:

```
switch(config)# ssh two-factor-authentication authorization radius
```

Disabling two-factor authentication for remote-only RADIUS-defined users without password prompting: :

```
switch(config)# no ssh two-factor-authentication authorization radius
```

Command History

Release	Modification
10.11	Added the **`authorization radius`** parameter
10.10	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

RADIUS accounting

This accounting information is captured and made available for sending to remote accounting servers:

- Port access accounting
- Exec Accounting: user login/logout events
- Command accounting: commands executed by users. The Vendor-Specific Attribute (VSA) `Aruba_Command_String` with a value of 46 is available.
- System accounting: remote accounting On/Off events.
- CLI show commands.
- Interactions on the non-CLI interfaces: REST and WebUI.

With RADIUS, command accounting logs a maximum of 247 characters per command entered by the user.

The following is not captured or made available as accounting information:

- CLI commands that reboot the switch.
- Interactions in the bash shell.

Local accounting (always enabled) must be functioning properly for remote Accounting to work.

The accounting information is sent to the first reachable remote RADIUS AAA server (configured for remote accounting). If no remote RADIUS server is reachable, local accounting remains available.

Sample general accounting information

```
~~~~~~~~ EXEC ~~~~~~~~~~

Mon Jul 16 16:25:27 2018
        User-Name = "admin"
        NAS-Identifier = "switchx"
        NAS-Port = 331
        NAS-Port-Type = Virtual
        Acct-Status-Type = Start
        Acct-Session-Id = "1531769192494"
        Acct-Authentic = Local
        Calling-Station-Id = "0.0.0.0"
        Event-Timestamp = "Jul 16 2018 16:25:22 PDT"
        Acct-Delay-Time = 0
        NAS-IP-Address = 10.10.10.1
        Acct-Unique-Session-Id = "b83e29f4140c17b1"
        Timestamp = 1531783527

~~~ EXEC stop ~~~
Mon Jul 16 16:26:42 2018
        User-Name = "admin"
        NAS-Identifier = "switchx"
        NAS-Port = 331
        NAS-Port-Type = Virtual
        Acct-Status-Type = Stop
        Acct-Session-Id = "1531769192494"
        Acct-Authentic = Local
        Calling-Station-Id = "0.0.0.0"
        Event-Timestamp = "Jul 16 2018 16:26:37 PDT"
        Acct-Delay-Time = 0
        Acct-Session-Time = 75
        NAS-IP-Address = 10.10.10.1
        Acct-Unique-Session-Id = "b83e29f4140c17b1"
        Timestamp = 1531783602


~~~~~~~~ CMD ACCOUNTING ~~~~~~~~~~~~
Mon Jul 16 16:26:42 2018
        User-Name = "admin"
        NAS-Identifier = "switchx"
        NAS-Port = 331
        NAS-Port-Type = Virtual
        Acct-Status-Type = Stop
        Acct-Session-Id = "1531769192496"
        Acct-Authentic = Local
        Aruba-Command-String = "exit"
        Calling-Station-Id = "0.0.0.0"
        Event-Timestamp = "Jul 16 2018 16:26:37 PDT"
        Acct-Delay-Time = 0
        NAS-IP-Address = 10.10.10.1
```

```
        Acct-Unique-Session-Id = "280710992629128c"
        Timestamp = 1531783602


~~~~~~~~~~~~~ SYSTEM ACCOUNTING ~~~~~~~~~~~~

Mon Jul 16 17:13:02 2018
        User-Name = "UNKNOWN"
        NAS-Identifier = "UNKNOWN"
        NAS-Port = 331
        NAS-Port-Type = Virtual
        Acct-Status-Type = Accounting-On
        Acct-Session-Id = "1531769192506"
        Acct-Authentic = Local
        Calling-Station-Id = "0.0.0.0"
        Event-Timestamp = "Jul 16 2018 17:12:56 PDT"
        Acct-Delay-Time = 0
        NAS-IP-Address = 10.10.10.1
        Acct-Unique-Session-Id = "b478e6402c86933e"
        Timestamp = 1531786382


Mon Jul 16 17:12:55 2018
        User-Name = "UNKNOWN"
        NAS-Identifier = "UNKNOWN"
        NAS-Port = 331
        NAS-Port-Type = Virtual
        Acct-Status-Type = Accounting-Off
        Acct-Session-Id = "1531769192491"
        Acct-Authentic = Local
        Calling-Station-Id = "0.0.0.0"
        Event-Timestamp = "Jul 16 2018 17:12:49 PDT"
        Acct-Delay-Time = 0
        NAS-IP-Address = 10.10.10.1
        Acct-Unique-Session-Id = "93da1f094121f2ee"
        Timestamp = 1531786375

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

This sample is representative and not from any particular RADIUS server implementation.

RADIUS accounting tasks

The RADIUS accounting-related tasks are as follows:

Task	Command name	Example
Configuring the accounting sequence for the default connection type	`aaa accounting all-mgmt`	`aaa accounting all-mgmt default start-stop group rg1 rg2 radius local`
Configuring the	`aaa accounting`	`aaa accounting all-mgmt https-server start-stop group rg1 radius local`

Task	Command name	Example
accounting sequence for the https-server connection type	`all-mgmt`	
Removing remote AAA for the default connection type	`aaa accounting all-mgmt`	`no aaa accounting all-mgmt default start-stop`
Showing the accounting configuration	`show aaa accounting`	`show aaa accounting`

Example: Configuring the switch for Remote AAA with RADIUS

Prerequisites

- RADIUS servers configured in general according to the information in Remote AAA RADIUS server configuration requirements . The exact settings appropriate to your environment will vary.
- Logged in to the switch with Administrator privilege and in the `config` context.

Procedure

1. Configure the global RADIUS passkey (shared secret) as "xjkW74932qX3j_$"

```
switch(config)# radius-server key plaintext xjkW74932qX3j_$
switch(config)#
```

2. Add these configuration details for two remote RADIUS servers.
   - Server 1 with IPv4 address 10.0.0.2, on the management interface (belonging to VRF “mgmt”), using the default PAP protocol.
   - Server 2 with IPv4 address 4.0.0.2, on the data interface (belonging to VRF “default”), using the CHAP protocol.

```
switch(config)# radius-server host 10.0.0.2 vrf mgmt
switch(config)# radius-server host 4.0.0.2 auth-type chap
switch(config)#
```

3. Create a RADIUS group named `rad_grp1`, assign RADIUS server 10.0.0.2 to the group, show the group information.

The default RADIUS group named `radius` includes every RADIUS server regardless of whether any RADIUS servers are also assigned to a user-defined RADIUS group.

```
switch(config)# aaa group server radius rad_grp1
switch(config-sg)# server 10.0.0.2 vrf mgmt
switch(config-sg)# exit
switch(config)#
switch(config)# do show aaa server-groups radius

******* AAA Mechanism RADIUS *******
------------------------------------------------------------------------------
GROUP NAME       | SERVER NAME               | PORT | VRF     | PRIORITY
------------------------------------------------------------------------------
rad_grp1         | 10.0.0.2                  | 1812 | mgmt    | 1
------------------------------------------------------------------------------
radius (default) | 10.0.0.2                  | 1812 | mgmt    | 1
radius (default) | 4.0.0.2                   | 1812 | default | 2
------------------------------------------------------------------------------
switch(config)#
```

4. Define the authentication sequence list so that the new RADIUS group is first, the default RADIUS group is second, and local is third. Show the authentication sequence.

```
switch(config)# aaa authentication login default group rad_grp1 radius local
switch(config)#
switch(config)# do show aaa authentication
AAA Authentication:
  Fail-through                          : Disabled
  Limit Login Attempts                  : Not set
  Lockout Time                          : 300
  Minimum Password Length               : Not set

Default Authentication for All Channels:
------------------------------------------------------------------------------
---
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------------
---
rad_grp1                        | 0
radius                          | 1
local                           | 2
------------------------------------------------------------------------------
---
switch(config)#
```

5. Define the accounting sequence list with two RADIUS server groups. Show the accounting sequence.

```
switch(config)# aaa accounting all default start-stop group rad_grp1 radius
switch(config)#
switch(config)# do show aaa accounting
AAA Accounting:
  Accounting Type                               : all
  Accounting Mode                               : start-stop
```

```
Default Accounting for All Channels:
-------------------------------------------------------------------------------
--
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
--
rad_grp1                          | 0
radius                            | 1
-------------------------------------------------------------------------------
--
```

aaa accounting allow-fail-through

```
aaa accounting allow-fail-through
no aaa accounting allow-fail-through
```

Description

Enables accounting fail-through. When this option is enabled, the next server or accounting method is attempted after an accounting failure.

The `no` form of this command disables accounting fail-through.The system only attempts to reach the next server or accounting method if there is an accounting failure due to an unreachable TACACS+ server or a shared key mismatch error between the switch and the server.

Example

Enabling accounting fail-through:

```
switch(config)# aaa accounting allow-fail-through
```

Command History

Release	Modification
10.12.1000	Command introduced.

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa accounting all-mgmt

```
aaa accounting all-mgmt <CONNECTION-TYPE> start-stop {local | group <GROUP-LIST>}
no aaa accounting all-mgmt <CONNECTION-TYPE> start-stop {local | group <GROUP-LIST>}
```

Description

Defines accounting as being local (with the name `local`) (the default). Or defines a sequence of remote AAA server groups to be accessed for accounting purposes.

For remote accounting, the information is sent to the first reachable remote server that was configured with this command for remote accounting. If no remote server is reachable, local accounting remains

available. Each available connection type (channel) can be configured individually as either local or using remote AAA server groups. All server groups named in your command, must exist. This command can be issued multiple times, once for each connection type. Local is always available for any connection type not configured for remote accounting.

The system accounting log is not associated with any connection type (channel) and is therefore sent to the accounting method configured on the default connection type (channel) only.

The `no` form of this command removes for the specified connection type, any defined remote AAA server group accounting sequence. Local accounting is available for connection types without a configured remote AAA server group list (whether default or for the specific connection type).

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Defines a list of accounting server groups to be used for the `default` connection type. This configuration applies to all other connection types (`console`, `ssh`, `https-server`, `telnet`) that are not explicitly configured with this command. For example, if you do not use `aaa accounting all-mgmt console...` to define the console accounting list, then this default configuration is used for console.
	`console`
	Defines a list of accounting server groups to be used for the `console` connection type.
	`ssh`
	Defines a list of accounting server groups to be used for the `ssh` connection type.
	`https-server`
	Defines a list of accounting server groups to be used for the `https-server` (REST, Web UI) connection type.
	`telnet`
	Defines a list of accounting server groups to be used for the `telnet` connection type.

`start-stop`	Selects accounting information capture at both the beginning and end of a process.
`local`	Selects local-only accounting when used without the `group` parameter.
`group` *<GROUP-LIST>*	Specifies the list of remote AAA server group names. Each name can be specified one time. Predefined remote AAA group names `tacacs` and `radius` are available. Although not a group name, predefined name `local` is available. User-defined TACACS+ and RADIUS server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa group server` and servers are added to a server group with the command `server`. If the remote server(s) in the group is unreachable or if there is a key mismatch error between the switch and the AAA Server, then the next accounting method is attempted.

Usage

Local accounting is always active. It cannot be turned off.

Examples

Defining the default accounting sequence based on two user-defined TACACS+ server groups, then the default TACACS+ server group, and finally (if needed), local accounting.

```
switch(config)# aaa accounting all-mgmt default start-stop group tg1 tg2 tacacs
local
```

Defining the console accounting sequence based on two user-defined TACACS+ server groups, then the default TACACS+ server group, and finally (if needed), local accounting.

```
switch(config)# aaa accounting all-mgmt console start-stop group tg2 tg3 tacacs
local
```

Defining the ssh accounting sequence based on one user-defined TACACS+ server group and then the default TACACS+ server group.

```
switch(config)# aaa accounting all-mgmt ssh start-stop group tg2 tacacs
```

Defining the Telnet accounting sequence based on one user-defined TACACS+ server group and then the default TACACS+ server groups.

```
switch(config)# aaa accounting all-mgmt telnet start-stop group tg1 tacacs
```

Defining the default accounting sequence based on two user-defined RADIUS server groups, then the default RADIUS server group, and finally (if needed), local accounting.

```
switch(config)# aaa accounting all-mgmt default start-stop group rg1 rg2 radius
local
```

Defining the https-server accounting sequence based on one user-defined RADIUS server group and then the default RADIUS server group.

```
switch(config)# aaa accounting all-mgmt https-server start-stop group rg1 radius
```

Setting local accounting for the default connection type:

```
switch(config)# aaa accounting all-mgmt default start-stop local
```

Command History

Release	Modification
10.11	Added the **telnet** parameter for all other platforms.

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication allow-fail-through

```
aaa authentication allow-fail-through
no aaa authentication allow-fail-through
```

Description

Enables authentication fail-through. If this feature is enabled, the next server or authetication method is tried after an authentication failure.

The `no` form of this command disables authentication fail-through. The system only attempts to reach the next server or authentication method if there is an accounting failure due to an unreachable TACACS+/RADIUS server or a shared key mismatch error between the switch and the server.

If your switch uses command authorization, best practices is to configure authorization fail-through before configuring authentication fail-through. If not, the switch may fall into an unusable state where authorization will fail for all commands.

Example

Enabling authentication fail-through:

```
switch(config)# aaa authentication allow-fail-through
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication login

```
aaa authentication login <CONNECTION-TYPE> {local | group <GROUP-LIST>}
no aaa authentication login <CONNECTION-TYPE> {local | group <GROUP-LIST>}
```

Description

Defines authentication as being local (with the name `local`) (the default). Or defines a sequence of remote AAA server groups to be accessed for authentication purposes. Each available connection type (channel) can be configured individually as either local or using remote AAA server groups. All server groups named in your command, must exist. This command can be issued multiple times, once for each connection type. Local is always available for any connection type not configured for remote AAA authentication.

If you do not want local authentication to occur in cases where all AAA servers contacted reject the user's credentials, do not enable authentication fail-through (command `aaa authentication allow-fail-through`).

The `no` form of this command removes for the specified connection type, any defined remote AAA server group authentication sequence. Local authentication is available for connection types without a configured remote AAA server group list (whether default or for the specific connection type).

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Defines a list of AAA server groups to be used for the `default` connection type. This configuration applies to all other connection types (`console`, `ssh`, `https-server`, `telnet`) that are not explicitly configured with this command. For example, if you do not use `aaa accounting all-mgmt console...` to define the console accounting list, then this default configuration is used for console.
	`console`
	Defines a list of AAA server groups to be used for the `console` connection type.
	`ssh`
	Defines a list of AAA server groups to be used for the `ssh` connection type.
	`https-server`
	Defines a list of AAA server groups to be used for the `https-server` (REST, Web UI) connection type.
	`telnet`
	Defines a list of AAA server groups to be used for the `telnet` connection type.

`local`	Selects local-only authentication when used without the `group` parameter.
`group` *<GROUP-LIST>*	Specifies the list of remote AAA server group names. Each name can be specified one time. Predefined remote AAA group names `tacacs` and `radius` are available. Although not a group name, predefined name `local` is available. User-defined TACACS+ and RADIUS server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the

Parameter	Description
	servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa group server` and servers are added to a server group with the command `server`. If the remote server(s) in the group is unreachable or if there is a key mismatch error between switch and the AAA Server, then the next authentication method is attempted.

Examples

Defining the default authentication sequence based on two user-defined TACACS+ server groups, then the default TACACS+ server group, and finally (if needed), local authentication.

```
switch(config)# aaa authentication login default group tg1 tg2 tacacs local
```

Defining the default authentication sequence based on two user-defined TACACS+ server groups, then the default TACACS+ server group, and finally (if needed), local authentication.

```
switch(config)# aaa authentication login console group tg2 tg3 tacacs local
```

Defining the ssh authentication sequence based on one user-defined TACACS+ server group and then the default TACACS+ server group.

```
switch(config)# aaa authentication login ssh group tg2 tacacs
```

Defining the Telnet authentication sequence with two user-defined TACACS+ server groups, the default TACACS+ server group, and finally (if needed), local authentication.

```
switch(config)# switch(config)# aaa authentication login telnet group tg1 tg2
tacacs local
```

Defining the default authentication sequence based on two user-defined RADIUS server groups, then the default RADIUS server group, and finally (if needed), local authentication.

```
switch(config)# aaa authentication login default group rg1 rg2 radius local
```

Defining the https-server authentication sequence based on one user-defined RADIUS server group and then the default RADIUS server group.

```
switch(config)# aaa authentication login https-server group rg1 radius
```

Setting local authentication for the default connection type:

```
switch(config)# aaa authentication login default local
```

Command History

Release	Modification
10.11	Added the **telnet** parameter on 10000, 9300, 83xx, 6100, 6000 and 4100i Switch Series.
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

aaa authorization allow-fail-through

```
aaa authorization allow-fail-through
no aaa authorization allow-fail-through
```

Description

Enables authorization fail-through. When this option is enabled, the next server or authorization method is attempted after an authorization failure.

The no form of this command disables authorization fail-through. The system only attempts to reach the next server or authorization method if there is an authorization failure due to an unreachable TACACS+/RADIUS server or a shared key mismatch error between the switch and the server.

If your switch uses command authorization, best practices is to configure authorization fail-through before configuring authentication fail-through. If not, the switch may fall into an unusable state where authorization will fail for all commands.

Example

Enabling authorization fail-through:

```
switch(config)# aaa authorization allow-fail-through
```

The following configurations use authorization fail-through in different scenarios.

Example configuration one:

```
aaa authentication allow-fail-through
aaa authorization allow-fail-through
aaa group server tacacs CPPM-TACACS
server 172.16.1.12
aaa authentication login ssh group CPPM-TACACS local
aaa authorization commands ssh group CPPM-TACACS local
```

Example configuration one does not support authentication via the TACACS+ server for a locally configured user. If the user is configured locally and that user does not have a profile present in the TACACS+ server, authentication fails with TACACS+, but the user is authenticated successfully with local

authentication. Similarly, if authorization is rejected, the user is authorized locally with a fail-through configuration.

Example configuration two:

```
aaa group server tacacs CPPM-TACACS
server 172.16.1.12
aaa authentication allow-fail-through
aaa authorization allow-fail-through
aaa authentication login ssh group CPPM-TACACS local
aaa authorization commands ssh group local CPPM-TACACS
```

With configuration two, if a user's profile is configured only in the TACACS+ server, user authorization is rejected locally and is authorized with TACACS using the fail-through configuration. When authentication fail-through is configured, if the first authentication method fails, authentication is attempted using the next server or authentication method. The authorization fail-through is based on the authorization sequence, and is independent of the authentication method of the user.

Example configuration three:

```
aaa group server tacacs CPPM-TACACS
server 172.16.1.12
aaa group server tacacs TACACS
server 192.168.10.15
aaa authentication allow-fail-through
aaa authorization allow-fail-through
aaa authentication login ssh group CPPM-TACACS local
aaa authorization commands ssh group TACACS local
```

Example configuration four:

```
aaa group server radius RAD-GRP
server 172.16.1.12
aaa group server tacacs TACACS
server 192.168.10.15
aaa authentication allow-fail-through
aaa authorization allow-fail-through
aaa authentication login ssh group RAD-GRP  local
aaa authorization commands ssh group TACACS local
```

With configurations three and four, the **CPPM-TACACS** or **RAD-GRP** groups reject authentication requests for locally configured users, and the users are authenticated locally with fail-through. Authorization is attempted with the TACACS group in these configurations, and if this authorization attempt fails, the user will be authorized locally due to the fail-through configuration.

When authorization is rejected by multiple servers/server groups due to the fail-through configuration, a delay may be seen while executing commands.

Command History

Release	Modification
10.12.1000	Command introduced.

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa authorization commands

```
aaa authorization commands <CONNECTION-TYPE> {local | none}
no aaa authorization commands <CONNECTION-TYPE> {local | none}
aaa authorization commands <CONNECTION-TYPE> group <GROUP-LIST>
no aaa authorization commands <CONNECTION-TYPE> group <GROUP-LIST>
```

Description

Defines authorization as being basic local RBAC (specified as `none`), or as full-fledged local RBAC specified as `local` (the default), or as remote TACACS+ (specified with `group <GROUP-LIST>`). Each available connection type (channel) can be configured individually. All server groups named in the command, must exist. This command can be issued multiple times, once for each connection type.

The `no` form of this command unconfigures authorization for the specified connection type, reverting to the default of `local`.

Although only TACACS+ servers are supported for remote authorization, local authorization (basic or full-fledged) can be used with remote RADIUS authentication. If your switch uses command authorization, best practices is to configure authorization fail-through before configuring authentication fail-through. If not, the switch may fall into an unusable state where authorization will fail for all commands.

Parameter	Description

<CONNECTION-TYPE>	One of these connection types (channels):
	`default`
	Selects the `default` connection type for configuration. This configuration applies to all other connection types (`console`, `ssh`, `telnet`) that are not explicitly configured with this command. For example, if you do not use `aaa authorization commands console...` to define the console authorization list, then this default configuration is used for console.
	`console`
	Selects the `console` connection type for configuration.
	`ssh`
	Selects the `ssh` connection type for configuration.
	`telnet`
	Selects the `telnet` connection type for configuration.

`local`	When used alone without `group <GROUP-LIST>`, selects local authorization which can be used to provide authorization for a purely local setup without any remote AAA servers and also for when RADIUS is used for remote Authentication and Accounting but Authorization is local. When used after `group`, provides for fallback (to full-fledged local authorization) when every server in

Parameter	Description
	every specified TACACS+ server group cannot be reached. **NOTE:** If any TACACS+ server in the specified groups is reachable, but the command fails to be authorized by that server, the command is rejected and local authorization is never attempted. Local authorization is only attempted if every TACACS+ server cannot be reached.
`none`	When used alone without `group <GROUP-LIST>`, selects basic local RBAC authorization, for use with the built-in user groups (`administrators`, `operators`, `auditors`). When used after `group`, provides for fallback (to basic local RBAC authorization) when every server in every specified TACACS+ server group cannot be reached. **NOTE:** With `none`, for users belonging to user-defined user groups, all commands can be executed regardless of what authorization rules are defined in such groups. For per-command local authorization, use `local` instead.
`group <GROUP-LIST>`	Specifies the list of remote AAA server group names. Predefined remote AAA group name `tacacs` is available. User-defined TACACS+ server group names may also be used. The remote AAA server groups are accessed in the order that the group names are listed in this command. Within each group, the servers are accessed in the order in which the servers were added to the group. Server groups are defined using command `aaa server group` and servers are added to a server group using command `server`. It is recommended to always include either the special name `local` or `none` as the last name in the group list. If both `local` and `none` are omitted, and no remote AAA server is reachable (or the first reachable server cannot authorize the command), command execution for the current user will not be possible. If the AAA server(s) in the group are not reachable, or if if there is a key mismatch error between the server and the switch, the next authorization method is attempted.

Usage

TACACS+ server authorization considerations

Use caution when configuring authorization, as it has no fail through. If the switch is not configured properly, the switch might get into an unusable state in which all command execution is prohibited.

To prevent authorization difficulties:

- Make sure that all listed TACACS+ servers can authorize users for command execution.
- Make sure that credential database changes are promptly synchronized across all TACACS+ servers.
- Make sure either `local` or `none` is included as the last name in the group list. If both `local` and `none` are omitted, and no remote TACACS+ server is reachable (or the first reachable server cannot authorize), authorization will not be possible.
- Although not recommended, if you choose to omit both `local` and `none` from the list, and are manipulating configuration files, special caution is necessary. If the source configuration includes

TACACS+ authorization and you are copying configuration from an existing switch into the running configuration of a new switch, and you have not yet configured the interface or routing information to reach the TACACS+ server, the switch will enter an unusable state, requiring hard reboot.

To avoid getting into this situation that can occur when `local` and `none` have been omitted, do either of the following:

- In the configuration source, delete or comment-out the line configuring remote authorization. Then, after the configuration copy and paste, manually configure authorization.
- Move the line configuring the authorization to the end of the source configuration before copying and pasting.

Examples

Defining the default authorization sequence based on a user-defined TACACS+ server group, then the default TACACS+ server group, and finally (as a precaution), `local` authorization:

```
switch(config)# aaa authorization commands default group tg1 tacacs local
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
```

Defining the Telnet authorization sequence based on a user-defined TACACS+ server group, then the default TACACS+ server group, and finally (as a precaution), `local` authorization:

```
switch(config)# aaa authorization commands telnet group tg1 tacacs local
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
```

Defining the console authorization sequence based on two user-defined TACACS+ server groups, and finally (as a precaution), `local` authorization:

```
switch(config)# aaa authorization commands console group tg1 tg2 local
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
```

Setting the authorization for default to `local`:

```
switch(config)# aaa authorization commands default local
```

Setting the authorization for the SSH interface to `none`:

```
switch(config)# aaa authorization commands ssh none
```

Command History

Release	Modification
10.11	Added the **`telnet`** parameter on the 10000, 9300, 83xx, 6100, 6000 and 4100i Switch Series.
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

aaa group server

```
aaa group server {tacacs | radius} <SERVER-GROUP-NAME>
no aaa group server {tacacs | radius} <SERVER-GROUP-NAME>
```

Description

Creates an AAA server group that is either empty or contains preconfigured RADIUS/TACACS+ servers. You can create a maximum of 28 server groups.

The `no` form of this command deletes a server group. Only a preconfigured user-defined RADIUS/TACACS+ server group can be deleted. RADIUS or TACACS+ servers that were in a deleted server group remain a part of their default server group. The default server group for TACACS+ servers is `tacacs`. The default server group for RADIUS servers is `radius`.

Parameter	Description
`server {tacacs | radius}`	Select either `tacacs` or `radius` for the server type.
<SERVER-GROUP-NAME>	Specifies the name of the server group to be created. The name of the server group can have a maximum of 32 characters.

Examples

Creating TACACS+ server group sg1:

```
switch(config)# aaa group server tacacs sg1
```

Creating RADIUS server group sg3:

```
switch(config)# aaa group server radius sg3
```

Deleting TACACS+ server group sg1:

```
switch(config)# no aaa group server tacacs sg1
```

Deleting RADIUS server group sg3:

```
switch(config)# no aaa group server radius sg3
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server auth-type

```
radius-server auth-type {pap | chap}
no radius-server auth-type {pap | chap}
```

Description

Enables the CHAP or PAP authentication protocol, which is used for communication with the RADIUS servers, at the global level. You can override this command with a fine-grained per server `auth-type` configuration.

The `no` form of this command resets the global authentication mechanism for RADIUS to PAP or CHAP. PAP is the default authentication mechanism for RADIUS.

Parameter	Description
`auth-type {pap | chap}`	Selects either the PAP or CHAP authentication protocol.

Examples

Authenticating CHAP:

```
switch(config)# radius-server auth-type chap
```

Authenticating PAP:

```
switch(config)# radius-server auth-type pap
```

Removing CHAP authentication:

```
switch(config)# no radius-server auth-type chap
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server host

```
radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}][vrf <VRF-NAME>]
no radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}][vrf <VRF-NAME>]
```

Description

Adds a RADIUS server. By default, the RADIUS server is associated with the server group named `radius`. The `no` form of this command removes a previously added RADIUS server.

For enhanced security with IPsec, the alternative command `radius-server host secure ipsec` is available. The standard non-IPsec `radius-server host` command does not modify any existing IPsec configuration. If IPsec is already configured for the RADIUS server, then IPsec will remain enabled for the server.

Parameter	Description
{*<FQDN>* | *<IPV4>* | *<IPv6>*}	Specifies the RADIUS server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
`key [plaintext` *<PASSKEY>* | `ciphertext` *<PASSKEY>*`]`	Selects either a plaintext or an encrypted local shared-secret passkey for the server. As per RFC 2865, shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `key` is entered without either sub-parameter, plaintext passkey prompting occurs upon pressing Enter. Enter must be pressed immediately after the `key` parameter without entering other parameters. The entered passkey characters are masked with asterisks. When `key` is omitted, the server uses the global passkey. This command requires either the global or local passkey to be set; otherwise the server will not be contacted. Command `radius-server key` is available for setting the global passkey.
`timeout` *<TIMEOUT-SECONDS>*	Specifies the timeout. Range: 1 to 60 seconds. If a timeout is not specified, the value from the global timeout for RADIUS is used.
`port` *<PORT-NUMBER>*	Specifies the authentication port number. Range: 1 to 65535. Default: 1812.

Parameter	Description
`auth-type {pap | chap}`	Selects either the PAP (the default) or CHAP authentication types. If this parameter is not specified, the RADIUS global default is used.
`acct-port <ACCT-PORT>`	Specifies the UDP accounting port number. Range: 1 to 65535. Default: 1813.
`retries <RETRY-COUNT>`	Specifies the number of retry attempts for contacting the specified RADIUS server. Range is 0 to 5 attempts. If no retry value is provided, the default value of 1 is used.
`tracking {enable | disable}`	Enables or disables server tracking for the RADIUS server. Tracked servers are probed at the start of each server tracking interval to check if they are reachable. Use command `radius-server tracking` to configure RADIUS server tracking globally. **NOTE:** Server tracking uses authentication request and response packets to determine server reachability status. The server tracking user name and password are used to form the request packet which is sent to the server with tracking enabled. Upon receiving a response to the request packet, the server is considered to be reachable.

`tracking-mode {any | dead-only}`	Configures tracking mode for the RADIUS server that has tracking enabled with the server. The tracking mode is used to monitor the status of RADIUS server reachability The default tracking mode is `any`.
	`any`
	Track the RADIUS server irrespective of its server reachability.
	`dead-only`
	Track the RADIUS server only when the server is marked as unreachable.

`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.

Usage

If the fully qualified domain name is provided for the RADIUS server, a DNS server must be configured and accessible through the same VRF which is configured for the RADIUS server. This configuration is required for the resolution of the RADIUS server hostname to its IP address. If a DNS server is not available for this VRF, the RADIUS servers reachable through this VRF must be configured by means of their IP addresses only.

Examples

Adding a RADIUS server with an IPv4 address and a prompted passkey:

```
switch(config)# radius-server host 1.1.1.5 key
Enter the RADIUS server key: *********
Re-Enter the RADIUS server key: *********
```

Deleting a RADIUS server with an IPv4 address and a prompted passkey:

```
switch(config)# no radius-server host 1.1.1.5 key
Enter the RADIUS server key: *********
Re-Enter the RADIUS server key: *********
```

Adding a RADIUS server with an IPv4 address and a named VRF:

```
switch(config)# radius-server host 1.1.1.1 vrf mgmt
```

Deleting a RADIUS server with an IPv4 address and a named VRF:

```
switch(config)# no radius-server host 1.1.1.1 vrf mgmt
```

Adding a RADIUS server with an IPv4 address, a port, and a named VRF:

```
switch(config)# radius-server host 1.1.1.2 port 32 vrf mgmt
```

Deleting a RADIUS server with an IPv4 address, a port, and a named VRF:

```
switch(config)# no radius-server host 1.1.1.2 port 32 vrf mgmt
```

Adding a RADIUS server with an IPv6 address:

```
switch(config)# radius-server host 2001:0db8:85a3:0000:0000:8a2e:0370:7334
```

Deleting a RADIUS server with an IPv6 address:

```
switch(config)# no radius-server host 2001:0db8:85a3:0000:0000:8a2e:0370:7334
```

Adding a RADIUS server with tracking enabled and tracking mode is set to dead-only:

```
switch(config)# radius-server host 1.1.1.1 tracking enable tracking-mode dead-only
```

Deleting a RADIUS server with tracking enabled and tracking mode is set to dead-only:

```
switch(config)# no radius-server host 1.1.1.1 tracking enable tracking-mode dead-
only
```

Adding a RADIUS server with tracking disabled:

```
switch(config)# radius-server host 1.1.1.1 tracking disable
```

Deleting a RADIUS server with tracking disabled:

```
switch(config)# no radius-server host 1.1.1.1 tracking disable
```

Deleting a RADIUS server with an IPv4 address and specified VRF:

```
switch(config)# no radius-server host 1.1.1.1 vrf mgmt
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config	Administrators or local user group members with execution rights for this command.

radius-server host secure ipsec

Syntax for a RADIUS server that uses IPsec for authentication:

```
radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}] [vrf <VRF-NAME>]
   secure ipsec authentication spi <SPI-INDEX> <AUTH-TYPE> <AUTH-KEY-TYPE> [<AUTH-KEY>]
no radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}] [vrf <VRF-NAME>]
   secure ipsec authentication spi <SPI-INDEX><AUTH-TYPE><AUTH-KEY-TYPE> [<AUTH-KEY>]
```

Syntax for a RADIUS server that uses IPsec for both authentication and encryption:

```
radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}] [vrf <VRF-NAME>]
   secure ipsec encryption spi <SPI-INDEX> <AUTH-TYPE> <AUTH-KEY-TYPE>
   [<AUTH-KEY>] <ENCRYPT-TYPE> <ENCRYPT-KEY-TYPE> [<ENCRYPT-KEY>]
no radius-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [acct-port <ACCT-PORT>] [retries <RETRY-COUNT>]
   [tracking {enable | disable}] [tracking-mode {any | dead-only}] [vrf <VRF-NAME>]
   secure ipsec encryption spi <SPI-INDEX><AUTH-TYPE><AUTH-KEY-TYPE>
   [<AUTH-KEY>] <ENCRYPT-TYPE><ENCRYPT-KEY-TYPE> [<ENCRYPT-KEY>]
```

Description

Adds a RADIUS server that uses IPsec for enhanced security (authentication and possibly encryption). By default, the RADIUS server is associated with the server group named `radius`.

The `no` form of this command removes a previously added RADIUS (with IPsec) server.

Unless enhanced security with IPsec is required, use the `radius-server host` command instead.

Parameter	Description
{*<FQDN>* | *<IPV4>* | *<IPv6>*}	Specifies the RADIUS server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
key [plaintext *<PASSKEY>* | ciphertext *<PASSKEY>*]	Selects either a plaintext or an encrypted local shared-secret passkey for the server. As per RFC 2865, shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `key` is entered without either sub-parameter, plaintext passkey prompting occurs upon pressing Enter. Enter must be pressed immediately after the `key` parameter without entering other parameters. The entered passkey characters are masked with asterisks. When `key` is omitted, the server uses the global passkey. This command requires either the global or local passkey to be set; otherwise the server will not be contacted. Command `radius-server key` is available for setting the global passkey.
timeout *<TIMEOUT-SECONDS>*	Specifies the timeout. Range: 1 to 60 seconds. If a timeout is not specified, the value from the global timeout for RADIUS is used.
port *<PORT-NUMBER>*	Specifies the authentication port number. Range: 1 to 65535. Default: 1812.
auth-type {*pap* | *chap*}	Selects either the PAP (the default) or CHAP authentication types. If this parameter is not specified, the RADIUS global default is used.
acct-port *<ACCT-PORT>*	Specifies the UDP accounting port number. Range: 1 to 65535. Default: 1813.
retries *<RETRY-COUNT>*	Specifies the number of retry attempts for contacting the specified RADIUS server. Range is 0 to 5 attempts. If no retry value is provided, the default value of 1 is used.
tracking {enable | disable}	Enables or disables server tracking for the RADIUS server. Tracked servers are probed at the start of each server tracking interval to check if they are reachable. Use command `radius-server tracking` to configure RADIUS server tracking globally. **NOTE:** Server tracking uses authentication request and response packets to determine server reachability status. The server tracking user name and password are used to form the request packet which is sent to the server with tracking enabled. Upon receiving a response to the request packet, the server is considered to be reachable.
tracking-mode {any | dead-only}	Configures tracking mode for the RADIUS server that has tracking enabled with the server. The tracking mode is used to monitor the

Parameter	Description

	status of RADIUS server reachability The default tracking mode is `any`.
	`any`
	Track the RADIUS server irrespective of its server reachability.
	`dead-only`
	Track the RADIUS server only when the server is marked as unreachable.

`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.
`spi <SPI-INDEX>`	Specifies the Security Parameters Index. The SPI is an identification tag carried in the IPsec AH header. The SPI must be unique on the switch. Range: 256 to 4294967295.
<AUTH-TYPE>	Specifies the authentication algorithm: `md5`, `sha1`, or `sha256`.
<AUTH-KEY-TYPE>	Specifies the authentication key type: `plaintext`, `hex-string`, or `ciphertext`.
[*<AUTH-KEY>*]	Specifies the authentication key. For *<AUTH-TYPE>* of `ciphertext`, this is the ciphertext string. For *<AUTH-TYPE>* of `plaintext` or `hex-string`: ■ `md5 (plaintext)`: 1 to 16 characters, `(hex-string)`: 2 to 32 hexadecimal digits. ■ `sha1 (plaintext)`: 1 to 20 characters, `(hex-string)`: 2 to 40 hexadecimal digits. ■ `sha256 (plaintext)`: 1 to 32 characters, `(hex-string)`: 2 to 64 hexadecimal digits. **NOTE:** When *<AUTH-KEY-TYPE>* is not followed by *<AUTH-KEY>*, plaintext authentication key prompting occurs upon pressing Enter. Enter must be pressed immediately after the *<AUTH-KEY-TYPE>* parameter without entering other parameters. The entered authentication key characters are masked with asterisks.
<ENCRYPT-TYPE>	Specifies the encryption algorithm: `3des`, `aes`, `des`, or `null`.
<ENCRYPT-KEY-TYPE>	Specifies the encryption key type: `plaintext`, `hex-string`, or `ciphertext`.
[*<ENCRYPT-KEY>*]	Specifies the encryption key. For *<ENCRYPT-TYPE>* of `ciphertext`, this is the ciphertext string. For *<ENCRYPT-TYPE>* of `plaintext` or `hex-string`: ■ `3des (plaintext)`: 24 characters, `(hex-string)`: 48 hexadecimal digits. ■ `aes (plaintext)`: 16, 24, or 32 characters, `(hex-string)`: 32, 48, or 64 hexadecimal digits. ■ `des (plaintext)`: 8 characters, `(hex-string)`: 16 hexadecimal digits.

Parameter	Description
	NOTE: When *<ENCRYPT-KEY-TYPE>* is not followed by *<ENCRYPT-KEY>*, plaintext encryption key prompting occurs upon pressing Enter. Enter must be pressed immediately after the *<ENCRYPT-KEY-TYPE>* parameter without entering other parameters. The entered encryption key characters are masked with asterisks.

Usage

If the fully qualified domain name is provided for the RADIUS server host, a DNS server must be configured and accessible through the same VRF as mentioned for the server host. This configuration is required for the resolution of the RADIUS server hostname to its IP address. If a DNS server is not available for this VRF, the RADIUS servers reachable through this VRF must be configured by means of their IP addresses only.

Examples

Adding a RADIUS server with an IPv4 address, a plaintext passkey, and IPsec authentication (md5 plaintext).

```
switch(config)# radius-server host 1.1.1.1 key plaintext 98ab vrf mgmt secure
   ipsec authentication spi 261 md5 plaintext 1abc
```

Deleting a RADIUS server with an IPv4 address, a plaintext passkey, and IPsec authentication (md5 plaintext).

```
switch(config)# no radius-server host 1.1.1.1 key plaintext 98ab vrf mgmt secure
   ipsec authentication spi 261 md5 plaintext 1abc
```

Adding a RADIUS server with an IPv4 address and a prompted IPsec authentication (md5) plaintext authentication key.

```
switch(config)# radius-server host 1.1.1.1  secure ipsec authentication spi 261
md5
Enter the IPsec authentication key: ********
Re-Enter the IPsec authentication key: ********
```

Deleting a RADIUS server with an IPv4 address and a prompted IPsec authentication (md5) plaintext authentication key.

```
switch(config)# no radius-server host 1.1.1.1 secure ipsec authentication spi 261
md5
Enter the IPsec authentication key: ********
Re-Enter the IPsec authentication key: ********
```

Adding a RADIUS server with an IPv4 address, IPsec authentication (MD5 plaintext), and IPsec encryption (AES plaintext):

```
switch(config)# radius-server host 1.1.1.2 vrf mgmt secure
   ipsec encryption spi 262 md5 plaintext 9xyz aes plaintext 1234567890abcdef
```

Deleting a RADIUS server with an IPv4 address, IPsec authentication (MD5 plaintext), and IPsec encryption (AES plaintext):

```
switch(config)# no radius-server host 1.1.1.2 vrf mgmt secure
   ipsec encryption spi 262 md5 plaintext 9xyz aes plaintext 1234567890abcdef
```

Adding a RADIUS server by providing an IPv4 address and IPsec MD5 authentication type, and then responding to prompts for the keys and encryption type:

```
switch(config)# radius-server host 1.1.1.6 secure ipsec encryption spi 262 md5
Enter the IPsec authentication key: ********
Re-Enter the IPsec authentication key: ********

Enter the IPsec encryption type (3des/aes/des/null)? aes

Enter the IPsec encryption key: ********
Re-Enter the IPsec encryption key: ********
```

Deleting a RADIUS server by providing an IPv4 address and IPsec MD5 authentication type, and then responding to prompts for the keys and encryption type:

```
switch(config)# no radius-server host 1.1.1.6 secure ipsec encryption spi 262 md5
Enter the IPsec authentication key: ********
Re-Enter the IPsec authentication key: ********

Enter the IPsec encryption type (3des/aes/des/null)? aes

Enter the IPsec encryption key: ********
Re-Enter the IPsec encryption key: ********
```

Adding a RADIUS server with an IPv4 address, tracking enabled, tracking mode, IPsec authentication (MD5 plaintext), IPsec encryption (AES plaintext) is set to dead-only:

```
switch(config)# radius-server host 1.1.1.1 tracking enable tracking-mode dead-only
   vrf mgmt secure ipsec encryption spi 262 md5 plaintext 9xyz
   aes plaintext 1234567890abcdef
```

Deleting a RADIUS server with an IPv4 address, tracking enabled, tracking mode, IPsec authentication (MD5 plaintext), IPsec encryption (AES plaintext) is set to dead-only:

```
switch(config)# no radius-server host 1.1.1.1 tracking enable tracking-mode dead-
only
   vrf mgmt secure ipsec encryption spi 262 md5 plaintext 9xyz
   aes plaintext 1234567890abcdef
```

Removing a RADIUS server:

```
switch(config)# no radius-server host 1.1.1.1 vrf mgmt
```

Removing the ipsec configuration from a RADIUS server:

```
switch(config)# no radius-server host 1.1.1.2 vrf mgmt secure ipsec encryption
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server host tls port-access

```
radius-server host {<FQDN> | <IPV4> | <IPV6>} tls port-access {status-server | keep-alive}
no radius-server host {<FQDN> | <IPV4> | <IPV6>} tls port-access {status-server | keep-alive}
```

Description

Configures the type of messages to be sent inside RadSec sessions for port access authentication. Default message type for port access authentication sessions is `status-server`.

The `no` form of this command removes the message type configured for port access authentication sessions and sets the default, `status-server`.

Parameter	Description
`{<FQDN> | <IPV4> | <IPv6>}`	Specifies the RADIUS server as: ▪ *<FQDN>*: a fully qualified domain name. ▪ *<IPV4>*: an IPv4 address. ▪ *<IPV6>*: an IPv6 address.
`port-access {status-server | keep-alive}`	Specifies the message type to be used for port access authentication in RadSec sessions. Following message types are supported: ▪ `status-server`: Sets status server message type for authentication. ▪ `keep-alive`: Sets keep-alive message type for authentication. **NOTE:** Keep-alive as tracking method and for port access sessions is recommended in networks where a RadSec server is connected to

Parameter	Description
	more number of RadSec clients. The server requires additional resources to process status-server and access-request messages when compared to keep-alive messages. This is because status-server and access-request messages are RADIUS protocol packets. However, keep-alive packets are TCP control packets that does not require any additional resources for processing by the RadSec server.

Examples

Configuring the `keep-alive` messages for port access authentication in RadSec session on host `1.1.1.1`:

```
switch(config)# radius-server host 1.1.1.1 tls port-access keep-alive
```

Deleting the message type configured on host `1.1.1.1` for port access authentication session and setting the method to the default, `status-server`:

```
switch(config)# no radius-server host 1.1.1.1 tls port-access status-server
```

Command History

Release	Modification
10.10	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

radius-server host tls tracking-method

```
radius-server host {<FQDN> | <IPV4> | <IPV6>} tls tracking-method {status-server | keep-alive | access-request}
no radius-server host {<FQDN> | <IPV4> | <IPV6>} tls tracking-method {status-server | keep-alive | access-request}
```

Description

Configures the tracking method to be used for RADIUS server tracking. RADIUS server tracking must be configured for enabling the tracking method. Default tracking method is `access-request`.

The `no` form of this command sets the tracking method to the default option, `access-request`.

Parameter	Description
{*<FQDN>* | *<IPV4>* | *<IPv6>*}	Specifies the RADIUS server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
tracking-method {status-server | keep-alive | access-request}	Specifies the tracking method for RadSec tracking. Following methods are supported: ■ `status-server`: Status server responses are used to update the reachability status of the RadSec server. ■ `keep-alive`: Server socket status is verified to update the reachability status of the RadSec server. **NOTE:** `keep-alive` as tracking method and for port access sessions is recommended in networks where a RadSec server is connected to more number of RadSec clients. The server requires additional resources to process `status-server` and `access-request` messages when compared to `keep-alive` messages. This is because `status-server` and `access-request` messages are RADIUS protocol packets. However, `keep-alive packets` are TCP control packets that does not require any additional resources for processing by the RadSec server. ■ `access-request`: Access response messages are used to update the reachability status of the RadSec server.

Usage

- If the network has a RADIUS proxy, then it is recommended to use the `access-request` tracking method to track the RadSec server.
- If `keep-alive` is the tracking method, then make sure to check whether the server has the capability to treat the `keep-alive` messages sent in RadSec sessions as valid RadSec messages to keep the session active.

Examples

Configuring the RADIUS server tracking method on host `1.1.1.1`:

```
switch(config)# radius-server host 1.1.1.1 tls tracking-method status-server
```

Deleting the RADIUS server tracking method on host `1.1.1.1` and setting the method to the default, `access-request`:

```
switch(config)# no radius-server host 1.1.1.1 tls tracking-method access-request
```

Command History

Release	Modification
10.10	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server key

```
radius-server key [plaintext <GLOBAL-PASSKEY> | ciphertext <GLOBAL-PASSKEY>]
no radius-server key [plaintext <GLOBAL-PASSKEY> | ciphertext <GLOBAL-PASSKEY>]
```

Description

Creates or modifies a RADIUS global passkey. The RADIUS global passkey is used as a shared-secret for encrypting the communication between all RADIUS servers and the switch. The RADIUS global passkey is required for authentication unless local passkeys have been set. By default, the RADIUS global passkey is empty. If the administrator has not set this key, the switch will not be able to perform RADIUS authentication. The switch will instead rely on the authentication mechanism configured with `aaa authentication login`.

When this command is entered without parameters, plaintext passkey prompting occurs upon pressing Enter. The entered passkey characters are masked with asterisks.

The `no` form of the command removes the global passkey.

Parameter	Description
`plaintext <GLOBAL-PASSKEY>`	Specifies the RADIUS global passkey in plaintext format with a length of 1 to 31 characters. As per RFC 2865, a shared-secret can be a mix of alphanumeric and special characters.
`ciphertext <GLOBAL-PASSKEY>`	Specifies the RADIUS global passkey in encrypted format.

Examples

Adding the global passkey:

```
switch(config)# radius-server key plaintext mypasskey123
```

Adding the global passkey with prompting:

```
switch(config)# radius-server key
Enter the RADIUS server key: *********
Re-Enter the RADIUS server key: *********
```

Removing the global passkey:

```
switch(config)# no radius-server key
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server retries

```
radius-server retries <0-5>
no radius-server retries <0-5>
```

Description

Sets at the global level the number of retries the switch makes before concluding that the RADIUS server is unreachable.

You can override this setting with a fine-grained per RADIUS server retries configuration.

The `no` form of this command resets the RADIUS global retries to the default retries value of 1.

Parameter	Description
`retries <0-5>`	Specifies the number of retry attempts for contacting RADIUS servers. Range is 0 to 5 retries.

Example

```
switch(config)# radius-server retries 3
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

radius-server status-server interval

```
radius-server status-server interval <10-86400>
no radius-server status-server interval <10-86400>
```

Description

Configures the time interval in seconds to send the status server requests to the RADIUS server.

The `no` form of this command configures the default time interval, `300` seconds.

Parameter	Description
<10-86400>	Specifies the status server time interval in seconds. Default: `300`.

Examples

Configuring the status server time interval of 200 seconds:

```
switch(config)# radius-server status-server interval 200
```

Resetting the status server time interval to the default, 300 seconds:

```
switch(config)# no radius-server status-server interval 200
```

Command History

Release	Modification
10.10	Command introduced

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server timeout

```
radius-server timeout [<1-60>]
no radius-server timeout [<1-60>]
```

Description

Specifies the number of seconds to wait for a response from the RADIUS server before trying the next RADIUS server. If a value is not specified, a default value of 5 seconds is used. You can override this value with a fine-grained per server timeout configured for individual servers.

The `no` form of this command resets the RADIUS global authentication timeout to the default of 5 seconds.

Parameter	Description
`timeout <1-60>`	Specifies the timeout interval of 1 to 60 seconds. Default: 5 seconds.

Examples

Setting the RADIUS server timeout:

```
switch(config)# radius-server timeout 10
```

Resetting the timeout for the RADIUS server to the default:

```
switch(config)# no radius-server timeout
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

radius-server tracking

```
radius-server tracking interval <INTERVAL>
no radius-server tracking interval

radius-server tracking retries <RETRIES>
no radius-server tracking retries

radius-server tracking user-name <NAME>
   [password [plaintext <PASSWORD> | ciphertext <PASSWORD>]]
no radius-server tracking user-name <NAME>
   [password [plaintext <PASSWORD> | ciphertext <PASSWORD>]]
```

Description

Configures RADIUS server tracking settings globally for all configured RADIUS servers that have tracking enabled with the `radius-server host` command on individual servers.

The `no` form of the command removes the specified configuration, reverting it to its default. The no form with `user-name` also clears the password (resets it to empty).

Parameter	Description
`interval <INTERVAL>`	Specifies the time interval, in seconds, to wait before checking the server reachability status. Default: 300. Range 60 to 84600.
`retries <RETRIES>`	Specifies the number of server retries. Default: Global RADIUS retries. Range: 0 to 5.

`user-name <NAME>`
`[password [plaintext <PASSWORD> |`
`ciphertext <PASSWORD>]]`
	Specifies the user name (and optionally a password) to be used for server checking. The default user name is `radius-tracking-user` with an empty password.
	The password is optional and may be entered as `plaintext` or pasted in as `ciphertext`. The plaintext password is visible as cleartext when entered but is encrypted thereafter. Command history does show the password as cleartext.
	
	NOTE: When `password` is entered without a following sub-parameter, plaintext password prompting occurs upon pressing Enter. The entered password characters are masked with asterisks.
	
	NOTE: The user does not have to be configured on the server. Server tracking can still be performed with a user which is not configured on the server because authentication failure on the server achieves confirmation that the server is reachable.
	
	NOTE: Server tracking uses authentication request and response packets to determine server reachability status. The server tracking user name and password are used to form the request packet which is sent to the server with tracking enabled. Upon receiving a response to the request packet, the server is considered to be reachable.

Examples

Configuring a tracking interval of 120 seconds:

```
switch(config)# radius-server tracking interval 120
```

Reverting the tracking interval to its default of 300 seconds:

```
switch(config)# no radius-server tracking interval
```

Configuring three retries:

```
switch(config)# radius-server tracking retries 3
```

Configuring user `radius-tracker` with a plaintext password.

```
switch(config)# radius-server tracking user-name radius-tracker
    password plaintext track$1
```

Configuring user `radius-tracker` with a prompted plaintext password.

```
switch(config)# radius-server tracking user-name radius-tracker password
Enter the RADIUS server tracking password: *******
Re-Enter the RADIUS server tracking password: *******
```

Reverting the tracking user name to its default of `radius-tracking-user`:

```
switch(config)# no radius-server tracking user-name
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

server

`server {<FQDN> | <IPV4> | <IPV6>} [port <PORT-NUMBER>] [vrf <VRF-NAME>]`
`no server {<FQDN> | <IPV4> | <IPV6>} [port <PORT-NUMBER>] [vrf <VRF-NAME>]`

Description

Adds a TACACS+ or RADIUS server to a server group. Only the configured TACACS+ or RADIUS servers are allowed to be added within the server group. If the same server name exists with multiple ports or multiple VRFs, specify the server name, port, and VRF when adding the server to the server-group.

The `no` form of this command removes a TACACS+/RADIUS server from a server-group.

On the 4100i, 6000, 6100, 6200, 6300, 6400, 8100, 8325, 8360, and 10000 Switch Series, a RADIUS server can be associated with a maximum of four different user-defined server groups.

On the 8320, 8400, and 9300 Switch Series, a RADIUS server can be associated with only one user-defined server group.

Parameter	Description
`{<FQDN> | <IPV4> | <IPv6>}`	Specifies the RADIUS server as: ▪ *<FQDN>*: a fully qualified domain name.

Parameter	Description
	▪ *<IPV4>*: an IPv4 address. ▪ *<IPV6>*: an IPv6 address.
`port` *<PORT-NUMBER>*	Specifies the authentication port number. Range: 1 to 65535. Default TACACS+ (TCP): 49, RADIUS (UDP): 1812. If a port number is not provided, the system searches the TACACS+/RADIUS server by host name and sets the default authentication port. Group server priority is assigned based on the sequence in which the servers are added.
`vrf` *<VRF-NAME>*	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.

Examples

Adding a server to TACACS+ server group sg1 by providing an IPv4 address, port number, and VRF name:

```
switch(config)# aaa group server tacacs sg1
switch(config-sg)# server 1.1.1.2 port 32 vrf default
```

Adding a server to TACACS+ server group sg2 by providing an IPv6 address and default VRF:

```
switch(config)# aaa group server tacacs sg2
switch(config-sg)# server 2001:0db8:85a3:0000:0000:8a2e:0370:7334 vrf default
```

Adding a server to RADIUS server group sg3 by providing an IPv4 address, port number, and VRF name:

```
switch(config)# aaa group server radius sg3
switch(config-sg)# server 1.1.1.5 port 12 vrf default
```

Adding a server to RADIUS server group sg4 by providing an IPv6 address and default VRF:

```
switch(config)# aaa group server radius sg4
switch(config-sg)# server 2001:0db8:85a3:0000:0000:8a2e:0371:7334 vrf default
```

Adding a server to RADIUS server group sg4 by providing an IPv4 address, port number, and VRF name:

```
switch(config)# aaa group server radius sg4
switch(config-sg)# server 1.1.1.6 port 32 vrf vrf_red
```

Specifying an IPv4 address when removing a TACACS+ server from server group sg1:

```
switch(config)# aaa group server tacacs sg1
switch(config-sg)# no server 1.1.1.2 port 12 vrf default
```

Specifying an IPv6 address when removing a TACACS+ server from server group sg2 with the default VRF:

```
switch(config)# aaa group server tacacs sg2
switch(config-sg)# no server 2001:0db8:85a3:0000:0000:8a2e:0370:7334 vrf default
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-sg`	Administrators or local user group members with execution rights for this command.

show aaa accounting

```
show aaa accounting [vsx-peer]
```

Description

Shows the accounting configuration per connection type (channel).

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Configuring and then showing the accounting sequence for TACACS+ groups and local:

```
(config)# aaa accounting all-mgmt default start-stop group sg1 tacacs radius
(config)# aaa accounting all-mgmt console start-stop local
(config)# aaa accounting all-mgmt ssh start-stop group radius tacacs local
(config)# aaa accounting all-mgmt https-server start-stop group sg1 tacacs
(config)# aaa accounting all-mgmt telnet start-stop group radius tacacs local
(config)# show aaa accounting
AAA Accounting:
Accounting Type               : all
Accounting Mode               : start-stop
Accounting Failthrough        : Enabled

Accounting for https-server channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                               | 0
tacacs                            | 1
--------------------------------------------------------------------------------
Accounting for console channel:
--------------------------------------------------------------------------------
```

```
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------
Accounting for default channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                             | 0
tacacs                          | 1
radius                          | 2
--------------------------------------------------------------------------------
Accounting for ssh channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
radius                          | 0
tacacs                          | 1
local                           | 2
--------------------------------------------------------------------------------
Accounting for telnet channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
radius                          | 0
tacacs                          | 1
local                           | 2
--------------------------------------------------------------------------------
```

Configuring and then showing the accounting sequence for RADIUS groups and local:

```
switch(config)# aaa accounting all default start-stop group rg1 rg2 radius local
switch(config)# aaa accounting all console start-stop group rg4 radius local
switch(config)# exit
switch# show aaa accounting
AAA Accounting:
Accounting Type                              : all
Accounting Mode                              : start-stop
Accounting Failthrough                       : Enabled
Accounting for default channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
rg1                             | 0
rg2                             | 1
radius                          | 2
local                           | 3
--------------------------------------------------------------------------------
Accounting for console channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
tg4                             | 0
radius                          | 1
local                           | 2
--------------------------------------------------------------------------------
```

Configuring and then showing only local accounting for default:

```
switch(config)# aaa accounting all default start-stop local
switch(config)# exit
switch# show aaa accounting
AAA Accounting:
Accounting Type                                 : all
Accounting Mode                                 : start-stop
Accounting for default channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
local                             | 0
--------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication

```
show aaa authentication [vsx-peer]
```

Description

Shows the authentication configuration per connection type (channel).

Parameter	Description
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Configuring TACACS+ authentication sequences and then showing the configuration per connection type (channel):

```
switch(config)# aaa authentication login default group sg1 sg2 sg3 sg4 tacacs
local
switch(config)# aaa authentication login ssh group sg1 sg2
switch(config)# aaa authentication login console group sg4 tacacs local
switch(config)# aaa authentication login https-server local group tacacs sg3
switch(config)# aaa authentication login telnet group sg1 sg2
switch(config)# exit
```

```
switch# show aaa authentication
AAA Authentication:
  Fail-through              : Enabled
  Limit Login Attempts      : Not set
  Lockout Time              : 300
  Minimum Password Length   : Not set

Authentication for ssh channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                               | 0
sg2                               | 1
--------------------------------------------------------------------------------

Authentication for https-server channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
local                             | 0
tacacs                            | 1
sg3                               | 2
--------------------------------------------------------------------------------

Authentication for console channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
sg4                               | 0
tacacs                            | 1
local                             | 2
--------------------------------------------------------------------------------

Authentication for default channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                               | 0
sg2                               | 1
sg3                               | 2
sg4                               | 3
tacacs                            | 4
local                             | 5
--------------------------------------------------------------------------------
Authentication for telnet channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                               | 0
sg2                               | 1
--------------------------------------------------------------------------------
```

Configuring RADIUS authentication sequences and then showing the configuration per connection type (channel):

```
switch(config)# aaa authentication login default group rg1 rg2 rg3 rg4 radius
local
switch(config)# aaa authentication login console group rg4 radius local
switch(config)# exit
switch# show aaa authentication
AAA Authentication:
```

```
  Fail-through              : Enabled
  Limit Login Attempts      : Not set
  Lockout Time              : 300
  Minimum Password Length   : Not set

Authentication for default channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
rg1                               | 0
rg2                               | 1
rg3                               | 2
rg4                               | 3
radius                            | 4
local                             | 5
--------------------------------------------------------------------------------

Authentication for console channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
rg4                               | 0
radius                            | 1
local                             | 2
--------------------------------------------------------------------------------
```

Configuring only default authentication and then showing the default connection type (channel):

```
switch(config)# aaa authentication login default local
switch(config)# exit
switch# show aaa authentication

AAA Authentication:
  Fail-through                          : Disabled
  Limit Login Attempts                  : Not set
  Lockout Time                          : 300
  Minimum Password Length               : Not set

Authentication for default channel:
--------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
--------------------------------------------------------------------------------
local                             | 0
--------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authorization

```
show aaa authorization [vsx-peer]
```

Description

Shows the authorization configuration per connection type (channel).

Parameter	Description
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Configuring and then showing the authorization sequence for default and console connection types (channels):

```
(config)# aaa authorization commands default group sg1 tacacs local
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
(config)# aaa authorization commands ssh group sg2
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
(config)# aaa authorization commands telnet group sg2
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
(config)# aaa authorization commands console group sg1 local
All commands will fail if none of the servers in the group list are reachable.
Continue (y/n)? y
(config)# aaa authorization radius ssh group sg1
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y
(config)# aaa authorization radius https-server group sg2
All commands will fail if none of the radsec servers in the group list are
reachable.
Continue (y/n)? y


(config)# show aaa authorization

******* Command authorization *******
Authorization for console channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                             | 0
local                           | 1
--------------------------------------------------------------------------------

Authorization for default channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
sg1                             | 0
tacacs                          | 1
local                           | 2
--------------------------------------------------------------------------------
```

```
Authorization for ssh channel:
-------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
sg2                               | 0
-------------------------------------------------------------------------------

Authorization for telnet channel:
-------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
sg2                               | 0
-------------------------------------------------------------------------------

******* User authorization through radius *******
Authorization for ssh channel:
-------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
sg1                               | 0
-------------------------------------------------------------------------------

Authorization for https-server channel:
-------------------------------------------------------------------------------
GROUP NAME                        | GROUP PRIORITY
-------------------------------------------------------------------------------
sg2                               | 0
-------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa server-groups

```
show aaa server-groups [tacacs | radius] [vsx-peer]
```

Description

Shows TACACS+ and RADIUS AAA server group information for all server types or for the specified server type.

Parameter	Description
tacacs	Narrows the command output to only TACACS+ servers.
radius	Narrows the command output to only RADIUS servers.
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Example

Showing all AAA server group information:

```
switch# show aaa server-groups

******* AAA Mechanism TACACS+ *******
-------------------------------------------------------------------------------
GROUP NAME       | SERVER NAME                       | PORT | VRF     | PRIORITY
-------------------------------------------------------------------------------
sg2              | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                         | 49   | default | 1
-------------------------------------------------------------------------------
sg1              | 1.1.1.2                           | 12   | mgmt    | 1
-------------------------------------------------------------------------------
tacacs (default) | FQDN.com                          | 32   | mgmt    | 1
tacacs (default) | 1.1.1.1                           | 49   | mgmt    | 2
tacacs (default) | 1.1.1.2                           | 12   | mgmt    | 3
tacacs (default) | abc.com                           | 32   | vrf_red | 4
tacacs (default) | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                         | 49   | default | 5
tacacs (default) | 1.1.1.3                           | 32   | vrf_blue| 6
-------------------------------------------------------------------------------
******* AAA Mechanism RADIUS *******
-------------------------------------------------------------------------------
GROUP NAME       | SERVER NAME                       | PORT | VRF     | PRIORITY
-------------------------------------------------------------------------------
sg4              | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                         | 1812 | default | 1
-------------------------------------------------------------------------------
sg3              | 1.1.1.5                           | 12   | mgmt    | 1
-------------------------------------------------------------------------------
radius (default) | 1.1.1.4                           | 1812 | mgmt    | 1
radius (default) | 1.1.1.5                           | 12   | mgmt    | 2
radius (default) | abc1.com                          | 32   | mgmt    | 3
radius (default) | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                         | 1812 | default | 4
radius (default) | 1.1.1.6                           | 32   | vrf_red | 5
radius (default) | 1.1.1.7                           | 32   | vrf_blue| 6
-------------------------------------------------------------------------------
```

Showing TACACS+ server group information:

```
switch# show aaa server-groups tacacs

******* AAA Mechanism TACACS+ *******
-------------------------------------------------------------------------------
GROUP NAME       | SERVER NAME                       | PORT | VRF     | PRIORITY
```

```
-------------------------------------------------------------------------------
sg2              | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                          | 49   | default | 1
-------------------------------------------------------------------------------
sg1              | 1.1.1.2                            | 12   | mgmt    | 1
-------------------------------------------------------------------------------
tacacs (default) | FQDN.com                           | 32   | mgmt    | 1
tacacs (default) | 1.1.1.1                            | 49   | mgmt    | 2
tacacs (default) | 1.1.1.2                            | 12   | mgmt    | 3
tacacs (default) | abc.com                            | 32   | vrf_red | 4
tacacs (default) | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                          | 49   | default | 5
tacacs (default) | 1.1.1.3                            | 32   | vrf_blue| 6
-------------------------------------------------------------------------------
```

Showing RADIUS server group information:

```
switch# show aaa server-groups radius

******* AAA Mechanism RADIUS *******
-------------------------------------------------------------------------------
GROUP NAME       | SERVER NAME                        | PORT | VRF     | PRIORITY
-------------------------------------------------------------------------------
sg4              | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                          | 1812 | default | 1
-------------------------------------------------------------------------------
sg3              | 1.1.1.5                            | 12   | mgmt    | 1
-------------------------------------------------------------------------------
radius (default) | 1.1.1.4                            | 1812 | mgmt    | 1
radius (default) | 1.1.1.5                            | 12   | mgmt    | 2
radius (default) | abc1.com                           | 32   | mgmt    | 3
radius (default) | 2001:0db8:85a3:0000:0000:8a2e:
                   0370:7334                          | 1812 | default | 4
radius (default) | 1.1.1.6                            | 32   | vrf_red | 5
radius (default) | 1.1.1.7                            | 32   | vrf_blue| 6
-------------------------------------------------------------------------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show accounting log

`show accounting log [last <QTY-TO-SHOW> | all]`

Description

Entered without optional parameters, this command shows all accounting log records for the current boot. Sensitive information is masked from the log, by being represented as asterisks.

This `show accounting log` command replaces the `show audit-log` command that is supported only in 10.00 releases.

Parameter	Description
`last` *<QTY-TO-SHOW>*	Specifies how many most-recent accounting log records to show for the current boot. Range: 1 to 1000.
`all`	Selects for showing, all accounting records from the current boot and the previous boot.

Usage

The log message starts with the record type, which is specific to AOS-CX. Values are the following:

`USER_START`

Record of a user login action.

`USER_END`

Record of a user logout action.

`USYS_CONFIG`

Record of a command executed by the user.

The three types of accounting log information are identified by the `msg=` element starting with the `rec=` item as follows:

- Exec is identified with: `msg='rec=ACCT_EXEC`
- Command is identified with: `msg='rec=ACCT_CMD`
- System is identified with: `msg='rec=ACCT_SYSTEM`

The user group is indicated by `priv-lvl`, which is specific to AOS-CX. Values are the following:

Privilege level	User group
1	`operators`
15	`administrators`
19	`auditors`

The value of `service` indicates which user interface was used:

`service=shell`

Indicates that the log entry is a result of a CLI command.

`service=https-server`

Indicates that the log entry is a result of a REST API request or a Web UI action.

The string value of `data` identifies the CLI command or REST API request that was executed.

These elements are shown in context under *Examples*.

Examples

Showing the accounting log for the previous and current boot. Line breaks have been added for readability.

```
switch# show accounting log all

--------------------------------------------------------------------------------
Local accounting logs from previous boot
--------------------------------------------------------------------------------
----
type=DAEMON_START msg=audit(Nov 05 2018  23:00:58.607:9057) :
auditd start, ver=2.4.3 format=raw kernel=4.9.119-yocto-standard res=success
----
type=USER_START msg=audit(Nov 05 2018  23:06:42.398:42) :
msg='rec=ACCT_EXEC op=start session=CONSOLE timezone=UTC user=user1 priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no
hostname=8xxx addr=0.0.0.0 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:06:42.399:43) :
msg='rec=ACCT_CMD op=stop session=CONSOLE timezone=UTC user=user1 priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no
data="enable" hostname=8xxx addr=0.0.0.0 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:08:24.693:51) :
msg='rec=ACCT_CMD op=stop session=CONSOLE timezone=UTC user=user1 priv-lvl=1
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no
data="configure terminal" hostname=8xxx addr=0.0.0.0 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:08:39.108:52) :
msg='rec=ACCT_CMD op=stop session=CONSOLE timezone=UTC user=user1 priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=yes
data="https-server rest access-mode read-write"
hostname=8xxx addr=0.0.0.0 res=success'
----
type=USER_START msg=audit(Nov 05 2018  23:10:57.238:58) :
msg='rec=ACCT_EXEC op=start session=REST timezone=UTC user=admin priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=https-server
data="http-method=POST http-uri=/rest/v1/login"
hostname=8xxx addr=127.0.0.1 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:15:11.958:75) :
msg='rec=ACCT_CMD op=stop session=CONSOLE timezone=UTC user=user1 priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=yes
data="tacacs-server host 2.2.2.2" hostname=8xxx addr=0.0.0.0 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:15:37.090:76) :
msg='rec=ACCT_CMD op=stop session=REST timezone=UTC user=admin priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=https-server
data="http-method=GET http-uri=/rest/v1/system/vrfs/mgmt/tacacs_servers"
hostname=8xxx addr=127.0.0.1 res=success'
----
type=USER_END msg=audit(Nov 05 2018  23:26:59.207:90) :
msg='rec=ACCT_EXEC op=stop session=REST timezone=UTC user=admin priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=https-server
data="http-method=POST http-uri=/rest/v1/logout"
hostname=8xxx addr=127.0.0.1 res=success'
----
type=USER_END msg=audit(Nov 05 2018  23:27:49.164:93) :
msg='rec=ACCT_EXEC op=stop session=CONSOLE timezone=UTC user=user1 priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no
hostname=8xxx addr=0.0.0.0 res=success'

--------------------------------------------------------------------------------
Local accounting logs from current boot
```

```
--------------------------------------------------------------------------------
----
type=DAEMON_START msg=audit(Nov 05 2018  23:32:05.642:626) :
auditd start, ver=2.4.3 format=raw kernel=4.9.119-yocto-standard res=success
----
type=USER_START msg=audit(Nov 05 2018  23:35:52.915:11) :
msg='rec=ACCT_EXEC op=start session=CONSOLE timezone=UTC user=admin priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no
hostname=8xxx addr=0.0.0.0 res=success'
----
type=USYS_CONFIG msg=audit(Nov 05 2018  23:35:52.917:12) :
msg='rec=ACCT_CMD op=stop session=CONSOLE timezone=UTC user=admin priv-lvl=15
auth-method=LOCAL auth-type=LOCAL service=shell isconfig=no data="enable"
hostname=8xxx addr=0.0.0.0 res=success'
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#) or Auditor (auditor)	Auditors or Administrators or local user group members with execution rights for this command. Auditors can execute this command from the auditor context (auditor>) only.

show radius-server

```
show radius-server [detail] [vsx-peer]
```

Description

Shows configured RADIUS servers information.

Parameter	Description
detail	Selects additional RADIUS server details and global parameters for showing.
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Usage

- When the `show radius-server` command shows `None` for the shared-secret, the passkey is missing.
- The `Tracking-Last-Attempted` and `Next-Tracking-Request` fields are applicable only when the RADIUS server tracking method is `access-request`.

For information about RADIUS server tracking methods, see the `radius-server host tls tracking-method`. command.

Examples

Showing a summary of the global RADIUS configuration:

```
switch# show radius-server
******* Global RADIUS Configuration *******

Shared-Secret:
AQBapRIb1nyfO/CyTOjj/lPIihQKoTcZWzPxlPwazapMPFKOCwAAAGJtiSZsV9EM/HZq
Timeout: 60
Auth-Type: pap
Retries: 5
Tracking Time Interval (seconds): 60
Tracking Retries: 5
Tracking User-name: radius-tracking-user
Tracking Password: None
Number of Servers: 1

-----------------------------------------------------------------
SERVER NAME                                | PORT | VRF
-----------------------------------------------------------------
20.1.1.129                                 | 1812 | default
1.1.1.4                                    | 1812 | default
1.1.1.5                                    | 12   | default
abc1.com                                   | 32   | default
2001:0db8:85a3:0000:0000:8a2e:0371:7334    | 1812 | default
-----------------------------------------------------------------
```

Showing a summary of a RADIUS server when the status server time interval is configured:

```
switch# show radius-server
Unreachable servers are preceded by *
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
Tracking User-name: radius-tracking-user
Tracking Password: None
Status-Server Time Interval (seconds): 400
Number of Servers: 2
-------------------------------------------------------------------------------
SERVER NAME                                | TLS  | PORT | VRF
-------------------------------------------------------------------------------
1.1.1.1                                    | Yes  | 2083 | default
2.2.2.2                                    |      | 1812 | default
-------------------------------------------------------------------------------
```

Showing details of a global RADIUS configuration:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: AQBapb+HsdpqV1QcA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout: 5
```

```
Auth-Type: pap
Retries: 5
Tracking Time Interval (seconds): 60
Tracking Retries: 5
Tracking User-name: radius-tracking-user
Tracking Password: None
Number of Servers: 1

****** RADIUS Server Information ******
Server-Name              : 20.1.1.129
Auth-Port                : 1812
Accounting-Port          : 1813
VRF                      : default
Shared-Secret            : None
Timeout                  : 60
Retries                  : 5
Auth-Type                : pap
Server-Group:Priority    : radius:1
Tracking                 : disabled
Tracking-Mode            : any
Reachability-Status      : N/A
ClearPass-Username       :
ClearPass-Password       : None
```

Showing details of a RADIUS server when the per-server shared key and the global RADIUS shared key are not set:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
Number of Servers: 1

****** RADIUS Server Information ******
Server-Name              : 1.1.1.1
Auth-Port                : 2083
VRF                      : default
Shared-Secret (default)  : None
Timeout (default)        : 5
Retries (default)        : 1
Auth-Type (default)      : pap
Server-Group:Priority    : radius:1
Default-Priority         : 1
```

Showing details of a RADIUS server when the `status-server` tracking method is configured:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
```

```
Tracking User-name: radius-tracking-user
Tracking Password: None
Status-Server Time Interval (seconds)       : 600
Number of Servers: 1

****** RADIUS Server Information ******
Server-Name                                 : 2.2.2.2
Auth-Port                                   : 2083
Accounting-Port                             : 2083
VRF                                         : default
TLS Enabled                                 : Yes
TLS Connection Status                       : tls_connection_established
Timeout                                     : 5
Auth-Type                                   : pap
Server-Group:Priority                       : radius:1
Default-Priority                            : 1
ClearPass-Username                          :
ClearPass-Password                          : None
Tracking                                    : disabled
Tracking-Mode                               : any
Tracking-Method                             : status-server
Reachability-Status                         : unknown
Tracking-Last-Attempted                     : N/A
Next-Tracking-Request                       : N/A
Port-Access session                         : status-server
```

Showing details of a RADIUS server when the `keep-alive` tracking method is configured:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
Tracking User-name: radius-tracking-user
Tracking Password: None
Status-Server Time Interval (seconds)       : 400
Number of Servers: 1

****** RADIUS Server Information ******
Server-Name                                 : 1.1.1.1
Auth-Port                                   : 2083
Accounting-Port                             : 2083
VRF                                         : default
TLS Enabled                                 : Yes
TLS Connection Status                       : tcp_connection_failed
Timeout                                     : 5
Auth-Type                                   : pap
Server-Group:Priority                       : radius:1
ClearPass-Username                          :
ClearPass-Password                          : None
Tracking                                    : disabled
Tracking-Mode                               : any
Tracking-Method                             : keep-alive
Reachability-Status                         : unknown
Tracking-Last-Attempted                     : N/A
```

```
Next-Tracking-Request                          : N/A
Port-Access session                            : status-server
```

Showing details of a RADIUS server when the `access-request` tracking method is configured:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
Tracking User-name: radius-tracking-user
Tracking Password: None
Status-Server Time Interval (seconds)       : 500
Number of Servers: 1

****** RADIUS Server Information ******
Server-Name                                 : 4.4.4.4
Auth-Port                                   : 2083
Accounting-Port                             : 2083
VRF                                         : default
TLS Enabled                                 : Yes
TLS Connection Status                       : tcp_connection_failed
Timeout                                     : 5
Auth-Type                                   : pap
Server-Group:Priority                       : radius:1
ClearPass-Username                          :
ClearPass-Password                          : None
Tracking                                    : disabled
Tracking-Mode                               : any
Tracking-Method                             : access-request
Reachability-Status                         : unknown
Tracking-Last-Attempted                     : N/A
Next-Tracking-Request                       : N/A
Port-Access session                         : keep-alive
```

Showing details of a RADIUS server when the server group is configured:

```
switch# show radius-server detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 10
Auth-Type: pap
Retries: 5
TLS Timeout: 5
Tracking Time Interval (seconds): 60
Tracking Retries: 5
Tracking User-name: radius
Tracking Password: None
Status-Server Time Interval (seconds): 300
Number of Servers: 12
AAA Server Status Trap: Enabled

****** RADIUS Server Information ******
```

```
Server-Name              : cppm2.cxsecurity.com
Auth-Port                : 1812
Accounting-Port          : 1813
VRF                      : sss
TLS Enabled              : No
Shared-Secret            :
AQBapVnmpJaWR3RsH/GUiZfDHpDP8e5QcjYPcsQfikQavpyECAAAAHGAflOgvyxO
Timeout                  : 10
Retries                  : 5
Auth-Type                : pap
Server-Group:Priority    : RG1:1, RG2:1, RG3:1, RG4:1
ClearPass-Username       :
ClearPass-Password       : None
Tracking                 : enabled
Tracking-Mode            : any
Reachability-Status      : reachable, Since Tue Mar 14 19:58:45 UTC 2023
Tracking-Last-Attempted  : Thu Mar 16 10:23:46 UTC 2023
Next-Tracking-Request    : 36 seconds
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show radius-server secure ipsec

```
show radius-server secure ipsec { server-list | host {<FQDN> | <IPV4> |  <IPv6>}
     [port <PORT-NUMBER>] [vrf <VRF-NAME>] [vsx-peer] }
```

Description

Shows information for one or all RADIUS servers configured with IPsec.

Parameter	Description
`server-list`	Selects all servers for showing.
`{<FQDN> | <IPV4> | <IPv6>}`	Specifies the RADIUS server as: ■ *<FQDN>*: a fully qualified domain name. ■ *<IPV4>*: an IPv4 address. ■ *<IPV6>*: an IPv6 address.
`port <PORT-NUMBER>`	Specifies the authentication port number. Range: 1 to 65535. Default: 1812.
`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the

Parameter	Description
	server. If no VRF name is provided, the default VRF named `default` is used.
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Usage

The IPsec key is shown in an exportable ciphertext format.

Examples

Showing information for RADIUS server 1.1.1.1 secured with IPsec:

```
switch# show radius-server secure ipsec host 1.1.1.1
IPsec                    : enabled
Protocol                 : ESP
Authentication           : MD5
Encryption               : AES
SPI                      : 1234
```

Showing information for all RADIUS servers secured with IPsec:

```
switch# show radius-server secure ipsec server-list
Server                   : 1.1.1.1
IPsec                    : enabled
Protocol                 : ESP
Authentication           : MD5
Encryption               : AES
SPI                      : 1234

Server                   : 1.1.1.2
IPsec                    : enabled
Protocol                 : ESP
Authentication           : MD5
Encryption               : AES
SPI                      : 12341
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platorms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show radius-server authentication statistics

```
show radius-server statistics authentication [vsx-peer]
```

Description

Shows authentication statistics for all configured RADIUS servers.

Parameter	Description
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Showing RADIUS server authentication statistics:

```
switch# show radius-server statistics authentication
 Server Name      : rad1
 Auth-Port        : 1812
 Accounting-Port  : 1813
 VRF              : mgmt

  Authentication Statistics
  -------------------------
    Round Trip Time            : 100
    Pending Requests           : 0
    Timeouts                   : 6
    Bad Authenticators         : 2
    Packets Dropped            : 0
    Access Requests            : 20
    Access Challenge           : 8
    Access Accepts             : 14
    Access Rejects             : 0
    Access Response Malformed  : 0
    Access Retransmits         : 0
    Tracking Requests          : 5
    Tracking Responses         : 5
    Unknown Response Code      : 0
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show radius-server authentication statistics host

```
show radius-server statistics authentication host {<FQDN> | <IPV4> |  <IPv6>}
     [port <PORT-NUMBER>] [vrf <VRF-NAME>] [vsx-peer]
```

Description

Shows authentication statistics for the specified RADIUS server.

Parameter	Description
{<FQDN> | <IPV4> | <IPv6>}	Specifies the RADIUS server as: ■ <FQDN>: a fully qualified domain name. ■ <IPV4>: an IPv4 address. ■ <IPV6>: an IPv6 address.
port <PORT-NUMBER>	Specifies the authentication port number. Range: 1 to 65535. Default: 1812.
vrf <VRF-NAME>	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named default is used.
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Showing RADIUS server authentication statistics:

```
switch# show radius-server statistics authentication host 20.1.1.49
 Server Name     : 20.1.1.49
 Auth-Port       : 2083
 Accounting-Port : 2083
 VRF             : default

  Authentication Statistics
  -------------------------
    Round Trip Time           : 3
    Pending Requests          : 0
    Timeouts                  : 0
    Bad Authenticators        : 0
    Packets Dropped           : 0
    Access Requests           : 13
    Access challenge          : 6
    Access Accepts            : 3
    Access Rejects            : 4
    Access Response Malformed : 0
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show tacacs-server

```
show tacacs-server [detail] [vsx-peer]
```

Description

Shows the configured TACACS+ servers.

Parameter	Description
`detail`	Selects additional TACACS+ server details and global parameters for showing.
`vsx-peer`	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Showing a summary of a global TACACS+ configuration with a shared-secret:

```
switch# show tacacs-server
******* Global TACACS+ Configuration *******

Shared-Secret: AQBapb+HsdpqV1Q3CPCBMQTG8e1cA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout: 5
Auth-Type: pap
Number of Servers: 5

--------------------------------------------------------------------------------
SERVER NAME                                    | PORT | VRF
--------------------------------------------------------------------------------
1.1.1.1                                        | 49   | mgmt
1.1.1.2                                        | 12   | mgmt
abc.com                                        | 32   | vrf_blue
2001:0db8:85a3:0000:0000:8a2e:0370:7334        | 49   | default
1.1.1.3                                        | 32   | vrf_red
--------------------------------------------------------------------------------
```

Showing details of a global TACACS+ configuration:

```
switch# show tacacs-server detail
******* Global TACACS+ Configuration *******

Shared-Secret: AQBapb+HsdpqV1Q3CPCBMQTG8e1cA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout: 5
Auth-Type: pap
Number of Servers: 5

****** TACACS+ Server Information ******
```

```
Server-Name              : 1.1.1.2
Auth-Port                : 12
VRF                      : mgmt
Shared-Secret (default)  : AQBapb+HsdpqV1Q3CPCBMQTG8eeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout (default)        : 5
Auth-Type (default)      : pap
Server-Group             : sg1
Group-Priority           : 1

Server-Name              : 2001:0db8:85a3:0000:0000:8a2e:0370:7334
Auth-Port                : 49
VRF                      : default
Shared-Secret (default)  : AQBapb+HsdpqV1Q3CPCBMQTG8eeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout (default)        : 5
Auth-Type (default)      : pap
Server-Group             : sg2
Group-Priority           : 1

Server-Name              : 1.1.1.1
Auth-Port                : 49
VRF                      : mgmt
Shared-Secret (default)  : AQBapb+HsdpqV1Q3CPCBMQTG8eeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout (default)        : 5
Auth-Type (default)      : pap
Server-Group (default)   : tacacs
Default-Priority         : 1

Server-Name              : abc.com
Auth-Port                : 32
VRF                      : vrf_red
Shared-Secret (default)  : AQBapb+HsdpqV1Q3CPCBMQTG8eeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout                  : 15
Auth-Type (default)      : pap
Server-Group (default)   : tacacs
Default-Priority         : 3

Server-Name              : 1.1.1.3
Auth-Port                : 32
VRF                      : vrf_blue
Shared-Secret            : AQBapfnqbSswqKC476tdUFZ+AncIRY92hDTYkQCAAAAFEAaHn43vNC
Timeout                  : 15
Auth-Type                : chap
Server-Group (default)   : tacacs
Default-Priority         : 5
```

Showing TACACS+ server when per-server shared key and global TACACS+ shared key is not set:

```
switch# show tacacs-server
******* Global TACACS+ Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Number of Servers: 1

--------------------------------------------------------------------------------
SERVER NAME                                | PORT | VRF
--------------------------------------------------------------------------------
1.1.1.1                                    | 49   | default
--------------------------------------------------------------------------------
```

Showing TACACS+ server details when per-server shared key and global TACACS+ shared key is not set:

```
switch# show tacacs-server detail
******* Global TACACS+ Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Number of Servers: 1

****** TACACS+ Server Information ******
Server-Name              : 1.1.1.1
Auth-Port                : 49
VRF                      : default
Shared-Secret (default)  : None
Timeout (default)        : 5
Auth-Type (default)      : pap
Server-Group (default)   : tacacs
Default-Priority         : 1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show tacacs-server statistics

```
show tacacs-server statistics [vsx-peer]
```

Description

Shows authentication statistics for all configured TACACS+ servers.

Parameter	Description
vsx-peer	Shows the output from the VSX peer switch. If the switches do not have the VSX configuration or the ISL is down, the output from the VSX peer switch is not displayed. This parameter is available on switches that support VSX.

Examples

Showing TACACS+ server authentication statistics:

```
switch# show tacacs-server statistics
Server Name      : tac1
Auth-Port        : 49
VRF              : mgmt
```

```
Authentication Statistics
-----------------------------------------
Round Trip Time           : 1
Pending Requests          : 0
Timeout                   : 0
Unknown Types             : 0
Packet Dropped            : 0
Auth Start                : 8
Auth challenge            : 0
Auth Accepts              : 4
Auth Rejects              : 4
Auth reply malformed      : 0
Tracking Requests         : 0
Tracking Responses        : 0
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show tech aaa

```
show tech aaa
```

Description

Shows the AAA configuration settings.

Example

Showing the AAA configuration settings:

```
switch# show tech aaa

=====================================================
Show Tech executed on Tue Feb 14 02:19:11 2017
=====================================================
=====================================================
[Begin] Feature aaa
=====================================================

********************************
Command : show aaa authentication
********************************
AAA Authentication:
  Fail-through              : Enabled
  Limit Login Attempts      : Not set
```

```
  Lockout Time              : 300
  Minimum Password Length   : Not set

Authentication for ssh channel:

--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

Authentication for https-server channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

Authentication for console channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

Authentication for default channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
tacacs                          | 0
local                           | 1
--------------------------------------------------------------------------------

Authentication for telnet channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

*********************************
Command : show aaa accounting
*********************************
AAA Accounting:

Accounting for default channel:
  Accounting Type                               : all
  Accounting Mode                               : start-stop
Default Accounting for login Channels:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
local                           | 0
--------------------------------------------------------------------------------

Accounting for ssh channel:
--------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
--------------------------------------------------------------------------------
tacacs                          | 0
local                           | 1
--------------------------------------------------------------------------------
```

```
Accounting for https-server channel:
------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------------
tacacs                          | 0
------------------------------------------------------------------------------

Accounting for telnet channel:
------------------------------------------------------------------------------
GROUP NAME                      | GROUP PRIORITY
------------------------------------------------------------------------------
tacacs                          | 0
local                           | 1
------------------------------------------------------------------------------


*********************************************
Command : show aaa accounting port-access
*********************************************
```
```
AAA Accounting Port Access
==========================
  Radius Accounting Enabled        : yes
  Radius Server Group              : acct_group
  Local Accounting Enabled         : no
  Accounting Mode                  : start-stop
  Interim Update Enabled           : true
  Interim Interval                 : 12 minutes
  Interim Update on-reauth Enabled : true
```

```
*************************************
Syntax  : show aaa accounting port-access interface <IFNAME | all> client-status
[mac <MAC-ADDRESS>]
Command : show aaa accounting port-access interface 1/1/1 client-status
*************************************
```
```
Port Access Client Status Details

Client 00:50:56:96:5b:9f, steve
===============================
  Session Details
  ---------------
    Port                : 1/1/22
    Session Time        : 141s
    IPv4 Address        : 10.0.0.3
    IPv6 Address        : 2001::1
                          2001::3


  Accounting Details
  ----------------------
    Accounting Session ID  : 1584556574841
    Input Packets          : 265
    Input Octets           : 28348
    Output Packets         : 341
    Output Octets          : 37761
    Input Gigaword         : 0
    Output Gigaword        : 0
```

```

##### No aaa clients

When there are no port-access accounting sessions:

```
switch# show aaa accounting port-access interface all client-status
Port-access accounting sessions not found.

switch# show aaa accounting port-access interface 1/1/2 client-status
Port-access accounting sessions not found.

switch# show aaa accounting port-access interface 1/1/2 client-status mac
6e:93:79:d9:cb:ee
Port-access accounting sessions not found.
```

```
****
Syntax : show accounting log {all | port-access}
Command : show accounting log port-access
****
Command to display the Local accouting logs for the network user.
```
```

May 29 2018 20:29:03.714:53 'acct-id=56789453 type=network user=NWUSER auth-
method=dot1x auth-type=radius rec=ACCT_START mac=00:0d:6a:4f:2a:44 input-pkt=0
ouput-pkt=0 input-octet=0 output-octets=0'

May 29 2018 20:30:03.714:53 'acct-id=56789453 type=network user=NWUSER auth-
method=dot1x auth-type=radius rec=ACCT_INTRM mac=00:0d:6a:4f:2a:44 input-pkt=2
ouput-pkt=30 input-octet=20 output-octets=50'

May 29 2018 24:29:03.714:53 'acct-id=56789453 type=network user=NWUSER auth-
method=dot1x auth-type=radius rec=ACCT_STOP mac=00:0d:6a:4f:2a:44 input-pkt=20
ouput-pkt=300 input-octet=200 output-octets=500'

May 29 2018 20:29:03.714:53 'acct-id=56789453 type=network user=NWUSER aauth-
method=macauth auth-type=local rec=ACCT_START mac=00:0d:6a:4f:2a:44 input-pkt=0
ouput-pkt=0 input-octet=0 output-octets=0'

```

```
****
Syntax : show radius-server statistics {authentication | accounting}
****
****
Command : show radius-server statistics authentication
****
```
```
 Server Name   : 2.2.2.2
 Auth-Port   : 1812
 Accounting-Port : 1813
 VRF   : mgmt

  Authentication Statistics

    Round Trip Time   : 100
    Pending Requests   : 0
    Timeouts   : 6
    Bad Authenticators   : 2
    Packets Dropped   : 0
```
```

```
    Access Requests           : 20
    Access Challenge          : 8
    Access Accepts            : 14
    Access Rejects            : 0
    Access Response Malformed : 0
    Access Retransmits        : 0
    Tracking Requests         : 5
    Tracking Responses        : 5
    Unknown Response Code     : 0
```
```
**************************************************************
Command : show radius-server statistics accounting
**************************************************************
```
```
 Server Name     : 2.2.2.2
 Auth-Port       : 1812
 Accounting-Port : 1813
 VRF             : mgmt

  Accounting Statistics
  -------------------------
    Round Trip Time               : 100
    Pending Requests              : 0
    Timeouts                      : 5
    Bad Authenticators            : 1
    Packets Dropped               : 0
    Accounting Requests           : 15
    Accounting Responses          : 10
    Accounting Response Malformed : 0
    Accounting Retransmits        : 0
    Unknown Response Code         : 0
```

```
********************************
Command : show aaa authorization
********************************

Authorization for default channel:
--------------------------------------------------------------------------------
GROUP NAME                     | GROUP PRIORITY
--------------------------------------------------------------------------------
local                          | 0
--------------------------------------------------------------------------------

Authorization for console channel:
--------------------------------------------------------------------------------
GROUP NAME                     | GROUP PRIORITY
--------------------------------------------------------------------------------
local                          | 0
--------------------------------------------------------------------------------

Authorization for ssh channel:
--------------------------------------------------------------------------------
GROUP NAME                     | GROUP PRIORITY
--------------------------------------------------------------------------------
tacacs                         | 0
local                          | 1
--------------------------------------------------------------------------------

Authorization for telnet channel:
--------------------------------------------------------------------------------
GROUP NAME                     | GROUP PRIORITY
```

```
-------------------------------------------------------------------------------
tacacs                          | 0
local                           | 1
-------------------------------------------------------------------------------

*********************************
Command : show aaa server-groups
*********************************

******* AAA Mechanism TACACS+ *******
-------------------------------------------------------------------------------
-----
GROUP NAME                      | SERVER NAME              | PORT | PRIORITY | VRF
-------------------------------------------------------------------------------
-----
tacacs                          | 1.1.1.1                  | 49   | 1        |
mgmt
-------------------------------------------------------------------------------
-----

******* AAA Mechanism RADIUS *******
-------------------------------------------------------------------------------
-----
GROUP NAME                      | SERVER NAME              | PORT | PRIORITY | VRF
-------------------------------------------------------------------------------
-----

***********************************
Command : show tacacs-server detail
***********************************
******* Global TACACS+ Configuration *******

Shared-Secret: AQBapb+HsdpqV1Q3CPCBMQTG8ekK1c...fbeA8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout: 5
Auth-Type: pap
Tracking Time Interval (seconds): 300
Tracking User-name: tacacs-tracking-user
Tracking Password: None
Number of Servers: 1

****** TACACS+ Server Information ******
Server-Name              : 1.1.1.1
Auth-Port                : 49
VRF                      : mgmt
Shared-Secret            : AQBapfiTREwB7yUKCdmOMT0f...9j2AUxlGAAAAF2MkfMTojqX

Timeout                  : 5
Auth-Type                : pap
Server-Group             : tacacs
Default-Priority         : 1
Tracking                 : disabled
Reachability-Status      : N/A

***********************************
Command : show radius-server detail
***********************************
******* Global RADIUS Configuration *******

Shared-Secret: AQBapb+HsdpqV1Q3CPCBMQTG8ekK1cA+Cy...8BEgikCgAAAJOwZSNzA2SWrLA=
Timeout: 5
Auth-Type: pap
Retries: 1
```

```
Number of Servers: 0

=====================================================
[End] Feature aaa
=====================================================


=====================================================
Show Tech commands executed successfully
=====================================================
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

tacacs-server auth-type

```
tacacs-server auth-type {pap | chap}
no tacacs-server auth-type [pap | chap]
```

Description

Enables the CHAP or PAP authentication protocol, which is used for communication with the TACACS+ servers, at the global level. You can override this command with a fine-grained per server `auth-type` configuration.

The `no` form of this command resets the global authentication mechanism for TACACS+ to PAP, which is the default authentication mechanism for TACACS+.

Parameter	Description
`auth-type {pap | chap}`	Selects either the PAP or CHAP authentication protocol.

Examples

Enabling command for CHAP authentication:

```
switch(config)# tacacs-server auth-type chap
```

Enabling command for PAP authentication:

```
switch(config)# tacacs-server auth-type pap
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

tacacs-server host

```
tacacs-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [tracking {enable | disable}] [vrf <VRF-NAME>]

no tacacs-server host {<FQDN> | <IPV4> | <IPV6>}
   [key [plaintext <PASSKEY> | ciphertext <PASSKEY>]]
   [timeout <TIMEOUT-SECONDS>] [port <PORT-NUMBER>]
   [auth-type {pap | chap}] [tracking {enable | disable}] [vrf <VRF-NAME>]
```

Description

Adds a TACACS+ server. By default, the TACACS+ server is associated with the server group named `tacacs`.

The `no` form of this command removes a previously added TACACS+ server.

Parameter	Description
`{<FQDN> | <IPV4> | <IPv6>}`	Specifies the TACACS+ server as: ▪ *<FQDN>*: a fully qualified domain name. ▪ *<IPV4>*: an IPv4 address. ▪ *<IPV6>*: an IPv6 address.
`key [plaintext <PASSKEY> | ciphertext <PASSKEY>]`	Selects either a plaintext or an encrypted local shared-secret passkey for the server. As per RFC 2865, shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `key` is entered without either sub-parameter, plaintext passkey prompting occurs upon pressing Enter. Enter must be pressed immediately after the `key` parameter without entering other parameters. The entered passkey characters are masked with asterisks. When `key` is omitted, the server uses the global passkey. This command requires either the global or local passkey to be set; otherwise the server will not be contacted. Command `tacacs-server key` is available for setting the global passkey.
`timeout <TIMEOUT-SECONDS>`	Specifies the timeout. Range: 1 to 60 seconds. Default : 5 seconds.
`port <PORT-NUMBER>`	Specifies the TCP authentication port number. Range: 1 to 65535.

Parameter	Description
	Default: 49.
`auth-type {pap | chap}`	Selects either the PAP (the default) or CHAP authentication types. If this parameter is not specified, the TACACS+ global default is used.
`tracking {enable | disable}`	Enables or disables server tracking for the RADIUS server. Tracked servers are probed at the start of each server tracking interval to check if they are reachable. Use command `tacacs-server tracking` to configure TACACS+ server tracking globally.
`vrf <VRF-NAME>`	Specifies the VRF name to be used for communicating with the server. If no VRF name is provided, the default VRF named `default` is used.

Usage

If the fully qualified domain name is provided for the TACACS+ server, a DNS server must be configured and accessible through the same VRF which is configured for the TACACS+ server. This configuration is required for the resolution of the TACACS+ server hostname to its IP address. If a DNS server is not available for this VRF, the TACACS+ servers reachable through this VRF must be configured by means of their IP addresses only.

Examples

Adding a TACACS+ server with an IPv4 address, plaintext passkey, timeout, port, authentication type, and VRF name:

```
switch(config)# tacacs-server host 1.1.1.3 key plaintext test-123 timeout 15 port
32 auth-type chap vrf vrf_red
```

Adding a TACACS+ server with an IPv4 address and prompted plaintext passkey:

```
switch(config)# tacacs-server host 1.1.1.5 key
Enter the TACACS server key: *********
Re-Enter the TACACS server key: *********
```

Adding a TACACS+ server with an IPv4 address and a named VRF:

```
switch(config)# tacacs-server host 1.1.1.1 vrf mgmt
```

Adding a TACACS+ server with an IPv4 address, a port, and a named VRF:

```
switch(config)# tacacs-server host 1.1.1.2 port 32 vrf mgmt
```

Adding a TACACS+ server with an FQDN, a timeout, port number, and a named VRF:

```
switch(config)# tacacs-server host abc.com timeout 15 port 32 vrf vrf_blue
```

Adding a TACACS+ server with an IPv6 address:

```
switch(config)# tacacs-server host 2001:0db8:85a3:0000:0000:8a2e:0370:7334
```

Deleting a TACACS+ server with an IPv4 address and specified VRF:

```
switch(config)# no tacacs-server host 1.1.1.1 vrf mgmt
```

Deleting a TACACS+ server with an FQDN, port, and specified VRF:

```
switch(config)# no tacacs-server host abc.com port 32 vrf vrf_blue
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

tacacs-server key

```
tacacs-server key [plaintext <GLOBAL-PASSKEY> | ciphertext <GLOBAL-PASSKEY>]
no tacacs-server key [plaintext <GLOBAL-PASSKEY> | ciphertext <GLOBAL-PASSKEY>]
```

Description

Creates or modifies a TACACS+ global passkey. The TACACS+ global passkey is used as a shared-secret for encrypting the communication between all TACACS+ servers and the switch. The TACACS+ global passkey is required for authentication unless local passkeys have been set. By default, the TACACS+ global passkey is empty. If the administrator has not set this key, the switch will not be able to perform TACACS+ authentication. The switch will instead rely on the authentication mechanism configured with `aaa authentication login`.

When this command is entered without parameters, plaintext passkey prompting occurs upon pressing Enter. The entered passkey characters are masked with asterisks.

The `no` form of the command removes the global passkey.

Parameter	Description
`plaintext <GLOBAL-PASSKEY>`	Specifies the TACACS+ global passkey in plaintext format with a length of 1 to 31 characters. As per RFC 2865, a shared-secret can be a mix of alphanumeric and special characters.
`ciphertext <GLOBAL-PASSKEY>`	Specifies the TACACS+ global passkey in encrypted format.

Examples

Adding the global passkey:

```
switch(config)# tacacs-server key plaintext mypasskey123
```

Adding the global passkey with prompting:

```
switch(config)# tacacs-server key
Enter the TACACS server key: *********
Re-Enter the TACACS server key: *********
```

Removing the global passkey:

```
switch(config)# no tacacs-server key
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

tacacs-server timeout

```
tacacs-server timeout [<1-60>]
no tacacs-server timeout [<1-60>]
```

Description

Specifies the number of seconds to wait for a response from the TACACS+ server before trying the next TACACS+ server. If a value is not specified, a default value of 5 seconds is used. You can override this value with a fine-grained per server timeout configured for individual servers.

The `no` form of this command resets the TACACS+ global authentication timeout to the default of 5 seconds.

Parameter	Description
`timeout <1-60>`	Specifies the timeout interval of 1 to 60 seconds. Default: 5 seconds.

Examples

Specifying the TACACS+ server timeout:

```
switch(config)# tacacs-server timeout 10
```

Resetting the timeout for the TACACS+ server to the default:

```
switch(config)# no tacacs-server timeout
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

tacacs-server tracking

```
tacacs-server tracking interval <INTERVAL>
no tacacs-server tracking interval [<INTERVAL>]

tacacs-server tracking user-name <NAME>
   [password [plaintext <PASSWORD> | ciphertext <PASSWORD>]]
no tacacs-server tracking [user-name [<NAME>] [ciphertext <PASSWORD>]]
```

Description

Configures TACACS+ server tracking settings globally for all configured TACACS+ servers that have tracking enabled with the `tacacs-server host` command on individual servers.

The `no` form of the command removes the specified configuration, reverting it to its default. The no form with `user-name` also clears the password (resets it to empty).

Parameter	Description
`interval <INTERVAL>`	Specifies the time interval, in seconds, to wait before checking the server reachability status. Default: 300. Range 60 to 84600.

`user-name <NAME>`
`[password [plaintext <PASSWORD> |`
`ciphertext <PASSWORD>]]`
	Specifies the user name (and optionally a password) to be used for server checking. The default user name is `tacacs-tracking-user` with an empty password.
	The password is optional and may be entered as `plaintext` or pasted in as `ciphertext`. The plaintext password is visible as cleartext when entered but is encrypted thereafter. Command history does show the password as cleartext.
	
	NOTE: When `password` is entered without a following sub-parameter, plaintext password prompting occurs upon

Parameter	Description
	pressing Enter. The entered password characters are masked with asterisks. **NOTE:** The user does not have to be configured on the server. Server tracking can still be performed with a user which is not configured on the server because authentication failure on the server achieves confirmation that the server is reachable. **NOTE:** Server tracking uses authentication request and response packets to determine server reachability status. The server tracking user name and password are used to form the request packet which is sent to the server with tracking enabled. Upon receiving a response to the request packet, the server is considered to be reachable.

Examples

Configuring a tracking interval of 120 seconds:

```
switch(config)# tacacs-server tracking interval 120
```

Reverting the tracking interval to its default of 300 seconds:

```
switch(config)# no tacacs-server tracking interval
```

Configuring user `tacacs-tracker` with a plaintext password.

```
switch(config)# tacacs-server tracking user-name tacacs-tracker password plaintext
track$1
```

Configuring user `tacacs-tracker` with a prompted plaintext password.

```
switch(config)# tacacs-server tracking user-name tacacs-tracker password
Enter the TACACS server tracking password: *******
Re-Enter the TACACS server tracking password: *******
```

Reverting the tracking user name to its default of `tacacs-tracking-user`:

```
switch(config)# no tacacs-server tracking user-name
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

RADIUS dynamic authorization provides the ability to make changes to a user account session while it is in progress. This ability includes disconnecting a session or updating some aspect of the authorization for the session. It also includes "pot bounce" in which the interface on which a client is connected is brought down and then back up (using COA (change of authorization).

RADIUS dynamic authorization enables or disables the processing of "Disconnect" and "Change of Authorization (CoA)" messages from the RADIUS server. When enabled, the RADIUS server can dynamically terminate or change the authorization parameters (such as VLAN/user-role assignment) used in an active client session on the switch.

See also *RFC 3576* available at http://www.ietf.org/rfc/rfc3576.txt for general information on the dynamic authorization extensions to RADIUS.

Requirements and tips

The switch validates these mandatory attributes that must be present in the CoA/Disconnect Message:

- `NAS IP` or `NAS IPV6` or NAS Identifier
- Any one of the following combinations is used to identify the client session:
  - `NAS-Port` and `Calling-Station-ID`
  - `NAS-Port-ID` and `Calling-Station-ID`
  - `Accounting-Session-ID`

RADIUS server requirements:

- For ClearPass to provide CoA capabilities, in the case where the switch sends the NAS-IP address as a routable IP address, the CLI command `ip source interface` must be executed with the `radius` parameter.
- In CISCO ISE, to send the CoA request with the same username as in the RADIUS Accept, the Identity rewrite option has to be configured.

RADIUS dynamic authorization commands

radius dyn-authorization enable

```
radius dyn-authorization enable
no radius dyn-authorization enable
```

Description

Enables RADIUS dynamic authorization. This command must be issued before the configuration set with other `radius dyn-authorization` commands takes effect.

The no form of this command disables RADIUS dynamic authorization.

Examples

Enabling RADIUS dynamic authorization:

```
switch(config)# radius dyn-authorization enable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

radius dyn-authorization client

```
radius dyn-authorization client {<IPV4> | <IPV6> | <HOSTNAME>}
   [secret-key [plaintext <PASSKEY> | ciphertext] <PASSKEY>]]
   [time-window <WIDTH>] [replay-protection {enable|disable}]
no radius dyn-authorization client {<IPV4> | <IPV6> | <HOSTNAME>} [vrf <VRF-NAME>]
   [secret-key [plaintext <PASSKEY> | ciphertext] <PASSKEY>]]
   [time-window <WIDTH>] [replay-protection {enable|disable}]
```

Description

Configures RADIUS dynamic authorization for the specified client on the specified (or `default`) VRF.

The `no` form of this command unconfigures RADIUS dynamic authorization for the specified client on the specified (or `default`) VRF.

Parameter	Description
*<IPV4>	<IPV6>	<HOSTNAME>*	Specifies the client IPv4 address, IPv6 address, or host name.
`secret-key [plaintext` *<PASSKEY>* `| ciphertext` *<PASSKEY>*`]`	Specifies the dynamic authorization server (RADIUS server) shared secret key required for client access. Provide either a plaintext or an encrypted shared-secret passkey. As per RFC 2865, the shared-secret can be a mix of alphanumeric and special characters. Plaintext passkeys are between 1 and 32 alphanumeric and special characters. **NOTE:** When `secret-key` is entered without either sub-parameter, plaintext shared secret prompting occurs upon pressing Enter. Enter must be pressed immediately after the `secret-key` parameter without entering other parameters. The entered shared secret characters are masked with asterisks.
`time-window` *<WIDTH>*	Specifies the width of the synchronization window (in seconds) between the RADIUS dynamic authorization client

Parameter	Description
	and the RADIUS dynamic authorization server. Default 300. Range: 1 to 65535.
`replay-protection {enable|disable}`	Enables or disables RADIUS dynamic authorization replay protection for the specified client on the specified (or `default`) VRF.
`vrf <VRF-NAME>`	Specifies the VRF on which the identified client is connected. When omitted, VRF `default` is assumed.

Examples

Configuring RADIUS dynamic authorization with replay protection for a client on the default VRF:

```
switch(config)# radius dyn-authorization client 1.1.2.5 replay-protection enable
```

Configuring RADIUS dynamic authorization with time window and shared secret for a client on the default VRF:

```
switch(config)# radius dyn-authorization client 1.1.2.7 time-window 8
                secret-key plaintext skF82#450
```

Configuring RADIUS dynamic authorization with a prompted shared secret:

```
switch(config)# radius dyn-authorization client 1.1.2.7 secret-key
Enter the RADIUS dyn-authorization key: *********
Re-Enter the RADIUS dyn-authorization key: *********
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

radius dyn-authorization port

`radius dyn-authorization port <PORT-NUMBER>`

Description

Sets the RADIUS dynamic authorization server UDP or TCP port.

Parameter	Description
<PORT-NUMBER>	Specifies the UDP or TCP port. Default UDP: 3799 and TCP:2083.

Examples

Setting the RADIUS dynamic authorization server UDP port back to its default 3799:

```
switch(config)# radius dyn-authorization port 3799
```

Setting the RADIUS dynamic authorization server TCP port back to its default 2083:

```
switch(config)# radius dyn-authorization port 2083
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

show radius dyn-authorization

`show radius dyn-authorization`

Description

Shows RADIUS dynamic authorization configuration and summarized statistics for all clients configured for dynamic authorization.

Usage

Show command output item identification:

- `Radius Dynamic Authorization`: Enabled or Disabled status, system wide.
- `Radius Dynamic Authorization Port`: The UDP or TCP port used for dynamic authorization (default 3799).
- `Invalid Client Address in CoA Requests`: The number of CoA (change of authorization) requests received with an incorrect DAC (dynamic authorization client) address.
- `Invalid Client Address in Disconnect Requests`: The number of disconnect requests received with incorrect DAC address.
- `Disconnect Requests`: The number of disconnect requests received from the DAC.
- `Disconnect ACKs`: The number of Disconnect-ACKs sent to the DAC.
- `Disconnect NAKs`: The number of Disconnect-NAKs sent to the DAC.
- `CoA Requests`: The number of CoA-requests received from the DAC.

- `CoA ACKs`: The number of CoA-ACKs sent to the DAC.
- `CoA NAKs`: The number of CoA-NAKs sent to the DAC.

Example

Showing RADIUS dynamic authorization summarized statistics for all clients configured for dynamic authorization:

```
switch# show radius dyn-authorization
Status and Counters - RADIUS Dynamic Authorization Information

  RADIUS Dynamic Authorization                   : Enabled
  RADIUS Dynamic Authorization UDP Port          : 3799
  Invalid Client Addresses in CoA Requests       : 0
  Invalid Client Addresses in Disconnect Requests: 0

Dynamic Authorization Client Information
========================================

IP Address          : 1.1.2.1
VRF                 : adm2
Replay Protection   : Disabled
Time Window         : 20
Disconnect Requests : 1
Disconnect ACKs     : 1
Disconnect NAKs     : 0
CoA Requests        : 7
CoA ACKs            : 2
CoA-NAKs            : 5
Shared-Secret       :
AQBapb+HsdpqV1Q3CPCBMQTG8ekK1cA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=


IP Address          : 1.1.2.5
VRF                 : default
Replay Protection   : Enabled
Time Window         : 20
Disconnect Requests : 6
Disconnect ACKs     : 6
Disconnect NAKs     : 0
CoA Requests        : 9
CoA ACKs            : 5
CoA-NAKs            : 4
Shared-Secret       :
AQBapb+HsdpqV1Q3CPCBMQTG8ekK1cA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=


IP Address          : 1.1.2.7
VRF                 : default
Replay Protection   : Disabled
Time Window         : 8
Disconnect Requests : 6
Disconnect ACKs     : 6
Disconnect NAKs     : 0
CoA Requests        : 9
CoA ACKs            : 5
CoA-NAKs            : 4
Shared-Secret       :
AQBapb+HsdpqV1Q3CPCBMQTG8ekK1cA+CyD0RvfbeA8BEgikCgAAAJOwZSNzA2SWrLA=
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show radius dyn-authorization client

`show radius dyn-authorization client <IP-ADDR> [vrf <VRF-NAME>]`

Description

Shows RADIUS dynamic authorization statistics for the specified client on the specified VRF.

Parameter	Description
<IP-ADDR>	Specifies the client IPv4 or IPv6 address.
`vrf` *<VRF-NAME>*	Specifies the VRF on which the identified client is connected. When omitted, VRF `default` is assumed.

Usage

Show command output item identification:

- `Total Requests`: The number of Disconnect and CoA (change of authorization) requests received from the DAC (dynamic authorization client).
- `Authorize Only Requests`: The number of Disconnect and CoA requests received from the DAC with an "Authorize only" Service-Type attribute.
- `Malformed Requests`: The number of malformed Disconnect and CoA requests received from the DAC.
- `Bad Authenticator Requests`: The number of Disconnect and CoA requests received from this DAC with an invalid authenticator field.
- `Dropped Requests`: The number of Disconnect and CoA requests from this DAC that have been silently discarded for reasons other than malformed, bad authenticators, or unknown type.
- `Total ACK Responses`: The number of Disconnect-ACKs sent to the DAC.
- `Total NAK Responses`: The number of Disconnect-NAKs sent to the DAC.
- `Session Not Found Responses`: The number of Disconnect-NAKs sent to the DAC because no session context could be found.
- `User Sessions Modified`: The number of user sessions for which authorization changed due to Disconnect and CoA requests received from the DAC.

Example

Showing RADIUS dynamic authorization statistics for client 1.1.2.1 on VRF default:

```
switch# show radius dyn-authorization client 1.1.2.1 vrf default
Status and Counters - RADIUS Dynamic Authorization Client Information

  VRF Name                 : default
  Authorization Client     : 1.1.2.1
  Unknown Packets          : 55
  Message-Type                    Disconnect       CoA
  ------------------------------------------------------------------
  Total Requests                  2147483647       10
  Authorize Only Requests         10               10
  Malformed Requests              10               10
  Bad Authenticator Requests      2147483647       2147483647
  Dropped Requests                10               10
  Total ACK Responses             10               10
  Total NAK Responses             10               10
  Session Not Found Responses     10               10
  User Sessions Modified          20               20
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

IP Flow Information Export (IPFIX) is an embedded network flow analysis tool that compiles characteristic and measured properties of flows and sends flow reports to flow collectors. IPFIX is configurable via CLI or REST. With IPFIX, customers configure flow records with match (key) fields and collection (non-key) fields. Match fields are the set of fields that define a flow, such as IP address or UDP port. Collection fields are the set of fields that identify information to collect for a flow, such as packet and byte counters.

A flow exporter defines where and how to export flow reports. Flow exporters are created as standalone entities in the `config` context to provide flow monitors the ability to export flow reports. A single flow exporter can be assigned to one or more flow monitors, and multiple flow exporters can be assigned to a single flow monitor.

IPFIX is a stand alone feature and can work on its own to monitor the traffic flow. On enabling Application Recognition and Control feature, application information along with flow properties are exported to external or internal IPFIX collectors.

The IPFIX feature on the 8360 switch series are for monitoring only.

For more information about IPFIX, see *Monitoring Guide*.

Flow monitoring commands

flow record

```
flow record <name>
   match
      ipv4|ipv6 {protocol|version}|{source|destination address}
      transport {source|destination} port
   collect
      application name
      counter {packets|bytes}
      timestamp absolute {first|last}
   description <description>
```

Description

Define data to be included in a flow record by configuring flow record match and collect fields. The **match** attributes define what makes the traffic flow unique. Traffic with matching attributes (for example, traffic coming from the same interface, sent to the same destination with the same protocol) are classified as a single flow. Information for some or all of the matched settings can be collected and exported to a destination defined by the flow exporter assigned to the flow monitor.

Traffic must match a match rule definition before it can be collected and sent. You cannot collect and send data that is not matched.

Parameter	Description
<name>	Name of the flow monitor , up to 64 characters.
match	match traffic according to one or more of the following key attributes: ■ **ipv4**: match traffic on an IPv4 network ■ **ipv6**: match traffic on an IPv6 network ■ **protocol**: Match traffic using the same IP protocol ■ **version**: Match traffic using the same IP version ■ **source**: Match traffic from the same source ■ **destination**: Match traffic to the same destination ■ **address**: Match traffic by source or destination IP address ■ **transport**: Match traffic by source or destination transport type ■ **port**: Match traffic by source or destination transport port
description	A description for the flow record up to 256 characters long, including spaces
collect	Configures data fields to be included a flow record. ■ **application name:** Include the application name as a non-key field in a flow record ■ **counter packets**: Collect counter data for packets in the flow ■ **counter bytes**: Collect counter data for bytes in the flow ■ **timestamp absolute first**: Collect absolute timestamp of the first packet observed.

Examples

Adding IPv4 and transport match fields to flow record **flow-record-1.**

```
switch(config)# flow record flow-record-1
switch(config-flow-record)# match ipv4 source address
switch(config-flow-record)# match ipv4 destination address
switch(config-flow-record)# match ipv4 protocol
switch(config-flow-record)# match ipv4 version
switch(config-flow-record)# match transport source port
switch(config-flow-record)# match transport destination port
switch(config-flow-record)# description Record used for basic ipv4 traffic
analysis
```

Removing the IPv4 destination match field from the flow record defined in the previous example.

```
switch(config)# flow record flow-record-1
switch(config-flow-record)# no match ipv4 destination address
```

Adding counter and timestamp collect fields to flow record flow-record-1.

```
switch(config)# flow record flow-record-1
switch(config-flow-record)# collect counter packets
switch(config-flow-record)# collect counter bytes
switch(config-flow-record)# collect timestamp absolute first
```

```
switch(config-flow-record)# collect timestamp absolute last
```

Related Commands

Command	Description
flow exporter	Define how a flow monitor exports the flow reports.
flow monitor	Define a flow monitor configuration, including the flow exporter and flow record associated to that monitor.
show flow record	Display flow record configuration and status.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-flow-record	Administrators or local user group members with execution rights for this command.

flow exporter

```
flow exporter <name>
   export-protocol ipfix
   description <description>
   destination
      <hostname> [vrf vrfname]
      <IPaddr> [vrf vrfname]
      <ip6addr>  [vrf vrfname]
      type {hostname-or-ip-addr | traffic-insight}
   no ..
   template data timeout <timeout>
   transport udp <port>
```

Description

A flow exporter is the part of the IP Flow Information Export (IPFIX) feature that defines how a flow monitor exports flow reports. You can assign the same flow exporter configuration to more than one flow monitor. Each flow exporter includes a destination setting that identifies the device to which the flow reports are sent. Each flow monitor supports a maximum of two different flow exporter configurations, sending flow records to up to two destinations.

Parameter	Description
<name>	Name of the flow exporter, up to 64 characters.

Parameter	Description
`export-protocol ipfix`	Define an export protocol for the flow exporter.The default **ipfix** protocol is the only protocol currently available.
`description <description>`	A description of the flow exporter, up to 256 characters and spaces.
`destination <hostname>|<IPaddr>|<ip6addr>`	The exporter sends flow records to this destination. The destination can be defined as a hostname, or an IPv4 or IPv6 IP address.
`[vrf vrfname]`	You can optionally include the name of the destination VRF in the destination definition.
`no ..`	Negate any configured parameter.
`template data timeout <timeout>`	A flow exporter template describes the format of exported flow reports. Therefore, flow reports cannot be decoded properly without the corresponding templates. This setting defines how often the flow exporter will resend templates to the flow monitor. The supported range is 1-86400 seconds, and the default is 600 seconds.
`transport udp <port>`	Transport protocol and port for sending flow record reports. The default port is port 4739,

Examples

The following example creates a flow exporter configuration named **exporter-1**.

```
switch(config)# flow exporter exporter-1
switch(config-flow-exporter)# destination 192.0.2.1 vrf VRF1
switch(config-flow-exporter)# template data timeout 1200
switch(config-flow-exporter)# description Exports flows to 192.0.2.1
```

Related Commands

Command	Description
flow record	Define data to be included in a flow record by configuring flow record match and collect fields
flow monitor	Define a flow monitor configuration, including the flow exporter and flow record associated to that monitor.
show flow exporter	Display flow exporter configuration, status, and statistics.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-flow-exporter`	Administrators or local user group members with execution rights for this command.

flow monitor

```
flow monitor <name>
   exporter <name>
   cache timeout active|inactive <timeout>
   description <description>
   record <name>
```

Description

A flow monitor is the part of the IP Flow Information Export (IPFIX) feature that performs network monitoring for the selected interface. A flow monitor configuration consists of a flow record, a flow cache, and one or more associated flow exporters. A flow monitor compiles data from the network traffic on the interface and stores it in the flow cache in a format defined by the flow record. The flow exporters associated with the monitor then export data from the flow cache to the flow exporter destination.

Parameter	Description
`<name>`	Name of the flow monitor , up to 64 characters.
`cache timeout active|inactive <timeout>`	Use the cache timeout parameter to define an active or inactive timeout for the flow monitor. A flow monitor closes a flow session that is active for longer than the active timeout or inactive for longer than the inactive timeout. The supported timeout ranges for both the active timeout and inactive timeout are 30-604800 seconds, and the default is 30 seconds.
`description`	A description up to 256 characters long, including spaces.
`exporter <name>`	Assign a flow exporter to a flow monitor. Each flow monitor supports a maximum of two different flow exporters, sending flow records to up to two destinations.
`record <name>`	Assigns a flow record to a flow monitor.

Examples

The following example creates a flow monitor configuration named **monitor-1**.

```
switch(config)# flow monitor monitor-1
switch(config-flow-monitor)# description Monitor for analyzing basic ipv4 traffic
switch(config-flow-monitor)# exporter flow-exporter-1
switch(config-flow-monitor)# exporter flow-exporter-2
switch(config-flow-monitor)# record flow-record-1
switch(config-flow-monitor)# cache timeout inactive 300
switch(config-flow-monitor)# cache timeout active 1500
```

The following workflow changes the flow record assigned to a flow monitor.

```
switch(config)# flow monitor flow-monitor-1
switch(config-flow-monitor)# record flow-record-2
```

Related Commands

Command	Description
flow exporter	Define how a flow monitor exports the flow reports.
flow record	Define data to be included in a flow record by configuring flow record match and collect fields
flow monitor	Enable flow monitoring on inbound traffic coming into an interface by assigning a flow monitor to that interface.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-flow-monitor	Administrators or local user group members with execution rights for this command.

ipv4|ipv6 flow monitor

```
[no] ip|ipv6 flow monitor <name> in
```

Description

Enable flow monitoring on inbound and outbound interfaces by assigning a flow monitor to that interface. Only physical interfaces and LAG interfaces can be monitored. A flow monitor cannot be applied to an interface that is part of a LAG. If an unsupported application is attempted, an error message will be displayed. If the flow monitor is associated with a flow record that contains application fields as collect fields, then Application Recognition should be enabled on the same interface.

The [no] form of command disables the flow monitoring.

Examples

Associate a flow monitor configuration named **flow-monitor-1** and **flow-monitor-2** for IPv4 or IPv6 traffic respectively on physical interface.

```
switch(config)# interface 1/1/1
switch(config-if)# ip flow monitor flow-monitor-1 in
switch(config-if)# ipv6 flow monitor flow-monitor-2 in
```

Associate a flow monitor configuration named **flow-monitor-3** and **flow-monitor-4** for IPv4 or IPv6 traffic respectively on a Lag interface.

```
switch(config)# interface lag 1
switch(config-lag-if)# ip flow monitor flow-monitor-3 in
switch(config-lag-if)# ipv6 flow monitor flow-monitor-4 in
```

Related Commands

Command	Description
flow exporter	Define how a flow monitor exports the flow reports.
flow record	Define data to be included in a flow record by configuring flow record match and collect fields
flow monitor	Define a flow monitor configuration, including the flow exporter and flow record associated to that monitor.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-flow-monitor	Administrators or local user group members with execution rights for this command.

show flow record

```
show flow record [<name>]
```

Description

Display flow record configuration and status. When no record name is specified, the output of this command displays information for all flow records.

The output of this command can indicate the following status types:

- Accepted
- Rejected (Internal error: failed to process record)
- Rejected (Mix of IPv4 and IPv6 match fields is not allowed. Specify match fields of the same IP version (IPv4 or IPv6))
- Rejected (Incomplete match fields. The mandatory match fields are: version, source address, destination address,
- protocol, transport destination port, and transport source port)

Parameter	Description
<name>	Name of the flow record.

Examples

Display the configuration of a flow record named **flow-record-1**.

```
switch# show flow record record-1
------------------------------------------------------------------------------
Flow record  'record-1'
------------------------------------------------------------------------------
Description             : Used for IPv4 traffic analysis
Status                  : Accepted
Match Fields
    ipv4 destination address
    ipv4 protocol
    ipv4 source address
    ipv4 version
    transport destination port
    transport source port
Collect Fields
    application name
    counter bytes
    counter packets
```

Related Commands

Command	Description
flow record	Define data to be included in a flow record by configuring flow record match and collect fields

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-flow-exporter	Administrators or local user group members with execution rights for this command.

show flow exporter

```
show flow exporter [<name>] [statistics]
```

Description

Display flow exporter configuration and status. When no exporter name is specified, the output of this command displays information for all flow exporters.

The output of this command can indicate the following status types:

- Accepted
- Rejected (Internal error: exporter does not exist)

- Rejected (Internal error: destination type does not exist)
- Rejected (Destination type is Traffic Insight, but no destination is specified)
- Rejected (Destination type is Traffic Insight, but the specified Traffic Insight instance does not exist)
- Rejected (Destination type is Traffic Insight, but the specified Traffic Insight instance is not enabled)
- Rejected (Destination type is Traffic Insight, but the specified Traffic Insight instance source is not IPFIX)
- Rejected (Internal error: destination type is Traffic Insight, but the specified Traffic Insight instance is invalid)
- Rejected (Destination type is hostname or IP address, but no destination is specified)
- Rejected (Destination type is hostname or IP address, but the specified hostname or IP address is invalid)

Parameter	Description
`<name>`	Name of the flow exporter.
`statistics`	The `statistics` parameter adds statistical information about the flow exporter to the output.

Examples

Display the configuration of a flow exporter named **exporter-1**.

```
switch# show flow exporter exporter-1
-------------------------------------------------------------------------------
Flow exporter 'exporter-1'
-------------------------------------------------------------------------------
Description             : Exports to the first collector
Status                  : Accepted
Export Protocol         : ipfix
Destination Type        : Hostname or IP address
Destination             : 192.168.0.1
Transport Configuration
    Protocol            : UDP
    Port                : 9995
```

```
switch# show flow exporter exporter-1 statistics

-------------------------------------------------------------------------------
Flow exporter 'exporter-1'
-------------------------------------------------------------------------------
Reports sent            : 14961
```

Related Commands

Command	Description
flow exporter	Define how a flow monitor exports the flow reports.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-flow-exporter`	Administrators or local user group members with execution rights for this command.

show flow monitor

```
show flow monitor [<name>][statistics]
```

Description

Display flow monitor configuration and status. When no monitor name is specified, the output of this command displays information for all flow monitors.

The output of this command can indicate the following status types:

- Accepted
- Rejected (Internal error: monitor does not exist)
- Rejected (A record must be assigned to the monitor, but no record is assigned)
- Rejected (The state of the assigned record is rejected)
- Rejected (Internal error: failure in processing the record configuration)
- Rejected (The state of one or more of the assigned flow exporters is rejected)

Parameter	Description
`<name>`	Name of the flow monitor.
`statistics`	Display additional flow and cache statistics.

Examples

Display the configuration of a flow moitor named **flow-monitor-1**.

```
switch# show flow monitor monitor-1
-------------------------------------------------------------------------------
Flow monitor 'monitor-1'
-------------------------------------------------------------------------------
Description             : Used for IPv4 traffic analysis
Status                  : Accepted
Flow Record             : record-1
Flow Exporter(s)        : exporter-1, exporter-2
Cache Configuration
    Inactive Timeout    : 1800
    Active Timeout      : 300
```

```
switch# show flow monitor monitor-1 statistics
-------------------------------------------------------------------------------
```

```
Flow monitor 'monitor-1'
--------------------------------------------------------------------------------
Current Entries          : 2
Flows Added              : 4
Total Flows Aged         : 2
    Active Timeout       : 1
    Inactive Timeout     : 1
```

The flow monitor statistics counters will be reset to zero after VSF ISSU switchover.

Related Commands

Command	Description
flow monitor	Define a flow monitor configuration, including the flow exporter and flow record associated to that monitor.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-flow-exporter	Administrators or local user group members with execution rights for this command.

show tech ipfix

```
show tech ipfix
```

Description

Shows the IPFIX configuration settings.

Examples

The example shows the IPFIX configuration settings.

```
switch#show tech ipfix
================================================
Show Tech executed on Tue Apr 11 02:43:06 2023
================================================
================================================
[Begin] Feature ipfix
================================================
*********************************
Command : show flow exporter
*********************************
--------------------------------------------------------------------------------
```

```
Flow exporter 'ipfix'
------------------------------------------------------------------------------
Status                  : Accepted
Export Protocol         : ipfix
Destination Type        : Traffic Insight
Destination             : t1
Transport Configuration
Protocol            : udp
Port                : 4739
------------------------------------------------------------------------------
Flow exporter 'V6E1'
------------------------------------------------------------------------------

....

======================================================
[End] Feature ipfix
======================================================
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

diag-dump ipfix basic

`diag-dump ipfix basic`

Description

Displays diagnostic information for IPFIX.

Examples

```
diag-dump ipfix basic
================================================================================
[Start] Feature ipfix Time : Tue Apr 11 02:23:03 2023
================================================================================
--------------------------------------------------------------------------------
[Start] Daemon ipfixd
--------------------------------------------------------------------------------
- IPFIX Record Cache dump -
- IPFIX Record ipfix -

....

:- IPFIX Monitor v6ti completed -
- End of IPFIX Monitor Cache dump -
--------------------------------------------------------------------------------
```

```
[End] Daemon ipfixd
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
[Start] Daemon ops-switchd
--------------------------------------------------------------------------------
Key format: <traffic_type>_<coalescence_id>_<agent_id>_<asic_port>
Key                              TCAM Entry ID    Count
-------------------------------- ---------------- -----
1_1532781829_3_20                0xffff7c7e7a00   1
1_3217499901_1_12                0xffff91187580   1
1_3217499901_1_13                0xffff91183d80   1
1_3217499901_1_14                0xffff91186e80   1

....

--------------------------------------------------------------------------------
[End] Daemon ops-switchd
--------------------------------------------------------------------------------
================================================================================
[End] Feature ipfix
================================================================================
Diagnostic-dump captured for feature ipfix
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

Traffic insight allows monitoring of large amount of data that it collects from various flow exporters like IPFIX provide the ability to filter, aggregate, and sort the data based on user flow monitor requests. Traffic insight tracks different monitor requests simultaneously and provides monitor reports per request.

Protocol and feature details

When traffic insight is enabled and clients on the network access SaaS services or public websites, a flow exporter like IPFIX caches flows in both directions and collects traffic statistics and source and destination MAC addresses.

The Application Recognition and Control (ARC) feature identifies the application corresponding to these flows and reports them to IPFIX. The IPFIX sends the flow record to traffic insight, and the traffic insight feature collects these records and updates the bidirectional traffic information to the Open vSwitch Database (OVSDB). For deployments that include network management and monitoring through Aruba Central.

Supported Platforms

The following table list the supported platforms for Traffic Insight.

Table 1: *Supported platforms for Traffic Insight.*

Platform	Traffic Insight
8360	Yes only `dns-average-latency`

Supported Monitor Types

Traffic insight supports below monitor types.

- DNS Average Latency
  - Monitors dns request and response flows and provides average dns-latency details per client
  - Every 5 minutes the client insights table in the data base is updated with dns average latency details

After enabling the client-insight feature the DNS average latency details are published for clients that onboard the switch.

Caveats for Traffic Insight

The following section provides details on the caveats to be noted for Traffic Insight.

- Only one traffic-insight instance is allowed.
- Maximum number of supported traffic insight monitors is 1

Configuring Traffic Insight

The below example describes the configuration of Traffic Insight.

Prerequisite:

- Enable IPFIX—Flow data is exported to Traffic Insight, which is an internal IPFIX collector.
- Both IPFIX and Client Insight feature should be enabled for Traffic Insight to publish the dns average latency.

Step 1: Create and enable Traffic Insight instance and specify the flow source

```
switch(config)# traffic-insight TI_Instance-01 -->Creates a Traffic Insight
                                                  instance with name TI_Instance-01
switch(config-ti)# source ipfix                  -->Sets the source protocol to
                                                     collect flow information
switch(config-ti)# enable                        -->Enables Traffic Insight
```

Step 2: Specify the flow configuration

```
switch(config)# flow exporter <EXPORTER_NAME>
    destination type traffic-insight
    destination traffic-insight test
    template data timeout <TIMEOUT_VALUE>

switch(config)# flow record <RECORDED_NAME>
    match ipv4 destination address
    match ipv4 protocol
    match ipv4 source address
    match ipv4 version
    match transport destination port
    match transport source port
    collect counter bytes
    collect counter packets
    collect application dns response-code
    collect timestamp absolute first
    collect timestamp absolute last
switch(config)# flow monitor <MONITOR_NAME>
    cache timeout active <TIMEOUT_VALUE>
    exporter <EXPOTER_NAME>
    record <RECORDED_NAME>
switch(config)# interface <Inboud_Interface>
switch(config-if)#ip flow monitor flow-monitor-1 in  -->Enable IPv4 or IPv6 flow
                                                        monitor on both inbound and
                                                        outbound interfaces
switch(config)# interface <Outbound_Interface>
switch(config-if)#ip flow monitor flow-monitor-1 in
```

Step 2: Specify the monitoring parameters for flow monitoring

```
switch(config-ti)# monitor DNSLatency type dns-average-latency
```

Step 4: Specify the show commands to get the desired output

```
switch# show traffic-insight instance-1 monitor-type dns-average-latency mntr2
Name                                    : mntr2
Type                                    : dns-average-latency
Start time for latency calculation      : 10/10/2022 04:47:26.869937 UTC
End time for latency calculation        : 10/10/2022 04:48:26.812820 UTC
client_mac          client_ip      dns_server_ip       dns_avergae_latency(msec)
-------------------------------------------------------------------------------
aa:aa:aa:aa:aa:aa   192.168.11.1   172.0.0.1           200
bb:bb:bb:bb:bb:bb   192.168.12.1   172.1.1.1           300
cc:cc:cc:cc:cc:cc   192.168.13.1   172.2.2.2           150
```

Traffic insight commands

diag-dump traffic-insight basic

```
diag-dump traffic-insight basic
```

Description

Displays diagnostic information for Traffic Insight.

Examples

```
Switch# diag-dump traffic-insight  basic
================================================================================
[Start] Feature traffic-insight Time : Wed Nov  2 18:26:45 2022
================================================================================
--------------------------------------------------------------------------------
[Start] Daemon traffic-insightd
--------------------------------------------------------------------------------
Printing App cache:
TI CPDI Clients MACs learnt: 0
Printing flows for instance test
Printing flows for instance test
Printing DNS cache received:
CLIENT: 100.10.10.10
  DNS_SERVER_IP    LATENCY    TOTAL_SAMPLES    PORT    REQUEST_TIME     RESPONSE_
TIME
  100.10.10.2          261               4

Printing DNS IP MAC cache:
IP address             MAC address
100.10.10.10           00:50:56:96:8a:67

--------------------------------------------------------------------------------
[End] Daemon traffic-insightd
--------------------------------------------------------------------------------
================================================================================
[End] Feature traffic-insight
================================================================================
Diagnostic-dump captured for feature traffic-insight
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show capacities traffic-insight

```
show capacities traffic-insight
```

Description

Displays the system capacities status and their values for Traffic Insight

Examples

```
Switch# show capacities traffic-insight

System Capacities: Filter TRAFFIC_INSIGHT
Capacities Name                                                                  Value
-------------------------------------------------------------------------------------
--
Maximum number of Traffic-insight instances                                        1
Maximum number of Traffic-insight monitors                                         5
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show debug buffer module trafficinsight

```
show debug buffer module trafficinsight
```

Description

Displays Traffic Insight debug logs stored in the debug buffer.

Examples

```
Switch# show debug buffer module trafficinsight
-------------------------------------------------------------------------------
show debug buffer
-------------------------------------------------------------------------------
2022-10-26:11:11:30.689510|traffic-insightd|LOG_
```

```
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|Unsupported record id: 210
2022-10-26:11:11:30.689573|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|DMAC: 10:4f:58:88:08:00
2022-10-26:11:11:30.689639|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|Unsupported record id: 210
2022-10-26:11:11:30.689700|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|octetDeltaCount: 13751
2022-10-26:11:11:30.689761|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|packetDeltaCount: 36
2022-10-26:11:11:30.689823|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|source interface: 0
2022-10-26:11:11:30.689887|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|Unsupported record id: 252
2022-10-26:11:11:30.689949|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT_PACKET|App id: 3235
2022-10-26:11:11:30.690159|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT|ti_recv_messages_in_cpdi_layer:
Received message with size 200 from DL
2022-10-26:11:11:30.690184|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT|ti_cpdi_layer_handle_events: Handling
message in CPDI event 10
2022-10-26:11:11:30.690321|traffic-insightd|LOG_
DEBUG|AMM|1/1|TRAFFICINSIGHT|TRAFFICINSIGHT|ti_topn_add_record_to_monitor:New TOPN
hash node created for SIP 3501::100, DIP 3701::100, VRF default,dst_port 80
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show events traffic-insightd

```
show events -d traffic-insightd
```

Description

Displays event logs generated by the switch modules since the last reboot for Traffic Insight.

Examples

Showing event logs of Traffic Insight:

```
Switch# show events -d traffic-insightd
-------------------------------------------------
Event logs from current boot
-------------------------------------------------
2022-10-26T07:55:17.369208+00:00 6410 traffic-insightd[2518]: Event|14005|LOG_
INFO|UMM|-|Traffic Insight instance t1 enabled
2022-10-26T07:55:17.369309+00:00 6410 traffic-insightd[2518]: Event|14001|LOG_
```

```
INFO|UMM|-|Instance t1 created
2022-10-26T08:09:53.077469+00:00 EdgeInt traffic-insightd[2518]: Event|14003|LOG_
INFO|UMM|-|dns-avergae-latency running-statistics cleared for the monitor top3 and
instance t1
2022-10-26T08:24:52.998692+00:00 EdgeInt traffic-insightd[2518]: Event|14003|LOG_
INFO|UMM|-|dns-avergae-latency running-statistics cleared for the monitor top3 and
instance t1
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show running-config traffic-insight

```
show running-config traffic-insight
```

Description

Display configuration settings for all traffic insight instances.

Examples

```
switch# show running-config traffic-insight
traffic-insight config-TI_1
    enable
    source ipfix
    !
    monitor mntr2 dns-average-latency
...
```

Related Commands

Command	Description
traffic insight	Create and configure a traffic insight instance

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

show tech traffic-insight

```
show tech traffic-insight
```

Description

Shows the Traffic Insight configuration settings.

Examples

The example shows the Traffic Insight configuration settings.

```
Switch# show tech traffic-insight
=====================================================
Show Tech executed on Wed Oct 26 11:11:37 2022
=====================================================
=====================================================
[Begin] Feature traffic-insight
=====================================================
*********************************
Command : show running-config traffic-insight
*********************************
traffic-insight t1
enable
source ipfix
!
monitor dns type dns-average-latency
=====================================================
[End] Feature traffic-insight
=====================================================
=====================================================
Show Tech commands executed successfully
=====================================================
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show traffic-insight monitor-type

```
show traffic-insight <INSTANCE_NAME> monitor-type dns-avergae-latency <MONITOR_NAME>
```

Description

Display information for traffic insight monitored flows.

Parameter	Description
<INSTANCE_NAME>	Name of the traffic insight instance, string of maximum length up to 32 characters.
monitor-type	Specifies traffic insight monitor type. **NOTE:** For 8100 and 8360 only dns-avergae-latency flow is supported
<MONITOR_NAME>	Specify a monitor name to display information for that monitor.

Examples

The following example shows dns-average-latency data for mntr2 monitoring, for instance instance-1:

```
switch# show traffic-insight instance-1 monitor-type dns-average-latency mntr2
Name                                    : mntr2
Type                                    : dns-average-latency
Start time for latency calculation      : 10/10/2022 04:47:26.869937 UTC
End time for latency calculation        : 10/10/2022 04:48:26.812820 UTC
client_mac          client_ip      dns_server_ip       dns_avergae_latency(msec)
------------------------------------------------------------------------------
aa:aa:aa:aa:aa:aa   192.168.11.1   172.0.0.1           200
bb:bb:bb:bb:bb:bb   192.168.12.1   172.1.1.1           300
cc:cc:cc:cc:cc:cc   192.168.13.1   172.2.2.2           150
```

Related Commands

Command	Description
traffic insight	Create and configure a traffic insight instance.

Command History

Release	Modification
10.12.1000	The **dns-onboarding-latency** sub-parameter was introduced.
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

traffic insight

traffic-insight *<INSTANCE_NAME>*

```
[no] enable
[no] source ipfix
[no] monitor <NAME> type dns-average-latency
```

Description

Traffic insight monitors data collected from flow exporters like the IP Flow Information Export (IPFIX) flow exporter. Traffic insight tracks multiple monitor requests simultaneously and provides monitor reports for each request.

Parameter	Description
<INSTANCE_NAME>	Name of the traffic insight instance, string of maximum length up to 32 characters.
`[no] enable`	Enable or disable this traffic insight configuration
`[no] source ipfix`	The traffic insight configuration uses this source protocol to collect traffic flows. The only available protocol is **ipfix**.
`monitor <INSTANCE_NAME>`	Enable flow monitoring on a traffic insight instance and configure rules for filtering and grouping traffic flows.
`type`	Specifies type of the monitor
`dns-average-latency`	Monitors DNS request and response flows and provides average dns-latency details per client. The Traffic Insight application flow table in the database is updated every 5 minutes with dns average latency information.
`no`	Negate a command or set its defaults

Examples

The following example creates a traffic insight instance named TI_1:

```
switch(config)# traffic-insight  TI_1
```

The following example deletes a traffic insight instance named `TI_1`:

```
switch(config)# no traffic-insight TI_1
```

The following example enables traffic insight instance for `TI_1` instance:

```
switch(config)# traffic-insight  TI_1:
switch(config-ti)#enable
```

The following example disables traffic insight instance for `TI_1` instance:

```
switch(config)# traffic-insight
switch(config-ti)#no enable
```

The following example sets the source protocol for `TI_1` instance to collect flows information from IPFIX:

```
switch(config)# traffic-insight TI_1
switch(config-ti)# source ipfix
```

The following example removed the source protocol for `TI_1` instance:

```
switch(config)# traffic-insight TI_1
switch(config-ti)# no source ipfix
```

The following examples create a traffic insight monitor for `dns-average-latency` for the `mnti3` instance:

```
switch(config-ti)# monitor mnti3 type dns-average-latency
```

Command History

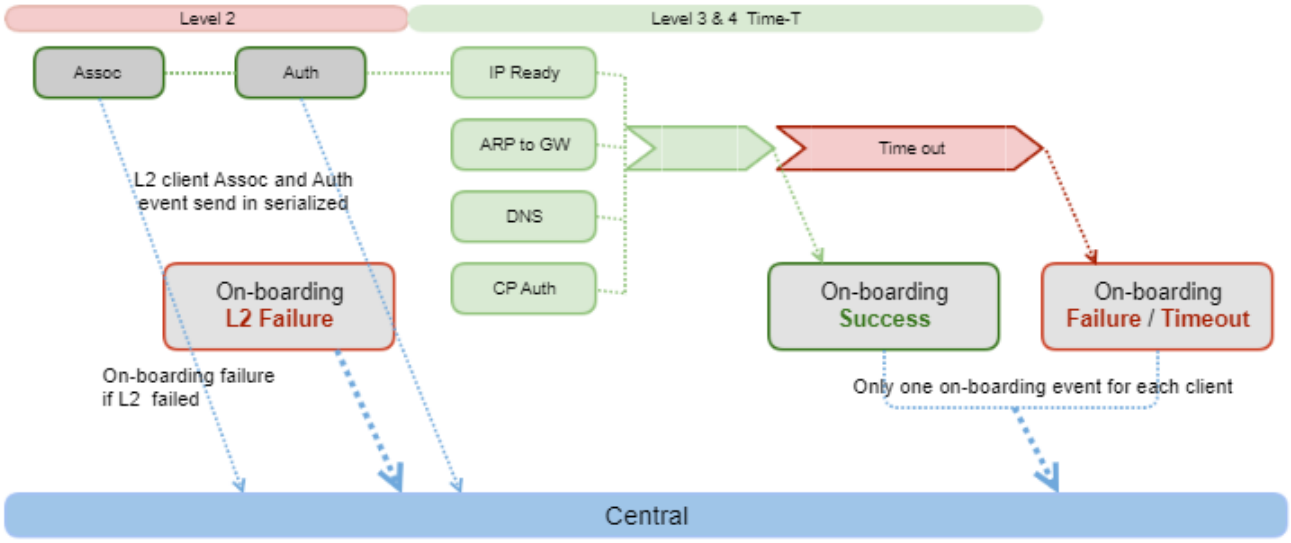
Release	Modification
10.12.1000	The **dns-onboarding-latency** sub-parameter was introduced.
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

The Client Insight feature captures L2, L3, and L4 onboarding details such as time taken for authentication, acquiring IP address and DNS resolution of the clients. The details published by the Client Insight feature help in providing better insight into the client activities, using the Aruba Central application. Client Insight can also be configured to generate event logs with client onboarding status.

Figure 1 *Onboarding Event Workflow*



Following is a brief explanation of the various stages in the feature:

- L2 stage—Client undergoes authentication or authorization. If security is disabled on the port, then the client is treated as L2 on-boarded client. For L2 clients undergoing authentication, RADIUS and authentication latencies are published in the Client Insight table. Using the authentication start and end time, port access publishes authentication start timestamp, end timestamp and authentication latencies to the Client Insight table. It also publishes time taken by authentication methods to send request and receive response from the RADIUS server. From these values, the following authentication latency can be derived:
  - `dot1x_radius_latency`—Time taken to complete 802.1x RADIUS authentication.
  - `macauth_radius_latency`—Time taken to complete mac-auth RADIUS authentication.

  > `radius_latency` values are a subset of `auth_latency`. Depending on the configuration, only one of either 802.1X and mac-auth RADIUS latency values is published. In case of concurrent onboarding or authentication precedence with priority, when both the methods are enabled, both latencies are published.

- L3 stage—Client acquires an IP address through the DHCP process, in case the onboarding latency would be the time taken by the DHCP exchange. Onboarding details are captured for only those clients that onboard the switch after enabling Client Insight configurations. Onboarding data will not be available or published for the existing clients before the Client Insight feature is enabled.

- The DHCP discover, offer, request, and acknowledge (DORA) message exchange between client and server need to be tracked to calculate per-client DHCP latency.
- L4 stage—Client accesses DNS service for it's DNS name resolution use cases.

Supported Platforms

Client Insight feature is supported on AOS-CX 4100i, 6000, 6100, 6200, 6300, 6400, 8325, 8360, 8400, and 10000 Switch Series.

Prerequisites

Listed below are the prerequisties to configure Client Insight:

- DHCP snooping must be enabled to capture the L3 onboarding status of clients. If DHCP snooping is not enabled, then all clients are marked with L3 timeout as onboarding status.
- Port access configuration is recommended if the authentication and latency values must be derived. If port access is not configured, MAC learn is considered to be L2 onboarding success.
- For average DNS latency, Traffic Insight instance must be configured for DNS packet sampling.
- On platforms where the Traffic Insight feature is not available, the Average DNS Latency values are not available.

Points to Note

- Onboarding details will not be captured for clients onboarded during process restart.
- There can be multiple onboarding event logs for a client if the client MAC ages out and rejoins repeatedly.
- UBT clients are ignored by Client Insight.
- Upon successful L3 onboarding, if switch relearns the client's MAC after the MAC ages out, L3 onboarding timestamp values would be older than L2 onboarding timestamps.
- In case of unavailability of L2 and L3 timestamps, the timestamp value in the onboarding event log will be displayed as `-1`.

Following are some of the scenarios where the L3 timestamp could be unavailable:

  - For clients onboarded while Client Insight is in disabled state, followed by feature enable and client MAC being aged out and relearnt in switch.

    In this scenario, the event log generated will have L2 timestamps but not L3 timestamps.
  - For successfully onboarded clients who have acquired IP address. Switch reboot will flush client MAC from the system and any traffic other than DHCP exchange will trigger client onboarding.

    In this scenario, L3 timestamp will not be available since the DHCP exchange did not take place during client onboarding.

- When a client is authenticated using port access device-mode, all Client Insight entries on the port except device MAC address will be cleared from the database. Further, Client Insight will only monitor device MAC client on the port and ignore other clients.

Limitations

Listed below are the limitations:

- Clients with static IP configuration—Static IP or static binding clients will enter L3 timeout state, as DHCP process will not be triggered for them
- L2 and L3 stage timeout values are configured as 3 minutes and 2 minutes. These values cannot be modified.
- For MAC authenticated clients, with concurrent onboarding or authentication priority, there is a delay in initiating the onboarding event. This is because authentication precedence and priority status is published only after the 802.1X authentication process is complete.
- If the client onboarding is successful after the onboarding timeout, no new event is generated. To check the current onboarding status, Aruba Central must monitor the events from appropriate features (port access, DHCP snooping). The same is applicable for clients where the onboarding fails.
- Old L3 latency values are published when the port to which clients are connected flaps, as the client will not trigger DHCP process after L2 authentication on rejoin.
- ND-snooping binding clients will enter L3 timeout state, as DHCP process will not be triggered for them.
- UBT clients will not be monitored.
- Clients that are onboarded on the LAG interfaces will not be monitored.

Feature Interoperability

- DHCP snooping must be enabled for L3 onboarding stage updates.
- A Traffic Insight instance must be created to check the average DNS latency values.
- Authentication is not required for dynamic clients. Therefore, if port access is disabled on the port, it will be considered as L2 successful soon after the MAC address is learnt.

Troubleshooting Client Insight

How do you check for a client's onboarding history?

To check a client's onboarding history, validate the client's onboarding event logs using the `sh events -c client-insight -r` command.

L3 latency data is not present for a client

if L3 latency data is not present for a client in the diag-dump output, validate the DHCP snooping binding table.

Client details is missing in the client-insight table

If any client MAC address is not present in the MAC address table, the client-insight table will not have any information regarding that client.

Client Insight Commands

client-insight enable

```
client-insight enable
no client-insight enable
```

Description

Enables the Client Insight feature on the device. Client Insight is disabled by default at the device level.

The `no` form of the command disables Client Insight.

Examples

Enabling the Client Insight feature:

```
switch(config)# client-insight enable
```

Disabling the Client Insight feature:

```
switch(config)# no client-insight enable
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

client-insight on-boarding event logs

```
client-insight
   event-log
   client-onboarding
```

Description

Enables generation of event logs that lists the onboarding status of each client. Onboarding event logs are disabled by default. For onboarding event logs to work, the Client Insight feature should be enabled before client onboarding. Use the no form of the command to disable onboarding event logs for clients.

Parameter	Description
`event-log`	Configure client onboarding event logs.
`client-onboarding`	Enable client onboarding event logs.

Examples

Enabling client onboarding event logs:

```
switch(config)# client-insight event-log client-onboarding
```

Disabling client onboarding event logs:

```
switch(config)# no client-insight event-log client-onboarding
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

diag-dump client-insight basic

diag-dump client-insight basic

Description

Displays the status of the Client Insight feature—whether enabled or disabled globally. It also displays latencies for all active clients that are onboarded.

Examples

```
switch# diag-dump client-in basic
================================================================================
[Start] Feature client-insight Time : Tue Jul 25 05:32:14 2023
================================================================================
--------------------------------------------------------------------------------
[Start] Daemon client-insightd
--------------------------------------------------------------------------------

Global client-insight         = ENABLED
Client on-boarding event logs = ENABLED
Client dns on-boarding latency= ENABLED

Displaying client entries with (mac) as key.
Total number of entries: 2

MAC : 00:50:56:96:0e:3f
-----------------------
Overall on-boarding status         : successful
Overall on-boarding failure reason : -

L2 on-boarding detail
---------------------
L2 on-boarding status         : successful
L2 on-boarding failure reason : -
```

```
L2 on-boarding start time     : 07/25/2023 05:28:50.495425 UTC
L2 on-boarding end time       : 07/25/2023 05:28:50.495425 UTC
L2 on-boarding latency        : 0 min, 0 sec, 0 us
802.1x RADIUS latency         : -
MAC-Auth RADIUS latency       : -

L3 on-boarding detail
---------------------
IP on-boarding status           : successful
IP on-boarding failure reason   : -
L3 on-boarding latency          : 0 min, 3 sec, 455792 us

VLAN : 20
-----------
IP details
----------
IPv4 on-boarding status         : successful
IPv6 on-boarding status         : -

DHCPv4                                          DHCPv6
------                                          ------
Status         : successful                     Status         : -
Failure reason : -                              Failure reason : -
Start time     : 07/25/2023 05:28:50.485325 UTC Start time     : -
End time       : 07/25/2023 05:28:53.941117 UTC End time       : -

DNS details
-----------
DNS on-boarding status : successful
Failure reason         : -

Server IP: 11.11.11.2
---------------------
On-boarding latency  : 0 min, 0 sec, 306 us
DNS request time     : 07/25/2023 05:28:59.656937 UTC
DNS response time    : 07/25/2023 05:28:59.657243 UTC

Average latency:
Server IP: 11.11.11.2
---------------------
Average latency                         : 7091960 usec
DNS start time for latency calculation : 07/25/2023 05:23:51.335296 UTC
DNS end time for latency calculation   : 07/25/2023 05:28:51.323025 UTC
Number of DNS requests                  : 14

Server IP: 12.12.12.2
---------------------
Average latency                         : 7954 usec
DNS start time for latency calculation : 07/25/2023 05:23:51.335296 UTC
DNS end time for latency calculation   : 07/25/2023 05:28:51.323025 UTC
Number of DNS requests                  : 12

Server IP: 13.13.13.2
---------------------
Average latency                         : 7388 usec
DNS start time for latency calculation : 07/25/2023 05:23:51.335296 UTC
DNS end time for latency calculation   : 07/25/2023 05:28:51.323025 UTC
Number of DNS requests                  : 12
------------------------------------------------------------------------
[End] Daemon client-insightd
------------------------------------------------------------------------
========================================================================
```

```
[End] Feature client-insight
================================================================================
Diagnostic-dump captured for feature client-insight
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

show capacities client-insight-client-limit

```
show capacities client-insight-client-limit
```

Description

Displays the maximum number of clients supported by the Client Insight feature on the switch.

Examples

```
switch# show capacities client-insight-client-limit

System Capacities: Filter Client-Insight client limit
Capacities Name                                                        Value
--------------------------------------------------------------------------------
Maximum number of clients supported by Client-Insight feature           4096
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

show capacities-status client-insight-client-limit

```
show capacities-status client-insight-client-limit
```

Description

Displays the maximum number of clients learnt by the Client Insight feature on the switch.

Examples

```
switch# show capacities-status client-insight-client-limit
System Capacities Status: Filter Client-Insight client limit
Capacities Status Name                                    Value Maximum
------------------------------------------------------------
Number of clients learnt by Client-Insight feature            0    4096
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

show events -c client-insight

```
show events -c client-insight
```

Description

Displays all the events logged by the Client Insight feature.

Following events are logged by the Client Insight feature:

Table 1: *Events Logged by Client Insight*

Process	Event ID	Severity	Message	Description
client-insightd	14301	Info	`Client {mac} {vlans} on {port_name} successfully on-boarded. Client on-boarding started at {ob_start_ts}; L2 complete at {l2_end_ts}; L3 complete at {l3_end_ts}`	Client successfully on-boarded with given timestamp values.
client-insightd	14302	Info	`Client {mac} {vlans} on {port_name} partial success in on-boarding. L2 status: {l2_ob_state} L3 status: {l3_ob_state}. Client on-boarding started at {ob_start_ts};L2 complete at {l2_end_ts}; L3 complete at {l3_end_ts}`	Client on-boarding is partial-successful with given timestamp values.
client-insightd	14303	Info	`Client {mac} on {port_name} failed to on-board with status: {onboarding_status} reason_code: {failure_phase_id}`	Client failed to on-board with given status and reason code.
client-insightd	14304	Info	`Maximum system wide client limit {client-number} reached`	Maximum system wide client limit is reached
client-insightd	14305	Info	`Maximum system wide client limit {client-number} reached`	Maxiumum system wide client limit is reached
client-insightd	14306	Info	`Client {mac} successfully on-boarded on VLAN {vlans}; Client on-boarding started at {ob_start_ts}; L2 complete at {l2_end_ts}; L3 complete at {l3_end_ts}; ARP to GW response received at {arp_end_ts}; DNS on-boarding to (dns_server_ip)`	Client successfully on-boarded with given timestamp values.

Process	Event ID	Severity	Message	Description
			`completed at {dns_end_ts}`	
client-insightd	14307	Info	`Client {mac} on-boarded on VLANs {vlans} and failed on VLANs {failed_vlans}; Client on-boarding started at {ob_start_ts}; L2 complete at {l2_end_ts}; L3 complete at {l3_end_ts}; ARP to GW response received at {arp_end_ts}; DNS on-boarding to (dns_server_ip) completed at {dns_end_ts}; L2 status {l2_ob_state} failure_reason_code – {l2_failure_reason}; L3 status {l3_ob_state} failure_reason_code – {l3_failure_reason}; DNS on-boarding status {dns_status} failure_reason_code – {dns_failure_reason}`	Client on-boarding is partial-successful with given timestamp values.
client-insightd	14308	Info	`Client {mac} failed to on-board with status: {onboarding_status} in failure phase: {failure_phase_id} with reason: {failure_reason}`	Client failed to on-board with given status, phase_id and reason code.

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

show tech client-insight

```
show tech client-insight
```

Description

Displays if the global Client Insight and client on-boarding event log features are enabled or disabled. Also displays the latencies for all active clients that are onboarded.

Examples

```
switch# show tech client-insight

=====================================================
Show Tech executed on Thu May 18 15:05:43 2022
=====================================================
=====================================================
[Begin] Feature client-insight
=====================================================
*********************************
Command : show client-insight
*********************************
Client Insight Information:
Global client-insight         = ENABLED
Client on-boarding event logs = ENABLED
=====================================================
[End] Feature client-insight
=====================================================
=====================================================
Show Tech commands executed successfully
=====================================================
```

Displaying L2, L3 client latencies and details:

```
switch# show tech client-insight
=====================================================
Show Tech executed on Thu Sep 22 06:34:16 2022
=====================================================
=====================================================
[Begin] Feature client-insight
=====================================================


*********************************
Command : diag-dump client-insight basic
*********************************
================================================================================
[Start] Feature client-insight Time : Thu Sep 22 06:34:16 2022
================================================================================
--------------------------------------------------------------------------------
[Start] Daemon client-insightd
--------------------------------------------------------------------------------

    Global client-insight         = ENABLED
```

```
    Client on-boarding event logs = ENABLED

  Displaying client entries with (mac) as key.
  Total number of entries: 1

MAC : 00:11:01:00:00:08
-----------------------
  Overall on-boarding status         : -
  Overall on-boarding failure reason : -

  L2 on-boarding detail
  ---------------------
    L2 on-boarding status         : successful
    L2 on-boarding failure reason : -
    L2 authentication start time  : 05/18/22 15:01:01.456789 UTC
    L2 authentication end time    : 05/18/22 15:01:02.123456 UTC
    L2 authentication latency     : 0 min, 0 sec, 666667 us
    802.1x RADIUS latency         : -
    MAC-Auth RADIUS latency       : 0 min, 0 sec, 332456 us

  L3 on-boarding detail
  ---------------------
    L3 on-boarding status           : in_progress
    L3 on-boarding failure reason   : -
    L3 on-boarding latency          : -

    VLAN : 10
    -----------
      IP details
      ----------
        IPv4 on-boarding status         : successful
        IPv6 on-boarding status         : -

        DHCPv4                                          DHCPv6
        ------                                          ------
          Status         : successful                     Status         : -
          Failure reason : -                              Failure reason : -
          Start time     : 05/18/22 15:01:02.456789 UTC   Start time     : -
          End time       : 05/18/22 15:01:02.999988 UTC   End time       : -

    VLAN : 20
    -----------
      IP details
      ----------
        IPv4 on-boarding status         : In_Progress
        IPv6 on-boarding status         : -

        DHCPv4                                          DHCPv6
        ------                                          ------
          Status         : In_Progress                    Status         : -
          Failure reason : -                              Failure reason : -
          Start time     : 05/18/22 15:01:03.256485 UTC   Start time     : -
          End time       : -                              End time       : -

  DNS details
  -----------
    Server IP: 172.16.1.8
    ---------------------
      Average latency                       : 0 min, 0 sec, 432456 us
      DNS start time for latency calculation : 05/18/22 15:01:03.123456 UTC
      DNS end time for latency calculation   : 05/18/22 15:01:03.425466 UTC
      Number of DNS requests                 : 16
```

```
   Server IP: 2003::1
   --------------------
      Average latency                          : 0 min, 0 sec, 432456 us
      DNS start time for latency calculation : 05/18/22 15:01:03.123456 UTC
      DNS end time for latency calculation   : 05/18/22 15:01:03.425466 UTC
      Number of DNS requests                   : 16



-------------------------------------------------------------------------------
[End] Daemon client-insightd
-------------------------------------------------------------------------------
===============================================================================
[End] Feature client-insight
===============================================================================
Diagnostic-dump captured for feature client-insight
=====================================================
[End] Feature client-insight
=====================================================


=====================================================
Show Tech commands executed successfully
=====================================================
Show Tech took 43 seconds for execution
```

For more information on features that use this command, refer to the Security Guide for your switch model.

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Administrators or local user group members with execution rights for this command.

The public key infrastructure (PKI) feature enables administrators to manage digital certificates on the switch. The switch uses certificates to validate SSH clients when acting as an SSH server, and when communicating with syslog servers when TLS encryption is used.

PKI concepts

Digital certificate

A digital certificate is an electronic form of identification that stores important information about an entity (such as a computer, program, or website). Certificates help secure digital transactions by enabling the end parties to validate each other's identity. Digital certificates are issued by a certificate authority (CA) and are composed of an encoded string of characters (usually stored in a file). For example:

```
-----BEGIN CERTIFICATE-----
MIIDsDCCApgCCQDJotuPPj9GCDANBgkqhkiG9w0BAQsAADCBqzELMAkGA1UEBh
VVMxEzARBgNVBAgMCkNhbGlmb3JuaWExEDAOBgNVBAcBM1JvY2tsaW4xDDAKBg
BAoMA0hQTjEVMBMGA1UECwwMSFBOUm9zZXZpbGxlMSokwAYDVQQDDCFocG5zdz
...
MioDy0096DvSMPsnOaI+jnZ3AozN8y+nLgotXUsg36pO/Ncc51oQhyUdcAbgA1
rzSLgyTnpXZKumvlaoTk3pzrIf7m5V103GTbgHGSFCzgO6QWxVxu9d7ju1o59S
aOIT7JSsYI5LsLpVz9ZqS599rj/lLoH+rLNlRDVXpS+J51
-----END CERTIFICATE-----
```

The switch can import PEM encoded ITU-T X.509 v3 certificates. (Certificates can be converted to human-readable form using a software decoder.)

An X.509 digital certificate typically includes the following information:

- Signature algorithm: The cryptographic algorithm used to generate the digital signature.
- Signature value: Digital signature of the certificate generated using the CA's private key.
- Version number: X.509 version number.
- Serial number: Certificate serial number.
- Issuer name: Name of the certificate authority (CA) that issued the certificate.
- Validity period: Beginning and ending dates.
- Subject name: Name of the entity to which the certificate is issued.
- Subject public key and key algorithm.
- Key usage extension: Purpose of the certificate.

Certificate authority

A certificate authority (CA) is an entity that can issue and sign digital certificates. A CA can be a well-known, trusted commercial company, or a private entity controlled by your organization. For a commercial CA, the CA validates the credentials of a user before issuing a certificate and signing it, guaranteeing a certificate holder's identity. For a private CA, self-signed certificates can be generated as needed for devices on your network without paying a commercial company.

Root certificate

A root certificate is a self-signed certificate that is deemed the root of trust for a certificate chain. This is the certificate that identifies a CA, and is used by the CA to sign any certificates that it issues. When two peers attempt to establish a secure connection, they use the CA's public key to verify that each other's certificates were indeed signed by a trusted certificate authority.

Each root CA certificate has a unique fingerprint, which is the hash value of the certificate content. The fingerprint of a root CA certificate can be used to authenticate the validity of the root CA.

In a certificate chain, the root CA generates a self-signed certificate, and each lower level CA holds a CA certificate (intermediate certificate) issued by the CA immediately above it. The hierarchy of these certificates forms a *chain of trust*.

Leaf certificate

This is the certificate used by a software entity, such as a syslog client, to identify itself to a peer when establishing a secure connection.

Intermediate certificate

An intermediate certificate is a CA which has been issued by the root certificate or by another intermediate certificate. Intermediate CAs can issue leaf certificates and sit in between the root and leaf certificates. The use of an intermediate CA allows administrators to segregate their PKI groups.

Trust anchor

This is the certificate that acts as the base of trust for the validation of other certificates. A trust anchor can be a root or intermediate certificate issued by a CA.

OCSP

The online certificate status protocol (OCSP) is a real-time method for determining the revocation status of a certificate. When two peers attempt to establish a secure connection, they can query an OCSP responder to determine the status (valid or revoked) of each other's certificates. The OCSP responder for a certificate is typically provided by a server managed by the CA that issued the certificate.

PKI on the switch

The AOS-CX Switch Series switches provides for installation of certificate authority (CA) certificates and the generation and installation of leaf certificates.

Trust anchor profiles

The switch supports 64 trust anchor (TA) profiles. Each TA profile stores a trusted CA certificate. The certificate can be either a root CA certificate, which must be self-signed, or an intermediate CA certificate that is issued by another CA.

The certificate must have its `BasicConstraints` field with CA key set to `true`, and its `KeyUsage` extension field set with `keyCertSign` and/or `cRLSign`.

CA certificates are used to:

- Validate the certificates that remote peers present when attempting to establish a secure connection with a service on the switch, for example, the SSH server.

- Validate leaf certificates installed on the switch that are used, for example, by the syslog client, the Web UI, or REST API.

The TA profile also enables configuration of real-time checking of certificate revocation (through OCSP).

Leaf certificates

Leaf certificates can be installed on the switch for use by features such as the syslog client, the Web UI, or REST API. If you are purchasing a certificate from a trusted CA, the switch can generate the certificate signing request (CSR) that is used to obtain the certificate. The switch can also directly generate self-signed certificates. Alternatively, the certificate and private key can be generated outside the switch and then imported. X509 certificate management software such as OpenSSL can be used to generate the private key and CSR and then combine the certificate and private key into one PEM or PKCS#12 file suitable for importation into the switch.

Mandatory matching of peer device hostname

While validating the peer device certificates, the switch checks that the peer device configured hostname matches either the Subject Alternative Name (SAN) field or the Common Name (CN) within the certificate Subject field. If the SAN field is present and matches the hostname, validation succeeds, otherwise it fails. If the SAN field is not present, and the CN matches the hostname, validation succeeds, otherwise it fails.

PKI EST

EST (Enrollment over Secure Transport) (RFC 7030) defines the protocol that devices use to request trusted certificate authority (CA) certificates and to enroll / re-enroll device certificates from CA services using secure channels, specifically HTTP over TLS.

Devices can be configured to request the trusted CA certificates and to request enrollment, and re-enrollment of device certificates automatically, without the need for administrator intervention, while maintaining the security and integrity of the whole enrollment process.

The switch includes an EST client implemented as a part of the PKI infrastructure.

For detailed CLI command descriptions, see:

- PKI commands
- PKI EST commands

EST usage overview

- The EST client on the switch requires EST profile configuration, including EST server URL and the VRF providing HTTP connection to the EST server.
- At the time the URL is set in the EST profile, the switch connects to the EST server and downloads the trusted CA certificate chain. To accommodate CA certificate updates, the certificate chain is also downloaded before a certificate enrollment or re-enrollment is attempted.
- EST supports up to:
  - 16 EST profiles
  - 63 trusted CA certificates downloaded from EST servers.
  - 18 device certificates enrolled through EST services.

- EST profile configuration is supported through the CLI and the REST API `PKI_EST_Profile`.
- CA certificate request and device certificate enrollment is supported through the CLI and the REST custom API `CertificateManager /certificate`.

Prerequisites for using EST for certificate enrollment

- Establish the PKI infrastructure for you organization, with the CA chain and service ready to issue certificates. Issue a service certificate for the EST server.
- Install the root CA certificate in a TA profile on the switch that will validate the EST server certificate using CLI commands crypto `pki ta-profile` and `ta-certificate`.
- Optionally, preconfigure an EST client certificate on the switch.
- Make the EST server reachable from the switch. Connect the CA service(s) to the EST server. If there is a client certificate for the EST client, install the root CA certificate on the server that will validate the client certificate.

EST profile configuration

In the global configuration context, create an EST profile and enter its context:

```
crypto pki est-profile <EST-NAME>
```

In an EST profile context, configure the EST profile parameters using these commands:

```
url <URL>
vrf <VRF-NAME>
username <USERNAME> password [ciphertext <CIPHERTEXT-PASSWORD> |
                              plaintext <PLAINTEXT-PASSWORD>]
retry-interval <INTERVAL>
retry-count <RETRIES>
arbitrary-label <LABEL>
arbitrary-label-enrollment <LABEL>
arbitrary-label-reenrollment <LABEL>
reenrollment-lead-time <LEAD-TIME>
```

Certificate enrollment

In the global configuration context, create a certificate and enter its context:

```
crypto pki certificate <CERT-NAME>
```

In a certificate configuration context, configure the certificate parameters:

```
key-type {rsa [key-size <K-SIZE>] | ecdsa [curve-size <C-SIZE>]}
subject [common-name <COMMON-NAME>]
        [country <COUNTRY>]
        [locality <LOCALITY>]
        [org <ORG-NAME>]
        [org-unit <ORG-UNIT>]
        [state <STATE>]
```

In a certificate configuration context, enroll the certificate using an EST service:

```
enroll est-profile <EST-NAME>
```

Certificate re-enrollment

- The re-enrollment request is sent automatically to the same EST server that was used for the original enrollment.

- The switch presents the enrolled certificate being re-enrolled to the EST server for authentication. If the certificate has expired or authentication fails for any reason, the switch falls back to using the EST client certificate or the username and password in the EST profile, whichever is configured, and performs a new certificate enrollment.
- Re-enrollment lead-time is configurable in the EST profile using CLI command `reenrollment-lead-time`. It sets the number of days before certificate expiry date that certificate re-enrollment will be initiated.

Checking EST profile and certificate configuration

Show the list of EST profiles or details of a specific EST profile:

```
show crypto pki est-profile [<EST-NAME>]
```

Show a list of TA profiles whether directly configured or EST-enrolled, or details of a specific TA profile:

```
show crypto pki ta-profile [<TA-NAME>]
```

Show the list of certificates whether directly configured or EST-enrolled, or details of a specific certificate:

```
show crypto pki certificate [<CERT-NAME> [plaintext | pem]]
```

Show all certificates assigned to the switch EST client as well as certificates that are assigned to other applications on the switch.:

```
show crypto pki application
```

EST best practices

Ensure the following:

- A time synchronization service is used on both the switch (the EST client) and the EST server.
- In all CA certificates, the `Basic Constraints` field has `CA` set to `true`, `pathlen` is set appropriately, and `Key Usage` is set with `keyCertSign`.
- In all leaf certificates, the `Extended Key Usage` field is set with the appropriate purpose as follows:
  - For server certificates, set with `serverAuth`. The `Key Usage field` has at least one of `digitalSignature`, `keyEncipherment`, or `keyAgreement`.
  - For client certificates, set with `clientAuth`. The `Key Usage field` has at least one of `digitalSignature`, or `keyAgreement`.
- The EST server is configured to include the intermediate issuer CA certificates in the trusted CA certificate chain that the EST server sends to the switch (the EST client) upon request.

Example using EST for certificate enrollment

This example illustrates the configuration of an EST profile and enrolling application certificates using an EST server.

Prerequisites:

- An EST server is reachable from the switch management port.
- Availability of the root CA certificate used to validate the server certificate.

This example shows the following:

- Installing the root CA certificate as a TA profile for validation of the EST server certificate.
- Configuring an EST profile with the EST server information, including the username and password for client authentication and the EST server URL.

- Issuing a request to enroll a leaf certificate using the EST server.
- Assigning the enrolled certificate to the EST client and syslog client on the switch.

Each section in the below example is preceded by descriptive text.

Example

```
================================================================================
The switch in its default configuration state.
================================================================================

switch# show running-config
Current configuration:
!
!Version AOS-CX FL.10.06.0001CM
!export-password: default
user admin group administrators password ciphertext AQBapTLgcT+DNrtd0bmdXIP2L0AY
NUpwwyQEIZX4oMKtwlXcYgAAAOmKlfxH+ugf3Fe2JuWar2uKG7A/R6bqMO/ZHS364NOmpXV/Ko37ZhCq
cFpaOJsk01+IJPRUkbpigCeEObM67Od8/vrASJaO6EAj+RBnWCrifwdChcUUS3XpbCUl7dmxYHNg
!
!
ssh server vrf default
ssh server vrf mgmt
vsf member 1
    type jl668a
vlan 1
spanning-tree
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    no routing
    vlan access 1
interface 1/1/2
    no shutdown
    no routing
    vlan access 1
interface 1/1/3
    no shutdown
    no routing
    vlan access 1
...
interface 1/1/26
    no shutdown
    no routing
    vlan access 1
interface 1/1/27
    no shutdown
    no routing
    vlan access 1
interface 1/1/28
    no shutdown
    no routing
    vlan access 1
interface vlan 1
    ip dhcp
!
!
https-server vrf default
https-server vrf mgmt
switch#
```

```
================================================================================
The mgmt port is connected to a network with DNS available and the
EST server reachable.
================================================================================

switch# show interface mgmt
  Address Mode                : dhcp
  Admin State                 : up
  Mac Address                 : 38:21:c7:59:cd:81
  IPv4 address/subnet-mask    : 999.100.205.146/24
  Default gateway IPv4        : 999.100.205.1
  IPv6 address/prefix         :
  IPv6 link local address/prefix: fe80::3a21:c7ff:fe59:cd81/64
  Default gateway IPv6        :
  Primary Nameserver          :
  Secondary Nameserver        :
switch#


================================================================================
Configure the root CA cert as a TA profile that will validate the server cert.
================================================================================

switch# config
switch(config)#
switch(config)# crypto pki ta-profile root-ca-for-est-server
switch(config-ta-root-ca-for-est-server)#
switch(config-ta-root-ca-for-est-server)# ta-certificate import terminal
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
NVBAYTonfig-ta-cert)# MIIB2DCCAX6gAwIBAgIJAKtmJvZZy9RdMAoGCCqGSM49BAMCMGIxCzAJBg
QKEwNIonfig-ta-cert)# AlVTMQswCQYDVQQIEwJDQTESMBAGA1UEBxMJUm9zZXZpbGxlMQwwCgYDVQ
0yMDA1onfig-ta-cert)# UEUxDjAMBgNVBAsTBUFydWJhMRQwEgYDVQQDEwtkYW5lc3Qtcm9vdDAeFw
...
YDVR0Ponfig-ta-cert)# VCnKTlhxfmV72nfxYpI979UsopuP5nCjHTAbMAwGA1UdEwQFMAMBAf8wCw
eo6yN0onfig-ta-cert)# BAQDAgEGMAoGCCqGSM49BAMCA0gAMEUCIQDb/uHvU8DFRTyfnP9wk1i6sd
c=00(config-ta-cert)# UvUO5t7/rrVxRQIgMHGjHhaN1nkjYBG8Ei3C1UDILiKlO7McMTCWVo4Ik5
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Subject: C = US, ST = CA, L = Roseville, O = HPE, OU = Aruba, CN = danest-root
Issuer:  C = US, ST = CA, L = Roseville, O = HPE, OU = Aruba, CN = danest-root
Serial Number: 0xAB6626FXXXXD45D
TA certificate import is allowed only once for a TA profile
Do you want to accept this certificate (y/n)? y
switch(config-ta-root-ca-for-est-server)#
switch(config-ta-root-ca-for-est-server)# exit
switch(config)#
switch(config)# show crypto pki ta-profile

TA Profile Name                 TA Certificate       Revocation Check
------------------------------- -------------------- ----------------
root-ca-for-est-server          Installed, valid     disabled

switch(config)#


================================================================================
Configure the EST profile with the EST server URL, username/password.
================================================================================
```

```
switch(config)# crypto pki est-profile test-est-server
switch(config-est-test-est-server)#
switch(config-est-test-est-server)# user fred password plaintext barney
switch(config-est-test-est-server)#
switch(config-est-test-est-server)# url https://999.0.10.229:8443/.well-known/est
switch(config-est-test-est-server)#
switch(config-est-test-est-server)# exit
switch(config)#


================================================================================
At the time the EST URL is set, the switch sends a request to the EST server to
get the set of trusted CA certs. If that is successful, TA profiles will be
auto-created for those CA certs.

Display the list of TA profiles and EST profile details.
================================================================================

switch(config)# show crypto pki ta-profile

TA Profile Name                  TA Certificate       Revocation Check
-------------------------------- -------------------- ----------------
test-est-server-est-ta00         Installed, valid     OCSP
test-est-server-est-ta02         Installed, valid     OCSP
test-est-server-est-ta05         Installed, valid     OCSP
test-est-server-est-ta01         Installed, valid     OCSP
root-ca-for-est-server           Installed, valid     disabled
test-est-server-est-ta04         Installed, valid     OCSP
test-est-server-est-ta03         Installed, valid     OCSP


switch(config)# show crypto pki est-profile
                                 Downloaded  Enrolled
Profile Name                     TA Profiles Certificates
-------------------------------- ----------- ------------
test-est-server                            6            1


switch(config)# show crypto pki est-profile test-est-server
  Profile Name              : test-est-server
  Service VRF               : mgmt
  Service URL               : https://999.0.10.229:8443/.well-known/est
    Arbitrary Label               : not configured
    Arbitrary Label Enrollment    : not configured
    Arbitrary Label Reenrollment  : not configured
  Authentication Username   : fred
  Authentication Password   :
    AQBapR7ndgoxkMlWQUQvK+Dvd3S6m+s9fdaPQwdkMbIYEMnMBgAAAHRhhliYwA==
  Retry Interval            : 30 seconds
  Retry Count               : 3 times
  Reenrollment Lead Time    : 2 days
  Downloaded TA Profiles    : 6
  Enrolled Certificates     :
    cert-for-app
switch(config)#


================================================================================
Originally, the switch only has two built-in certificates.
================================================================================
```

```
switch(config)# show crypto pki certificate

Certificate Name       Cert Status    EST Status        Associated Applications
---------------------- -------------- ----------------- --------------------------
device-identity        installed      n/a               none
local-cert             installed      n/a               dot1x-supplicant,
                                                        est-client, hsc,
                                                        https-server,
                                                        syslog-client



================================================================================
Create a new certificate, configure its key type, key size, and subject fields.
================================================================================

switch(config)# crypto pki certificate cert-for-app
switch(config-cert-cert-for-app)#
switch(config-cert-cert-for-app)# key-type ecdsa curve-size 521
switch(config-cert-cert-for-app)#
switch(config-cert-cert-for-app)# subject
Do you want to use the switch serial number as the common name (y/n)? n
Common Name: 999.100.205.146
Org Unit: Aruba-Roseville
Org Name: HPE
Locality: Roseville
State: CA
Country: US
switch(config-cert-cert-for-app)#


================================================================================
Request to enroll the certificate through the EST server.
================================================================================

switch(config-cert-cert-for-app)# enroll est-profile test-est-server
You are enrolling a certificate with the following attributes:
Subject: C=US, ST=CA, L=Roseville, OU=Aruba-Roseville, O=HPE,
         CN=999.100.205.146
Key Type: ECDSA (521)

Continue (y/n)? y
Certificate enrollment via test-est-server has been initiated. Please use
'show crypto pki certificate cert-for-app' to check its status.
switch(config-cert-cert-for-app)#


================================================================================
Check the cert status to see if enrollment is successful. It is.
================================================================================


switch(config)# show crypto pki certificate

Certificate Name       Cert Status    EST Status        Associated Applications
---------------------- -------------- ----------------- --------------------------
device-identity        installed      n/a               none
local-cert             installed      n/a               dot1x-supplicant,
                                                        est-client, hsc,
                                                        https-server,
                                                        syslog-client
cert-for-app           installed      enroll success    none
```

```
switch(config-cert-cert-for-app)#
switch(config-cert-cert-for-app)# exit
switch(config)#
switch(config)# show crypto pki certificate cert-for-app pem
  Certificate Name: cert-for-app
  Associated Applications:
    est-client
  Certificate Status: installed
  EST Status: enroll success
  Certificate Type: regular
  Intermediates:
    Subject: C = US, ST = CA, O = HPE, OU = Aruba, CN = danest-int2
      Issuer: C = US, ST = CA, O = HPE, OU = Aruba, CN = danest-int1
      Serial Number: 0x02
    Subject: C = US, ST = CA, O = HPE, OU = Aruba, CN = danest-int1
      Issuer: C = US, ST = CA, L = Roseville, O = HPE, OU = Aruba, CN = danest-
root
      Serial Number: 0x01
    Subject: C = US, ST = CA, L = Roseville, O = HPE, OU = Aruba, CN = danest-root
      Issuer: C = US, ST = CA, L = Roseville, O = HPE, OU = Aruba, CN = danest-
root
      Serial Number: 0xAB6626FXXXXD45D
    -----BEGIN CERTIFICATE-----
    MIICizCCAjKgAwIBAgICAIgwCQYHKoZIzj0EATBOMQswCQYDVQQGEwJVUzELMAkG
    A1UECBMCQ0ExDDAKBgNVBAoTA0hQRTEOMAwGA1UECxMFQXJ1YmExFDASBgNVBAMT
    C2RhbmVzdC1pbnQyMB4XDTIwMTAyODE5NTczOVoXDTIwMTEyNTE5NTczOVowbzEL
   ...
    RTEOMAwGA1UECxMFQXJ1YmExFDASBgNVBAMTC2RhbmVzdC1pbnQxggECMAkGByqG
    SM49BAEDSAAwRQIgVC1kVIewXhpBSQVqVsQ36MbzrhR4XsaGbQeu7+O8gbUCIQCH
    cS17gcLbNxJ1WVr2jnZpPBxy9vID38FjirJiGZ5cZw==
    -----END CERTIFICATE-----
    -----BEGIN CERTIFICATE-----
    MIIBpzCCAU2gAwIBAgIBAjAJBgcqhkjOPQQBME4xCzAJBgNVBAYTAlVTMQswCQYD
    VQQIEwJDQTEMMAoGA1UEChMDSFBFMQ4wDAYDVQQLEwVBcnViYTEUMBIGA1UEAxML
    ZGFuZXN0LWludDEwHhcNMjAwNTIwMDUyNDExWhcNMzAwNTE4MDUyNDExWjBOMQsw
    ...
    7ovbXodgN8lqDvBl1VTJYlLBSzl9FKMdMBswDAYDVR0TBAUwAwEB/zALBgNVHQ8E
    BAMCAQYwCQYHKoZIzj0EAQNJADBGAiEA+i3x7KEZsxObVruM1kwqWe+QXiLKbgNL
    fL077jsSMhYCIQD/dFBkH/yN0NFzb3wI7OaooO83HY2p/47t2pIBk/JNfg==
    -----END CERTIFICATE-----
    -----BEGIN CERTIFICATE-----
    MIIBuTCCAWGgAwIBAgIBATAJBgcqhkjOPQQBMGIxCzAJBgNVBAYTAlVTMQswCQYD
    VQQIEwJDQTESMBAGA1UEBxMJUm9zZXZpbGxlMQwwCgYDVQQKEwNIUEUxDjAMBgNV
    BAsTBUFydWJhMRQwEgYDVQQDEwtkYW5lc3Qtcm9vdDAeFw0yMDA1MjAwNTE1MjNa
    ...
    BgNVHRMEBTADAQH/MAsGA1UdDwQEAwIBBjAJBgcqhkjOPQQBA0cAMEQCIGrlZmBX
    SmbhDvG9pRiXG0YMqVbvZd37jRQdE+mEk2jfAiBFGhzMjUadhQbuPUTNs9A7bdYk
    wej0mJe5bRpd7sqwRQ==
    -----END CERTIFICATE-----
    -----BEGIN CERTIFICATE-----
    MIIB2DCCAX6gAwIBAgIJAKtmJvZZy9RdMAoGCCqGSM49BAMCMGIxCzAJBgNVBAYT
    AlVTMQswCQYDVQQIEwJDQTESMBAGA1UEBxMJUm9zZXZpbGxlMQwwCgYDVQQKEwNI
    UEUxDjAMBgNVBAsTBUFydWJhMRQwEgYDVQQDEwtkYW5lc3Qtcm9vdDAeFw0yMDA1
    ...
    VCnKTlhxfmV72nfxYpI979UsopuP5nCjHTAbMAwGA1UdEwQFMAMBAf8wCwYDVR0P
    BAQDAgEGMAoGCCqGSM49BAMCA0gAMEUCIQDb/uHvU8DFRTyfnP9wk1i6sdeo6yN0
    UvUO5t7/rrVxRQIgMHGjHhaN1nkjYBG8Ei3C1UDILiKlO7McMTCWVo4Ik5c=
    -----END CERTIFICATE-----
switch(config)#
```

```
================================================================================
Initially, all applications use the default local-cert.
================================================================================

switch(config)# show crypto pki application

Associated Applications    Certificate Name           Cert Status

-------------------------- ------------------ ---------------------------------
est-client                                    not configured, using local-cert
https-server                                  not configured, using local-cert
syslog-client                                 not configured, using local-cert
switch(config)#


================================================================================
Assign the newly enrolled cert to applications as desired.
In this example, the cert is assigned to the est-client and syslog.
================================================================================

switch(config)# crypto pki application est-client certificate cert-for-app
switch(config)# crypto pki application syslog-client certificate cert-for-app
switch(config)#
switch(config)# show crypto pki application

Associated Applications    Certificate Name    Cert Status
-------------------------- ------------------ ------------------------------
est-client                 cert-for-app        valid
https-server                                   not configured, using local-cert
syslog-client              cert-for-app        valid
switch(config)#
```

Example including the use of an intermediate certificate

This example shows the following:

- Installing a root CA as a TA profile.
- Creating a CSR for a leaf certificate.
- Installing the signed leaf certificate issued by an intermediate CA. The intermediate CA certificate is included after the signed leaf certificate.

Each section in the below example is preceded by descriptive text.

Example

```
================================================================================
Install root CA as a TA profile
================================================================================

switch(config)# crypto pki ta-profile root
switch(config-ta-root)# ta-certificate import terminal
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIGATCCA+mgAwIBAgIJAL/JIZfJ0GpcMA0GCSqGSIUAMIGOMQswCQYD
switch(config-ta-cert)# VQQGEwJVUzETMBEGA1UECAwKQ2FsaWZvcm5pYTESBwwJUm9zZXZpbGxl
switch(config-ta-cert)# MQwwCgYDVQQKDANIUEUxEzARBgNVBAsMCk5ldmcxFTATBgNVBAMMDFRl
...
```

```
switch(config-ta-cert)# rvadRXSAsUlevJRNNOyINrEJyOfUX2hAfLaiBYP+In6gKTAwVh1xLiXn
switch(config-ta-cert)# LlryAb2/go4BTYjil3eJyXxweUHheuBeesEslBawLv0cPCQPTTdbc97O
switch(config-ta-cert)# iWbyAmfSpD/TS3AgCLnBFPKEKsms0f0LF3/C9dRUXjIHT/LDBr+lgzY3
switch(config-ta-cert)# m2NCvxY=
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Subject: C = US, ST = California, L = Roseville, O = HPE, OU = Networking,
 CN = Test CA root, emailAddress = generic@corp.com
Issuer:  C = US, ST = California, L = Roseville, O = HPE, OU = Networking,
CN =Test CA root, emailAddress = generic@corp.com
Serial Number: 0xBFC92197xxxxxxxx
TA certificate import is allowed only once for a TA profile
Do you want to accept this certificate (y/n)? y
switch(config-ta-root)# exit


================================================================================
Create a CSR for a leaf certificate
================================================================================

switch(config)# crypto pki certificate leaf
switch(config-cert-leaf)# subject
Do you want to use the switch serial number as the common name (y/n)? y
Common Name: SG9Zxxxxxx
Org Unit:
Org Name:
Locality:
State:
Country:
switch(config-cert-leaf)# enroll terminal
You are enrolling a certificate with the following attributes:
Subject: C=<empty>, ST=<empty>, L=<empty>, OU=<empty>, O=<empty>,
         CN=SG9Zxxxxxx
Key Type: RSA (2048)

Continue (y/n)? y

-----BEGIN CERTIFICATE REQUEST-----
MIICWjCCAUICAQIwFTETMBEGA1UEAwwKU0c5WktONDAwSoZIhvcN
AQEBBQADggEPADCCAQoCggEBAMKdtoucDEMeuZjPGvCcWTm4D39A
WBA8K/bduJvM1E2B/uirU2TX7mF6lN30akClSxZOoofZAmBPCzI3
...
wZtb5c8fYCSR+TpLwZAdoXrvGJqJ1aGzV6/kVfb7rM6ulBksfBo/
JwO+7x8Vn5h1dGCrsl9CPJienni/fq24+1CJzspMbY9BKu9EIL+P
5ND9BmN0IzEmDO26F+Ip74DqFCIYjXtl3uPJk4cwJkXq121hlcrG
UlatpvjNEpZOtfoEryDJSs0pHXky7VjltYABIuDy
-----END CERTIFICATE REQUEST-----


================================================================================
Install the signed leaf certificate issued by an intermediate CA. The
1intermediate CA certificate is included after the signed leaf certificate.
================================================================================

switch(config-cert-leaf)# import terminal ta-profile root
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIEKTCCAhGgAwIBAgIJAO1LSoBmKxtbMA0GCSqGSIYxCzAJBgNV
switch(config-cert-import)# BAYTAkFVMRUwEwYDVQQIDAxJbnRlcm1lZGNVBAoMGEludGVybmV0
switch(config-cert-import)# IFdpZGdpdHMgUHR5IEx0ZDENMAsGA1UEAw0yMDA1MTQyMDI3MTla
...
```

```
switch(config-cert-import)# axnZcIaNp4eNi95in+TvckXA0eMLScNyR7IF+Wjn56H0fQKYsHp/
switch(config-cert-import)# jllbCkyB1xKnn6IpzIj/hvAx3NpA0jXx/qJA+V/cltaAL6+QPZmI
switch(config-cert-import)# vr5GZsoV72BHFOXxoteZlmWMUdVldYXXP2DzEUbttr9zojwz0MyK
switch(config-cert-import)# Qz5tc0BlGfJAtghykw==
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIFyzCCA7OgAwIBAgIJAO1LSoBmKxtwMA0GCSqGCIGOMQswCQYD
switch(config-cert-import)# VQQGEwJVUzETMBEGA1UECAwKQ2FsaWZvc1UEBwwJUm9zZXZpbGxl
switch(config-cert-import)# MQwwCgYDVQQKDANIUEUxEzARBgNVBAsMCmcxFTATBgNVBAMMDFRl
...
switch(config-cert-import)# LM9DV3YNWOM4UMMP2HXaDDfqxZPX9Zsj6Gl/stRCh8SVfsF2duYR
switch(config-cert-import)# 5brLfEpiDhXrZVXxF9lljRABO2JPLSUufg7xr6M/K5aCujxVYzK7
switch(config-cert-import)# DQaCEw5NlmC1vpYlY2TG3dlUQPZDeQOAHwuBd4HewqDHWfp/T04=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)#
Leaf certificate is validated with root and imported successfully.
switch(config-cert-leaf)#
```

Installing a self-signed leaf certificate (created inside the switch)

This procedure describes how to create (wholly inside the switch) and install a self-signed X.509 leaf certificate. And associate it with one of the following switch features: syslog client, HTTPS server, or HSC (hardware switch controller).

Procedure

1. Create a leaf certificate context with the command `crypto pki certificate`. This switches to the leaf certificate configuration context.
2. Define leaf certificate properties with the command `subject`.
3. Set the encryption key type for the leaf certificate with the command `key-type`.
4. Generate and install the self-signed certificate with the command `enroll self-signed`.
5. Exit the leaf certificate context with the command `exit`.
6. Associate the leaf certificate with a switch feature (syslog client, HTTPS server, or HSC) with the command `crypto pki application`.

Example

This example:

- Creates the leaf certificate context.
- Defines the leaf certificate characteristics.
- Creates and installs the self-signed leaf certificate.
- Associates the leaf certificate with the syslog client (application) on the switch.

```
switch(config)# crypto pki cert SS_LC
8400X(config-cert-SS_LC)# subject common-name SSLeaf country US
state CA locality Rocklin org Company org-unit Site
8400X(config-cert-SS_LC)# key-type rsa key-size 3072
8400X(config-cert-SS_LC)# enroll self-signed
You are enrolling a certificate with the following attributes:
Subject: C=US, ST=CA, L=Rocklin, OU=Site, O=Company,
         CN=SSLeaf
```

```
Key Type: RSA (3072)

Continue (y/n)? y
Self-signed certificate is created and enrolled successfully.
8400X(config-cert-SS_LC)# exit
switch(config)# crypto pki application syslog-client certificate SS_LC
```

Installing a self-signed leaf certificate (created outside the switch)

This procedure describes how to install a self-signed X.509 leaf certificate (that was created outside the switch). And then associate the certificate with one of the following switch features: syslog client, HTTPS server, or HSC (hardware switch controller).

Prerequisites

A self-signed leaf certificate (including private-key data) must be created outside the switch.

Procedure

1. Create the leaf certificate context with the command `crypto pki certificate` which then switches to the created leaf certificate context.
2. Import the leaf certificate data into the switch with the command `import(self-signed leaf certificate)`.
3. Exit the leaf certificate context with the command `exit`.
4. Associate the leaf certificate with a switch feature (syslog client, HTTPS server, or HSC) with the command `crypto pki application`.

Example

This example:

- Creates the leaf certificate context.
- Imports the self-signed leaf certificate.
- Associates the leaf certificate with the syslog client (application) on the switch.

```
switch(config)# switch(config)# crypto pki certificate SS_LC2
switch(config)# switch(config-cert-SS_LC)# import terminal self-signed
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIFRDCCAyygAwIBAgIQP8nnS2Vp15u07xXMdktDJzANBgkqhkiG9
switch(config-cert-import)# MQswCQYDVQQGEwJVUEOMAwGA1UECgwFXJ1YmxDAOgNBAMMB1Jvb3gw
switch(config-cert-import)# HhcNMTkNDEwMjIwNT1WhcjIwMTA0MjIwNE1WjBzQswQYDVQQGEwJV
...
switch(config-cert-import)# 1fIYZYGQyla0AwFuPTTxBXHYwRxTPbUYU5tumJrfwRPmE4OVY8S9D
switch(config-cert-import)# 1NGNm3NG03GqPScs/TF9bVyFA5BOrS5lmm7kNfRYlK8D/kMTfRreS
switch(config-cert-import)# YQ1u1NqShps=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)# -----BEGIN ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)# MIIFDjBABgkqhkiG9wBBQ0wMzAbBgkqkiw0QwwDQImNpJMN7sVGwC
switch(config-cert-import)# MBQGCCqGSIb3DQMHAit+2qadNAASCMg5LYJ4AFm3EffhH5p51Ggr8
switch(config-cert-import)# IJ6L/UhEtH523nUkdV6gvoAWgoYaeD83PeswToAGv5VS8OMFTPttr
...
switch(config-cert-import)# OgSecqZsG6arbx0ESaYBir1c/6rPs1pcjbDxw283DiD1MWOpeoS2a
```

```
switch(config-cert-import)# iKnXnUMpVPfLc74ty2S41DtH0X9Sgf6aa1LjiStg+N7cND9XfGtj/
switch(config-cert-import)# cb4=
switch(config-cert-import)# -----END ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)#
Enter import password: *******
Leaf certificate is validated as self-signed certificate and imported
successfully.
switch(config-cert-SS_LC2)# exit
switch(config)# crypto pki application syslog-client certificate SS_LC2
```

Installing a certificate of a root CA

Prerequisites

- A certificate of a root CA (that is used as the signer).
- Revocation checking URLs for the CA (optional).

Procedure

1. Create a TA profile with the command `crypto pki ta-profile` which then switches to the created TA profile context.

Step 2 is optional and suggested only for advanced users.

2. Optionally enable certificate revocation checking with the command `revocation-check ocsp`. Most certificates contain revocation checking URLs for OCSP. If you want to override these URLs, configure custom revocation checking URLs with the command `ocsp url`.
3. Import the certificate of the root CA with the command `ta-certificate`.

Example

This example installs the certificate **root-cert** and defines custom revocation checking URLs:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# revocation-check ocsp
switch(config-ta-root-cert)# ocsp url primary http://ocsp-server.site.com
switch(config-ta-root-cert)# ocsp url secondary http://ocsp-server2.site.com
switch(config-ta-root-cert)# ta-certificate import terminal
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBqzELMAEBh
switch(config-ta-cert)# VVMxEzARBgNVBAgMCkNhbGlmb3JuaWExEDAOBgNVBAcMB1JvY2tsDAKBg
switch(config-ta-cert)# BAoMA0hQTjEVMBMGA1UECwwMSFBOUm9zZXZpbGxlMSowKAYDVQocG5zdz
...
switch(config-ta-cert)# x3WFf3dFZ8o9sd5LVAHneH/ztb9MP34z+le1V346r12L2kpxmTOVJVyTO
switch(config-ta-cert)# BIzD/ST/HaWI+0S+S80rm93PSscEbb9GWk7vshh5EnW/moehBKcE4O1zy
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYMsAW0nG7yYHWkEOQu9s
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer:  C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=site.com/emailAddress=test.ca@site.com
Subject: C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=8400/emailAddress=test.ca@site.com
Serial Number: 12121221634631568498 (0xaea51217d5945772)
```

```
TA certificate import is allowed only once for a TA profile
Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-root-cert)#
```

Installing a downloadable user role certificate

This procedure describes how to create and install a downloadable user role (DUR) certificate.

Prerequisites

- A certificate of a root CA (that is used as the signer).

Procedure

1. Create a TA profile with the command `crypto pki ta-profile` which then switches to the created TA profile context.
2. Import the certificate of the root CA with the command `ta-certificate`.

Example

```
switch(config)# crypto pki ta-profile DUR-cert
switch(config-ta-DUR-cert)# ta-profile
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)#
MIIGFjCCA/6gAwIBAgIJAMtlKN7Gy9GCMA0GCSqGSIb3DQEBCwUAMIGWMQswCQYD
VQQGEwJJTjESMBAGA1UECAwJS2FybmF0YWdhMRIwEAYDVQQHDAlCYW5nYWxvcmUx
DDAKBgNVBAoMA0hQRTEMMAoGA1UECwwDSFBOMRcwFQYDVQQDDA4xNS4yMTIuMjIx
LjE5NDEqMCgGCSqGSIb3DQEJARYbcmFkaGFrcmlzaG5hbi5nb3BhbEBocGUuY29t
MCAXDTIwMDExNTA5MzgwM1oYDzQxODMxMDIyMDkzODAzWjCBljELMAkGA1UEBhMC
SU4xEjAQBgNVBAgMCUthcm5hdGFnYTESMBAGA1UEBwwJQmFuZ2Fsb3JlMQwwCgYD
VQQKDANIUEUxDDAKBgNVBAsMA0hQTjEXMBUGA1UEAwwOMTUuMjEyLjIyMS4xOTQx
KjAoBgkqhkiG9w0BCQEWG3JhZGhha3Jpc2huYW4uZ29wYWxAaHBlLmNvbTCCAiIw
DQYJKoZIhvcNAQEBBQADggIPADCCAgoCggIBALs99p/xrJHXgYTAiV4WjwgHgJJt
aRwisIoA8iKBZN3zmc1HKJNeGHYXJl0QNC7xfAFSptwgmQ+bhawLuGLNWWMlzQdP
68GmJS1Ojn1xkQ1VIwjrDCfk5t7RAMY/bZKPRjPnfzbZ03Nv3tqp9h/bWTP1y17S
SzYdDF9SiEVfx/4EWicXIDx2ie44kE+9CGB817Q/kovALiIjREJxtv2WJLvE4g/X
2pBu2WMMKhxU95JX2WdIrbHLM1sETUMvb6itg6jfhnPDIzWF5Xbb0c22HsJ6Ynvy
FylHqkN5QjTBaWo9UpvVeeNEAl2tm8D7UsRGJO5u0Y01j4Xp1bQgDf/S6b6LHYQZ
4TLZIEjBn9tH1hXoPd0wXAdpXnYqBZ0UO4ZHaRxvG5wEsvZ3LOyJXNU1J2Z5osC+
HkJRr5tMKV9Dc0gON81LPXj4+JmubyWi7ABM8+ktNyDqTeGqMaUZaB+NvGwQyMUr
Ntgvam9ntI+/njW0ViKYEwQJ4OB9D+0sWXJHFrqfZpbVYTQjZktDDnVhSL9Z5Fce
5+AIBBlCCFcNc933fv29jC0oVWjZ2RHt/8B0DdPY/hDPb0epy+WEosxIQzQ++D+M
s9aBPYVgwCKE2mkT6lnqBhAaNNiSK7wiUU92rHvYhRr2W6Zib+wU9BFWZIzFKbXd
D8I7P0Zm0hf/j0wVAgMBAAGjYzBhMB0GA1UdDgQWBBRV0riw2MVuuc/Y9VtGgstN
PTrm+DAfBgNVHSMEGDAWgBRV0riw2MVuuc/Y9VtGgstNPTrm+DAPBgNVHRMBAf8E
BTADAQH/MA4GA1UdDwEB/wQEAwIBhjANBgkqhkiG9w0BAQsFAAOCAgEAU7fff1Ci
lyA7yq37jlxzdnGXiuR+00xiuZ62xBcu6F/p2SwsieesQCJ2odiOcaqeYXIAIiI2
EAHpesan7OQap2KQ/Xw/00H3/q+SQo47LiGiZjWLeGjaJ5NXBBra6MhZXjli1EEG
70Qn0dehM7am5bsLRhYvRR+TesWEceNoFQN11yiqpGWCPII8Q4eL4MsSTEMl6Qki
yaVDzQko2FW9P3sDV7RGwKrxJIYT8HqPrU6WZUaT7+C0G5EwqP8peg7HOaInKM6Z
lsmFXaSlTvHGbgjJm8uReWr1wNr+V3nugzOCUFspy32OexP90fJ873K1glIbEfxw
bmWMq6za1KQ9rzyNVI2ucp9F7oyXz0vy/6/Fagu1Kkv2BoUxExU9AVwCkDsdVnun
IuQMly2CVGpj+5bhcDRS3ZUmKWAMw0uBwky0BiE1A48LN7R/OYbOmr4QkmveAJAD
MOZIGK4KbutsrIGsT0vs+lU9wrfdiG2TiZ1hsWIT47EYg/C9ZkeDtQUuilob6uaO
Wt/2il/ePUbsSZn9YX9jLBNEsNWbW9B5wyqhAh1AwOpC5KVkHPOsXPOLJZPNO2RI
UKVv7wqGQMMFwKVnn4MoNEdQCYwRsTt6l0+yY1C1dA6xsG0LUXa2SpuX/gpovaNW
```

```
6VA2QAAIJIcSFB4Ky1gncPvV2gUr+GbD0lM=
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
```

Installing a CA-signed leaf certificate (initiated in the switch)

This procedure describes how to create and install an X.509 leaf certificate that is initiated inside the switch but signed outside the switch by a CA. And then associate the certificate with one of the following switch features: syslog client, HTTPS server, or HSC (hardware switch controller).

Prerequisites

Root CA certificate `root-cert` must be installed as described in Installing a certificate of a root CA.

Procedure

1. Create a leaf certificate context with the command `crypto pki certificate` which then switches to the created leaf certificate configuration context.
2. Define leaf certificate properties with the command `subject`.
3. Set the encryption key type for the leaf certificate with the command `key-type`.
4. Generate the certificate signing request (CSR) with the command `enroll terminal`.
5. Use the CSR to obtain a leaf certificate from the root CA, using the root CA directly as the signer CA.
6. Import the leaf certificate into the switch with the command `import(CA-signed leaf certificate)`.
7. Exit the leaf certificate context with the command `exit`.
8. Associate the leaf certificate with a switch feature (syslog client, HTTPS server, or HSC) with the command `crypto pki application`.

Example

This example:

- Creates the leaf certificate context.
- Defines the leaf certificate characteristics.
- Generates the leaf certificate signing request in the switch for getting signed outside the switch by a CA.
- Imports the CA-signed leaf certificate into the switch.
- Associates the leaf certificate with the syslog client (application) on the switch.

```
switch(config)# crypto pki certificate lcert
switch(config-cert-lcert)# subject common-name Leaf country US state CA
 locality Rocklin org Company org-unit Site
switch(config-cert-lcert)# key-type rsa key-size 3072
switch(config-cert-lcert)# enroll terminal
You are enrolling a certificate with the following attributes:
Subject: C=US, ST=CA, L=Rocklin, O=Company, OU=Site
         CN=Leaf
Key Type: RSA (2048)
```

```
Continue (y/n)? y

-----BEGIN CERTIFICATE REQUEST-----
MIIBozCCAQwCAQAwYzEVMBMGA1UEAxMMcG9kMDEtODQwMC0xMQ4wDAYDV
nViYTEMMAoGA1UEChMDSFBFMRIwEAYDVQQHEwlSb3NldmlsbGUxCzAJBg
NBMQswCQYDVQQGEwJVUzCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYE
...
GBAJ4L3lFFfWBEL+KAKpOGjZcVmwlBMqSKFtOFNF9nzmUmONmU3SKy6dz
7Au22mf3lWDxzrtCC/dj5RtWJeJekxp2LCIK/3eRXUwbYveQDKcxH7j9Z
ace+2tA68F2vlgRCQ/hcQH0YmNuaq4Ne3w0dhm7HlUrx
-----END CERTIFICATE REQUEST-----

switch(config-cert-lcert)# import terminal ta-profile root-cert
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIFRDCCAyygwIBAgIQPnnS2Vp5u07XMdktDJzANBgkqhkiG9w0Bv
switch(config-cert-import)# MQswCQYDVQQGEwJVEOMAwG1UECgwFJ1YmxDAOgNBMMB1Jvb3QgQ0Ew
switch(config-cert-import)# HhcNMTkNDEwMjIwNTWcjIwMTA0MjwNE1WBzQswQYDVQQGEwJVUzEL
...
switch(config-cert-import)# 1fIYZYGQyla0AwFuTTxBXYwRxPbUYU5tumrfwRPmE4OVY8S9DQgcr
switch(config-cert-import)# 1NGNm3NG03GqPcs/T9bVyF5BOrS5lmm7kNfRYl8D/kMTfRreSdxis
switch(config-cert-import)# YQ1u1NqShps=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)#
Leaf certificate is validated with root-cert and imported successfully.
switch(config-cert-lcert)# exit
switch(config)# crypto pki application syslog-client certificate lcert
```

Installing a CA-signed leaf certificate (created outside the switch)

This procedure describes how to install an X.509 leaf certificate that was created and signed (by a CA) outside the switch. And then associate the certificate with one of the following switch features: syslog client, HTTPS server, or HSC (hardware switch controller).

Prerequisites

- Root CA certificate `root-cert` installed as described in Installing a certificate of a root CA.
- A CA-signed leaf certificate (including private-key data) created outside the switch.

Procedure

1. Create the leaf certificate context with the command `crypto pki certificate` which then switches to the created leaf certificate context.
2. Import the leaf certificate into the switch with the command `import (CA-signed leaf certificate)`.
3. Exit the leaf certificate context with the command `exit`.
4. Associate the leaf certificate with a switch feature (syslog client, HTTPS server, or HSC) with the command `crypto pki application`.

Example

This example:

- Creates the leaf certificate context.
- imports the CA-signed leaf certificate.
- Associates the leaf certificate with the syslog client (application) on the switch.

```
switch(config)# switch(config)# crypto pki certificate CA_LC
switch(config)# switch(config-cert-CA_LC)# import terminal ta-profile root-cert
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIFRDCCAyygAwIBAgIQP8nn2Vp15u07XMktDJANBgkqhkiG9w0Bv
switch(config-cert-import)# MQswCQYDVQQGEwJVUEOMAw1UECgwFX1YmxDOgNBAMMB1Jvb3QgQ0Ew
switch(config-cert-import)# HhcNMTkNDEwMjIwNT1WhjIMTA0MjIwNE1jBzQswYDVQQGEwJVUzEL
...
switch(config-cert-import)# 1fIYZYGQyla0AwFuPTTxBXHYRxTPbUYUtmJrwRPmE4OVY8S9DQgcr
switch(config-cert-import)# 1NGNm3NG03GqPScs/TF9bVyFABOrlmm7kNfRlK8D/kMTfRreSdxis
switch(config-cert-import)# YQ1u1NqShps=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)# -----BEGIN ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)# MIIFDjBABgkqhkiG9wBBQ0wMzAbBgkiwQwwQImNpJMN7sVGwCAggA
switch(config-cert-import)# MBQGCCqGSIb3DQMHAit+2qadNAASCMgLYJ4AFEfhH5p51Ggr86VqS
switch(config-cert-import)# IJ6L/UhEtH523nUkdV6gvoAWgoYaeD8eswAGv5VS8OMFTPttrn5/K
...
switch(config-cert-import)# OgSecqZsG6arbx0ESaYBir1c6rPs1pcbDx283DD1MWOpeoS2aEmOX
switch(config-cert-import)# iKnXnUMpVPfLc74ty2S41tH0X9gfaa1LiStg+N7cND9XfGtjaV2+/
switch(config-cert-import)# cb4=
switch(config-cert-import)# -----END ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)#
Enter import password: *******
Leaf certificate is validated with root-cert and imported successfully.
switch(config-cert-CA_LC)# exit
switch(config)# crypto pki application syslog-client certificate CA_LC
```

PKI commands

crypto pki application

```
crypto pki application <APP-NAME> certificate <CERT-NAME>
no crypto pki application <APP-NAME> certificate <CERT-NAME>
```

Description

Associates a leaf certificate with a feature (application) on the switch. By default, all features are associated with the default, self-signed certificate `local-cert`. This certificate is created by the switch the first time it starts.

The `no` form of this command associates the specified feature with the default certificate.

Parameter	Description
<APP-NAME>	Specifies the name of a feature on the switch: ▪ `dot1x-supplicant`: 802.1X supplicant ▪ `est-client`: EST client ▪ `hsc`: Hardware switch controller ▪ `https-server`: HTTPS server ▪ `syslog-client`: Syslog client `syslog-client` communicates with syslog server over TLS. You can associate a certificate with the `syslog-client`

Parameter	Description
	application by enrolling the certificate manually or through EST.
<CERT-NAME>	Specifies the name of an installed leaf certificate.

Examples

Associating the EST client with leaf certificate **leaf-cert1**:

```
switch(config)# crypto pki application est-client certificate leaf-cert1
```

Associating the syslog client with leaf certificate **leaf-cert**:

```
switch(config)# crypto pki application syslog-client certificate leaf-cert
```

Setting the syslog client to use the default certificate:

```
switch(config)# no crypto pki application syslog-client certificate
```

Associating the HTTPS server with leaf certificate **leaf-cert2**:

```
switch(config)# crypto pki application https-server certificate leaf-cert2
```

Associating the 802.1X supplicant with leaf certificate **cert1**:

```
switch(config)# crypto pki application dot1x-supplicant certificate cert1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

crypto pki certificate

```
crypto pki certificate <CERT-NAME>
no crypto pki certificate <CERT-NAME>
```

Description

Creates a leaf certificate and changes to its context `config-cert-<CERT-NAME>`. If the specified leaf certificate exists, this command changes to its context.

The first time the switch starts it creates a self-signed, default leaf certificate called `local-cert`. This certificate is used by any switch application that does not have an associated leaf certificate.

The `no` form of this command deletes the specified leaf certificate. The default leaf certificate `local-cert` cannot be deleted.

Parameter	Description
<CERT-NAME>	Specifies the name of a leaf certificate. Range: 1 to 32 alphanumeric characters (excluding ").

Examples

Creating leaf certificate **leaf-cert**:

```
switch(config)# crypto pki certificate leaf-cert
switch(config-cert-leaf-cert)#
```

Deleting leaf certificate **leaf-cert**:

```
switch(config)# no crypto pki certificate leaf-cert
The leaf certificate has associated applications. Deleting the certificate
will make the applications use the default certificate local-cert.
Continue (y/n)? y
switch(config)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

crypto pki ta-profile

`crypto pki ta-profile <TA-NAME>`
`no crypto pki ta-profile <TA-NAME>`

Description

Creates a trust anchor (TA) profile and changes to the `config-ta-<TA-NAME>` context for the profile. Each TA profile stores the certificate for a trusted CA. Up to 64 profiles can be defined.

If the specified TA profile exists, this command changes to the `config-ta-<TA-NAME>` context for the profile.

The `no` form of this command removes the specified TA profile.

When creating a new profile, If you exit the `config-ta-<TA-NAME>` context without importing the TA certificate, the profile is discarded.

Parameter	Description
<TA-NAME>	Specifies the TA profile name. Range: 1 to 48 alphanumeric characters excluding ". **NOTE:** The TA profile name cannot end with `est-ta<nn>` where *<nn>* is `00` to `99`. For example, `company-trust-anchor-est-ta01` is not allowed. This TA profile name suffix is reserved for TA profiles that are created for CA certificates from EST servers.

Examples

Creating the TA profile **root-cert**:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)#
```

Removing TA profile **root-cert**:

```
switch(config)# no crypto pki ta-profile root-cert
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

enroll self-signed

`enroll self-signed`

Description

Generates a key pair and generates a self-signed certificate with it.

The subject fields and key type of the current leaf certificate must be defined before running this command. If not, you are prompted to fill in the subject fields, and the key type is set to `RSA 2048`.

Example

Enrolling the leaf certificate **leaf-cert**:

```
switch(config-cert-leaf-cert)# enroll self-signed
You are enrolling a certificate with the following attributes:
Subject: C=US, ST=CA, L=Rocklin, OU=Site, O=Comp,
         CN=Leaf01
Key Type: RSA (2048)

Continue (y/n)? y
Self-signed certificate is created and enrolled successfully.

switch(config-cert-leaf-cert)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

enroll terminal

`enroll terminal`

Description

Generates a key pair and certificate signing request (CSR) for the current leaf certificate. Use the CSR to obtain a signed certificate from a certificate authority (CA), and then import the certificate onto the switch with the command `import terminal`.

The key type, and the certificate common name in the subject fields of the current leaf certificate must be completed before running this command.

Example

Enrolling the leaf certificate **leaf-cert**:

```
switch(config-cert-leaf-cert)# enroll terminal
You are enrolling a certificate with the following attributes:
Subject: C=US, ST=CA, L=Rocklin, OU=Site, O=Comp,
         CN=Leaf01
Key Type: RSA (2048)

Continue (y/n)? y

-----BEGIN CERTIFICATE REQUEST-----
MIIBozCCAQwCAQAwYzEVMBMGA1UEAxMMcG9kMDEtODQwMC0xMQ4wDAYDVQQLEwV
nViYTEMMAoGA1UEChMDSFBFMRIwEAYDVQQHEwlSb3Nldmlsb GUxCzAJBgNVBAgT
NBMQswCQYDVQQGEwJVUzCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYEAtKcLS
...
GBAJ4L3lFFfWBEL+KAKpOGjZcVmwlBMqSKFtOFNF9nzmUmONmU3SKy6dzQ+6ynR
7Au22mf3lWDxzrtCC/dj5RtWJeJekxp2LCIK/3eRXUwbYveQDKcxH7j9ZB+BAp2
ace+2tA68F2vlgRCQ/hcQH0YmNuaq4Ne3w0dhm7HlUrx
```

```
-----END CERTIFICATE REQUEST-----
switch(config-cert-leaf-cert)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

import (CA-signed leaf certificate)

```
import terminal ta-profile <TA-NAME> [password <PW>]
import <REMOTE-URL> ta-profile <TA-NAME> [password <PW>][vrf <VRF-NAME>]
import <STORAGE-URL> ta-profile <TA-NAME> [password <PW>]
```

Description

Imports a CA-signed leaf certificate and then validates the certificate against the specified TA profile. If the imported data includes a private key, the private key must match the leaf certificate being imported. If the imported data does not include a private key, the certificate must match a CSR that was previously generated with the command `enroll terminal` and must be signed by the CA whose root certificate is installed in the specified TA profile. The TA profile must exist and have a TA certificate configured.

Parameter	Description
`terminal`	Import the certificate by pasting PEM-format data at the console. Upon execution, the `config-cert-import` context is entered for certificate pasting. To complete certificate data entry press Control-D in your terminal program. Alternatively, the pasted certificate data can include at its end the delimiter `END_OF_CERTIFICATE` (after the `-----END CERTIFICATE-----` line), making entry of Control-D unnecessary.
`ta-profile <TA-NAME>`	Specifies the TA profile name. Range: 1 to 48 alphanumeric characters excluding ".
`password <PW>`	Specifies the plaintext password used to decrypt the private key in the imported certificate data. When this parameter is omitted, the password is prompted for as required. Range: 1 to 32 alphanumeric characters.
`<REMOTE-URL>`	Specifies a certificate data file on a remote TFTP or SFTP server. The URL syntax is: `{tftp:// | sftp://<USER>@} {<IP>|<HOST>} [:<PORT>] [;blocksize=<SIZE>]/<FILE>`
`vrf <VRF-NAME>`	Specifies the name of the VRF to use for the remote URL file

Parameter	Description
	transfer. The default is `mgmt`.
<STORAGE-URL>	Available on switch families that provide USB device file import capability, specifies a certificate data file on a USB storage device inserted in the switch USB port. The URL syntax is `usb:/<FILE>`.

Usage

- The imported data must include all the intermediate CA certificates in the certificate chain leading to the certificate imported into the specified TA profile.
- This command cannot be used with the default certificate `local-cert`.
- The PEM data format is supported for all import sources. The PKCS#12 data format is supported for *<REMOTE-URL>* and *<STORAGE-URL>*.
- The PEM data must be delimited with these lines for the certificate data:

```
-----BEGIN CERTIFICATE-----
-----END CERTIFICATE-----
```

And the PEM data must be delimited with either of these line pairs for the private key data:

```
-----BEGIN PRIVATE KEY-----
-----END PRIVATE KEY-----

-----BEGIN ENCRYPTED PRIVATE KEY-----
-----END ENCRYPTED PRIVATE KEY-----
```

Examples

Importing a leaf certificate from the console:

```
switch(config)# crypto pki certificate leaf-cert
switch(config-cert-leaf-cert1)# import terminal ta-profile root-cert
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIIFRDCCAyygAwIBAgQP8nS2Vp15u0xXMdkDJzANBgkqhkiG9w0Bv
switch(config-cert-import)# MQswCQYDVQGEwJVUEOMAwGA1UCgwFXJ1YmDAgNBAMM1Jvb3QgQ0Ew
switch(config-cert-import)# HhcNMTkNDEwMjIwNT1WhcjIwMT0MjwNE1WjzQswQDVQQGEwJVUzEL
...
switch(config-cert-import)# 1fIYZYGQyla0AwFuPTTxBXHYwRxTPbUYU5umJfRPmE4VY8S9DQgcr
switch(config-cert-import)# 1NGNm3NG03GqPScs/TF9bVyFA5BOS5lmmkfRYK8D/kMTfRreSdxis
switch(config-cert-import)# YQ1u1NqShps=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)# -----BEGIN ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)# MIIFDjBABgkqhkiG9wBBQ0wMzAbBgqkw0QwwDQIpJMN7sVGwCAggA
switch(config-cert-import)# MBQGCCqGSIb3DQMHAit+2qadNAASCgLYJ4Am3EfhH5p51Ggr86VqS
switch(config-cert-import)# IJ6L/UhEtH523nUkdV6gvAgoYaD83PswToAGv5VS8OMFTPttrn5/K
...
switch(config-cert-import)# OgSecqZsG6arbx0ESaYBir1c/6rPspcjbx283iD1MWOpeoS2aEmOX
switch(config-cert-import)# iKnXnUMpVPfLc74ty2S41DtH0X9gf6aa1jStg+7cND9XfGtjaV2+/
switch(config-cert-import)# cb4=
switch(config-cert-import)# -----END ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)#
Enter import password: *******
Leaf certificate is validated with root-cert and imported successfully.
switch(config-cert-leaf-cert)#
```

Importing a leaf certificate from a remote file:

```
switch(config)# crypto pki certificate leaf-cert2
switch(config-cert-leaf-cert2)# import tftp://1.1.1.2/c2.p12 ta-profile root-cert
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  3722  100  3722    0     0   391k      0 --:--:-- --:--:-- --:--:--  391k
100  3722  100  3722    0     0   376k      0 --:--:-- --:--:-- --:--:--  376k
Enter import password: *******
Leaf certificate is validated with root-cert and imported successfully.
switch(config-cert-leaf-cert2)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

import (self-signed leaf certificate)

```
import terminal self-signed [password <PW>]
import <REMOTE-URL> self-signed [password <PW>][vrf <VRF-NAME>]
import <STORAGE-URL> self-signed [password <PW>]
```

Description

Imports a self-signed leaf certificate including its matching private key.

Parameter	Description
`terminal`	Import the certificate by pasting PEM-format data at the console. Upon execution, the `config-cert-import` context is entered for certificate pasting. To complete certificate data entry press Control-D in your terminal program. Alternatively, the pasted certificate data can include at its end the delimiter `END_OF_CERTIFICATE` (after the `-----END CERTIFICATE-----` line), making entry of Control-D unnecessary.
`password <PW>`	Specifies the plaintext password used to decrypt the private key in the imported certificate data. When this parameter is omitted, the password is prompted for as required. Range: 1 to 32 alphanumeric characters.
<REMOTE-URL>	Specifies a certificate data file on a remote TFTP or SFTP server. The URL syntax is: `{tftp:// | sftp://<USER>@} {<IP>|<HOST>} [:<PORT>] [;blocksize=<SIZE>]/<FILE>`
`vrf <VRF-NAME>`	Specifies the name of the VRF to use for the remote URL file transfer. The default is `mgmt`.

Parameter	Description
<STORAGE-URL>	Available on switch families that provide USB device file import capability, specifies a certificate data file on a USB storage device inserted in the switch USB port. The URL syntax is `usb:/<FILE>`.

Usage

- This command cannot be used with the default certificate `local-cert`.
- The PEM data format is supported for all import sources. The PKCS#12 data format is supported for *<REMOTE-URL>* and *<STORAGE-URL>*.
- The PEM data must be delimited with these lines for the certificate data:

```
-----BEGIN CERTIFICATE-----
-----END CERTIFICATE-----
```

And the PEM data must be delimited with either of these line pairs for the private key data:

```
-----BEGIN PRIVATE KEY-----
-----END PRIVATE KEY-----

-----BEGIN ENCRYPTED PRIVATE KEY-----
-----END ENCRYPTED PRIVATE KEY-----
```

Example

Importing a self-signed leaf certificate from the console:

```
switch(config)# crypto pki certificate ss-leaf-cert
switch(config-cert-ss-leaf-cert)# import terminal self-signed
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-cert-import)# -----BEGIN CERTIFICATE-----
switch(config-cert-import)# MIID2TCCAsGgAwIBAgIJAKcrqokm6p9GMA0GCSqGSIb3DQEBCwUAM
switch(config-cert-import)# tDCCA5ygAwIBAgICEAEwDQYJKoZIhvcNAQELBQAwgYgxCzABAYTAl
switch(config-cert-import)# VQQGEwJVUzELMAkGA1UECAwCQ0ExDTALBgNVBAcMBFJvc2UxDDAKB
...
switch(config-cert-import)# +fWQLxhp+jKJGZGOZz/FENt2uSfZHzlXiu8n3g+EgqExenY1pBRJr
switch(config-cert-import)# VuEEoNb/YfkPXHHva4Zfx223q+f694wlVsHkENSzqr2goHpa2fOzq
switch(config-cert-import)# alewwdmVqCES+x8bvhf3C/6IB6ePkEsnMlHNTeM=
switch(config-cert-import)# -----END CERTIFICATE-----
switch(config-cert-import)# -----BEGIN ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)# MIIFDjBABgkqhkiG9w0BBQ0wMzAbBgkqhkiG9w0BBQwwDgQIt8Ni3
switch(config-cert-import)# MBQGCCqGSIb3DQMHBAiBHrejkcdpdASCBMjVxrrYYPNt3V1abr9k8
switch(config-cert-import)# 5GE0U99awh9ys4360WR95xOFGThvjkTyRWG511nGwVeLZs/7TPXWI
...
switch(config-cert-import)# hzc5ZT/w2F08icRI5mFbGoTAAw9IIWMOXGweaWQJDyKGrhg89GrnV
switch(config-cert-import)# M2UuP/tYuuO328QcenKZEJmZKCbx78oFRR+pgma4oeMaFTIyXE6Pr
switch(config-cert-import)# GAdCK8tkDiJ9DKbqdM5W0/nTJfqwUQlfl27dNrBAodsHdrw3UR99H
switch(config-cert-import)# SPo=
switch(config-cert-import)# -----END ENCRYPTED PRIVATE KEY-----
switch(config-cert-import)#
Enter import password: *******
Leaf certificate is validated as self-signed certificate and imported
successfully.
switch(config-cert-ss-leaf-cert)#
```

Importing a leaf certificate from a remote file:

```
switch(config)# crypto pki certificate ss-leaf-cert2
switch(config-cert-ss-leaf-cert2)# import tftp://1.1.1.2/ss2.p12 self-signed
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  3230  100  3230    0     0   875k      0 --:--:-- --:--:-- --:--:--  875k
100  3230  100  3230    0     0   831k      0 --:--:-- --:--:-- --:--:--  831k
Enter import password: *******
Leaf certificate is validated as self-signed certificate and imported
successfully.
switch(config-cert-ss-leaf-cert2)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

key-type

`key-type {rsa [key-size <K-SIZE>] | ecdsa [curve-size <C-SIZE>]}`

Description

Sets the key type and key size for the current leaf certificate. The key type of the default certificate `local-cert` cannot be changed.

Parameter	Description
`rsa`	Selects the RSA key type.
`key-size <K-SIZE>`	Specifies the RSA key size in bits. Supported values: 2048, 3072, 4096. Default: 2048
`ecdsa`	Selects the ECDSA key type.
`curve-size <C-SIZE>`	Specifies the ECDSA elliptic curve size in bits. Supported values: 256, 348, 521. Default: 256

Examples

Setting RSA encryption on the leaf certificate **leaf-cert**:

```
switch(config)# crypto pki certificate leaf-cert
switch(config-cert-leaf-cert)# key-type rsa key-size 3072
```

Setting ECDSA encryption on the leaf certificate **leaf-cert**:

```
switch(config)# crypto pki certificate leaf-cert
switch(config-cert-leaf-cert)# key-type ecdsa curve-size 521
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

ocsp disable-nonce

```
ocsp disable-nonce
no ocsp disable-nonce
```

Description

Configures exclusion of the nonce from OCSP requests. A nonce is a unique identifier that an OCSP client inserts in an OCSP request and expects the OCSP responder to include it in the corresponding OCSP response. The nonce mechanism helps prevent replay attacks in which a malicious player attempts to masquerade as the OCSP responder. Although the nonce is included by default, it can be excluded. Some OCSP responders choose to not support the use of the nonce due to performance considerations.

The `no` form of this command re-enables nonce inclusion in OCSP requests.

Examples

Disable inclusion of the nonce in OCSP requests for TA profile `root-cert`:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# ocsp disable-nonce
```

Enable inclusion of the nonce in OCSP requests for TA profile `root-cert`:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# no ocsp disable-nonce
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-ta-<TA-NAME>`	Administrators or local user group members with execution rights for this command.

ocsp enforcement-level

```
ocsp enforcement-level {strict | optional}
no enforcement-level
```

Description

Sets either strict or reduced enforcement of the OCSP check of certificates. Strict enforcement is enabled by default.

The `no` form of this command resets enforcement to its default of `strict`.

Parameter	Description
`strict`	Sets strict OCSP checking of certificates. The certificate is accepted only if all possible checking (including validation failures, software system errors, configuration errors, transactional errors) is successful.
`optional`	Sets reduced OCSP checking of certificates. The certificate is accepted unless one or more of these validation errors occur: ■ Response signature invalid. ■ Nonce in response mismatch. ■ Certificate revoked, but only when revocation checking is possible. if revocation check is not possible, the certificate is still accepted if there are no other validation errors.

Examples

Setting reduced OCSP checking of certificates:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# ocsp enforcement-level optional
```

Setting strict OCSP checking of certificates:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# ocsp enforcement-level strict
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-ta-<TA-NAME>`	Administrators or local user group members with execution rights for this command.

ocsp url

```
ocsp url {primary | secondary} <URL>
no ocsp url {primary | secondary}
```

Description

Configures the OCSP responder URLs that the current TA profile uses to verify the revocation status of an X.509 digital certificate. These URLs override the OCSP responder URL contained within the peer certificate being verified (as well as URLs defined in any intermediate CAs in the chain of trust).

If no OCSP responder URLs are defined for a TA profile (default setting), then the OCSP responder URL in the peer certificate is used for revocation status checking. (The OCSP responder URL is contained in a certificate's Authority Information Access field, which is an X.509 v3 certificate extension.)

The `no` form of this command deletes the specified OCSP responder URL (primary or secondary) from the current TA profile.

Parameter	Description
`{primary | secondary} <URL>`	Specify the HTTP URL of the primary or secondary OCSP responder using either a fully qualified domain name or IPv4 address.

Examples

Defining the primary OCSP URL for the TA profile **root-cert**:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# revocation-check ocsp
switch(config-ta-root-cert)# ocsp url primary http://ocsp-server.site.com
```

Removing the primary OCSP URL from the TA profile **root-cert**:

```
switch(config)# crypto pki ta-profile oot-cert
switch(config-ta-root-cert)# revocation-check ocsp
switch(config-ta-root-cert)# no ocsp url primary
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-ta-<TA-NAME>`	Administrators or local user group members with execution rights for this command.

ocsp vrf

```
ocsp vrf <VRF-NAME>
no ocsp vrf
```

Description

Sets the VRF that the switch uses to communicate with OCSP responders for OCSP checking. VRF mgmt is used by default.

The `no` form of this command resets the VRF to its default `mgmt`.

Parameter	Description
<VRF-NAME>	Specifies the name of the VRF the switch uses to communicate with OCSP responders. Default: `mgmt`.

Examples

Reverting the OCSP responder VRF to its default:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# no ocsp vrf
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-ta-<TA-NAME>`	Administrators or local user group members with execution rights for this command.

revocation-check ocsp

```
revocation-check ocsp
no revocation-check
```

Description

Enables certificate revocation checking for the current profile using the online certificate status protocol (OCSP).

The `no` form of this command disables certificate revocation checking for the current profile.

Examples

Enabling revocation checking for the TA profile **root-cert**:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# revocation-check ocsp
```

Disabling revocation checking for the TA profile **root-cert**:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# no revocation-check
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config-ta-*<TA-NAME>*	Administrators or local user group members with execution rights for this command.

show crypto pki application

```
show crypto pki application
```

Description

Shows certificate information for all features (applications) using leaf certificates that are managed by PKI.

Examples

Showing certificate information for all features (applications) using leaf certificates:

```
switch# show crypto pki application1

Associated Applications  Certificate Name       Cert Status
-----------------------  ---------------------- --------------------------------
https-server                                    not configured, using local-cert
syslog-client            local-cert             valid
hsc                      xhsccert               invalid, using local-cert
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show crypto pki certificate

`show crypto pki certificate [<CERT-NAME> [plaintext | pem]]`

Description

Shows a list of all configured leaf certificates, or detailed information for a specific leaf certificate.

Possible values for Cert Status are: `CSR pending`, `expired`, `expires soon`, `installed`, `malformed`, `not yet known`.

Possible values for EST Status are: `enroll failed`, `enroll pending`, `enroll retrying`, `enroll success`, `n/a` (certificate is not EST-enrolled), `reenroll failed`, `reenroll pending`, `reenroll retrying`.

Parameter	Description
<CERT-NAME>	Specifies the leaf certificate name. Range: 1 to 32 alphanumeric characters excluding "
`plaintext`	Shows certificate information in plain text.
`pem`	Shows certificate information in PEM format.

Examples

Showing a list of all configured leaf certificates:

```
switch# show crypto pki certificate

Certificate Name     Cert Status    EST Status        Associated Applications
-------------------- -------------- ----------------- ---------------------------
--
device-identity      installed      n/a               none
pod01-test-1         installed      n/a               dot1x-supplicant
pod01-99-1           installed      n/a               https-server, est-client
syslog-1             CSR pending    enroll retrying   syslog-client
leaf-cert1           installed      enroll success    none
leaf-cert2           CSR pending    enroll failed     none
```

Showing detailed information (in plaintext format) for leaf certificate `pod01-99-1`:

```
switch# show crypto pki certificate pod01-99-1 plaintext

  Certificate Name: pod01-99-1
  Associated Applications:
    https-server, est-client
  Certificate Status: installed
  EST Status: n/a
  Certificate Type: regular
  Intermediates:
    Subject: C = US, ST = CA, O = Company, OU = Lab-IT, CN = DeviceCA
      Issuer: C = US, ST = CA, O = Company, OU = Lab-IT, CN = Lab-CA
      Serial Number: 0x02
```

```
    Subject: C = US, ST = CA, O = Company, OU = Lab-IT, CN = Lab-CA
      Issuer: C = US, ST = CA, O = Company, OU = Lab-IT, CN = Lab-Root
      Serial Number: 0x01
  Certificate:
    Data:
        Version: 1 (0x0)
        Serial Number: 14529416756121781768 (0xc9a2db8f3e3f4608)
    Signature Algorithm: sha256WithRSAEncryption
        Issuer: C=US, ST=CA, OU=Lab-IT, O=Company, CN=DeviceCA
        Validity
            Not Before: Jan 12 23:36:57 2018 GMT
            Not After : Nov  1 23:36:57 2020 GMT
        Subject: C=US, ST=CA, OU=Lab-IT, O=Company, CN=pod01-99-1
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                Public-Key: (2048 bit)
                Modulus:

                    00:a0:cd:ef:1b:f9:b8:bd:39:fc:7a:0e:00:17:ff:
                    2b:72:d8:4e:d4:df:49:36:ca:3a:f9:05:05:d7:e3:
                    d1:97:29:71:e6:33:b8:bb:8e:f0:ee:a6:e4:4a:f8:
                    ...
                    fe:dd:d9:a0:af:59:47:25:b4:34:06:af:03:1d:33:
                    30:c3:85:fe:5c:e7:19:7f:ff:3a:b2:21:b8:e8:ed:
                    83:09
                Exponent: 65537 (0x10001)
    Signature Algorithm: sha256WithRSAEncryption
         39:f6:03:86:03:d9:05:61:39:25:5f:0d:75:cc:05:ae:04:7e:
         4c:a3:13:0b:f0:1e:af:68:0e:40:9f:ed:48:b6:5e:56:8c:53:
         46:5b:c9:a4:e0:b0:bc:31:4b:a7:5d:0a:ed:7c:9c:f6:bf:1e:
         ...
         39:f5:26:58:68:e2:13:ec:94:ac:60:8e:4b:b0:ba:45:cf:d6:
         6a:4b:9f:7d:ae:3f:e5:2e:81:fe:ac:b3:65:44:35:47:a5:2f:
         89:e7:58:a0
```

Showing detailed information (in PEM format) for leaf certificate `leaf-cert1` with a status of `CSR pending`:

```
switch# show crypto pki certificate leaf-cert1 pem

  Certificate Name: leaf-cert1

  Associated Applications:
    syslog-client
  Certificate Status: CSR pending
  EST Status: enroll retrying
  Certificate Type: regular
    -----BEGIN CERTIFICATE REQUEST-----

    MIICtTCCAZ0CAQAwcDEWMBQGA1UEAxMNc3lzbG9nLTg0MBYGA1UECxMPQ
    XJ1YmEtUm9zZXZpbGxlMQ4wDAYDVQQKEYTESMBAGA1EBxMJUm9zZXZpbG
    xlMQswCQYDVQQIEwJDQTELMAGA1UEBhMCVVMwggEiMSIb3DQEBAQUAA4I
    ...
    cw2ytN6Idgh81k59x6DH7V/eORaKd5lq+oO7nkr6+QBf5L3f5Kb+TOFio
    lei+EdCHMxxc07MK0n3dkziSW25HFUGsyEXVMK+BID3zbKDoUe6XVhvqI
    mamXyghigLYDcbsn6WVw==
    -----END CERTIFICATE REQUEST-----
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show crypto pki ta-profile

```
show crypto pki ta-profile [<TA-NAME>]
```

Description

Shows a list of all configured TA profiles, or detailed information for a specific profile.

This command shows information for both directly-configured TA profiles and TA profiles that were dynamically downloaded from EST servers.

Parameter	Description
<TA-NAME>	Specifies the TA profile name. Range: 1 to 48 alphanumeric characters excluding ".

Examples

Showing a list of all configured TA profiles:

```
switch# show crypto pki ta-profile

Profile Name                    TA Certificate     Revocation Check
------------------------------- ------------------ ----------------
BASE_CA                         Installed,valid    disabled
BASE02_CA                       Installed,expired  disabled
root-cert                       Installed,valid    OCSP
ROOT-A_CA                       Not Installed      OCSP
EST-Service1                    Installed,valid    None
EST-Service2                    Installed,valid    None
```

Showing detailed information for TA profile **root-cert**:

```
switch# show crypto pki ta-profile root-cert

  TA Profile Name          : root-cert
  Revocation Check         : OCSP
    OSCP Primary URL       : http://ocsp1.domain.com
    OCSP Secondary URL     : Not Configured
    OCSP Disable-nonce     : false
    OCSP Enforcement Level: strict
    OCSP VRF               : mgmt
  TA Certificate: Installed and valid
```

```
Version: 3 (0x2)
Serial Number:
   74:e6:6d:22:3f:52:cc:94:43:41:ab:66:a8:8d:47:b1
Signature Algorithm: sha1withRSAEncryption
Issuer: OU=DeviceTrust, OU=Operations, O=Site, C=US,
        CN=Site Trusted Computing Root CA 1.0
Validity
   Not Before: Sep 14 03:12:06 2007 GMT
   Not After : Sep 14 03:21:14 2032 GMT
Subject: OU=DeviceTrust, OU=Operations, O=Site, C=US,
         CN=Site Trusted Computing Root CA 1.0
Subject Public Key Info:
   Public Key Algorithm: rsaEncryption
      RSA Public Key: (2048 bit)
      Modulus (2048 bit):
          30:0d:06:09:2a:86:48:86:f7:0d:01:01:01:05:33:
          03:82:01:0f:00:30:82:01:3a:02:82:01:01:00:ac:
          3d:60:3a:2e:ca:a4:34:db:5c:3b:6b:07:df:73:62:
          ...
          20:c8:df:63:14:5a:e8:d3:ea:83:d8:47:a3:b5:2e:
          bb:64:51:f0:be:13:b6:91:e4:32:45:58:5e:1f:0d:
          02:03:01:00:01
      Exponent: 65537 (0x10001)
X509v3 extensions:
   X509v3 Key Usage:
      Digital Signature, Certificate Signing, CRL Signing
   X509v3 Basic Constraints:
      CA:TRUE, pathlen:4
   X509v3 Subject Key Identifier:
      eb:d7:ec:db:8a:cb:f2:51:d5:06:e1:42:7b:39:a7:d0:1e:31:6e:bf

Signature Algorithm: sha1withRSAEncryption
   1c:90:f3:a4:f0:0d:e2:e3:e9:ae:01:e1:7d:a7:13:e2:cc:0b:
   17:31:26:92:a2:5d:1d:19:60:54:03:13:9b:e1:73:6c:e4:b3:
   01:4f:4e:ae:61:bd:ae:b6:12:d3:ab:08:ae:8c:47:92:d7:0d:
   ...
   ca:cf:11:78:55:6d:06:49:fa:d4:8d:f3:ef:7f:79:38:35:5d:
   16:5a:57:7f:a8:dc:b0:f8:a2:04:0d:17:0b:bb:58:32:30:e0:
   2d:a8:37:a2
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

ta-certificate

`ta-certificate { [import [terminal]] | import {<REMOTE-URL> | <STORAGE-URL>} }`

Description

Imports a CA certificate for use in the current TA profile. The certificate must be in PEM format. The PEM data must be delimited with these lines:

```
-----BEGIN CERTIFICATE-----
-----END CERTIFICATE-----
```

Only the first certificate in the PEM data is imported. Any additional certificates are ignored.

Parameter	Description
`[import [terminal]]`	Import the certificate by pasting PEM-format data at the console. Upon execution, the `config-cert-import` context is entered for certificate pasting. To complete certificate data entry press Control-D in your terminal program. Alternatively, the pasted certificate data can include at its end the delimiter `END_OF_CERTIFICATE` (after the `-----END CERTIFICATE-----` line), making entry of Control-D unnecessary.
`import <REMOTE-URL>`	Import the certificate from a file on a remote TFTP or SFTP server. The URL syntax is: `{tftp:// | sftp://<USER>@} {<IP>|<HOST>} [:<PORT>] [;blocksize=<SIZE>]/<FILE>`
`import <STORAGE-URL>`	Available on switch families that provide USB device file import capability, import the certificate from a file on a USB storage device inserted in the switch USB port. The URL syntax is `usb:/<FILE>`.

Example

Importing a certificate into the TA profile **root-cert** by pasting PEM-format certificate data at the console:

```
switch(config)# crypto pki ta-profile root-cert
switch(config-ta-root-cert)# ta-certificate import terminal
Paste the certificate in PEM format below, then hit enter and ctrl-D:
switch(config-ta-cert)# -----BEGIN CERTIFICATE-----
switch(config-ta-cert)# MIIDuTCCAqECCQCuoxeJ2ZNYcjANBgkqhkiG9w0BAQsFADCBqzELMAEBh
switch(config-ta-cert)# VVMxEzARBgNVBAgMCkNhbGlmb3JuaWExEDAOBgNVBAcMB1JvY2tsDAKBg
switch(config-ta-cert)# BAoMA0hQTjEVMBMGA1UECwwMSFBOUm9zZXZpbGxlMSowKAYDVQocG5zdz
...
switch(config-ta-cert)# x3WFf3dFZ8o9sd5LVAHneH/ztb9MP34z+le1V346r12L2kpxmTOVJVyTO
switch(config-ta-cert)# BIzD/ST/HaWI+0S+S80rm93PSscEbb9GWk7vshh5EnW/moehBKcE4O1zy
switch(config-ta-cert)# 3LvMLZcssSe5J2Ca2XIhfDme8UaNZ7syGYMsAW0nG7yYHWkEOQu9s
switch(config-ta-cert)# -----END CERTIFICATE-----
switch(config-ta-cert)#
The certificate you are importing has the following attributes:
Issuer:  C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=site.com/emailAddress=test.ca@site.com
Subject: C=US, ST=CA, L=Rocklin, O=Company, OU=Site,
         CN=9000/emailAddress=test.ca@site.com
Serial Number: 12121221634631568498 (0xaea51217d5945772)

TA certificate import is allowed only once for a TA profile
Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-root-cert)#
```

Importing a certificate into the TA profile **root-cert2** from file `rcert2-data` on the USB device:

```
switch(config)# crypto pki ta-profile root-cert2
switch(config-ta-root-cert2)# ta-certificate import usb:/rcert2-data
The certificate you are importing has the following attributes:
Issuer: C=US, ST=California, L=Rocklin, O=Company, OU=Site,
CN=site.com/emailAddress=test.ca@site.com
Subject: C=US, ST=California, L=Rocklin, O=Company, OU=Site,
CN=9000/emailAddress=test.ca@site.com
Serial Number: 12121221634631568498 (0xaea51217d5945772)

TA certificate import is allowed only once for a TA profile
Do you want to accept this certificate (y/n)? y
TA certificate accepted.
switch(config-ta-root-cert2)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-ta-<TA-NAME>`	Administrators or local user group members with execution rights for this command.

subject

```
subject [common-name <COMMON-NAME>] [country <COUNTRY>] [locality <LOCALITY>]
        [org <ORG-NAME>] [org-unit <ORG-UNIT>] [state <STATE>]
```

Description

Sets the subject fields for the current leaf certificate. If the `common-name` parameter is not specified, then you are prompted to define a value for each field. If a configured value exists for any field, it is presented as the default.

The subject fields of the default certificate `local-cert` cannot be changed.

Parameter	Description
`common-name <COMMON-NAME>`	Specifies the common name.
`country <COUNTRY>`	Specifies the country or region.
`locality <LOCALITY>`	Specifies the locality such as city.
`org <ORG-NAME>`	Specifies the organization.
`org-unit <ORG-UNIT>`	Specifies the organizational unit.
`state <STATE>`	Specifies the state.

Examples

Setting subject fields for the leaf certificate **leaf-cert**:

```
switch(config-cert-leaf-cert)# subject common-name Leaf01 country US
locality CA org Company org-unit Site state CA
```

Setting subject fields for the leaf certificate **leaf-cert** interactively:

```
switch(config-cert-leaf-cert)# subject
Do you want to use the switch serial number as the common name (y/n)? n
Enter Common Name : Leaf01
Enter Org Unit : Site
Enter Org Name : Company
Enter Locality : Rocklin
Enter State : CA
Enter Country : US
switch(config-cert-leaf-cert)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-<CERT-NAME>`	Administrators or local user group members with execution rights for this command.

PKI EST commands

arbitrary-label

```
arbitrary-label <LABEL>
no arbitrary-label
```

Description

Within the EST profile context, configures the generic optional label (also known as arbitrary label) to be concatenated to the EST server URL that is configured with the `url` command. There is no arbitrary label configured by default. Any existing arbitrary label is replaced by this command. The use of arbitrary labels is optional.

RFC 7030 allows the use of arbitrary labels so that one EST server may serve multiple CAs with the same server URL that gets concatenated with different arbitrary labels. The same label is used for every request made under a particular EST profile.

Some EST schemes use arbitrary labels in a more sophisticated way, defining different labels for different types of requests under the same EST profile. For example, the CA certificate request could use the generic label (configured with this `arbitrary-label` command) , the certificate enrollment request could use the enrollment label (configured with the `arbitrary-label-enrollment` command), and the re-enrollment request could use the re-enrollment label (configured with the `arbitrary-label-reenrollment` command). Note that only one label of each of the three available types can be configured in any EST profile.

The no form of this command removes the generic arbitrary label.

Parameter	Description
<LABEL>	Specifies the generic arbitrary label. Range: Up to 64 characters.

Examples

Configuring the URL and generic arbitrary label. Note that with the URL and arbitrary label configured in this example, the final URL the switch uses to request CA certificates from the EST server is `https://est-service999.com/.well-known/est/rsa2048/cacerts`.

```
switch(config)# crypto pki est-profile EST-service1
switch(config)# url https://est-service999.com/.well-known/est
switch(config-est-EST-service1)# arbitrary-label rsa2048
```

Removing the generic arbitrary label:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no arbitrary-label
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-`*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

arbitrary-label-enrollment

```
arbitrary-label-enrollment <LABEL>
no arbitrary-label-enrollment
```

Description

Within the EST profile context, configures the arbitrary enrollment label to be concatenated to the EST server URL that is configured with the `url` command. This label is specific to the enrollment operation. There is no arbitrary enrollment label configured by default. Any existing arbitrary enrollment label is replaced by this command. The use of arbitrary enrollment labels is optional.

When the enrollment label is not configured, the generic arbitrary label (created with the `arbitrary-label` command) is used (if configured) for enrollment.

RFC 7030 allows the use of arbitrary labels so that one EST server may serve multiple CAs with the same server URL that gets concatenated with different arbitrary labels. The same label is used for every request made under a particular EST profile.

Some EST schemes use arbitrary labels in a more sophisticated way, defining different labels for different types of requests under the same EST profile. For example, the CA certificate request could use

the generic label (configured with the `arbitrary-label` command) , the certificate enrollment request could use the enrollment label (configured with this `arbitrary-label-enrollment` command), and the re-enrollment request could use the re-enrollment label (configured with the `arbitrary-label-reenrollment` command). Note that only one label of each of the three available types can be configured in any EST profile.

The no form of this command removes the arbitrary enrollment label.

Parameter	Description
<LABEL>	Specifies the arbitrary enrollment label. Range: Up to 64 characters.

Examples

Configuring the arbitrary enrollment label:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# arbitrary-label-enrollment ipsec-v7
```

Removing the arbitrary enrollment label :

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no arbitrary-label-enrollment
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-`*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

arbitrary-label-reenrollment

```
arbitrary-label-reenrollment <LABEL>
no arbitrary-label-reenrollment
```

Description

Within the EST profile context, configures the arbitrary re-enrollment label to be concatenated to the EST server URL that is configured with the `url` command. This label is specific to the re-enrollment operation. There is no arbitrary re-enrollment label configured by default. Any existing arbitrary re-enrollment label is replaced by this command. The use of arbitrary re-enrollment labels is optional.

When the re-enrollment label is not configured, the generic arbitrary label (created with the `arbitrary-label` command) is used (if configured) for re-enrollment.

RFC 7030 allows the use of arbitrary labels so that one EST server may serve multiple CAs with the same server URL that gets concatenated with different arbitrary labels. The same label is used for every request made under a particular EST profile.

Some EST schemes use arbitrary labels in a more sophisticated way, defining different labels for different types of requests under the same EST profile. For example, the CA certificate request could use the generic label (configured with the `arbitrary-label` command) , the certificate enrollment request could use the enrollment label (configured with the `arbitrary-label-enrollment` command), and the re-enrollment request could use the re-enrollment label (configured with this `arbitrary-label-reenrollment` command). Note that only one label of each of the three available types can be configured in any EST profile.

The no form of this command removes the arbitrary re-enrollment label.

Parameter	Description
<LABEL>	Specifies the arbitrary re-enrollment label. Range: Up to 64 characters.

Examples

Configuring the arbitrary re-enrollment label:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# arbitrary-label-reenrollment ipsec-v7
```

Removing the arbitrary re-enrollment label :

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no arbitrary-label-reenrollment
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-<EST-NAME>`	Administrators or local user group members with execution rights for this command.

crypto pki est-profile

```
crypto pki est-profile <EST-NAME>
no crypto pki est-profile <EST-NAME>
```

Description

Creates a certificate Enrollment over Secure Transport (EST) profile and changes to the `config-est-<EST-NAME>` context for the profile. Each EST profile stores information about the EST service, including EST server URL Up to 16 profiles can be created.

If the specified EST profile exists, this command changes to the `config-est-<EST-NAME>` context for the profile.

The `no` form of this command deletes the specified EST profile. It also deletes the TA profiles whose CA certificates were downloaded from the corresponding EST server, and the leaf certificates that were enrolled using this EST profile.

The deletion of the related TA profiles and enrolled certificates is permanent. If the EST profile is in the startup configuration and the EST profile is deleted but this deletion is not updated in the startup configuration before a switch reboot, the EST profile will still exist after the reboot but the related TA profiles and enrolled certificates will not exist.

Parameter	Description
<EST-NAME>	Specifies the EST profile name. Range: Up to 32 alphanumeric characters (excluding ").

Examples

Creating EST profile **EST-Service1**:

```
switch(config)# crypto pki est-profile EST-Service1
switch(config-est-service1)#
```

Removing EST profile **service1**:

```
switch(config)# no crypto pki est-profile EST-Service1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

enroll est-profile

`enroll est-profile <EST-NAME>`

Description

Enrolls a leaf certificate through a remote EST (Enrollment over Secure Transport) server.

Per RFC 7030, EST enables clients to request certificate signing services over secure TLS connections. The switch generates a key pair and the corresponding CSR. The CSR is sent to the EST server to request signing, and the signed certificate is be returned to the switch where it is validated. If the whole process

succeeds, the certificate can be used as a leaf certificate on the switch. When the leaf certificate approaches its expiry date, it will be renewed automatically through the same EST server.

Each enrollment or re-enrollment attempt starts with a `/cacerts` request sent to the EST server to get the latest chain of CA certificates. After the enrollment or re-enrollment succeeds, this chain of CA certificates will be compared with those downloaded previously from the same EST server. Updates will be made as appropriate.

The subject fields of the current leaf certificate must be defined before running this command. If the common name subject field is not configured, this command is rejected.

This command cannot be used to enroll or renew the default certificate "local-cert."

Parameter	Description
<EST-NAME>	Specifies an existing EST profile name. Range: Up to 32 alphanumeric characters (excluding ").

Example

Enrolling leaf certificate **leaf-cert1** through the EST server identified in EST profile `EST-service1`:

```
switch(config-cert-leaf-cert1)# enroll est-profile EST-service1
You are enrolling a certificate with the following attributes:
  Subject: C=US, ST=CA, L=Roseville, OU=Aruba-Roseville, O=Aruba,
         CN=leaf-cert1
  Key Type: RSA (2048 bits)

Continue (y/n)? y
Certificate enrollment via EST-service1 has been initiated.
Please use `show crypto pki certificate leaf-cert1` to check its status.

switch(config-cert-leaf-cert1)#
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-cert-`*<CERT-NAME>*	Administrators or local user group members with execution rights for this command.

reenrollment-lead-time

```
reenrollment-lead-time <LEAD-TIME>
no reenrollment-lead-time
```

Description

Within the EST profile context, sets the certificate re-enrollment lead time which is the number of days before certificate expiry date that certificate re-enrollment will be initiated.

The no form of this command resets the EST server re-enrollment lead time to its default of 2 days.

Parameter	Description
<LEAD-TIME>	Specifies the certificate re-enrollment lead time in days. Range: 0 to 30 days. Default: 2 days.

Examples

Setting the certificate re-enrollment lead time to 15 days:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# reenrollment-lead-time 15
```

Resetting the certificate re-enrollment lead time to its default of 2 days :

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no reenrollment-lead-time
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config-est-*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

retry-count

```
retry-count <RETRIES>
no retry-count
```

Description

Within the EST profile context, sets the maximum number of retires to be attempted after the initial certificate enrollment request fails.

The no form of this command resets the maximum number of certificate enrollment request retries to its default of 3.

Parameter	Description
<RETRIES>	Specifies the maximum number of certificate enrollment request retries. Range: 0 to 32 retries. Default: 3 retries.

Examples

Setting the retry count to 5 retries:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# retry-count 5
```

Resetting the retry count to its default of 3 retries:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no retry-count
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config-est-*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

retry-interval

```
retry-interval <INTERVAL>
no retry-interval
```

Description

Within the EST profile context, sets the interval at which a failed certificate enrollment request is retried. The no form of this command resets the enrollment request retry interval to its default of 30 seconds.

Parameter	Description
<INTERVAL>	Specifies the enrollment request retry interval in seconds. Range: 30 to 600 seconds. Default: 30 seconds.

Examples

Setting the certificate enrollment request retry interval to 45 seconds:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# retry-interval 45
```

Resetting the retry interval to its default of 30 seconds:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no retry-interval
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-<EST-NAME>`	Administrators or local user group members with execution rights for this command.

show crypto pki est-profile

`show crypto pki est-profile [<EST-NAME>]`

Description

Shows a list of all configured EST profiles, or detailed information for a specific profile.

Parameter	Description
<EST-NAME>	Specifies the EST profile name. Range: Up to 32 alphanumeric characters (excluding ").

Examples

Showing a list of all configured EST profiles:

```
switch# show crypto pki est-profile
                                 Downloaded  Enrolled
Profile Name                     TA Profiles Certificates
-------------------------------- ----------- ------------
EST-service1                     2           3
EST-service2                     1           2
EST-service3                     2           0
```

Showing detailed information for EST profile **EST-service1**:

```
switch# show crypto pki est-profile EST-service1
  Profile Name             : EST-service1
  Service VRF              : mgmt
  Service URL              : https://est-service999.com
    Arbitrary Label              : not configured
    Arbitrary Label Enrollment   : /ipsec-VP7
    Arbitrary Label Reenrollment : not configured
  Authentication Username  : est1
  Authentication Password  :
    AQBapREALpWYm2z7L1LanOtR3vGkqhBN1hBUU2CuvQXUF/ggYgAAnAnGTnKq49P4c
    dNQ6UqPbjHL4XzCO0T04djkhSUxPKGfnsWuFEONveh+JbEobqKImfwJjc3eWHiaUb
    eNpPx2zN2Q1DdyxAAQi4rmKr8LITMTTMd7qr
  Retry Interval           : 45 seconds
  Retry Count              : 5 times
  Reenrollment Lead Time   : 2 days
  Downloaded TA Profiles   : 2
  Enrolled Certificates    :
    leaf-cert1
```

```
    leaf-cert2
    leaf-cert3
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

url

```
url <URL>
no url
```

Description

Within the EST profile context, configures the URL of the certificate enrollment EST server. This is not configured by default. Any existing URL is replaced by this command.

The no form of this command removes the EST server URL within the selected EST profile. The removal of the URL does not affect the TA profiles and enrolled certificates from the EST server.

Parameter	Description
<URL>	Specifies the EST server URL. Range: Up to 192 characters.

Usage

- The configuration and update of the EST profile URL triggers the sending of a `/cacerts` request to the EST server. A successful request will result in a chain of trusted CA certificates being downloaded from the EST server. Each CA certificate, either root CA certificates or intermediate CA certificates, will be saved as a TA profile, with TA profile name *<est-name>*`-est-taNN` with `NN` representing two numerical digits. This TA profile naming scheme with the `-est-taNN` suffix is reserved for TA profiles downloaded from EST servers.
- Upon connection with an EST server, the switch authenticates the server by validating the server certificate. For this validation to succeed, a TA profile needs to pre-exist in the switch with a CA certificate from the issuer chain of the server certificate. Once the server is authenticated, all CA certificates in its `/cacerts` response will be trusted, with no further validation occurring for them.
- The TA profiles with CA certificates downloaded from an EST server will have their revocation check set to OCSP, enforcement set to optional, and the OCSP VRF set to the same as that of the EST profile.

Examples

Configuring the EST server URL:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# url https://est-service999.com/.well-known/est
```

Removing the EST server URL:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no url
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	config-est-*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

username

```
username <USERNAME> password [ciphertext <CIPHERTEXT-PASSWORD> |
         plaintext <PLAINTEXT-PASSWORD>]
no username
```

Description

Within the EST profile context, configures the user account information for the EST server that is used to authenticate the switch before accepting requests from the switch. This is not configured by default. Any existing username and password is replaced by this command.

When entered without either optional `ciphertext` or `plaintext` parameters, the plaintext password is prompted for twice, with the characters entered masked with "*" symbols.

The no form of this command removes the user account information within the selected EST profile.

There are two ways the EST client on a CX switch can prove itself to an EST server: a certificate, and/or username and password. At least one of the two must be configured for the EST request to succeed. If both are configured, certificate authentication will be used. If a certificate is not configured or certificate authentication fails, and username and password is configured, the username and password will be sent to the EST server for authentication.

Parameter	Description
<USERNAME>	Specifies the EST server account user name. The exact user name requirements are set by the chosen EST service. Range: Up to 32 alphanumeric characters.
ciphertext *<CIPHERTEXT-PASSWORD>*	Specifies the EST server account password as Base64 ciphertext. No password prompts are provided and the ciphertext password is validated before the configuration is applied for the user.

Parameter	Description
	NOTE: The ciphertext password must be gotten from the EST service.
`plaintext <PLAINTEXT-PASSWORD>`	Specifies the password without prompting. The password is visible as cleartext when entered but is encrypted thereafter. The exact password requirements are set by the chosen EST service. Range: Up to 64 alphanumeric characters.

Examples

Configuring an EST user with prompted cleartext password entry :

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# username est1 password
Enter password: ********
Confirm password: ********
switch(config-est-EST-service1)#
```

Configuring an EST user with direct cleartext password entry:

```
switch(config)# crypto pki est-profile EST-service2
switch(config-est-EST-service2)# username est1 password plaintext concept_leap739
```

Configuring an EST user with ciphertext password entry :

```
switch(config)# crypto pki est-profile EST-service3
switch(config-est-EST-service3)# username est1 password ciphertext
AQBpRALpWYm2z7L1LanOtR3vGkqhN1hBU2CuvQXUF/ggYgAAAHWaPqxU6nAnGTnKq49P4cdNQ6U
qPbjHL4XzO0T04djkUPKGfnsWuFEONveh+JbEobq63+1k80qBKImfwJjc3eWHiaUbeNpPx2zN2Q
1DdyxAAQi4rmKr8LITMTTMd7qr
```

Removing the EST user account information for EST profile EST-service2:

```
switch(config)# crypto pki est-profile EST-service2
switch(config-est-EST-service2)# no username
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-<EST-NAME>`	Administrators or local user group members with execution rights for this command.

vrf

```
vrf <VRF-NAME>
no vrf
```

Description

Within the EST profile context, selects the VRF through which the EST server can be reached. Any existing VRF selection is replaced by this command. When this command is not used, VRF `mgmt` is used by default on switch families supporting the `mgmt` VRF, otherwise the default VRF named `default` is used.

The no form of this command selects the default VRF either `mgmt` or `default`.

Parameter	Description
<VRF-NAME>	Specifies the name of the VRF to use for EST server communication

Examples

Selecting VRF `it-services` for EST server communications:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# vrf it-services
```

Resetting the VRF to its default of `mgmt` for EST server communications:

```
switch(config)# crypto pki est-profile EST-service1
switch(config-est-EST-service1)# no vrf
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config-est-`*<EST-NAME>*	Administrators or local user group members with execution rights for this command.

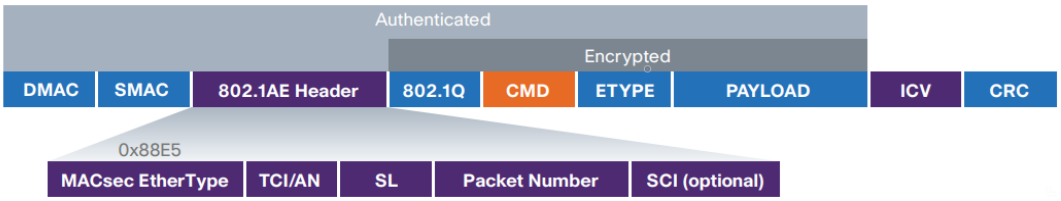
MACsec is available on the 8360 Switch Series.

Media Access Control security (MACsec) provides Layer 2 security for wired LANs, protecting network communications against a range of attacks including: denial of service, intrusion, man-in-the-middle, and eavesdropping. These attacks exploit Layer 2 vulnerabilities and often cannot be detected. MACsec appends a header and tail to all Ethernet frames, and encrypts data payload within the frame. Receiving device checks header and tail for integrity. If the check fails, traffic is dropped. If the check is successful, the frame is encrypted.

The Media Access Control security (MACsec) protocol:

- Provides a Layer 2 hop-by-hop encryption on point-to-point Ethernet links, enabling a bi-directional secure link after an exchange and verification of security keys between two connected devices.
- Secures switch-to-switch infrastructure using the MKA (MACsec Key Agreement) protocol and Static CAK (Connectivity Association Key).
- MACsec encrypts all fields behind the source/destination MAC addresses except for MACsec SecTAG.
- MACsec secures switch to switch infrastructure using the MACsec Key Agreement (MKA) protocol and Static Connectivity Association Key (CAK).
- The pre-shared key (PSK) includes a connectivity association name (CKN) and a connectivity association key (CAK). The CKN and CAK are configured by the administrator and must match on both ends of the link.
- The MACsec frame format includes an additional 32-byte MACsec header, which includes a well-known EtherType field (0x88E5), while allowing the Ethernet source/destination MAC addresses to be left in the clear for Ethernet frame forwarding.

Figure 2 *MACsec Frame Format*



MACsec in AOS-CX

8360 Switch Series models that support MACsec:

8360 model	Ports	Speed
JL700A, JL701A	1/1/1 to 1/1/4	10G or 25G

8360 model	Ports	Speed
JL704C, JL705C, JL719C	1/1/1 to 1/1/4 1/1/53 to 1/1/54 in split mode with breakout cables (1/1/53 when used with QSA28 Adapter (845970-B21) does not support the use of MACsec))	10G or 25G
JL704C, JL705C, JL719C	1/1/53, 1/1/54	40G or 100G

MACsec is also supported on split interfaces.

MACsec provides:

- **Connectionless data integrity**: Unauthorized changes to data cannot be made without being detected. Each MAC frame carries a separate integrity verification code.
- **Replay protection**: When enabled, packets are expected to arrive within the replay protection window number of packets. MAC frames copied from the network by an attacker cannot be resent into the network without being detected.
- **Secure Channel Identifier (SCI) tag**: Enables inclusion of the Secure Channel Identifier (SCI) tag in the Security TAG (SecTAG) field of the MACsec header. The Secure Channel Identifier (SCI) tag in the Security TAG (SecTAG) field of the MACsec header is comprised of a globally unique MAC Address and a port identifier that is unique within the system. An explicitly encoded SCI field in the SecTAG is not required on point-to-point links if the transmitting link has only one MACsec peer.
- **Data origin authenticity**: A received MAC frame is guaranteed to have been sent by the authenticated device.
- **Confidentiality**: The data payload of each MAC frame is encrypted to prevent it from being eavesdropped by unauthorized parties. The start-of-encryption offset is configurable, with available offset options of 0, 30 or 50 bytes. The default offset of 0 causes the entire data payload to be encrypted.
- **Bounded receive delay**: MAC frames cannot be intercepted by a man-in-the-middle attack and delayed by more than a few seconds without being detected.
- **Multiple Cipher Suites**:
  - gcm-aes-128: AES-128 encryption with Galois/Counter mode.
  - gcm-aes-256: AES-256 encryption with Galois/Counter mode.
  - gcm-aes-xpn-128: AES-128 encryption with Galois/Counter mode and extended packet numbering.
  - gcm-aes-xpn-256: AES-128 encryption with Galois/Counter mode and extended packet numbering. (Default)

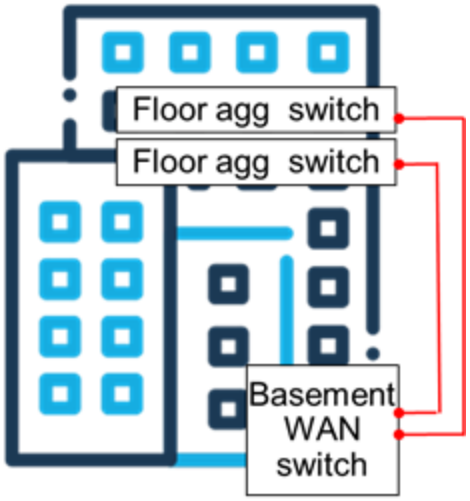
MACsec use cases

The following deployments include point-to-point links between directly connected MACsec-capable devices. In these diagrams, potential MACsec links appear in red.

Use Case 1: *Central campus*

In this example, a company is leasing several floors on a building, where fiber is in the riser of the building.

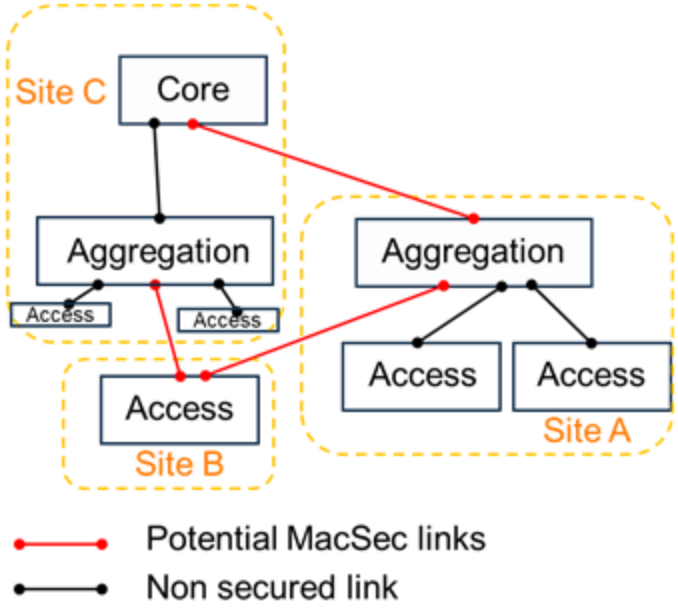
Figure 3 *Central campus building with switches on different floors*



Use Case 2: Distributed campus

In this low-density distributed campus, multiple sites are linked with both MACsec and non-secured links.

Figure 4 *Distributed campus deployments*



Use Case 3: ERPS connected campus

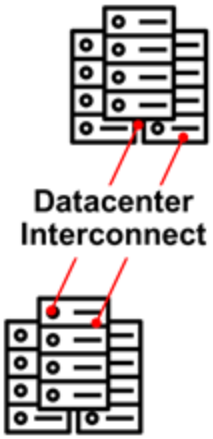
In this example, a multi-site campus is connected using Ethernet Ring Protection Switching (ERPS).

Figure 5 *ERPS Campus*

Use Case 4: Multi-Site Datacenter

A multi-site datacenter can use MACsec links between the sites.

Figure 6 *Datacenter deployment*



MACsec configuration (using 802.1X EAP TLS)

For more information on this feature, see this related video on the Aruba AirHeads Broadcasting Channel.

MACsec with 802.1X EAP TLS requires at least AOS-CX 10.10.

MACsec with EAP TLS is 802.1X standard compliant and interoperates with other vendor NAS servers.

Using MACsec with 802.1X EAP TLS makes it unnecessary to manually configure an MKA policy with its pre-shared keys on the authenticator and supplicant. The MKA policy is dynamically generated on both the authenticator and the supplicant after 802.1X authentication. This simple example illustrates the basic configuration required on both the authenticator switch and the supplicant switch.

In the following command sequences, the authenticator switch is identified with the CLI prompt `auth` and the supplicant switch is identified with the CLI prompt `supp`.

Configure the authenticator

- Configure the RADIUS server for authentication over the OOBM port:

```
auth(config)# radius-server host 192.168.1.1 key ciphertext AQBa...A/g8= vrf mgmt
```

- Associate the RADIUS server with a server group:

```
auth(config)# aaa group server radius dot1x
auth(config-sg)# server 192.168.1.1 vrf mgmt
auth(config-sg)# exit
auth(config)#
```

- Create and configure a MACsec policy:

```
auth(config)# macsec policy macsec-aoscx
auth(config-macsec-policy)# cipher-suite gcm-aes-256 gcm-aes-xpn-256
auth(config-macsec-policy)# exit
auth(config)#
```

- Create a port access role to assign to the switch authenticating itself using 802.1X. The role puts the port in device mode (since the authenticating client is a device), enables access on a set of VLANs, and includes the MACsec policy to use after authentication.

```
auth(config)# port-access role AOSCX-Switch
auth(config-pa-role)# associate macsec-policy macsec-aoscx
auth(config-pa-role)# auth-mode device-mode
auth(config-pa-role)# vlan trunk native 10
auth(config-pa-role)# vlan trunk allowed 10,30
auth(config-pa-role)# exit
auth(config)#
```

- Enable 802.1X globally and associate the RADIUS server group:

```
auth(config)# aaa authentication port-access dot1x authenticator enable
auth(config)# aaa authentication port-access dot1x authenticator radius server-
group dot1x
```

- Configure the interface for the 802.1X authenticator with MACsec. Set the client-limit to 2 to ensure any traffic sourced directly from the authenticating device (base MAC of the authenticating device) does not cause the 802.1X authentication of the device itself (using the interface MAC) to fail due to client limit. Optionally, set the CAK length for MKA to 16 bytes if the supplicant derives a 16 byte CAK post EAP-TLS authentication.

```
auth(config)# interface 1/1/1
auth(config-if)# no shutdown
auth(config-if)# no routing
auth(config-if)# vlan access 1
auth(config-if)# aaa authentication port-access client-limit 2
auth(config-if)# aaa authentication port-access dot1x authenticator
auth(config-if-dot1x-auth)# mka cak-length 16
auth(config-if-dot1x-auth)# macsec
auth(config-if-dot1x-auth)# enable
auth(config-if-dot1x-auth)# exit
auth(config-if)# exit
auth(config)#
```

Configure the supplicant

- Use a signed certificate named “supplicant” installed on the switch for 802.1X EAP TLS authentication. Note that the root certificate should also be installed on switch.

```
supp(config)# crypto pki application dot1x-supplicant certificate supplicant
```

- Create and configure a MACsec policy:

```
supp(config)# macsec policy macsec-aoscx
supp(config-macsec-policy)# cipher-suite gcm-aes-256 gcm-aes-xpn-256
supp(config-macsec-policy)# exit
supp(config)#
```

- Create a supplicant policy to use for 802.1X EAP TLS authentication. This policy also sets the MACsec policy that is to be used after authentication. Optionally, set the CAK length for MKA to 16 bytes if the authenticator derives a 16 byte CAK post EAP-TLS authentication.

```
supp(config)# aaa authentication port-access dot1x supplicant
supp(config-dot1x-supp)# policy supplicant-aoscx
supp(config-dot1x-supp-policy)# eap-identity identity AOSCX
supp(config-dot1x-supp-policy)# macsec-policy macsec-aoscx
supp(config-dot1x-supp-policy)# mka cak-length 16
supp(config-dot1x-supp-policy)# exit
supp(config-dot1x-supp)# exit
supp(config)#
```

- Enable the 802.1X supplicant globally:

```
supp(config)# aaa authentication port-access dot1x supplicant
supp(config-dot1x-supp)# enable
supp(config-dot1x-supp)# exit
supp(config)#
```

- Configure the interface for the 802.1X supplicant with MACsec.

```
supp(config)# interface 1/1/1
supp(config-if)# no shutdown
supp(config-if)# no routing
supp(config-if)# vlan access 1
supp(config-if)# aaa authentication port-access dot1x supplicant
supp(config-if-dot1x-supp)# macsec
supp(config-if-dot1x-supp)# associate policy supplicant-aoscx
supp(config-if-dot1x-supp)# enable
supp(config-if-dot1x-supp)# exit
supp(config-if)# exit
supp(config)#
```

MACsec configuration (using pre-shared keys)

A simple configuration example is provided here to illustrate MACsec configuration using pre-shared keys in the MKA policy:

- Create and configure a MACsec policy:

```
switch(config)# macsec policy MS_Policy1
switch(config-macsec-policy)# cipher-suite gcm-aes-256 gcm-aes-xpn-256
switch(config-macsec-policy)# replay-protection window-size 100
switch(config-macsec-policy)# exit
switch(config)#
```

- Create and configure an MKA policy:

```
switch(config)# mka policy MKA_Policy1
switch(config-mka-policy)# pre-shared-key ckn abcdef12 cak plaintext 123abcdef
switch(config-mka-policy)# key-server-priority 5
switch(config-mka-policy)# exit
switch(config)#
```

- Apply the MACsec and MKA policy to a port range:

```
switch(config)# interface 1/1/1-1/1/4
switch(config-if-<1/1/1-1/1/4>)# apply macsec policy MS_Policy1
switch(config-if-<1/1/1-1/1/4>)# apply mka policy MKA_Policy1
switch(config-if-<1/1/1-1/1/4>)# exit
switch(config)#
```

- Show commands are provided for showing policy information and monitoring MACsec and MKA status and statistics:

```
switch(config)# show macsec policy MS_Policy1
...
switch# show macsec status
...
switch# show macsec statistics
...
switch# show mka policy MKA_Policy1
...
switch# show mka status
...
switch# show mka statistics
...
```

MACsec best practices

- Enable MACsec on links that have the potential to be compromised, and can be vulnerable to man-in-the-middle and masquerading attacks.
- Avoid enabling MACsec on links that are operating at 85% or greater capacity. The overhead of a MACsec header can lead to packet drops on a link operating close to full capacity.
- In an environment with devices running AOS-Switch, do not enable UDLD on both links. The UDLD session can toggle between UP and DOWN continuously when both MACsec and UDLD are enabled on the same link.

- Use the default values for the following configurations are recommended for most deployments.
  - **Confidentiality** (Default: Enabled)
  - **Confidentiality-Offset** (Default: 0)
  - **Replay Protection** (Default: Enabled, Window-Size 0)
  - **Transmit-Interval** (Default: 2 seconds)
- Configure the most secure cipher-suite that both the ends of a MACsec channel can support.
- One of the MACsec peers becomes the key-server, which generates and sends secure key information to members of a MACsec CA. When configuring the key-server priority, ensure the device to be elected as the key-server is configured with a lower key-server priority value than the other device on the channel.
- Disable the **Include-SCI tag** option for a slight improvement in performance caused by the reduced overhead in the MACsec header on point-to-point links.
- 802.1X EAP TLS MACsec and Preshared key (PSK) MACsec must not be configured on the same port.
- When running 802.1X EAP TLS MACsec, if it is not clear whether the peer can support MACsec, use a MACsec policy with `secure-mode` configured as `should-secure`. Doing this allows the channel to switch to non-MACsec if the peer does not send any MKA frames after 802.1X authentication.
- In an environment with a Cisco device, the Cisco device must be designated as the key server. Designating the AOS-CX server as the key server results in complete traffic loss.
- In an environment with Cisco and HPE FlexFabric devices, do not update confidentiality-offset on the live channel. There can be complete traffic loss for an extended period on the MACsec channel when confidentiality-offset is updated on both ends.
- In an environment with Cisco devices, when the GCM-AES-XPN-128 or GCM-AES-XPN-256 cipher suite is used for establishing the MACsec channel, the MKA policy on the Cisco device must be configured with **ssci-based-on-sci**.
- The **cak-length** should be configured to 16 under dot1x authenticator mode when Cisco AnyConnect is used as a supplicant .

MACsec troubleshooting

- As a result of standard PHY behavior, the FedCert Event log can indicate that there are packets seen on MACsec interface with a **UNKNOWN_SCI** value, even though other statistics show that this log entry represents combination of packets with either the **not valid** or **UNKNOWN_SCI** values.
- Use the **`copy support-files feature macsec`** and **`copy diag-dump feature macsec`** commands to capture diagnostic data specific to MACsec.
- Debug logs are available for MACsec. Issue the **`debug macsec all`** command for verbose logs when debugging issues.
- When MACsec does not work between two endpoints.
  - Verify the MKA session is **Secured** on both the sides.
    - When the MKA sessions between the two MACsec endpoints flaps continuously between Secured and Unsecured.
    - Verify the cipher-suite advertised by the elected key-server is supported on the peer.
    - Verify the confidentiality-offset configuration is identical on the MACsec peers.
  - Verify the MACsec status shows as **Up** and the state shows as **Retire**.
  - Check the MACsec statistics for packets being dropped.
  - Ok packets must increment on the transmitting channel.

- **Not Valid** packets incrementing on the transmitting channel indicates an issue with the key programmed on either side of the MACsec channel.

MACsec commands

apply macsec policy

```
apply macsec policy <MACSEC-POLICY-NAME>
no apply macsec policy
```

Description

Within the selected interface context, applies the specified MACsec policy to the selected port. When a MACsec policy is applied to a port, MACsec is enabled on the port and all data traffic is blocked on the port until a secure channel is successfully established.

A MACsec policy can be applied to a physical interface port that is not part of any LAG ports or to a lag port. It can also be applied to an interface that is configured as an MCLAG, VSX keep-alive, or VSX inter-switch-link.

If a MACsec policy is already applied to the selected port, this command replaces the existing policy application.

For MACsec to work, an MKA policy must also be configured and applied to the same ports.

The `no` form of this command dissociates the specified policy from the port.

Parameter	Description
<MACSEC-POLICY-NAME>	Specifies the MACsec policy name. Range: 1 to 128 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Usage

- When any MACsec or MKA policy parameter is updated, any active MACsec session on all interfaces running the MACsec or MKA policy is terminated and restarted. This is indicated with the following prompt that provides an opportunity to not execute the `apply` command.

```
This policy is currently in use by one or more interfaces.
Updating the policy will cause existing MACsec sessions using
the policy to restart.
Continue (y/n)?
```

- For non-LAG ports, a range of ports can be specified in the `interface` command used to enter the interface context. For example, entering the interface context for ports 1/1/1 through 1/1/2:

```
switch(config)# interface 1/1/1-1/1/2
switch(config-if-<1/1/1-1/1/2>)# apply macsec policy MS_Policy1
```

- Not all interfaces on a switch may support the MACsec capability. An error will be generated when a policy is applied to a physical interface that is not capable of MACsec. For LAG ports, any non-MACsec capable interfaces that are part of the LAG will be blocked.
- The 32-port 8360 Switch Series (models JL700A, JL701A) does not support both MACsec and priority-based flow-control (PFC) on same interface. Applying a MACsec policy to an interface associated with an existing PFC configuration will disable the interface. PFC must be unconfigured on the interface before MACsec can be used.

Examples

Applying a MACsec policy to a range of two ports:

```
switch(config)# interface 1/1/1-1/1/2
switch(config-if-<1/1/1-1/1/2>)# apply macsec policy MS_Policy1
```

Attempting to apply a MACsec policy to a port that already has PFC enabled:

```
switch(config)# interface 1/1/3
switch(config-if)# apply macsec policy MS_Policy1

MACsec and priority-based flow control (PFC) cannot be configured at the same time
on
this interface. Applying a MACsec policy will disable the interface until PFC is
removed.
Continue (y/n)?
```

Attempting to apply a MACsec policy to a port that is not MACsec capable:

```
switch(config)# interface 1/1/5
switch(config-if)# apply macsec policy MS_Policy1

MACsec is not supported on the interface.
switch(config-if)#
```

Removing MACsec policy association from a port:

```
switch(config)# interface 1/1/1
switch(config-if)# no apply macsec policy
```

Applying a MACsec policy to a LAG port:

```
switch(config)# interface lag 1
switch(config-if)# apply macsec policy MS_Policy1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	config-if	Administrators or local user group members with execution rights for this command.

cipher-suite

```
cipher-suite {<CIPHER-SUITE>} [<CIPHER-SUITE>] ... [<CIPHER-SUITE>]
no cipher-suite [<CIPHER-SUITE>] ... [<CIPHER-SUITE>]
```

Description

Within the MACsec policy context, configures one or more cipher suites to be used to generate the SAK (Secure Authentication Key) for when the switch is the key server. When multiple cipher suites are configured, the most secure cipher suite is considered first during negotiation.

The no form of this command (without the *<CIPHER-SUITE>* parameter) resets to the default of considering (during negotiation) all supported cipher suites while giving priority to the most secure suite `gcm-aes-xpn-256`. Include the *<CIPHER-SUITE>* parameter to disable a particular cipher suite.

Parameter	Description
<CIPHER-SUITE>	Selects the cipher suite. Available cipher suites are: ■ gcm-aes-128: AES-128 encryption with Galois/Counter mode. ■ gcm-aes-256: AES-256 encryption with Galois/Counter mode. ■ gcm-aes-xpn-128: AES-128 encryption with Galois/Counter mode and extended packet numbering. ■ gcm-aes-xpn-256: AES-128 encryption with Galois/Counter mode and extended packet numbering. (The default and the most secure.)

Examples

Enabling a single cipher suite:

```
switch(config-macsec-policy)# cipher-suite gcm-aes-128
```

Enabling two cipher suites:

```
switch(config-macsec-policy)# cipher-suite gcm-aes-256 gcm-aes-xpn-256
```

Disabling a particular cipher suite:

```
switch(config-macsec-policy)# no cipher suite gcm-aes-128
```

Resetting to the default of considering all available cipher suites while giving priority to `gcm-aes-xpn-256`:

```
switch(config-macsec-policy)# no cipher-suite
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-macsec-policy`	Administrators or local user group members with execution rights for this command.

clear macsec statistics

`clear macsec statistics [interface <IF-RANGE>]`

Description

Clears MACsec statistics on all MACsec-enabled interfaces or on a specific interface or interface range. MACsec statistics are cleared for the entire switch rather than just in the current user session.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces for which MACsec statistics information is to be cleared.

Examples

Clearing MACsec statistics on an interface range:

```
switch# clear macsec statistics interface 1/1/1-1/1/4
```

Clearing MACsec statistics on all MACsec-enabled interfaces:

```
switch# clear macsec statistics
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Manager (#)	Administrators or local user group members with execution rights for this command.

confidentiality

```
confidentiality [offset {0|30|50}]
no confidentiality
```

Description

Within the MACsec policy context, enables Ethernet packet encryption after the MACsec header, optionally including a start-of-encryption offset. Confidentiality is enabled by default with an offset of 0 bytes after the MACsec header.

An offset of 0 causes the entire packet (after the MACsec header) to be encrypted. It is sometimes desirable to offset the start of the encryption deeper into the packet to allow for fields such as MPLS labels and 802.1Q tags to remain unencrypted.

Omitting the `offset` parameter enables confidentiality with whatever offset was configured previously.

The `no` form of this command disables confidentiality.

Parameter	Description
`offset {0|30|50}`	Selects the start-of-encryption offset (in bytes) into the packet after the MACsec header. Default 0 bytes.

Examples

Enabling confidentiality with an offset of 30 bytes:

```
switch(config-macsec-policy)# confidentiality offset 30
```

Disabling confidentiality

```
switch(config-macsec-policy)# no confidentiality
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-macsec-policy`	Administrators or local user group members with execution rights for this command.

include-sci-tag

```
include-sci-tag
no include-sci-tag
```

Description

Within the MACsec policy context, enables inclusion of the Secure Channel Identifier (SCI) tag in the Security TAG (SecTAG) field of the MACsec header. This is the default.

Inclusion of the SCI tag is not required on point-to-point links if the transmitting link has only one MACsec peer.

On the 8360 Switch Series models JL700A and JL701A, inclusion (or exclusion) of the SCI tag must be set identically at both ends of a MACsec channel. Asymmetric SCI tag settings are not supported.

The `no` form of this command disables inclusion of the Secure Channel Identifier (SCI) tag in the Security TAG (SecTAG) field of the MACsec header.

Examples

Enabling the SCI tag:

```
switch(config-macsec-policy)# include-sci-tag
```

Disabling the SCI tag:

```
switch(config-macsec-policy)# no include-sci-tag
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-macsec-policy`	Administrators or local user group members with execution rights for this command.

macsec policy

`macsec policy` *<MACSEC-POLICY-NAME>*
`no macsec policy` *<MACSEC-POLICY-NAME>*

Description

Creates the specified MACsec policy and then enters its context (displayed in the CLI as `config-macsec-policy`). If the MACsec policy already exists, this command enters the specified MACsec policy context.

A MACsec policy can be applied to one or more switch ports, enabling MACsec on the ports. An MKA (MACsec Key Agreement) policy must be applied to the same ports.

The `no` form of this command deletes the MACsec policy.

8360 Switch Series models that support MACsec:

8360 model	Ports	Speed
JL700A, JL701A	1/1/1 to 1/1/4	10G or 25G

8360 model	Ports	Speed
JL704C, JL705C, JL719C	1/1/1 to 1/1/4 1/1/53 to 1/1/54 in split mode with breakout cables (1/1/53 when used with QSA28 Adapter (845970-B21) does not support the use of MACsec))	10G or 25G
JL704C, JL705C, JL719C	1/1/53, 1/1/54	40G or 100G

MACsec is also supported on split interfaces.

A MACsec policy cannot be deleted if it is currently applied to any ports. All application of the policy must be removed before the policy can be deleted.

Parameter	Description
<MACSEC-POLICY-NAME>	Specifies the MACsec policy name. Range: 1 to 128 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Examples

Creating a MACsec policy:

```
switch(config)# macsec policy MS_Policy1
switch(config-macsec-policy)#
```

Deleting a MACsec policy (the policy cannot be currently applied to any ports):

```
switch(config)# no macsec policy MS_Policy1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config`	Administrators or local user group members with execution rights for this command.

macsec selftest

```
macsec selftest
no macsec selftest
```

Description

Configures the system to run a self test for MACsec on all MACsec-capable interfaces.

The `no` form of the command disables the MACsec self test on the device.

When enabled, the system will drop traffic on all MACsec capable interfaces until the MACsec selftest completes successfully on the interface. A MACsec selftest will be run in the following scenarios:

- On a VSF stack, the self test will run on a newly added switch
- When member is removed and re-added to stack
- When interface is removed from VSF link
- After every reboot (if enabled)

Examples

Running a MACsec self test:

```
switch(config)# macsec selftest
```

Disabling the MACsec self test:

```
switch(config)# no macsec selftest
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8360	`config`	Administrators or local user group members with execution rights for this command.

replay-protection

```
replay-protection [window-size <WINDOW-SIZE>]
no replay-protection
```

Description

Within the MACsec policy context, enables replay protection with the default or specified window size. With replay protection enabled, packets are expected to arrive within the replay protection window number of packets. For example with a window size of 10, any packet arriving out-of-sequence by more than 10 packets will be discarded. A window size of 0 (the default) enforces strict order of packet reception, discarding all packets not received in perfect sequence.

The `no` form of this command disables replay protections and resets the window size to its 0 default.

Parameter	Description
<WINDOW-SIZE>	Specifies the replay protection window size in packets. Default 0 packets. Range: 0 to 4294967295 packets.

Examples

Enabling replay protection with the default window size of 0 (strict order of packet reception):

```
switch(config-macsec-policy)# replay-protection
```

Enabling replay protection with a windows size of 100 packets:

```
switch(config-macsec-policy)# replay-protection window-size 100
```

Disabling replay protection.

```
switch(config-macsec-policy)# no replay-protection
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-macsec-policy`	Administrators or local user group members with execution rights for this command.

secure-mode

```
secure-mode {should-secure | must-secure}
no secure-mode [should-secure | must-secure]
```

Description

Configures the MACsec protection behavior on the interface when a MACsec Key Agreement (MKA) session is not established. Use `should-secure` to enable fail open mode for MACsec. Fail open mode ensures that traffic continues to flow if the MKA session is not established. Use `must-secure` (the default) to use MACsec in fail closed mode.

The `no` form of the command resets the behavior to the default, `must-secure`.

Parameter	Description
`{should-secure | must-secure}`	With `should-secure` set: ▪ If the MKA session is not established, traffic is still allowed in

Parameter	Description
	clear text without the MACsec header. ■ If the MKA session is established successfully, traffic is allowed with the MACsec header. With `must-secure` set: ■ If the MKA session is not established, traffic is blocked on the data-plane. ■ If the MKA session is established successfully, traffic is allowed with the MACsec header.

Examples

Configuring `should-secure`:

```
switch(config)# macsec policy Aggregator-Connect
switch(config-macsec-policy)# secure-mode should-secure
OR
switch(config)# macsec policy Aggregator-Connect secure-mode should-secure
```

Configuring `must-secure`:

```
switch(config)# macsec policy Aggregator-Connect
switch(config-macsec-policy)# secure-mode must-secure
OR
switch(config)# macsec policy Aggregator-Connect secure-mode must-secure
```

Resetting to the default (`must-secure`):

```
switch(config)# macsec policy Aggregator-Connect
switch(config-macsec-policy)# no secure-mode
OR
switch(config)# no macsec policy Aggregator-Connect secure-mode
```

Command History

Release	Modification
10.10	Command introduced.

Command Information

Platforms	Command context	Authority
8360	`config` `config-macsec-policy`	Administrators or local user group members with execution rights for this command.

show macsec policy

`show macsec policy [<MACSEC-POLICY-NAME>]`

Description

Shows information for one or all MACsec policies.

Parameter	Description
<MACSEC-POLICY-NAME>	Specifies the MACsec policy name. Range: 1 to 128 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Examples

Showing information for a specific MACsec policy:

```
switch# show macsec policy Aggregator-Connect

MACsec Policy Details

  Policy Name: Aggregator-Connect
  ------------------------------------------------------------------------------
    Cipher suite             : GCM-AES-128
    Include SCI              : Yes
    Confidentiality          : Enabled
    Confidentiality offset   : 0
    Replay protection        : Enabled
    Replay protection window : 0
    Data delay protection    : Enabled
    Secure mode              : Must-Secure
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show macsec selftest

```
show macsec selftest [interface <IFRANGE>]
```

Description

Shows the status of the MACsec selftest for MACsec capable interfaces. If an interface fails the self test then MACsec selftest should be disabled.

Parameter	Description
<IFRANGE>	Specifies the interface(s) for which to show MACsec selftest information.

Examples

Showing MACsec self test information for all interfaces that are MACsec capable:

```
switch# show macsec selftest
MACsec selftest status

Interface  Status          Failure Reason
---------  -----------     ----------------------
1/1/1      Initializing    --
1/1/2      Passed          --
1/1/3      Queued for run  --
1/1/4      Running
1/1/5      Failed          Encryption test failed
1/1/6      Failed          Decryption test failed
1/1/7      Failed          Initialization failed
1/1/8      Failed          Time out
1/1/9      Initialized
```

Showing MACsec self test information for a specific interface:

```
switch# show macsec selftest interface 1/1/1

MACsec selftest status

Interface  Status  Failure Reason
---------  ------  ----------------------------
1/1/1      Passed  --
```

Showing MACsec self test information for an interface range:

```
switch# show macsec selftest interface 1/1/1-1/1/3

MACsec selftest status

Interface   Status       Failure Reason
---------   -----------  -------------------------
1/1/1       Passed       --
1/1/2       Running      --
1/1/3       Failed       Decryption test failed
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show macsec statistics

```
show macsec statistics [interface <IF-RANGE>]
```

Description

Shows MACsec statistics for all MACsec-enabled interfaces or a specific interface or interface range.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces for which MACsec statistics information is to be shown.

Examples

Showing MACsec statistics for a specific interface:

```
switch# show macsec statistics interface 1/1/1

MACsec Statistics

Interface 1/1/1
===============

  Rx Statistics
  -------------
    Unicast Uncontrolled Packets    : 170438363226
    Multicast Uncontrolled Packets  : 66586
    Broadcast Uncontrolled Packets  : 4399
    Rx Uncontrolled Drop Packets    : 0
    Rx Uncontrolled Error Packets   : 0
    Rx Controlled Unicast Packets   : 170438369232
    Rx Controlled Multicast Packets : 31298
    Rx Controlled Broadcast Packets : 4399
    Rx Controlled Drop Packets      : 0
    Rx Controlled Error Packets     : 0
    Uncontrolled Octets             : 27270198219337
    Controlled Octets               : 21816165353719

  Tx Statistics
  -------------
    Unicast Uncontrolled Packets    : 0
    Multicast Uncontrolled Packets  : 33756
    Broadcast Uncontrolled Packets  : 0
    Rx Uncontrolled Drop Packets    : 0
    Rx Uncontrolled Error Packets   : 0
    Unicast Controlled Packets      : 171226945517
    Multicast Controlled Packets    : 98215
    Broadcast Controlled Packets    : 71894
    Rx Controlled Drop Packets      : 0
    Rx Controlled Error Packets     : 0
    Uncontrolled Octets             : 4658308
    Controlled Octets               : 21917110733304
    Common Octets                   : 27396383670012

  SecY Statistics
  ---------------
    Port Identifier : 1

    Rx Statistics
    -------------
      Transform Error Packets : 0
      Control Packets         : 35288
      Untagged Packets        : 0
      No Tag Packets          : 0
```

```
    Bad Tag Packets         : 39
    No SCI Packets          : 0
    Unknown SCI Packets     : 0
    Tagged Control Packets  : 0
    Overrun Packets         : 0

  Tx Statistics
  -------------
    Transform Error Packets : 0
    Control Packets         : 33756
    Untagged Packets        : 0

Transmit Secure Channel
-----------------------
  SCI : ec0273f72f4d0001

  Statistics
  ----------
    Encrypted Packets : 171227173728
    Protected Packets : 0

  Secure Association
  ------------------
    Association Number : 0

    Statistics
    ----------
      Encrypted Packets          : 171227173728
      Encrypted Octets           : 19862392663792
      Protected Packets          : 0
      Protected Octets           : 0
      Too Long Packets           : 0
      SA Not In Use Packets      : 0

Receive Secure Channel
----------------------
  SCI : 00fd4568f4110001

  Statistics
  ----------
    Late Packets      : 0
    Not Valid Packets : 0
    Delayed Packets   : 0
    Ok Packets        : 170438441668

  Secure Association
  ------------------
    Association Number : 0

    Statistics
    ----------
      Unchecked Packets          : 0
      Delayed Packets            : 0
      Late Packets               : 0
      Ok Packets                 : 170438441668
      Invalid Packets            : 0
      Not Valid Packets          : 0
      Not Using SA Packets       : 0
      Unused SA Packets          : 0
      Decrypted Octets           : 19770908750641
      Validated Octets           : 0
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show macsec status

`show macsec status [interface <IF-RANGE>] [detailed]`

Description

Shows MACsec status information for all MACsec-enabled interfaces or a specific interface or interface range.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces for which MACsec status information is to be shown.
`detailed`	Specifies that detailed status information is to be shown.

Usage

Applicable to when the `detailed` parameter is included: The stop time for the MACsec secure channel and secure association is updated only when the secure channel or association entry is being deleted. Therefore, it is never shown as set in the `show macsec status detailed command` output.

Examples

Showing MACsec summary information for all interfaces:

```
switch# show macsec status

MACsec Protocol Status

 Interface  Port ID  Policy                    Protection        Status  State
 ---------- -------- ------------------------- ----------------- ------- ------
 1/1/1      0        MS_Policy1                Conf, Offset 0    Up      Retire
 1/1/2      0        MS_Policy1                IC                Down    Init
 ...
```

Showing detailed MACsec information for a specific interface:

```
switch# show macsec status interface 1/1/1 detailed

Interface 1/1/1
================
```

```
Port Identifier: 0
==========================

  Policy          : MS_Policy1
  Status          : Up
  State           : Retire
  Cipher Suite    : GCM-AES-128
  Protection      : Conf, Offset 0

  Transmit Secure Channel
  -----------------------
    SCI  : 000C29F6A4380004C
    SSCI : 1

    Secure Association
    ------------------
      Association Number   : 0 (old)
      Key Identifier       : 4F18CE25228178FD15976E4C
      Packet Number        : 9500
      SA-Start-Time        : Sun Oct 18 04:05:11 UTC 2020
      SA-Stop-Time         : Sun Oct 18 04:10:12 UTC 2020

      Association Number   : 1 (current)
      Key Identifier       : 4F18CE25228178FD15976E4C
      Packet Number        : 19000
      SA-Start-Time        : Sun Oct 18 04:10:13 UTC 2020
      SA-Stop-Time         : -

  Receive Secure Channel
  ----------------------
    SCI  : 000C29F6A4360003B
    SSCI : 2

    Secure Association
    ------------------
      Association Number   : 0 (old)
      Key Identifier       : 4F18CE25228178FD15976E4C
      Lowest Packet Number : 9500
      SA-Start-Time        : Sun Oct 18 04:05:12 UTC 2020
      SA-Stop-Time         : Sun Oct 18 04:10:12 UTC 2020

      Association Number   : 1 (current)
      Key Identifier       : 4F18CE25228178FD15976E4C
      Lowest Packet Number : 19000
      SA-Start-Time        : Sun Oct 18 04:10:13 UTC 2020
      SA-Stop-Time         : -
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

MKA commands (MACsec)

apply mka policy

```
apply mka policy <MKA-POLICY-NAME>
no apply mka policy
```

Description

Within the selected interface context, applies the specified MKA policy to the selected port. To start the MKA protocol on the port, a MACsec policy must also be applied to the port.

An MKA policy can be applied to a physical interface port that is not part of any LAG ports or to a lag port. It can also be applied to an interface that is configured as an MCLAG, VSX keep-alive, or VSX inter-switch-link.

If an MKA policy is already applied to the selected port, this command replaces the existing policy application.

The `no` form of this command dissociates the specified policy from the port.

Parameter	Description
<MKA-POLICY-NAME>	Specifies the MKA policy name. Range: 1 to 32 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Usage

- When any MACsec or MKA policy parameter is updated, any active MACsec session on all interfaces running the MACsec or MKA policy is terminated and restarted. This is indicated with the following prompt that provides an opportunity to not execute the `apply` command.

```
This policy is currently in use by one or more interfaces.
Updating the policy will cause existing MACsec sessions using
the policy to restart.
Continue (y/n)?
```

- For non-LAG ports, a range of ports can be specified in the `interface` command used to enter the interface context. For example, entering the interface context for ports 1/1/1 through 1/1/4:

```
switch(config)# interface 1/1/1-1/1/4
switch(config-if-<1/1/1-1/1/4>)# apply mka policy MKA_Policy1
```

- Not all interfaces on a switch may support the MACsec capability. An error will be generated when a policy is applied to a physical interface that is not capable of MACsec. For LAG ports, any non-MACsec capable interfaces that are part of the LAG will be blocked.

Examples

Applying an MKA policy to a range of two ports:

```
switch(config)# interface 1/1/1-1/1/2
switch(config-if-<1/1/1-1/1/2>)# apply mka policy MKA_Policy1
```

Attempting to apply an MKA policy to a port that is not MACsec capable:

```
switch(config)# interface 1/1/5
switch(config-if)# apply mka policy MKA_Policy1

MACsec is not supported on the interface.
switch(config-if)#
```

Removing MKA policy association from a port:

```
switch(config)# interface 1/1/1
switch(config-if)# no apply mka policy
```

Applying an MKA policy to a LAG port:

```
switch(config)# interface lag 1
switch(config-if)# apply mka policy MKA_Policy1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	config-if	Administrators or local user group members with execution rights for this command.

clear mka statistics

`clear mka statistics [interface <IF-RANGE>]`

Description

Clears MKA statistics on all MACsec-enabled interfaces or on a specific interface or interface range. MKA statistics are cleared for the entire switch rather than just in the current user session.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces (ports) for which MKA statistics information is to be cleared.

Examples

Clearing MKA statistics on an interface range:

```
switch# clear mka statistics interface 1/1/1-1/1/4
```

Clearing MKA statistics on all MACsec-enabled interfaces:

```
switch# clear mka statistics
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

data-delay-protection

```
data-delay-protection
no data-delay-protection
```

Description

Configures the MACsec policy to use data delay protection. Data delay protection allows MKA participants to ensure that the data frames protected by MACsec are not delayed by more than 2 seconds.

Enabling data delay protection necessitates transmission of MKPDUs at a frequency of 0.5 second to meet a maximum data delay of 2 seconds while minimizing connectivity interruption due to the possibility of lost or delayed MKPDUs.

Data delay protection should be enabled only when there is a need to drop MACsec protected frames that are delayed by more than 2 seconds on the wire. It is recommended to not enable data delay protection unless absolutely required as it adds extra load on the system.

Disabled by default.

When data delay protection is enabled, a default of 0.5 second is used as transmit-interval and transmit-interval configuration under MKA policy is ignored.

Examples

Enabling data delay protection:

```
switch(config)# macsec policy Aggregator-Connect data-delay-protection
```

or

```
switch(config)# macsec policy Aggregator-Connect
switch(config-macsec-policy)# data delay protection
```

Disabling data delay protection:

```
switch(config)# no macsec policy Aggregator-Connect data-delay-protection
```

or

```
switch(config)# macsec policy Aggregator-Connect
switch(config-macsec-policy)# no data delay protection
```

Command History

Release	Modification
10.11	Command introduced.

Command Information

Platforms	Command context	Authority
8360	`config` `config-macsec-policy`	Administrators or local user group members with execution rights for this command.

key-server-priority

`key-server-priority <PRIORITY>`
`no key-server-priority`

Description

In the `config-mka-policy` policy context, configures the MKA key server priority. The highest priority is 0 and indicates that this switch strongly wants to be the MKA key server. The lowest priority is 255 and indicates that switch does not want to be the MKA key server, allowing the switch at the other end of the link to be the key server. Set this priority on the switches at either end of the link to achieve the desired effect.

If the key server priority is 0 on both switches then the switch with the lowest system MACsec address is elected as key server.

The `no` form of this command resets the MKA key server priority to its default of 0.

Parameter	Description
<PRIORITY>	Selects the MKA key server priority for this switch. Default 0 (highest priority). Range: 0 to 255.

Examples

Setting the MKA key server priority:

```
switch(config-mka-policy)# key-server-priority 5
```

Resetting the MKA key server priority to its default of 0:

```
switch(config-mka-policy)# no key-server-priority
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-mka-policy`	Administrators or local user group members with execution rights for this command.

mka policy

```
mka policy  <MKA-POLICY-NAME>
no mka policy <MKA-POLICY-NAME>
```

Description

Creates the specified MKA (MACsec Key Agreement) policy and then enters its context (displayed in the CLI as `config-mka-policy`). If the MKA policy already exists, this command enters the specified MKA policy context.

An MKA policy can be applied to one or more switch ports, enabling MKA on the ports. A MACsec policy must be applied to the same ports.

The `no` form of this command deletes the MKA policy.

An MKA policy cannot be deleted if it is currently applied to any ports. All application of the policy must be removed before the policy can be deleted.

Parameter	Description
<MKA-POLICY-NAME>	Specifies the MKA policy name. Range: 1 to 32 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Examples

Creating an MKA policy:

```
switch(config)# mka policy MKA_Policy1
switch(config-mka-policy)#
```

Deleting an MKA policy (the policy cannot be currently applied to any ports):

```
switch(config)# no mka policy MKA_Policy1
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config`	Administrators or local user group members with execution rights for this command.

pre-shared-key

```
pre-shared-key keychain <NAME>
pre-shared-key ckn <CA-KEY-NAME> cak {plaintext [<PLAINTEXT-CAK>] | ciphertext
<CIPHERTEXT-CAK>}
```

Description

Configures the Pre-Shared Key (PSK) to use for an MKA policy.

A PSK can be configured one of two ways:

1. Configure the Connectivity Association Key Name (CKN) and Connectivity Association Key (CAK) directly in the PSK.
2. Configure the PSK to use an existing keychain for the CKN (key name) and CAK (key-string).

If both a key chain and a static CKN/CAK are configured in the PSK, then the key chain will be used for MKA operations.

When using a PSK with a key chain, only the send lifetime is considered for CAK lifetime. It is recommended to not configure an accept lifetime in the key chain used for MACsec.

The `no` form of this command deletes the PSK configuration including the key chain association, the CKN and the CAK.

Parameter	Description
<CA-KEY-NAME>	Specifies the CKN (Connectivity Association Key Name). Range: 1 to 64 hexadecimal characters.
<PLAINTEXT-CAK>	Specifies the CAK (Connectivity Association Key) in plaintext. Range: 1 to 64 hexadecimal characters.
<CIPHERTEXT-CAK>	Specifies the CAK (Connectivity Association Key) as ciphertext.
<NAME>	Specifies the keychain name.

Examples

Configuring the pre-shared key with a specified plaintext CAK:

```
switch(config-mka-policy)# pre-shared-key ckn abcdef12 cak plaintext 123abcdef
```

Configuring the pre-shared key with a prompted plaintext CAK:

```
switch(config-mka-policy)# pre-shared-key ckn abcdef12 cak plaintext
Enter CAK: ******
Confirm CAK: ******
```

Configuring the pre-shared key with a ciphertext CAK:

```
switch(config-mka-policy)# pre-shared-key ckn abcdef12 cak ciphertext
AQBapUvjDZgUxtTpgA4NLqnsn7CjXqbDch+BOS7y9fcWExLUBgAAAKUmDYdhew==
```

Configuring a key chain for an MKA policy:

```
switch(config)# mka policy Agg-To-Agg
switch(config-mka-policy)# pre-shared-key keychain macsec_keys
```

Deleting the PSK configuration including its CKN and CAK:

```
switch(config-mka-policy)# no pre-shared-key
```

Deleting a key chain from an MKA policy:

```
switch(config)# mka policy Agg-To-Agg
switch(config-mka-policy)# no pre-shared-key keychain macsec_keys
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	`config-mka-policy`	Administrators or local user group members with execution rights for this command.

show mka policy

`show mka policy [<MKA-POLICY-NAME>]`

Description

Shows information for one or all MKA policies.

Parameter	Description
<MKA-POLICY-NAME>	Specifies the MKA policy name. Range: 1 to 32 alphanumeric characters including only the three special characters "." (period), "-" (hyphen), and "_" (underscore).

Examples

Showing information for a specific MKA policy:

```
switch# show mka policy Agg-To-Agg

MKA Policy Details

  Policy Name: Agg-To-Agg
  ------------------------------------------------------------------------------
  Mode                      : Pre-shared key
  CKN                       : abcdef123456
  CAK (encrypted)           :
AQBapUwNK5Uf+r1vmhBIncQPw1YPVH0V1nYr7Yjm/bPn3bBVCgAAAHFKt8mcSv/A/g8=
  Keychain                  : macsec_keys
  Key-server Priority       : 5
  Transmit Interval         : 6 seconds
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show mka statistics

`show mka statistics [interface <IF-RANGE>]`

Description

Shows MKA statistics for all MACsec-enabled interfaces or a specific interface or interface range. The MKA statistics are refreshed periodically, approximately every five seconds.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces for which MKA statistics information is to be shown.

Examples

Showing MKA statistics information for a specific interface:

```
switch# show mka statistics interface 1/1/1


Interface 1/1/1
================
```

```
  KaY
  ----
    SCI : ec0273f72f4d0001

    Statistics
    ----------
      MKPDUs With Invalid Version : 0
      MKPDUs With Invalid CKN     : 0

    Participant
    -----------
      CKN : 1234567890

      Statistics
      ----------
        Tx MKPDUs                 : 33834
        Rx MKPDUs                 : 35375
        SAKs Distributed          : 1
        SAKs Received             : 0
        MKPDUs With Invalid ICV   : 0
        MKPDUs With Duplicate MI  : 0
        MKPDUs With Invalid MN    : 0
...
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show mka status

`show mka status [interface <IF-RANGE>]`

Description

Shows MKA status information for all MACsec-enabled interfaces or a specific interface or interface range.

Parameter	Description
`interface <IF-RANGE>`	Specifies one or more interfaces for which MKA status information is to be shown.

Examples

Showing MKA status information for a specific interface (Pre-shared key):

```
switch# show mka status interface 1/1/1

MKA Protocol Status

Interface 1/1/1
================

MKA Port Identifier : 1
MKA Policy Name     : mka2
MKA Session Status  : Secured
Mode                : Pre-shared key
CKN                 : 1234567890
CAK (encrypted)     : AQBapew1NbxX9YFVLZM5J1QEd...JNkMOpgsCQAAAGra8Hsk2Ch8aQ==
Member Identifier   : 1a1dfb1c6950a1e66f173d01
Message Number      : 474167
Capability          : IC, Conf, Offset 50
Transmit Interval   : 2 seconds
Key Server Priority : 0
Key Server          : Yes

Live Peer List:
MI                       MN       PRI Capability            Rx-SCI
------------------------ -------- --- --------------------- ----------------
abcf557488e06a455b78d408 478159   250 IC, Conf, Offset      187a3b1b814e0001

Potential Peer List:
MI                       MN       PRI Capability            Rx-SCI
------------------------ -------- --- --------------------- ----------------
```

Showing MKA status information for a specific interface (EAP TLS):

```
switch# show mka status interface 1/1/1


MKA Protocol Status

Interface 1/1/1
================

MKA Port Identifier : 1
MKA Policy Name     : MKA_Policy1
MKA Session Status  : Secured
Mode                : EAP-TLS
CKN                 : c226b7b47abe41300f450a0d16306bec
CAK (encrypted)     : AQBapXr3AEPapQFOuOUNfjLg...KxnEBreoa2qdo/AqXG1CzwqT9Gs...
Member Identifier   : b37cb1b5848977a649308c9f
Message Number      : 5
Capability          : IC, Conf, Offset 50
Transmit Interval   : 2 seconds
Key Server Priority : 255
Key Server          : No

Live Peer List:
MI                       MN       PRI Capability            Rx-SCI
------------------------ -------- --- --------------------- ----------------
e0314605e4efa1ac249f1a3f 4        0   IC, Conf, Offset      00fd456705d10001

Potential Peer List:
MI                       MN       PRI Capability            Rx-SCI
------------------------ -------- --- --------------------- ----------------
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

transmit-interval

```
transmit-interval <INTERVAL>
no transmit-interval
```

Description

In the `config-mka-policy` policy context, configures the MKA packet transmit interval.

The `no` form of this command resets the MKA packet transmit interval to its default of 2 seconds.

Parameter	Description
<INTERVAL>	Selects the MKA packet transmit interval. Default 2 seconds. Range: 2 to 6 seconds.

Examples

Setting the MKA packet transmit interval:

```
switch(config-mka-policy)# transmit-interval 4
```

Resetting the MKA packet transmit interval to its default of 2 seconds:

```
switch(config-mka-policy)# no transmit-interval
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

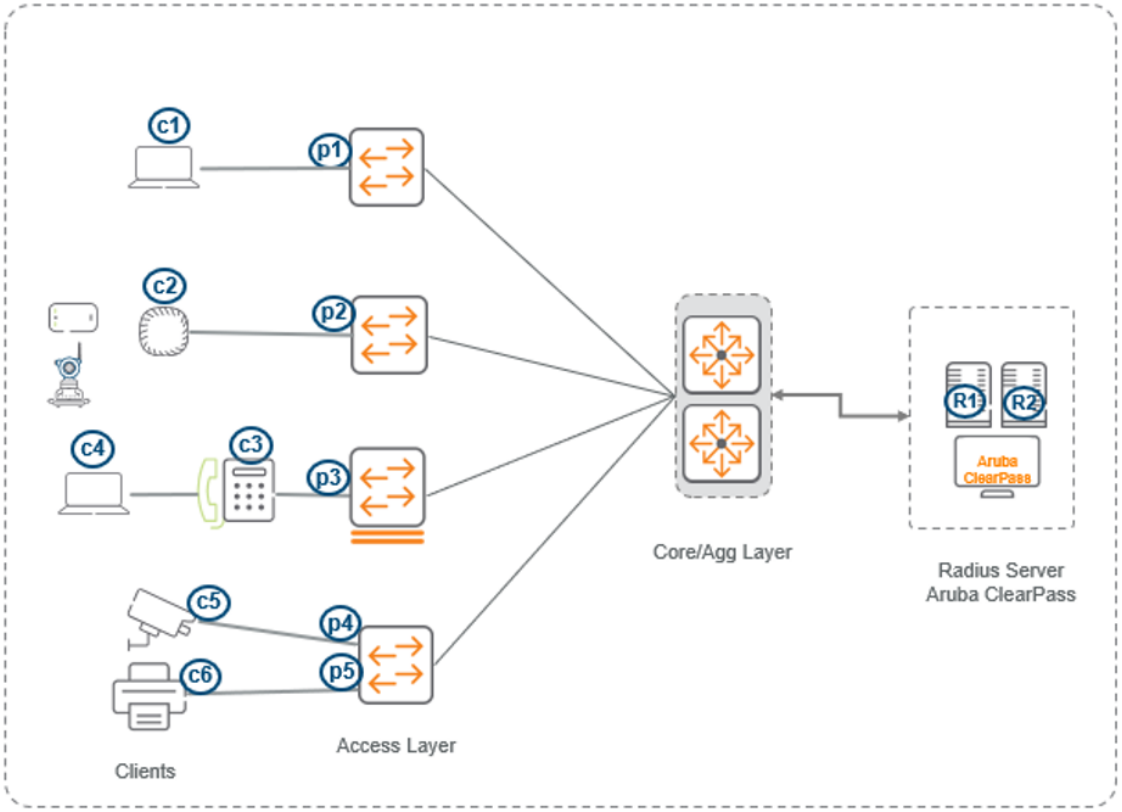
Platforms	Command context	Authority
8360	`config-mka-policy`	Administrators or local user group members with execution rights for this command.

Local Area Networks are often deployed in a way that allows unauthorized clients to attach to network devices or allow unauthorized users to get access to unattended clients on a network. 802.1X and MAC authentication simplify security management by providing access control plus the ability to control user profiles, allowing a given user entering valid user credentials access from multiple points within the network.

AOS-CX access switches support the following port access authentication types:

- 802.1X authentication
- MAC authentication

Figure 7 *802.1X and MAC authentication*



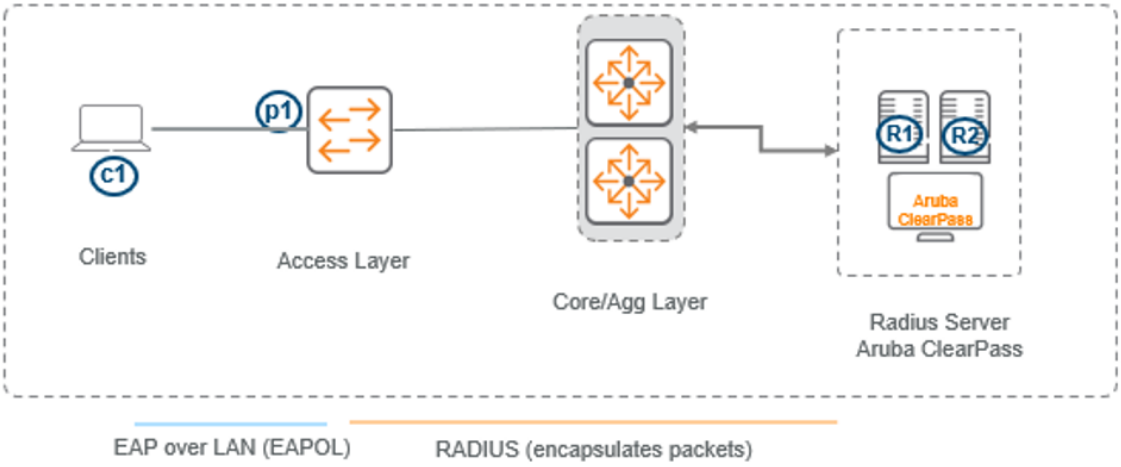
Port access 802.1X authentication

IEEE 802.1X is a standard for port-based authentication. This standard provides administrators with an authentication mechanism for devices trying to access a LAN or WLAN. 802.1X defines the encapsulation of the Extensible Authentication Protocol (EAP) over IEEE 802, which is known as EAP over LAN (EAPOL).

802.1X port-based authentication provides port-level security. It allows LAN access only on ports where a single 802.1X-capable client (supplicant) has entered authorized RADIUS user credentials. 802.1X

authentication is recommended for applications where only one client can connect to the port at a time. Using this option, the port processes all IP traffic as if it comes from the same client.

Figure 8 *802.1X authentication*



802.1X authentication involves the following entities:

- **Supplicant:** A client device that tries to access the LAN.
- **Authenticator:** A network device (typically a switch) that authenticates the supplicant.
- **Authentication Server:** A host running software supporting the RADIUS and EAP protocols that provides an authentication service to the authenticator.

Until the supplicant is authenticated, the authenticator allows only EAPOL traffic through the port to which the supplicant is connected. Only after the authentication is successful, the authenticator allows normal traffic from the supplicant.

802.1X requires a supplicant (client), authenticator (switch), and authentication server (RADIUS). Aruba ClearPass provides a RADIUS server, as well as other capabilities for monitoring and managing user access.

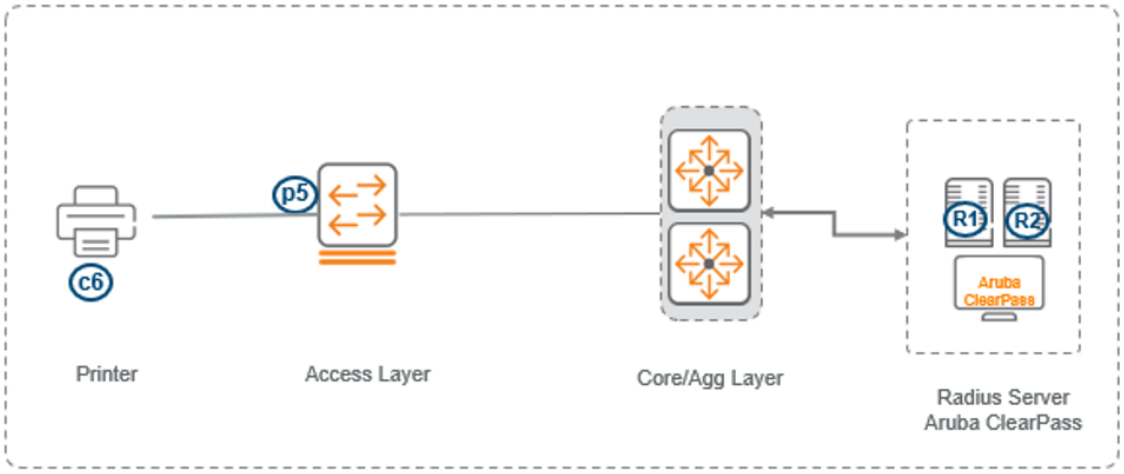
You can alternatively use a third-party RADIUS server such as Microsoft Network Policy Server (NPS) or an open source server such as FreeRADIUS.

In wired deployments, 802.1X is most commonly used in instances where the supplicant is an end-user machine (such as a PC, laptop, phone, and so on) and the authenticator is a switch. In certain deployments, the supplicant can itself be a switch (for example, an access switch). To ensure that the access switch connecting to an upstream switch has the right credentials, a switch should be able to be operate as an 802.1X supplicant.

Port access MAC authentication

MAC authentication is designed to be used at the edge of a network. It provides port-based security measures for protecting private networks and switches from unauthorized access. Because this method does not require clients to run special supplicant software (unlike 802.1X authentication), it is suitable to be used in legacy systems, IoT devices, and temporary access situations where introducing supplicant software is not an attractive option. Only a MAC address is required for authentication.

Figure 9 *MAC authentication*



MAC authentication relies on a RADIUS server to authenticate clients. This technique simplifies access security management by using a database on a single server to control client access. Up to three RADIUS servers can be used for backup in case access to the primary server fails. It also means that the same credentials can be used for authentication, regardless of which switch or switch port is the current access point into the LAN.

On a port configured for MAC authentication, the switch operates as a port-access authenticator using a RADIUS server, and the Challenge-Handshake Authentication Protocol (CHAP) and Password Authentication Protocol (PAP) protocols. Inbound traffic is processed by the switch alone, until authentication occurs. Some traffic from the switch to an unauthorized client is supported (for example, broadcast or unknown destination packets) before authentication occurs.

How MAC authentication works

MAC authentication grants access to a secure network by authenticating devices. When a device connects to the switch, either by direct link or through the network, the switch forwards the device MAC address to the RADIUS server for authentication. The RADIUS server uses the device MAC address as the user name and password, and grants or denies network access in the same way that it does for clients capable of interactive logons. The process does not use a client device configuration or a logon session. MAC authentication is well suited for clients not capable of providing interactive logons, such as telephones, printers, and wireless access points. Also, because most RADIUS servers allow for authentication to depend on the source switch and port through which the client connects to the network, you can use MAC authentication to lock a particular device to a specific switch and port.

802.1X port access and MAC authentication can be configured at the same time on a port. A total of 256 clients can be configured per port and 16,384 clients on the entire switch, irrespective of the authentication method. After the limit of 16,384 clients is reached, no additional authentication clients are allowed on any port for any method. The default is one client.

MAC authentication, MAC lockout, MACsec, and port security are mutually exclusive on a given port. If you configure any of these authentication methods on a port, you must disable LACP on the port.

How RADIUS server is used in MAC authentication

MAC authentication uses a RADIUS server to temporarily assign a port to a static VLAN to support an authenticated client. During client authentication, the switch port membership is determined according to the following hierarchy:

- A RADIUS-assigned VLAN.
- A static, port-based, untagged VLAN to which the port is configured. A RADIUS-assigned VLAN has priority over switch-port membership in any VLAN.

Supported platforms and standards

Port access is supported on the 4100i, 6000, 6100, 6200, 6300, 6400, 8325, 8360, and 10000 Switch Series.

Scale

Client authentication type	4100i	6000 6100	6200	6300 6400	8325	8360	10000
802.1X authenticated clients per port	32	32	256	256	256	256	256
MAC authenticated clients per port	32	32	256	256	256	256	256
Multiple authenticated clients per system (802.1X or MAC)	736	736	2048	4094	4094	4094	4094

Supported RFCs and standards

- IEEE 2010
- RADIUS (Remote Authentication Dial In User Service) as defined in RFC [2865]
- EAP (Extensible Authentication Protocol) as defined in RFC [3748]

Port access configuration task list

The following example shows the tasks that need to be performed to configure port access.

Note that before enabling 802.1X on the switch, first set up an authentication (RADIUS) server for the switch to use. Identify of the authentication server must be known before the following tasks can be performed.

Port access 802.1X and MAC authentication configuration example

Step 1: Configure the radius server group

The server order defines the priority order.

```
Switch(config)# aaa group server radius AAA-RADIUS
Switch(config-sg)# server tmeswitching1.aaa
Switch(config-sg)# server tmeswitching2.aaa
Switch(config-sg)# server tmeswitching3.aaa
```

Step 2: Configure the DNS server

If you define a FQDN (fully qualified domain name) for the RADIUS server, you must define a DNS server to resolve the name to an IP address:

```
Switch(config)# ip dns domain-name aaa
Switch(config)# ip dns server-address 10.20.10.11
Switch(config)# ip dns server-address 10.20.10.12
```

Step 3: Configure the RADIUS server secret key

```
Switch(config)# radius-server host tmeswitching1.aaa key plaintext admin123
Switch(config)# radius-server host tmeswitching2.aaa key plaintext admin@123
Switch(config)# radius-server host tmeswitching3.aaa key plaintext admin#123
```

Step 4: Configure the Downloadable User Role (DUR) using ClearPass

```
Switch(config)# Switch(config)# radius-server host tmeswitching1.aaa clearpass-
username <USER> clearpass-password plaintext <PASS> vrf <VRF>
```

Step 5: Configure RADIUS server tracking

Configure the tracking:

```
Switch(config)# Switch(config)# radius-server host tmeswitching1.aaa tracking
enable vrf <VRF>
```

Configure the tracking mode (any or dead-only):

```
Switch(config)# Switch(config)# radius-server host tmeswitching1.aaa tracking-mode
enable vrf <VRF>
```

Step 6: Configure RADIUS dynamic authorization

```
Switch(config)# radius dyn-authorization enable
Switch(config)# radius dyn-authorization client tmeswitching1.aaa secret-key
plaintext admin123
Switch(config)# radius dyn-authorization client tmeswitching2.aaa secret-key
plaintext admin@123
```

Step 7: Configure AAA authentication fail-through

```
Switch(config)# aaa authentication allow-fail-through
```

Step 8: Configure port access authentication on an access port

```
Switch(config)# interface 1/1/1
Switch(config-if)# aaa authentication port-access auth-precedence mac-auth dot1x
Switch(config-if)# aaa authentication port-access client-limit 3
Switch(config-if)# aaa authentication port-access dot1x authenticator
Switch(config-if-dot1x-auth)# cached-reauth
Switch(config-if-dot1x-auth)# cached-reauth-period 60 (default is 30sec)
Switch(config-if-dot1x-auth)# max-eapol-requests 1
Switch(config-if-dot1x-auth)# max-retries 1
Switch(config-if-dot1x-auth)# quiet-period 5
Switch(config-if-dot1x-auth)# discovery-period 10
```

```
Switch(config-if-dot1x-auth)# enable
Switch(config-if-dot1x-auth)# exit
Switch(config-if)#
Switch(config-if# aaa authentication port-access mac-auth
Switch(config-if-macauth)# enable
Switch(config-if-macauth)# end
Switch# end
```

These commands are available for tuning 802.1X authentication:

- `aaa authentication port-access dot1x authenticator max-eapol-requests`
- `aaa authentication port-access dot1x authenticator max-retries`
- `aaa authentication port-access dot1x authenticator quiet-period`
- `aaa authentication port-access dot1x authenticator discovery-period`

See also:

- Port access 802.1X authentication commands
- Port access MAC authentication commands
- Port access general commands

Use cases

Some port access use cases are as follows.

Use case 1: Faster onboarding of MAC authentication clients using concurrent onboarding

With this default port access authentication precedence configuration, it could take up to 162 seconds to onboard the MAC authentication clients.

```
show running-config interface 1/1/12
  interface 1/1/12
  no shutdown
  no routing
  vlan access 1
aaa authentication port-access dot1x authenticator
enable
aaa authentication port-access mac-auth
enable
```

802.1X timers could be tuned to reduce onboarding time, but it could still take 60 seconds to start MAC authentication with the following 802.1X timers configuration. Note that reducing the `eapol-timeout` any further could cause 802.1X to fail in some cases.

```
aaa authentication port-access dot1x authenticator
  eapol-timeout 30
  max-retires 1
  max-eapol-request 1
```

However, with a concurrent onboarding configuration like this, MAC authentication clients can be onboarded quickly.

```
show running-config interface 1/1/12
  interface 1/1/12
  no shutdown
  no routing
  vlan access 1
port-access onboarding-method concurrent enable
aaa authentication port-access dot1x authenticator
enable
aaa authentication port-access mac-auth
enable
```

Use case 2: PXE clients that download the supplicant

PXE (Preboot Execution Environment) clients expect the IP address to be assigned within 15 to 20 seconds before continuing the PXE process of connecting to a server to download and install the image and supplicant. With concurrent onboarding, this can be achieved as MAC authentication occurs quickly, gaining access to the PXE network. Once the supplicant is downloaded, the PXE client reboots and starts 802.1X authentication.

Port access 802.1X authentication commands

aaa authentication port-access dot1x authenticator

```
aaa authentication port-access dot1x authenticator {enable | disable}
no aaa authentication port-access dot1x authenticator {enable | disable}
```

Description

Enables or disables 802.1X authentication globally or at the port-level.

The `no` form of the command deletes global 802.1X configuration details and disables 802.1X authentication.

Examples

Enabling 802.1X authentication globally:

```
switch(config)# aaa authentication port-access dot1x authenticator enable
```

Disabling 802.1X authentication globally:

```
switch(config)# aaa authentication port-access dot1x authenticator disable
```

Deleting and disabling global 802.1X authentication:

```
switch(config)# no aaa authentication port-access dot1x authenticator
```

Enabling 802.1X authentication on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator enable
```

Disabling 802.1X authentication on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator disable
```

Deleting and disabling 802.1X authentication configuration on a port:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator auth-method

```
aaa authentication port-access dot1x authenticator auth-method eap-radius
no aaa authentication port-access dot1x authenticator auth-method eap-radius
```

Description

Configures the authentication mechanism used to control access to the network. The configured authentication method will be used to authenticate 802.1X clients.

The `no` form of the command resets the authentication mechanism to the default, `eap-radius`.

Parameter	Description
`eap-radius`	Specifies the EAP RADIUS as the 802.1X authentication method.

Examples

Enabling the EAP RADIUS 802.1X authentication method on the switch:

```
switch(config)# aaa authentication port-access dot1x authenticator auth-method
eap-radius
```

Resetting the EAP RADIUS 802.1X authentication method on the switch:

```
switch(config)# no aaa authentication port-access dot1x authenticator auth-method
eap-radius
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator cached-reauth

```
aaa authentication port-access dot1x authenticator cached-reauth
no aaa authentication port-access dot1x authenticator cached-reauth
```

Description

Enables cached reauthentication on a port. Cached reauthentication allows 802.1X reauthentications to succeed when the RADIUS server is unavailable. Users already authenticated retain their currently assigned RADIUS attributes.

The `no` form of the command disables the cached reauthentication on a port.

Examples

Enabling cached reauthentication on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator cached-
reauth
```

Disabling cached reauthentication on a port:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator cached-
reauth
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator cached-reauth-period

```
aaa authentication port-access dot1x authenticator cached-reauth-period <PERIOD>
```

```
no aaa authentication port-access dot1x authenticator cached-reauth-period
```

Description

Configures the period during which an authenticated client, which has failed to reauthenticate because the RADIUS server is unreachable, remains authenticated.

The `no` form of the command resets the cached reauthentication period to the default, 30 seconds.

Parameter	Description
<PERIOD>	Specifies the cached reauthentication period (in seconds). Default: 3600. Range: 1 to 4294967295.

Examples

Configuring the cached reauthentication period on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator cached-reauth-period 300
```

Resetting the cached reauthentication period to the default value:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator cached-reauth-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator discovery-period

```
aaa authentication port-access dot1x authenticator discovery-period <PERIOD>
no aaa authentication port-access dot1x authenticator discovery-period
```

Description

Configures the period the port waits to retransmit the next EAPOL request identity frame on an 802.1X enabled port that has no authenticated clients.

The `no` form of the command resets the discovery period to the default, 30 seconds.

Parameter	Description
<PERIOD>	Specifies the discovery period (in seconds). Default: 30. Range: 1 to 65535.

Examples

Configuring the discovery period on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator discovery-period 120
```

Resetting the discovery period to the default value:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator discovery-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator eap-tls-fragment

```
aaa authentication port-access dot1x authenticator eap-tls-fragment towards-server <max-fragment-size>
no aaa authentication port-access dot1x authenticator eap-tls-fragment towards-server
```

Description

Configure the maximum size in bytes of an EAP-TLS fragment encoded in a single RADIUS request packet. The no form of the command resets the size to the default value of 3072 bytes.

Examples

Setting the EAP-TLS fragment size for RADIUS request to 1024 bytes:

```
switch(config)# aaa authentication port-access dot1x authenticator eap-tls-fragment towards-server 1024
```

Resetting EAP-TLS fragment size back to the default value of 3072 bytes

```
switch(config-if)# no aaa authentication port-access dot1x authenticator eap-tls-
fragment towards-server
```

Command History

Release	Modification
10.11	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator eapol-timeout

```
aaa authentication port-access dot1x authenticator eapol-timeout <EAPOL-TIMEOUT>
no aaa authentication port-access dot1x authenticator eapol-timeout
```

Description

Configure the period the switch waits for a response from a client before retransmitting an EAPOL PDU. If the value is `0`, the time period is calculated as per RFC 2988.

As per RFC 2988 2.1: Before Round-Trip Time (RTT) measurement, set Retransmission Timeout (RTO) to 3 seconds for initial retransmission and then double the RTO to provide back off as per section 5.5. Limit the maximum RTO (RTOmax) to 20 seconds as per section 4.3 of RFC 3748.

The `no` form of the command resets the timeout period to the default.

Parameter	Description
<EAPOL-TIMEOUT>	Specifies the EAPOL timeout period (in seconds). Range: 1 to 65535.

Examples

Configuring EAPOL timeout on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator eapol-
timeout 120
```

Resetting the EAPOL timeout to the default value:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator eapol-
timeout
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator initial-auth-response-timeout

```
aaa authentication port-access dot1x authenticator
    initial-auth-response-timeout <TIMEOUT>
no aaa authentication port-access dot1x authenticator
    initial-auth-response-timeout [<TIMEOUT>]
```

Description

Configures the period of time (in seconds) the switch waits for the first EAPOL frame from a client before deeming the client to be incapable of 802.1X and therefore attempting the next authentication method, if any. The default is for this timeout to be disabled.

The `no` form of this command disables the timeout.

Parameter	Description
<TIMEOUT>	Specifies the timeout period (in seconds). Range: 1 to 65535.

Examples

Setting a 30 second timeout:

```
switch(config-if)# aaa authentication port-access dot1x authenticator
   initial-auth-response-timeout 30
```

Disabling the timeout:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator
   initial-auth-response-timeout
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator macsec

```
aaa authentication port-access dot1x authenticator macsec
no aaa authentication port-access dot1x authenticator macsec
```

Description

Enables the switch to provision a MACsec channel dynamically when the 802.1X client is authenticated using an EAP method that supports mutual authentication. MACsec is supported in device mode and in client mode with a client limit of one on MACsec-capable ports.

If a MACsec policy is not associated with the role applied to the client on the port with MACsec enabled, a MACsec channel will not be established and the port will be blocked on the data-plane.

The `no` form of the command disables MACsec using EAP on the port.

Examples

Enabling MACsec using EAP on a port:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator macsec
OR
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# macsec
```

Disabling MACsec using EAP on a port:

```
switch(config)# interface 1/1/1
switch(config-if)# no aaa authentication port-access dot1x authenticator macsec
OR
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# no macsec
```

Command History

Release	Modification
10.10	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config-if config-if-dot1x-auth	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator max-eapol-requests

```
aaa authentication port-access dot1x authenticator max-eapol-requests <MAX-EAPOL-REQUESTS>
no aaa authentication port-access dot1x authenticator max-eapol-requests
```

Description

Configures the number of EAPOL requests to send to a supplicant that must time out before authentication fails and the authentication session ends.

The `no` form of the command resets the maximum number of EAPOL requests to the default, 5.

Parameter	Description
<MAX-EAPOL-REQUESTS>	Specifies the maximum number of EAPOL requests. Default: 5. Range: 1 to 10.

Examples

Configuring maximum EAPOL requests on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator max-eapol-requests 3
```

Resetting the maximum EAPOL requests on a port to default:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator max-eapol-requests
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator mka cak-length

```
aaa authentication port-access dot1x authenticator mka cak-length {16|32}
no aaa authentication port-access dot1x authenticator mka cak-length {16|32}
```

Description

Configures the length of the Connectivity Association Key (CAK) to generate for EAP based MACsec.

The `no` form of this command resets the length to the default value of 32 bytes.

Parameter	Description
{16|32}	Specifies the CAK length. Default: 32.

Examples

Configuring the CAK length to 16 bytes:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator mka cak-
length 16
OR
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# mka cak-length 16
```

Configuring the CAK length to default:

```
switch(config)# interface 1/1/1
switch(config-if)# no aaa authentication port-access dot1x authenticator mka cak-
length
OR
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# no mka cak-length
OR
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# no mka cak-length 16
```

Command History

Release	Modification
10.10.1000	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config-if config-if-dot1x-auth	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator max-retries

```
aaa authentication port-access dot1x authenticator max-retries <max-retries>
no aaa authentication port-access dot1x authenticator max-retries
```

Description

Configures the maximum number of retries that the switch attempts to authenticate a client on a port before marking the client as unauthenticated.

The no form of the command resets the maximum number of retries to the default, 2.

Parameter	Description
<max-retries>	Indicates the number of authentication attempts. Default: 2. Range: 1 to 10.

Examples

Configuring maximum authentication attempts on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator max-retries
5
```

Resetting the maximum authentication attempts on a port to default:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator max-
retries
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator quiet-period

```
aaa authentication port-access dot1x authenticator quiet-period <PERIOD>
no aaa authentication port-access dot1x authenticator quiet-period
```

Description

Configures the period during which the port does not try to acquire a supplicant. This period begins after the last authentication attempt, authorized by the maximum retries parameter, fails.

You can configure the number of maximum retries with the `aaa authentication port-access dot1x authenticator max-retries` command.

The `no` form of the command resets the quiet period to the default, 60 seconds.

Parameter	Description
<PERIOD>	Specifies the quiet period (in seconds). Default: 60. Range: 0 to 65535.

Examples

Configuring quiet period on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator quiet-period
100
```

Resetting the quiet period on a port to default:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator quiet-
period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator radius server-group

`aaa authentication port-access dot1x authenticator radius server-group` *<GROUP-NAME>*
`no aaa authentication port-access dot1x authenticator radius server-group` *<GROUP_NAME>*

Description

Configures the switch to use an existing RADIUS server group for 802.1X authentication globally or for a particular port.

The **no** form of the command resets the server group to the default, **radius**.

When configured on a port, the **no** form of the command resets the server group on that port to the globally configured group. If no global RADIUS server group is configured, the **no** form of the command resets the configuration to the default group, **radius**.

When the RADIUS server group for 802.1X authentication is updated on a port, any existing clients on the port that were authenticated using the previous globally configured group will associate with the new group for the port during the next re-authentication cycle. Any new client that is onboarding on the port after the server group update will associate with the new group immediately.

Parameter	Description
<GROUP-NAME>	Specifies the name of the RADIUS server group.

Examples

Configuring the switch to use RADIUS server group `employee`:

```
switch(config)# aaa authentication port-access dot1x authenticator radius server-
group employee
```

Resetting RADIUS server group configuration to default:

```
switch(config)# no aaa authentication port-access dot1x authenticator radius
server-group
```

Configuring the RADIUS authentication server group on `1/1/1`:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# radius server-group group2
```

Resetting 802.1X RADIUS server group configuration on `1/1/1`:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x authenticator
switch(config-if-dot1x-auth)# no radius server-group
```

Command History

Release	Modification
10.12	Command is now configurable on a port
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-auth`
	`config-if-dot1x-auth`
		Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator reauth

```
aaa authentication port-access dot1x authenticator reauth
no aaa authentication port-access dot1x authenticator reauth
```

Description

Enables periodic reauthentication of authenticated clients on the port.

The `no` form of the command disables periodic reauthentication.

Examples

Enabling periodic reauthentication on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator reauth
```

Disabling periodic reauthentication on a port:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator reauth
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x authenticator reauth-period

```
aaa authentication port-access dot1x authenticator reauth-period <PERIOD>
no aaa authentication port-access dot1x authenticator reauth-period
```

Description

Configures the period after which the authenticated clients are reauthenticated on the port. You must enable reauthentication on the port before configuring the reauthentication period.

The no form of the command resets the reauthentication period to the default, 3600 seconds.

Parameter	Description
<PERIOD>	Specifies the reauthentication period (in seconds). Default: 3600. Range: 1 to 4294967295.

Examples

Configuring reauthentication period on a port:

```
switch(config-if)# aaa authentication port-access dot1x authenticator reauth-
period 100
```

Resetting the reauthentication period to the default value:

```
switch(config-if)# no aaa authentication port-access dot1x authenticator reauth-
period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

clear dot1x authenticator statistics interface

```
clear dot1x authenticator statistics [interface <IF-NAME>]
```

Description

Clears the 802.1X authentication statistics associated with the port and all the authenticator clients attached to this port.

If no interface is specified, the statistics is cleared for all 802.1X enabled ports.

Parameter	Description
<IF-NAME>	Specifies the interface name.

Examples

Clearing authentication statistics on a port:

```
switch# clear dot1x authenticator statistics interface 1/1/1
```

Clearing authentication statistics on a port:

Clearing authentication statistics on all ports:

```
switch# clear dot1x authenticator statistics
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show aaa authentication port-access dot1x authenticator interface client-status

```
show aaa authentication port-access dot1x authenticator interface {all|<IF-NAME>}
     client-status [mac <MAC-ADDRESS>]
```

Description

Shows information about active 802.1X authentication sessions. The output can be filtered by interface or MAC address.

Parameter	Description
`all`	Specifies all interfaces.
<IF-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing client status information for all ports.

```
switch# show aaa authentication port-access dot1x authenticator interface all
client-status

Client  FE:04:D7:50:89:37, johndoe, 1/1/1
==========================================

  Authentication Details
  ----------------------
    Status                        : Authenticated
    Type                          : Pass-Through
    EAP-Method                    : MD5
    Time Since Last State Change  : 10s

  Authentication Statistics
  -------------------------
    Authentication                          : 0
    Authentication Timeout                  : 0
    EAP-Start While Authenticating          : 0
    EAP-Logoff While Authenticating         : 0
    Successful Authentication               : 0
    Failed Authentication                   : 0
    Re-Authentication                       : 0
    Successful Re-Authentication            : 0
    Failed Re-Authentication                : 0
    EAP-Start When Authenticated            : 0
    EAP-Logoff When Authenticated           : 0
    Re-Auths When Authenticated             : 0
    Cached Re-Authentication                : 0

Client  9A:B4:59:97:D0:7E, janedoe, 1/1/1
==========================================

  Authentication Details
  ----------------------
    Status                        : Authenticated
    Type                          : Pass-Through
    EAP-Method                    : TLS
    Time Since Last State Change  : 5s

  Authentication Statistics
  -------------------------
    Authentication                          : 0
    Authentication Timeout                  : 0
    EAP-Start While Authenticating          : 0
    EAP-Logoff While Authenticating         : 0
    Successful Authentication               : 0
```

```
    Failed Authentication                  : 0
    Re-Authentication                      : 0
    Successful Re-Authentication           : 0
    Failed Re-Authentication               : 0
    EAP-Start When Authenticated           : 0
    EAP-Logoff When Authenticated          : 0
    Re-Auths When Authenticated            : 0
    Cached Re-Authentication               : 0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access dot1x authenticator interface port-statistics

`show aaa authentication port-access dot1x authenticator interface {all|<IF-NAME>} port-statistics`

Description

Shows information about 802.1X ports. The output can be filtered by interface.

Parameter	Description
`all`	Specifies all interfaces.
<IF-NAME>	Specifies the interface name.

Examples

Showing information for all ports.

```
switch# show aaa authentication port-access dot1x authenticator interface all
port-statistics

Port 1/1/1
==========

  Client Details
  --------------
    Number of Clients                 : 1
    Number of Authenticated Clients   : 1
    Number of Unauthenticated Clients : 0
    Number of authenticating clients  : 0
```

```
  Statistics
  ----------
    EAPOL Frames Received                  : 4
    EAPOL Frames Transmitted               : 3
    EAPOL Start Frames Received            : 1
    EAPOL Logoff Frames Received           : 0
    EAPOL Response ID Frames Received      : 2
    EAPOL Response Frames Received         : 1
    EAPOL Request ID Frames Transmitted    : 2
    EAPOL Request Frames Transmitted       : 1
    EAPOL Invalid Frames Received          : 0
    EAPOL EAP Length Error Frames Received : 0
    EAPOL Last Received Frame Version      : 0
    EAPOL Last Received Frame Client MAC   : 0

Port 1/1/2
==========

  Client Details
  --------------
    Number of Clients                 : 1
    Number of Authenticated Clients   : 1
    Number of Unauthenticated Clients : 0

  Statistics
  ----------
    EAPOL Frames Received                  : 4
    EAPOL Frames Transmitted               : 3
    EAPOL Start Frames Received            : 1
    EAPOL Logoff Frames Received           : 0
    EAPOL Response ID Frames Received      : 2
    EAPOL Response Frames Received         : 1
    EAPOL Request ID Frames Transmitted    : 2
    EAPOL Request Frames Transmitted       : 1
    EAPOL Invalid Frames Received          : 0
    EAPOL EAP Length Error Frames Received : 0
    EAPOL Last Received Frame Version      : 0
    EAPOL Last Received Frame Client MAC   : 0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access MAC authentication commands

aaa authentication port-access mac-auth

```
aaa authentication port-access mac-auth {enable | disable}
no aaa authentication port-access mac-auth {enable | disable}
```

Description

Enables or disables MAC authentication globally or at the port-level.

Examples

Enabling MAC authentication on all interfaces:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# enable
```

Disabling MAC authentication on all interfaces:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# disable
```

Enabling MAC authentication on an interface:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# enable
```

Disabling MAC authentication on an interface:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# disable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth addr-format

```
aaa authentication port-access mac-auth addr-format {no-delimiter | single-dash |
     multi-dash |multi-colon | no-delimiter-uppercase | single-dash-uppercase |
     multi-dash-uppercase | multi-colon-uppercase}
no aaa authentication port-access mac-auth addr-format {no-delimiter | single-dash |
       multi-dash |multi-colon | no-delimiter-uppercase | single-dash-uppercase |
       multi-dash-uppercase | multi-colon-uppercase}
```

Description

Configures the MAC address format that the switch must use in the RADIUS request message.

The `no` form of the command resets the MAC address format to the default, `no-delimiter`.

Examples

Setting the MAC address format on the switch:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# addr-format single-dash
```

Resetting the MAC address format on the switch to its default:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# no addr-format
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth auth-method

```
aaa authentication port-access mac-auth auth-method {chap | pap}
no aaa authentication port-access mac-auth auth-method
```

Description

Configures the RADIUS authentication method for MAC authentication.

Following are the MAC authentication methods supported:

- CHAP
- PAP

The PEAP-MSCHAPv2 method of authentication is not supported.

The `no` form of the command resets the authentication method to the default, `chap`.

Examples

Configuring the RADIUS authentication method on the switch:

```
switch# config
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# auth-method pap
```

Resetting the RADIUS authentication method on the switch:

```
switch(config)# no aaa authentication port-access mac-auth auth-method
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth cached-reauth

```
aaa authentication port-access mac-auth cached-reauth
no aaa authentication port-access mac-auth cached-reauth
```

Description

Enables cached reauthentication on a port. Cached reauthentication allows MAC reauthentications to succeed when the RADIUS server is unavailable. Users who are already authenticated, retain their currently assigned RADIUS attributes.

The `no` form of the command disables cached reauthentication.

Examples

Enabling cached reauthentication on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# cached-reauth
```

Disabling cached reauthentication on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no cached-reauth
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth cached-reauth-period

```
aaa authentication port-access mac-auth cached-reauth-period <PERIOD>
no aaa authentication port-access mac-auth cached-reauth-period
```

Description

Configures the period during which an authenticated client, which has failed to reauthenticate because the RADIUS server is unreachable, remains authenticated.

The `no` form of the command resets the cached reauthentication period to the default, 3600 seconds.

Parameter	Description
<PERIOD>	Specifies the cached reauthentication period (in seconds). Default: 3600. Range: 1 to 4294967295.

Examples

Configuring cached reauthentication period on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# cached-reauth-period 300
```

Resetting the cached reauthentication period to the default value:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no cached-reauth-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth password

```
aaa authentication port-access mac-auth password {plaintext|ciphertext}<PASSWORD>
no aaa authentication port-access mac-auth password
```

Description

Enables and configures the global password that the switch must use for MAC authentication. The password can be either in ciphertext or plaintext format.

The `no` form of the command disables the password for MAC authentication.

Parameter	Description
{plaintext|ciphertext}<*PASSWORD*>	Specifies the global password to be used by all MAC authenticating devices in either plaintext or ciphertext format.

Examples

Setting the MAC authentication password:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# password plaintext maX99J#
```

Disabling the MAC authentication password:

```
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# no password
```

Command History

Release	Modification
10.09	Command introduced on the 8360
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth quiet-period

```
aaa authentication port-access mac-auth quiet-period <PERIOD>
no aaa authentication port-access mac-auth quiet-period
```

Description

Configures the period during which the switch does not try to authenticate a rejected client.

The no form of the command resets the quiet period to the default, 60 seconds.

Parameter	Description
<*PERIOD*>	Specifies the quiet period (in seconds). Default: 60. Range: 0 to 65535.

Examples

Configuring the quiet period on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# quiet-period 65
```

Resetting the quiet period on a port to default:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no quiet-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth radius server-group

```
aaa authentication port-access mac-auth radius server-group <GROUP-NAME>
no aaa authentication port-access mac-auth radius server-group <GROUP-NAME>
```

Description

Configures the MAC authentication server group globally or for a particular port.

The **no** form of the command resets the authentication server group to the default value, **radius**.

When configured on a port, the **no** form of the command resets the server group on that port to the globally configured group. If no global RADIUS server group is configured, the **no** form of the command resets the configuration to the default group, **radius**.

When the RADIUS server group for MAC authentication is updated on a port, any existing clients on the port that were authenticated using the previous globally configured group will associate with the new group for the port during the next re-authentication cycle. Any new client that is onboarding on the port after the server group update will associate with the new group immediately.

Parameter	Description
<GROUP-NAME>	Specifies the name of the MAC authentication server group.

Examples

Configuring the RADIUS server group for MAC authentication globally:

```
switch# config
switch(config)# aaa authentication port-access mac-auth
switch(config-macauth)# radius server-group group1
```

Configuring the RADIUS server group for MAC authentication on `1/1/5`:

```
switch(config)# interface 1/1/5
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# radius server-group group2
```

Resetting the RADIUS server group configuration on `1/1/5`:

```
switch(config)# interface 1/1/5
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no radius server-group
```

Command History

Release	Modification
10.12	Command is now configurable on a port
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-macauth`
	`config-if-macauth`
		Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth reauth

```
aaa authentication port-access mac-auth reauth
no aaa authentication port-access mac-auth reauth
```

Description

Enables periodic MAC reauthentication of authenticated clients on the port.

The `no` form of the command disables periodic MAC reauthentication on the port.

Examples

Enabling reauthentication on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# reauth
```

Disabling reauthentication on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no reauth
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access mac-auth reauth-period

```
aaa authentication port-access mac-auth reauth-period <PERIOD>
no aaa authentication port-access mac-auth reauth-period
```

Description

Configures the period after which MAC authenticated clients must be reauthenticated on the port. You must first enable MAC reauthentication on the port before configuring the MAC reauthentication period.

The no form of the command resets the MAC reauthentication period to the default, 3600 seconds.

Parameter	Description
<PERIOD>	Specifies the MAC reauthentication period (in seconds). Default: 3600. Range: 1 to 4294967295.

Examples

Configuring the MAC reauthentication period on a port:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# reauth-period 60
```

Resetting the MAC reauthentication period to its default:

```
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# no reauth-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

clear mac-auth statistics

```
clear mac-auth statistics [interface <IF-NAME>]
```

Description

Clears the MAC authentication statistics associated with the port and all the authenticator state machines associated to this port.

If no interface is specified, the statistics is cleared for all MAC authentication enabled ports.

Parameter	Description
<IF-NAME>	Specifies the interface name.

Examples

Clearing MAC authentication statistics on a port:

```
switch# clear mac-auth statistics interface 1/1/1
```

Clearing MAC authentication statistics on all ports:

```
switch# clear mac-auth statistics
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access mac-auth interface client-status

```
show aaa authentication port-access mac-auth interface {all|<IF-NAME>}
 client-status [mac <MAC-ADDRESS>]
```

Description

Shows information about MAC authentication clients status. The output can be filtered by interface or MAC address.

Parameter	Description
`all`	Specifies all interfaces.
<IF-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing client status information for all ports:

```
switch# show aaa authentication port-access mac-auth interface all client-status

Port Access Client Status Details

Client  AB:CD:DE:FF:AA:BB, 1/1/1
========================================
  Authentication Details
  ----------------------
    Status                                : Authenticated
    Type                                  : Pass-Through
    Auth-Method                           : CHAP
    Time Since Last State Change          : 10 secs

  Authentication Statistics
  -------------------------
        Authentication                 : 1
  Authentication Timeout         : 0
  Successful Authentication      : 1
  Failed Authentication          : 0
  Re-Authentication              : 0
  Successful Re-Authentication   : 0
  Failed Re-Authentication       : 0
        Re-Auths When Authenticated    : 0
  Cached Re-Authentication       : 0

Client  DD:CD:AB:CS:EE:OI, 1/1/2
========================================
  Authentication Details
  ----------------------
    Status                                : Unauthenticated
    Type                                  : Pass-Through
    Auth-Method                           : CHAP
    Auth Failure reason                   : Server reject/ Server timeout
    Time Since Last State Change          : 15 secs

  Authentication Statistics
  -------------------------
  Authentication                 : 1
  Authentication Timeout         : 0
  Successful Authentication      : 0
  Failed Authentication          : 1
  Re-Authentication              : 0
  Successful Re-Authentication   : 0
  Failed Re-Authentication       : 0
  Re-Auths When Authenticated    : 0
  Cached Re-Authentication       : 0
```

Showing status information for a client:

```
switch# show aaa authentication port-access mac-auth interface 1/1/1 client-status
mac ab:cd:de:ff:aa:bb

Port Access Client Status Details

Client  AB:CD:DE:FF:AA:BB, 1/1/1
========================================
  Authentication Details
  ----------------------
    Status                                : Authenticated
    Type                                  : Pass-Through
    Auth-Method                           : CHAP
    Time Since Last State Change          : 10 secs

  Authentication Statistics
  -------------------------
       Authentication                 : 1
  Authentication Timeout         : 0
  Successful Authentication      : 1
  Failed Authentication          : 0
  Re-Authentication              : 0
  Successful Re-Authentication   : 0
  Failed Re-Authentication       : 0
       Re-Auths When Authenticated    : 0
  Cached Re-Authentication       : 0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access mac-auth interface port-statistics

`show aaa authentication port-access mac-auth interface {all|<IF-NAME>} port-statistics`

Description

Shows information about MAC authentication ports. The output can be filtered by interface.

Parameter	Description
`all`	Specifies all interfaces.
<IF-NAME>	Specifies the interface name.

Examples

Showing information for all ports.

```
switch# show aaa authentication port-access mac-auth interface all port-statistics

Port 1/1/1
==========

  Client Details
  --------------
    Number of Clients                 : 3
    Number of authenticated clients   : 2
    Number of unauthenticated clients : 1
    Number of authenticating clients  : 0

Port 1/1/2
==========

  Client Details
  --------------
    Number of Clients                 : 4
    Number of authenticated clients   : 2
    Number of unauthenticated clients : 2
    Number of authenticating clients  : 0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access general commands

aaa authentication port-access allow-lldp-auth

```
aaa authentication port-access allow-lldp-auth
no aaa authentication port-access allow-lldp-auth
```

Description

By default authentication is allowed via LLDP packets which are received on the port. Use the **no** version of this command to prevent authentication using LLDP packets received on the port.

Examples

Disabling authentication via LLDP packets:

```
switch(config-if)# no aaa authentication port-access allow-lldp-auth
```

Command History

Release	Modification
10.09	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access allow-cdp-auth

```
aaa authenticationport-access allow-cdp-auth
no aaa authentication port-access allow-cdp-auth
```

Description

By default authentication is allowed via CDP packets which are received on the port. Use the **no** version of this command to prevent authentication using CDP packets received on the port.

Examples

Disabling authentication via CDP packets:

```
switch(config-if)# no aaa authentication port-access allow-cdp-auth
```

Command History

Release	Modification
10.09	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access auth-mode

```
aaa authentication port-access auth-mode {client-mode | device-mode | multi-domain}
```

Description

Configures the authentication mode for the port. By default, client mode is enabled.

Parameter	Description
`client-mode`	Selects client mode. In this mode, all clients connecting to the port are sent for authentication. The maximum number of clients allowed to connect to the port is limited by the client limit value configured with the `aaa authentication port-access client-limit` command.
`device-mode`	Selects device mode. In this mode, only the first client connecting to the port is sent for authentication. Once this client is authenticated, the port is considered as open and all subsequent clients trying to connect on that port are not sent for authentication.
`multi-domain`	Selects multidomain mode. In this mode only one voice device is allowed to be authenticated in addition to the configured data devices on a port. By default only one data device is allowed to be authenticated on the multidomain mode along with one voice device. You can configure the maximum number of data devices allowed with the `aaa authentication port-access client-limit multi-domain` command. If a second voice device or a data device greater than the configured data client limit onboards, a violation is triggered. You must configure a voice VLAN for IP phones to onboard a voice device in the multidomain authentication mode. To authorize a voice device, you must perform one of the following: ▪ Configure the AAA server to send the `Aruba-Device-Traffic-Class` Aruba VSA with value `1`. ▪ Configure the `device-traffic-class` parameter in the role to be applied to indicate a voice device. Without this VSA value or the device type in the role, the switch considers the voice device as a data device.

Examples

Configuring device mode authentication for a port:

```
switch(config)# interface  1/1/1
switch(config-if)# aaa authentication port-access auth-mode device-mode
```

Configuring multidomain mode authentication for a port:

```
switch(config)# interface  1/1/1
switch(config-if)# aaa authentication port-access auth-mode multi-domain
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access auth-precedence

```
aaa authentication port-access auth-precedence [dot1x mac-auth | mac-auth dot1x]
no aaa authentication port-access auth-precedence [dot1x mac-auth | mac-auth dot1x]
no aaa authentication port-access auth-precedence
```

Description

Configures the per port authentication precedence using the space separator.

By default, 802.1X authentication (`dot1x`) takes a higher precedence than MAC authentication (`mac-auth`).

The `no` form of the command resets the port access authentication precedence to the default, 802.1X authentication followed by MAC authentication.

Parameter	Description
`dot1x mac-auth`	Specifies that the port access authentication precedence is 802.1X authentication followed by MAC authentication.
`mac-auth dot1x`	Specifies that the port access authentication precedence is MAC authentication followed by 802.1X authentication.

Examples

Configuring MAC authentication precedence on a port:

```
switch(config-if)# aaa authentication port-access auth-precedence mac-auth dot1x
```

Resetting the authentication precedence to the default value:

```
switch(config-if)# no aaa authentication port-access auth-precedence mac-auth
dot1x
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

aaa authentication port-access auth-priority

```
aaa authentication port-access auth-priority [dot1x mac-auth | mac-auth dot1x]
no aaa authentication port-access auth-priority [dot1x mac-auth | mac-auth  dot1x]
no aaa authentication port-access auth-priority
```

Description

Configures the authentication priority using the space separator to specific interface.

Default `auth-priority` with concurrent onboarding is 802.1X followed by MAC authentication. With authentication precedence, the default `auth-priority` follows the `auth-precedence` order.

The `no` form of the command resets the port access authentication priority to the default, is same as the configured `auth-precedence` order.

The authentication priority is useful in deployments where clients such as wireless access points (APs), IT-compliant-laptops or phones, or laptops without pre-loaded supplicant software must download the supplicant software or firmware patches before attempting 802.1X authentication. In such cases, configure the MAC authentication as the primary authentication method followed by 802.1X for the authentication order. Meanwhile, configure 802.1X as the primary authentication priority and MAC authentication as secondary to enforce access based on 802.1X. Thus the client (or end access device) will initially be authenticated by MAC authentication with the access required to onboard and install the software or patches, and subsequently attempt the 802.1X authentication.

Reauthentication will be triggered for all high priority methods and not just the final successful authentication method.

Parameter	Description
`dot1x mac-auth`	Specifies that the port access authentication precedence is 802.1X authentication followed by MAC authentication.
`mac-auth dot1x`	Specifies that the port access authentication precedence is MAC authentication followed by 802.1X authentication.

Examples

Configuring MAC authentication priority on a port:

```
switch(config-if)# aaa authentication port-access auth-priority mac-auth dot1x
```

Resetting the authentication priority to the default value:

```
switch(config-if)# no aaa authentication port-access auth-priority mac-auth dot1x
switch(config-if)# no aaa authentication port-access auth-priority
```

Sample configuration:

```
interface 1/1/1
    no shutdown
    no routing
    vlan access 1
    aaa authentication port-access auth-precedence mac-auth dot1x
    aaa authentication port-access auth-priority dot1x mac-auth
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access auth-role

```
aaa authentication port-access [critical-role|preauth-role|reject-role|
   auth-role|critical-voice-role] <ROLE-NAME>
no aaa authentication port-access [critical-role|preauth-role|reject-role|
   auth-role|critical-voice-role]
```

Description

Configures the role to assign to the clients depending on the client authentication state.

The `no` form of the command disassociates the roles that you assign to clients based on the authentication state.

Parameter	Description
`critical-role`	Specifies the role that is applied when the RADIUS server is unreachable for authentication or when there is a request timeout.
`preauth-role`	Specifies the role that is applied when authentication is still in progress.
`reject-role`	Specifies the role that is applied when authentication has failed.
`auth-role`	Specifies the role that is applied to authenticated clients when a specific role is not assigned in the RADIUS server.
`critical-voice-role`	Specifies the role for a voice client when the RADIUS server is unreachable for authentication during reauthentication period. This is applicable when multidomain authentication mode is enabled with the `aaa authentication port-access auth-mode` command.
<ROLE-NAME>	Specifies the role name.

Examples

Configuring critical role for clients:

```
switch(config-if)# aaa authentication port-access critical-role role1
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access client-auto-log-off final-authentication-failure

```
aaa authentication port-access client-auto-log-off final-authentication-failure
no aaa authentication port-access client-auto-log-off final-authentication-failure
```

Description

Use this command to automatically remove a client when authentication fails due to any reason except **server-reject** or **server-timeout**. This feature is disabled by default.

The `no` form of this command disables this feature if it has been previously enabled.

Automatic client log-off is not supported on Layer-3 interfaces.

Examples

Configuring the client-auto-log-off feature on interface 1/1/1:

```
switch(config)# interface  1/1/1
switch(config-if)# aaa authentication port-access client-auto-log-off final-
authentication-failure
```

Command History

Release	Modification
10.08.1090	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access client-limit

```
aaa authentication port-access client-limit <CLIENTS>
no aaa authentication port-access client-limit
```

Description

Configures the maximum number of clients that can simultaneously connect to a port.

The `no` form of this command resets the number of clients to the default.

Parameter	Description
<CLIENTS>	Specifies the maximum number of clients. Default: 1. Range:

Examples

Configuring the client limit for a port:

```
switch(config-if)# aaa authentication port-access client-limit 25
```

Command History

Release	Modification
10.09	Command introduced on 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access client-limit multi-domain

`aaa authentication port-access client-limit multi-domain <DATA-CLIENT-LIMIT>`

Description

Configures the data client limit on the multidomain enabled interface. By default, the data client limit on a multidomain enabled interface is `1`, and the maximum number of data clients supported on a multidomain enabled port is `5`.

Parameter	Description
<DATA-CLIENT-LIMIT>	Specifies the maximum data client limit on the multidomain enabled interface. Range: `1` to `5`

Examples

Configuring data cliemt limit of **4** on the multidomain enabled interface **1/1/4**:

```
switch(config)# interface  1/1/1
switch(config-if)# aaa authentication port-access client-limit multi-domain 4
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access radius-override

```
aaa authentication port-access radius-override {enable | disable}
no aaa authentication port-access radius-override {enable | disable}
```

Description

Enables or disables `radius-override` support at the interface context. When `radius-override` support is enabled, a new RADIUS overridden role is created with a combination of LUR/DUR along with RADIUS attributes for the corresponding client-role attributes such as VLANs. When the RADIUS override support is disabled, then only the user-roles get applied to the client.

The `no` form of this command disables the support for `radius-override`.

The `radius-override` support is applicable only for Auth-role.

Usage

The following table describes the access-response for the combination of roles with `radius-override` enabled and disabled:

Combination of roles in Access-Accept	Action with `radius-override` disabled	Action with `radius-override` enabled
Local User Role and RADIUS attributes	Local User Role is applied	New RADIUS Overridden role with Local User Role and RADIUS attributes is created and applied
Downloadable User Role and RADIUS attributes	Downloadable User Role is applied	New RADIUS Overridden role with Downloadable User Role and RADIUS attribute is created and applied
Local User Role and Downloadable User Role	Local User Role is applied	Local User Role is applied
Local User Role, Downloadable User Role, and RADIUS attributes	Local User Role is applied	New RADIUS Overridden role with Local User Role and RADIUS attributes is created and applied

Examples

Enabling radius-override support:

```
switch(config-if)# aaa authentication port-access radius-override enable
```

```
switch(config-if)# no aaa authentication port-access radius-override disable
```

Disabling radius-override support:

```
switch(config-if)# aaa authentication port-access radius-override disable
```

```
switch(config-if)# no aaa authentication port-access radius-override enable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

port-access allow-flood-traffic

```
port-access allow-flood-traffic {enable | disable}
```

Description

Enables or disables transmission of flood traffic, such as broadcast, multicast, and unknown unicast messages through a security enabled port on which no client has been authenticated.

By default, transmission of flood traffic is disabled.

Usage

This command can be used to allow Wake-on-LAN packets on security enabled ports, before a client is authenticated.

Examples

Enabling flood traffic on a port:

```
switch(config-if)# port-access allow-flood-traffic enable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

port-access auto-vlan

```
port-access auto-vlan
no port-access auto-vlan
```

Description

Creates VLAN automatically for the port-access clients globally, if the VLAN is not configured statically on the switch. By default, `port-access auto-vlan` is disabled.

The `no` form of this command disables the port-access automatic VLAN creation globally on the switch.

The type for the VLAN created using the auto-vlan feature is displayed as `port-access` in the `show vlan` command.

Examples

Enabling automatic VLAN creation for clients:

```
switch(config)# port-access auto-vlan
```

Disabling automatic VLAN creation for clients(default):

```
switch(config)# no port-access auto-vlan
```

Command History

Release	Modification
10.08	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

port-access client-move

```
port-access client-move {enable | disable | secure}
```

Description

When client move is enabled (the default), a port access client can move to other port access-enabled interfaces, at which time they will be re-authenticated on the new interface.

When client move is disabled, a client cannot move to other port access-enabled interfaces.

An authenticated client will be moved immediately if the new port to which the client will move has a pre-auth role configured, even when client move is enabled as secure.

Parameter	Description
`enable`	Enables this feature so port access clients can move to other port access-enabled interfaces.
`disable`	Disables this feature so port access clients cannot move to other port access-enabled interfaces.
`secure`	Use this configuration setting to stop a potential attacker from denying a genuine client access by spoofing the client's MAC on a different port-access enabled port of the switch. An authenticated client will be moved immediately if the new port to which the client moved has a pre-authentication role configured, even when client-move is enabled as secure. **NOTE:** Secure client move is enabled by default.

Examples

Enabling client move:

```
switch(config)# port-access client-move enable
```

Enabling secure client move:

```
switch(config)# port-access client-move enable secure
```

Disabling client move:

```
switch(config)# port-access client-move disable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

port-access event-log client

```
port-access event-log client
no port-access event-log client
```

Description

Enables port access informational event logs for the client. These event logs help with client telemetry on a remote management station such as Aruba Central. By default, these informational event logs are disabled.

Starting with AOS-CX 10.10, the event IDs 10510 and 10511 are logged when the port access informational event log configuration is enabled.

The `no` form of the command disables port access informational event logs for the client.

Example

Enabling port access event log:

```
switch(config)# port-access event-log client
```

Disabling port access event log:

```
switch(config)# no port-access event-log client
```

Command History

Release	Modification
10.10	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

port-access fallback-role

```
port-access fallback-role <ROLE-NAME>
no port-access fallback-role <ROLE-NAME>
```

Description

Configures the fallback role to assign to the clients onboarding on a port. This role is applied only when no derived role is applied to the clients.

The `no` form of the command resets the fallback role.

Parameter	Description
<ROLE-NAME>	Specifies the fallback role name. The maximum number of characters supported is 64.

Usage

Following are the conditions for the fallback role to be applied on onboarding devices:

- The device profile local MAC match feature with block-until-profile-applied mode is configured.
- Device profile along with AAA is configured but no match was found for the device profile client.
- AAA method with no reject or critical role is configured, and the connection to RADIUS server failed.
- 802.1X authentication is enabled on the port, but the supplicant of the device timed out to respond to the authentication request.

Example

Configuring fallback role for a port:

```
switch(config)# interface  1/1/3
switch(config-if)# port-access fallback-role fallback01
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

port-access log-off client

```
port-access log-off client mac <MAC-ADDRESS>
port-access log-off client interface <INTERFACE-NAME>
port-access log-off client role <ROLE-NAME>
```

Description

Logs off the client connected to a port access-enabled interface.

Parameter	Description
<MAC-ADDRESS>	Specifies the client MAC address.
<INTERFACE-NAME>	Specifies the client interface.
<ROLE-NAME>	Specifies the client MAC address.

Example

Logging a client off from the switch, specifying the MAC address:

```
switch# port-access log-off client mac 00:50:56:bd:04:2d
```

Logging a client off from the switch, specifying the interface:

```
switch# port-access log-off client interface 1/1/1
```

Logging a client off from the switch, specifying the role:

```
switch# port-access log-off client role r1
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

port-access onboarding-method precedence

```
port-access onboarding-method precedence [aaa device-profile | device-profile aaa]
no port-access onboarding-method precedence [aaa device-profile | device-profile aaa]
```

Description

Configures the precedence for the method to be used to authenticate onboarding devices for each interface.

The `no` form of the command resets the authentication method precedence to the default precedence of AAA followed by device profile.

AAA includes the 802.1X and MAC authentication methods whose precedence can be configured using the `aaa authentication port-access auth-precedence` command. Here, the default precedence is 802.1X authentication.

For example, if you configure AAA (both 802.1X and MAC) authentication methods and device profile on a port, by default, the authentication precedence would be 802.1X, then MAC, and lastly device profile.

`aaa` in the parameters refers to the authentication precedence configured using the `aaa authentication port-access auth-precedence` command.

Parameter	Description
`aaa device-profile`	Specifies that the precedence for per port onboarding authentication method is AAA followed by device profile.
`device-profile aaa`	Specifies that the precedence for per port onboarding authentication method is device profile followed by AAA.

Examples

Configuring AAA method precedence on a port:

```
switch(config)# interface  1/1/1
switch(config-if)# port-access onboarding-method precedence device-profile aaa
```

Resetting the authentication method precedence:

```
switch(config)# interface  1/1/1
switch(config-if)# no port-access onboarding-method precedence device-profile aaa
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

port-access onboarding-method concurrent

`port-access onboarding-method concurrent <enable | disable>`

Description

Configures all methods to start concurrently for faster onboarding process. If authentication priority is not configured when enabling concurrent onboarding, the priority will be 802.1X followed by `mac-auth` and `device-profile`.

Default priority for concurrent onboarding is 802.1X followed by `mac-auth` and `device-profile`.

When enabling concurrent onboarding on the port, existing clients will be de-authenticated and freshly onboarded concurrently.

When concurrent onboarding is enabled, then auth-precedence will be ignored.

If concurrent onboarding is configured, the client will stay in pre-auth role till it gets succeeded by one authentication method or gets failed by all the authentication methods.

When the authentication method with the highest priority fails, the profile of the next successful authentication method is applied.

If all methods fail, the reject or critical role is applied based on the 802.1X authentication failure reason and continues to reauthenticate with the 802.1X method.

Reauthentication will be triggered for all high priority methods and not just the final successful authentication method.

Some RADIUS server may block the client when it receives two requests, `mac-auth` and 802.1X, from the same client at the same time. This is because the RADIUS server allows only one authentication request. In such cases, concurrent onboarding is not feasible. To prevent such scenarios, configure `auth-precedence` with `auth-priority`.

Parameter	Description
`enable`	Enable clients to be onboarded concurrently.
`disable`	Disable clients to be onboarded concurrently.

Examples

Enabling concurrent onboarding on a port:

```
switch(config)# interface  1/1/1
switch(config-if)# port-access onboarding-method concurrent enable
```

Disabling concurrent onboarding on a port:

```
switch(config)# interface  1/1/1
switch(config-if)# port-access onboarding-method concurrent disable
```

Sample configuration:

```
interface 1/1/1
    no shutdown
    no routing
    vlan access 999
    !aaa authentication port-access auth-precedence mac-auth dot1x
    port-access onboarding-method concurrent enable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

port-access reauthenticate interface

`port-access reauthenticate interface <INTERFACE-NAME>`

Description

Forcefully reauthenticates all clients connected to an interface.

Clients that are in the `HELD` state are ignored.

Parameter	Description
<INTERFACE-NAME>	Specifies the interface name.

Examples

Configuring reauthentication of all clients on a port:

```
switch# port-access reauthenticate interface 1/1/1
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Manager (#)	Administrators or local user group members with execution rights for this command.

show aaa authentication port-access interface client-status

```
show aaa authentication port-access interface {all | <IFRANGE>}
client-status [mac <MAC-ADDRESS>]
```

Description

Shows information about the status of the role applied on ports. RADIUS overridden user roles are suffixed with *. The role name is not displayed for clients that do not use local, downloaded, or RADIUS overridden role.

Parameter	Description
`all`	Specifies all interfaces.
<IFRANGE>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing information about a client:

```
switch# show aaa authentication port-access interface all client-status
Port Access Client Status Details
RADIUS overridden user roles are suffixed with '*'
Client 00:50:56:96:93:d6, John Doe
==============================

Session Details
```

```
---------------
Port         : 1/1/13
Session Time : 30s
IPv4 Address : 10.0.0.1
IPv6 Address :


Authentication Details
----------------------
Status          : dot1x Authenticated
Auth Precedence : dot1x - Authenticated, mac-auth - Not attempted
Auth History    : dot1x    - Authenticated, 5s ago
mac-auth - Unauthenticated, Server-Reject, 10s ago
mac-auth - Unauthenticated, Server-Reject, 15s ago
dot1x    - Unauthenticated, Server-Timeout, 15s ago
dot1x    - Attempted, 20s ago


Authorization Details
---------------------
Role   : Employee*
Status : Applied


Client 00:50:56:96:50:28
============================
Session Details
---------------
Port         : 1/1/14
Session Time : 10s
IPv4 Address : 10.0.0.2
IPv6 Address :


Authentication Details
----------------------
Status          : mac-auth Authenticated
Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
Auth History    : dot1x    - Unauthenticated, Server-Reject, 5s ago
mac-auth - Authenticated, 10s ago


Authorization Details
---------------------
Status : Applied
```

Command History

Release	Modification
10.12	Command output modified to be suffixed with * for RADIUS overridden user roles. The role name will not be displayed for clients that do not use local, downloaded, or RADIUS overridden role.
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access clients

`show port-access clients [dhcp-info|ubt|vxlan] [interface <INTERFACE-NAME>] [mac <MAC-ADDRESS>]`

Description

Shows summarized active port access client information.

The **User-Role** column in the output will not display any value for clients not using local, downloaded or RADIUS overridden role. When an explicit client name is not available, only the MAC address of the client will be displayed.

The VLANs in the output display the tags, **u, t**, and **multi** to indicate untagged VLAN, single tagged VLAN, and multiple VLANs respectively.

Parameter	Description
dhcp	Shows DHCP information of port access clients. **NOTE:** To view the DHCP information of port access clients, either client IP tracker or DHCP snooping must be enabled. If client IP tracker is enabled, then the command does not display the lease time. This command does not display information about tagged VLAN.
ubt	Shows port access information about UBT clients. **NOTE:** The output displays information only about untagged VLAN.
vxlan	Shows port access information about VXLAN clients. **NOTE:** The output displays information about both tagged and untagged VLAN without the tags, **u** and **t**.
<INTERFACE-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing information for all clients:

```
switch# show port-access clients
Port Access Clients jhdoadjfoadk

Status Codes: d device-mode, c client-mode, m multi-domain
```

```
--------------------------------------------------------------------------------
------------------
   Port      MAC-Address        Onboarding      Status       Role
   Device Type
                                Method
--------------------------------------------------------------------------------
------------------
c  1/1/4     00:50:56:bd:04:c8  port-security   Success
c  1/1/5     00:50:56:bd:32:07                  Success      reject-role, reject
c  1/1/5     00:50:56:bd:32:08                  Fail         critical-...,
critical
c  1/1/5     00:50:56:cd:32:08                  Fail         cached-critical
c  1/1/6     00:50:56:bd:50:43  mac-auth        Success      auth-role, auth
c  1/1/6     00:50:56:bd:50:45  dot1x           Success      RADIUS_773420618
c  1/1/19    08:97:34:ad:e4:00  device-profile  Success      ap-role
c  1/1/20    00:50:56:bd:32:08                  In-Progress  preauth-role, preauth
c  1/1/20    00:50:56:bd:32:06                  In-Progress
c  1/1/20    00:50:56:bd:32:09                  Fail
d  1/1/25    08:97:34:ad:f4:03  mac-auth        Success      RADIUS_453420632
c  1/1/212   00:60:56:bd:50:43  mac-auth        Success      fallback-role,
fallback
m  1/1/7     00:50:56:bd:50:45  dot1x           Success      RADIUS_773420620
     data
m  1/1/7     00:50:56:bd:50:c5  dot1x           Success      RADIUS_773420621
     voice
m  1/1/8     00:50:56:bd:50:c6  dot1x           Fail         test-voice,critical
voice  voice
```

Showing information for clients on a particular interface:

```
switch# show port-access clients interface 1/1/5

Port Access Clients

Status codes: d device-mode, c client-mode, m multi-domain

--------------------------------------------------------------------------------
-
   Port      MAC Address        Onboarded       Status       Role
                                Method
--------------------------------------------------------------------------------
-
c  1/1/5     00:50:56:bd:32:07                  Success      reject-role, Reject
c  1/1/5     00:50:56:bd:32:08                  Fail         critical-...,
Critical
```

Showing information for all clients including multidomain mode clients:

```
switch# show port-access clients

Port Access Clients

Status codes: d device-mode, c client-mode, m multi-domain

--------------------------------------------------------------------------------
-----------------------
   Port      MAC-Address        Onboarding      Status       VLAN    Role
          Device Type
```

```
                                Method
------------------------------------------------------------------------------
----------------------
c  1/1/4     00:50:56:bd:04:c8  port-security   Success
c  1/1/5     00:50:56:bd:32:07                  Success      10      reject-role,
reject
c  1/1/5     00:50:56:bd:32:08                  Fail         20      critical-...,
critical
c  1/1/6     00:50:56:bd:50:43  mac-auth        Success              auth-role,
auth
c  1/1/6     00:50:56:bd:50:45  dot1x           Success      20      RADIUS_
773420618
c  1/1/19    08:97:34:ad:e4:00  device-profile  Success              ap-role
c  1/1/20    00:50:56:bd:32:08                  In-Progress  10      preauth-role,
preauth
c  1/1/20    00:50:56:bd:32:06                  In-Progress
c  1/1/20    00:50:56:bd:32:09                  Fail
d  1/1/25    08:97:34:ad:f4:03  mac-auth        Success      10      RADIUS_
453420632
c  1/1/212   00:60:56:bd:50:43  mac-auth        Success              fallback-
role, fallback
m  1/1/7     00:50:56:bd:50:45  dot1x           Success      21      RADIUS_
773420620           data
m  1/1/7     00:50:56:bd:50:c5  dot1x           Success      22      RADIUS_
773420621           voice
m  1/1/8     00:50:56:bd:50:c6  dot1x           Fail         23      test-
voice,critical voice  voice
```

Showing information for all clients including multidomain mode clients and UBT fallback role applied:

```
switch# show port-access clients
Port Access Clients

Status codes: d device-mode

------------------------------------------------------------------------------
------------------
   Port      MAC-Address        Onboarding      Status       Role
     Device Type
                                Method
------------------------------------------------------------------------------
------------------
   1/1/4     00:50:56:bd:04:c8  port-security   Success
   1/1/5     00:50:56:bd:32:07                  Success      reject-role, reject
   1/1/5     00:50:56:bd:32:08                  Fail         critical-...,
critical
   1/1/6     00:50:56:bd:50:43  mac-auth        Success      auth-role, auth
   1/1/6     00:50:56:bd:50:45  dot1x           Success      RADIUS_773420618
   1/1/19    08:97:34:ad:e4:00  device-profile  Success      ap-role
   1/1/20    00:50:56:bd:32:08                  In-Progress  preauth-role, preauth
   1/1/20    00:50:56:bd:32:06                  In-Progress
   1/1/20    00:50:56:bd:32:09                  Fail
d  1/1/25    08:97:34:ad:f4:03  mac-auth        Success      RADIUS_453420632
   1/1/212   00:60:56:bd:50:43  mac-auth        Success      fallback-role,
fallback
   1/1/7     00:50:56:bd:50:45  dot1x           Success      RADIUS_773420620
     data
   1/1/7     00:50:56:bd:50:c5  dot1x           Success      RADIUS_773420621
     voice
   1/1/8     00:50:56:bd:50:c6  dot1x           Fail         test-voice,critical
voice  voice
```

```
   1/1/21    00:50:56:bd:32:13  mac-auth        Success      ubt-role, ubt-
fallback
```

Showing information about a specific client:

```
switch# show port-access clients mac 00:50:56:bd:50:43
Port Access Clients
RADIUS overridden user roles are suffixed with '*'

Flags: Onboarding-Method|Mode|Device-Type|Status

Onboarding-Method: 1x 802.1X, ma MAC-Auth, ps Port-Security, dp Device-Profile,m
Multi-Domain

Mode: c Client-Mode, d Device-Mode, p Proxy-Mode, m Multi-Domain

Device-Type: d Data, v Voice

Status: s Success, f Failed, p In-Progress, d Role-Download-Failed

--------------------------------------------------------------------------------
---------------------------
Port     Client-Name             IPv4-Address    User-Role
  VLAN            Flags
--------------------------------------------------------------------------------
---------------------------
1/1/5    00:50:56:bd:50:43                       reject-role, reject
  (u)1234,(t)1000 1x|c|-|s
```

Showing information for clients on a particular interface:

```
switch# show port-access clients interface 1/1/5
Port Access Clients
RADIUS overridden user roles are suffixed with '*'

Flags: Onboarding-Method|Mode|Device-Type|Status

Onboarding-Method: 1x 802.1X, ma MAC-Auth, ps Port-Security, dp Device-Profile

Mode: c Client-Mode, d Device-Mode, p Proxy-Mode, m Multi-Domain

Device-Type: d Data, v Voice

Status: s Success, f Failed, p In-Progress, d Role-Download-Failed

--------------------------------------------------------------------------------
---------------------------
Port     Client-Name             IPv4-Address    User-Role
  VLAN            Flags
--------------------------------------------------------------------------------
---------------------------
1/1/5    00:50:56:bd:32:07                       reject-role, reject
  (u)1234,(t)1000 1x|c|-|s
1/1/5    test                                    critical-..., critical
  (u)56           1x|c|-|f
1/1/9    00:50:56:bd:50:c7                       rp-role
                 rp|p|-|s
```

Showing DHCP information of port access clients:

```
switch# show port-access clients dhcp-info
Port Access Clients
--------------------------------------------------------------------------------
--------------
Port     Client-Name             IP-Address
VLAN  Lease-Time
--------------------------------------------------------------------------------
--------------
1/1/1    Camera-1023             10.10.10.10                                10
  268
1/1/2    CAP-8-G22               aaaa:bbbb:cccc:dddd:eeee:1234:5678:abcd       20
  500
```

Showing port access information about UBT clients:

```
switch# show port-access clients ubt
Port Access Clients
RADIUS overridden user roles are suffixed with '*'

Flags: Onboarding-Method|Mode|Device-Type|Status

Onboarding-Method: 1x 802.1X, ma MAC-Auth, ps Port-Security, dp Device-Profile

Mode: c Client-Mode, d Device-Mode,m Multi-Domain

Device-Type: d Data, v Voice

Status: s Success, f Failed, p In-Progress, d Role-Download-Failed

--------------------------------------------------------------------------------
-------------------------------------
Port     Client-Name         IPv4-Address    User-Role               Gateway-Role
        UBT           VLAN  Flags
Zone
--------------------------------------------------------------------------------
-------------------------------------
1/1/12   00:50:56:96:93:d6   10.10.10.10     test_role               authenticated
        zone1         10    ma|c|-|s
1/1/10   CAP-8-G22           10.10.10.11     student
authenticated_gate... zone1         9857  1x|c|-|s
```

Showing port access information about VXLAN clients:

```
switch# show port-access clients vxlan
Port Access Clients
RADIUS overridden user roles are suffixed with '*'

Flags: Onboarding-Method|Mode|Device-Type|Status

Onboarding-Method: 1x 802.1X, ma MAC-Auth, ps Port-Security, dp Device-Profile

Mode: c Client-Mode, d Device-Mode, m Multi-Domain

Device-Type: d Data, v Voice

Status: s Success, f Failed, p In-Progress, d Role-Download-Failed
```

```
--------------------------------------------------------------------------------
----------------------
Port     Client-Name             IPv4-Address    User-Role
  VLAN  VNI  Flags
--------------------------------------------------------------------------------
----------------------
1/1/21   00:50:56:96:93:d6       10.10.10.10     student
  5678  2432 ma|c|-|s
1/1/21   user_12@gmail.com                       employee
  9857  4678 1x|c|-|s
```

Command History

Release	Modification
10.12	The following changes were introduced: ■ The **dhcp-info**, **ubt**, and **vxlan** parameters were introduced. ■ Command output modified to display only **Port**, **Client-Name**, **IPv4-Address**, **User-Role**, **VLAN,** and **Flags.**
10.10	Command output updated to display cached-critical role
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access clients detail

`show port-access clients [interface <INTERFACE-NAME>] [mac <MAC-ADDRESS>] detail`

Description

Shows detailed active port access clients information including the VLAN group and VLAN association for each of the authenticated clients. The output can be filtered by interface or MAC address.

Parameter	Description
<INTERFACE-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing detailed information for clients on a particular interface (one client):

```
switch# show port-access clients interface 1/1/7 detail
Port Access Client Status Detail
--------------------------------
```

```
Client 2c:41:38:7f:35:c8, Jamie Doe
============================
  Session Details
  ---------------
    Port         : 1/1/8
    Session Time : 33s
    IPv4 Address :
    IPv6 Address :

  VLAN Details
  ------------
    VLANs Assigned  : 10,20,30
      Access          :
      Native Untagged : 10
      Alllowed Trunk  : 20,30

  Authentication Details
  ----------------------
    Status          : mac-auth Authenticated
    Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
    Auth History    : mac-auth - Authenticated, 5s ago
                      dot1x    - Unauthenticated, Server-Timeout, 10s ago

  Authorization Details
  ----------------------
    Role   : RADIUS_Overridden_3029903100
    Status : Applied


Attributes overridden by RADIUS are prefixed by '*'.

Name      : RADIUS_Overridden_3598790787
Type      : radius
Base Role : local, Fri Jul 09 14:34:29 IST 2021
-------------------------------------------------------------------------------
    Reauthentication Period             : 600 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     : 800 secs
    Client Inactivity Timeout           : 1000 secs
    Description                         :
   *Gateway Zone                        : stdn_ctrl
    Access VLAN                         :
    Native VLAN                         :
   *Allowed Trunk VLANs                 : 5
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
   *MTU                                 : 9198
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
    Policy                              :
    GBP                                 :
    Device Type                         :
```

```
switch# show port-access clients interface 1/1/7 detail
Port Access Client Status Detail
--------------------------------
```

```
Client 2c:41:38:7f:35:c8, Jamie Doe
===========================
  Session Details
  ---------------
    Port         : 1/1/8
    Session Time : 33s
    IPv4 Address :
    IPv6 Address :

  VLAN Details
  ------------
    VLAN Group Name :
    VLANs Assigned  : 10,20,30
      Access          :
      Native Untagged : 10
      Alllowed Trunk  : 20,30

  Authentication Details
  ----------------------
    Status          : mac-auth Authenticated
    Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
    Auth History    : mac-auth - Authenticated, 5s ago
                      dot1x    - Unauthenticated, Server-Timeout, 10s ago

  Authorization Details
  ----------------------
    Role   : RADIUS_Overridden_3029903100
    Status : Applied


Attributes overridden by RADIUS are prefixed by '*'.

Name      : RADIUS_Overridden_3598790787
Type      : radius
Base Role : MixedRole_XX00_LUR_1, local, Fri Jul 09 14:34:29 IST 2021
-------------------------------------------------------------------------------
    Reauthentication Period             : 600 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     : 800 secs
    Client Inactivity Timeout           : 1000 secs
    Description                         :
   *Gateway Zone                        : stdn_ctrl
   *UBT Gateway Role                    : stdn-authenticated-vrf1_dur
    UBT Gateway Clearpass Role          :
    Access VLAN                         :
    Native VLAN                         :
   *Allowed Trunk VLANs                 : 5
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
    VLAN Group Name                     :
   *MTU                                 : 9198
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
    PVLAN Port Type                     :
    Captive Portal Profile              :
    Policy                              :
    GBP                                 :
    Device Type                         :
```

```
switch# show port-access clients interface 1/1/7 detail
Port Access Client Status Detail
--------------------------------

Client 2c:41:38:7f:35:c8, Jamie Doe
============================
  Session Details
  ---------------
    Port         : 1/1/8
    Session Time : 33s
    IPv4 Address :
    IPv6 Address :

  VLAN Details
  ------------
    VLAN Group Name :
    VLANs Assigned  : 10,20,30
      Access          :
      Native Untagged : 10
      Alllowed Trunk  : 20,30

  Authentication Details
  ----------------------
    Status          : mac-auth Authenticated
    Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
    Auth History    : mac-auth - Authenticated, 5s ago
                      dot1x    - Unauthenticated, Server-Timeout, 10s ago

  Authorization Details
  ---------------------
    Role   : RADIUS_Overridden_3029903100
    Status : Applied


Attributes overridden by RADIUS are prefixed by '*'.

Name      : RADIUS_Overridden_3598790787
Type      : radius
Base Role : MixedRole_XX00_LUR_1, local, Fri Jul 09 14:34:29 IST 2021
-------------------------------------------------------------------------------
    Reauthentication Period             : 600 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     : 800 secs
    Client Inactivity Timeout           : 1000 secs
    Description                         :
   *Gateway Zone                        : stdn_ctrl
   *UBT Gateway Role                    : stdn-authenticated-vrf1_dur
    UBT Gateway Clearpass Role          :
    Access VLAN                         :
    Native VLAN                         :
   *Allowed Trunk VLANs                 : 5
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
    VLAN Group Name                     :
   *MTU                                 : 9198
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
    PVLAN Port Type                     :
    Captive Portal Profile              :
```

```
    Policy                                :
    GBP                                   :
    Device Type                           :
```

```
switch# show port-access clients interface 1/1/7 detail
Port Access Client Status Detail
--------------------------------

Client 2c:41:38:7f:35:c8, Jamie Doe
===========================
  Session Details
  ---------------
    Port         : 1/1/8
    Session Time : 33s
    IPv4 Address :
    IPv6 Address :

  VLAN Details
  ------------
    VLAN Group Name :
    VLANs Assigned  : 10,20,30
      Access          :
      Native Untagged : 10
      Alllowed Trunk  : 20,30

  Authentication Details
  ----------------------
    Status          : mac-auth Authenticated
    Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
    Auth History    : mac-auth - Authenticated, 5s ago
                      dot1x    - Unauthenticated, Server-Timeout, 10s ago

  Authorization Details
  ----------------------
    Role   : RADIUS_Overridden_3029903100
    Status : Applied


Attributes overridden by RADIUS are prefixed by '*'.

Name      : RADIUS_Overridden_3598790787
Type      : radius
Base Role : MixedRole_XX00_LUR_1, local, Fri Jul 09 14:34:29 IST 2021
------------------------------------------------------------------------------
    Reauthentication Period             : 600 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     : 800 secs
    Client Inactivity Timeout           : 1000 secs
    Description                         :
    Access VLAN                         :
    Native VLAN                         :
   *Allowed Trunk VLANs                 : 5
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
    VLAN Group Name                     :
   *MTU                                 : 9198
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
```

```
    Policy                              :
    GBP                                 :
    Device Type                         :
```

Showing information for a particular client MAC address:

```
switch# show port-access clients mac 00:00:00:00:00:c8 detail
Port Access Client Status Details:
Client 00:00:00:00:00:c8, 00:00:00:00:00:c8
============================
Session Details
---------------
Port         : 1/1/1
Session Time : 888s
IPv4 Address :
IPv6 Address :
VLAN Details
------------
VLAN Group Name : test_group
VLANs Assigned  : 22
Access          : 22
Native Untagged :
Allowed Trunk   :
Authentication Details
----------------------
Status          : mac-auth Authenticated
Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
Auth History    : mac-auth - Authenticated, 288s ago
dot1x - Unauthenticated, Supplicant-Timeout, 703s ago
dot1x - Unauthenticated, 798s ago
mac-auth - Authenticated, 888s ago
Authorization Details
---------------------
Role   : RADIUS_2801090107
Status : Applied
Role Information:
Name  : RADIUS_2801090107
Type  : radius
---------------------------------------------
Reauthentication Period             : 600 secs
Cached Reauthentication Period      :
Authentication Mode                 :
Session Timeout                     :
Client Inactivity Timeout           :
Description                         :
Gateway Zone                        :
UBT Gateway Role                    :
UBT Gateway Clearpass Role          :
Access VLAN                         :
Native VLAN                         :
Allowed Trunk VLANs                 :
Access VLAN Name                    :
Native VLAN Name                    :
Allowed Trunk VLAN Names            :
VLAN Group Name                     : test_group
MTU                                 :
QOS Trust Mode                      :
STP Administrative Edge Port        :
PoE Priority                        :
Captive Portal Profile              :
Policy                              :
```

```
GBP                                 :
switch#
```

Showing detailed information for clients on a particular interface:

```
switch# show port-access clients interface 1/1/7-1/1/8 detail
Port Access Client Status Details:
----------------------------------

RADIUS overridden user roles are suffixed with '*'

Client 2c:41:38:7f:35:b9, John Doe
==============================
Session Details
---------------
Port         : 1/1/7
Session Time : 203s
IPv4 Address : 10.10.10.10
IPv6 Address :

Authentication Details
----------------------
Status          : mac-auth Authenticated
Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
Auth History    : mac-auth - Authenticated, 5s ago
dot1x    - Unauthenticated, Server-Reject, 10s ago

Authorization Details
---------------------
Status : Applied


RADIUS Attributes
-----------------
User-Name                     : Student
Filter-ID                     : DHCP, WebServices-Student, DataCenter-Student,
RemoteAccess-Student, Printer-Student
Framed-MTU                    : 1500 bytes
Session-Timeout               : 500 seconds
Idle-Timeout                  : 200 seconds
Termination-Action            : RADIUS-Request
Egress-VLAN-ID                : 10(t), 15(t), 20(u)
Egress-VLAN-Name              : VLAN100(t), VLAN200(u)
Tunnel-Type                   : 13
Tunnel-Medium-Type            : 6
Tunnel-Private-Group-ID       : 20
NAS-Filter-Rule               : permit in 17 from any to any
deny in tcp from any to 10.10.10.3/8
Aruba-Captive-Portal-URL      : http://arubanetworks.com/student/captiveportal.php
Aruba-PoE-Priority            : Low
Aruba-Port-Auth-Mode          : client-mode
Aruba-NAS-Filter-Rule         : deny in icmp from 10.10.10.1 to any 27
Aruba-QoS-Trust-Mode          : dscp
Aruba-UBT-Gateway-Role        : gateway_student_role
Aruba-Gateway-Zone            : student_zone
Aruba-STP-Admin-Edge-Port     : false
Aruba-UBT-Gateway-CPPM-Role   : ubt_gateway_cppm_student_role
Aruba-Device-Traffic-Class    : data
Aruba-PVLAN-Port-Type         : secondary
RADIUS Role Name : RADIUS_115315236
```

Showing information for a particular client MAC address:

```
switch# show port-access clients mac 2c:41:38:7f:35:c8 detail
Port Access Client Status Detail
--------------------------------
RADIUS overridden user roles are suffixed with '*'
Client 2c:41:38:7f:35:c8, John Doe
==============================

Session Details
---------------
Port         : 1/1/8
Session Time : 33s
IPv4 Address :
IPv6 Address :


VLAN Details
---------------
VLAN Group Name :
VLANs Assigned  : 10,20,30
Access          :
Native Untagged : 10
Alllowed Trunk  : 20,30


Authentication Details
----------------------
Status          : mac-auth Authenticated
Auth Precedence : dot1x - Unauthenticated, mac-auth - Authenticated
Auth History    : mac-auth - Authenticated, 5s ago
dot1x    - Unauthenticated, Server-Timeout, 10s ago


Authorization Details
---------------------
Role   : student
Status : Applied
Role Information:
-----------------
Name  : student
Type  : local
-----------------------------------------------
Reauthentication Period             : 333 secs
Authentication Mode                 : device
Native VLAN                         : 10
Allowed Trunk VLANs                 : 20,30
PoE Allocation method               : usage
PoE Priority                        : low
Captive Portal Profile              : testcpprof_29451201
Policy                              : PERMIT-ALL_87364653


Captive Portal Profile Configuration:
-------------------------------------
Name                            : testcpprof_29451201
Type                            : local
URL                             : http://google.com
URL Hash Key                    : SWNGWyMeYubHPDgVIirpEUwNK5Uf+r1vmhBIncQPw1Y=


Access Policy Details:
----------------------
```

```
Policy Name   : PERMIT-ALL_87364653
Policy Type   : Local
Policy Status : Applied
Base Policy   : N/A
ACL Names     : N/A
SEQUENCE    CLASS                          TYPE ACTION
----------- ------------------------------ ---- ----------------------------------
10          dns                            ipv4 permit
20          dhcp                           ipv4 permit


Class Details:
-------------
class ip dns
10 match tcp any any
class ip dhcp
20 match any any any
```

Command History

Release	Modification
10.12	The following changes were introduced: ■ Command output modified to display RADIUS attributes for clients not using local, downloaded or RADIUS overridden role. ■ Command output modified to display **Base Policy** and **ACL Names.**
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access clients onboarding-method

`show port-access clients onboarding-method` *<METHOD>*

Description

Shows active port access client information for the specified onboarding method.

Parameter	Description
<METHOD>	Selects the onboarding method. Available methods: `device-profile`, `dot1x`, `mac-auth`, `port-security`.

Examples

Showing information for clients onboarded using MAC authentication.

```
switch# show port-access clients onboarding-method mac-auth

Port Access Clients

Status codes: device-mode

--------------------------------------------------------------------------------
-
   Port      MAC-Address        Onboarding      Status       Role
                                Method
--------------------------------------------------------------------------------
-
   1/1/6     00:50:56:bd:50:43  mac-auth        Success      auth-role, auth
   1/1/212   00:60:56:bd:50:43  mac-auth        Success      fallback-role,
fallback
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access debugging and troubleshooting

Debugging and troubleshooting Information for RADIUS, MAC authentication, and 802.1X authentication is provided as follows:

- Radius server reachability debugging and troubleshooting
- Port access MAC authentication debugging and troubleshooting
- Port access 802.1X authentication debugging and troubleshooting

Radius server reachability debugging and troubleshooting

Ensure that a valid RADIUS server is correctly identified to the switch and that the RADIUS server is reachable in the network.

Command `radius-server host` is used to identify the RADIUS server to the switch.

The following command sequences show how the RADIUS server is identified to the switch (using command `radius-server host`) and then ping is used to confirm that the RADIUS server is reachable from the switch. Also, RADIUS server information is displayed with related show commands.

```
switch-4# show running-config | in radi
radius-server host cec-cp.cectme.net key ciphertext AQBapdAz4irj...BQAAADY26liu
   tracking enable tracking-mode dead-only clearpass-username cecdur
   clearpass-password ciphertext AQBapXi8CEcB...BgAAAPMfbjuQtw==
radius dyn-authorization enable
ip source-interface radius 192.168.2.4
ipv6 source-interface radius fd00:4:1::b
switch-4#

switch-4# ping  cec-cp.cectme.net
PING cec-cp.cectme.net (192.168.8.50) 100(128) bytes of data.
108 bytes from 192.168.8.50: icmp_seq=1 ttl=62 time=0.314 ms
108 bytes from 192.168.8.50: icmp_seq=2 ttl=62 time=0.331 ms
108 bytes from 192.168.8.50: icmp_seq=3 ttl=62 time=0.355 ms
108 bytes from 192.168.8.50: icmp_seq=4 ttl=62 time=0.424 ms
108 bytes from 192.168.8.50: icmp_seq=5 ttl=62 time=0.341 ms

--- cec-cp.cectme.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4098ms
rtt min/avg/max/mdev = 0.314/0.353/0.424/0.037 ms


switch-4#
switch-4# show radius-server
Unreachable servers are preceded by *
******* Global RADIUS Configuration *******
Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
Tracking User-name: radius-tracking-user
Tracking Password: None
Number of Servers: 1
--------------------------------------------------------------------------------
SERVER NAME                                  | TLS   | PORT | VRF
```

```
--------------------------------------------------------------------------------
*cec-cp.cectme.net                          |      | 1812 | default

--------------------------------------------------------------------------------

switch-4# show radius-server  detail
******* Global RADIUS Configuration *******

Shared-Secret: None
Timeout: 5
Auth-Type: pap
Retries: 1
TLS Timeout: 5
Tracking Time Interval (seconds): 300
Tracking Retries: 1
Tracking User-name: radius-tracking-user
Tracking Password: None
Number of Servers: 1
****** RADIUS Server Information ******
Server-Name              : cec-cp.cectme.net
Auth-Port                : 1812
Accounting-Port          : 1813
VRF                      : default
TLS Enabled              : No
Shared-Secret            : AQBapdAz4irjSK61Zg/CFArsNYWKbn1LObqDD/v9SH1eMQ6DY26liu
Timeout                  : 5
Retries                  : 1
Auth-Type                : pap
Server-Group             : radius
Default-Priority         : 1
ClearPass-Username       : cecdur
ClearPass-Password       : AQBapXi8CEcBRKUSLT70WhU6oy+ULtKCc6j9oNBgAAAPMfbjuQtw==
Tracking                 : enabled
Tracking-Mode            : dead-only
Reachability-Status      : unreachable, Since Sun Oct 03 23:09:26 PDT 2021
Tracking-Last-Attempted  : Sun Oct 03 23:09:16 PDT 2021
Next-Tracking-Request    : 234 seconds
```

Port access MAC authentication debugging and troubleshooting

Using show commands

Use command **`show aaa authentication port-access mac-auth interface all client-status`** to help debug the client/server failure reason.

Example 1: Server timeout (typically caused when RADIUS server becomes unreachable):

```
switch# show aaa authentication port-access mac-auth interface all client-status

Port Access Client Status Details

Client  AB:CD:DE:FF:AA:BB, 1/1/1
========================================
  Authentication Details
  ----------------------
    Status                              : Unauthenticated
    Auth-Method                         : CHAP
    Auth Failure reason                 : Server-Timeout
    Time Since Last State Change        : 200 secs
...
```

Example 2: Server reject (typically caused by invalid user credentials):

```
switch# show aaa authentication port-access mac-auth interface all client-status

Port Access Client Status Details

Client  AB:CD:DE:FF:AA:BB, 1/1/1
========================================
  Authentication Details
  ----------------------
    Status                                : Unauthenticated
    Auth-Method                           : CHAP
    Auth Failure reason                   : Server-reject
    Time Since Last State Change          : 30 secs
...
```

Example 3: Held (caused by a user authentication attempt made sooner than allowed after an earlier failed authentication attempt):

```
switch# show aaa authentication port-access mac-auth interface all client-status

Port Access Client Status Details

Client  AB:CD:DE:FF:AA:BB, 1/1/1
========================================
  Authentication Details
  ----------------------
    Status                                : Unauthenticated
    Auth-Method                           : CHAP
    Auth Failure reason                   : Held
    Time Since Last State Change          : 30 secs
...
```

Using debug commands

The following command sequences illustrate how the debug command can be used to help debug port access MAC authentication:

```
 # debug portaccess macauth all
  mac       MAC address to filter debug logs
  port      PORT name to filter debug logs
  severity  Minimum log severity to filter debug logs
  <cr>
```

Step 1:

```
switch(config-macauth)# 2020-08-02T06:00:05.356+00:00 port-accessd[3250]:
debug|LOG_DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_CONFIG|logID=8378 Posting
event 'MAC-Auth Global Enable' to '15'
2020-08-02T06:00:05.356+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_CONFIG|logID=8378 Creating event 'MAC-
Auth Global Enable' for port '(null)'
2020-08-02T06:00:05.356+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_CONFIG|logID=8378 Posting event 'MAC-
Auth Global Enable' to '16'
2020-08-02T06:00:05.356+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8379 logID=8379 Handling
```

```
event 'MAC-Auth Global Enable' in state 'DISABLED'
2020-08-02T06:00:05.357+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8379 logID=8379 macauth
SM State transition [DISABLED] -> [ENABLED] for object with key 'null'
```

Step 2:

```
switch(config-macauth)# addr-format multi-colon
switch(config-macauth)# 2020-08-02T06:00:39.986+00:00 port-accessd[3250]:
debug|LOG_DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_CONFIG|logID=8416 Posting
event 'MAC-Auth Address Format Change' to '15'
2020-08-02T06:00:39.986+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8417 logID=8417 Handling
event 'MAC-Auth Address Format Change' in state 'ENABLED'
```

Step 3:

```
switch(config)# interface 1/1/2
switch(config-if)# aaa authentication port-access mac-auth
switch(config-if-macauth)# enable
switch(config-if-macauth)# 2020-08-02T06:01:26.918+00:00 port-accessd[3250]:
debug|LOG_DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_CONFIG|logID=8464 Posting
event 'MAC-Auth Enabled on Port' to '16'
2020-08-02T06:01:26.918+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8465 logID=8465 Handling
event 'MAC-Auth Enabled on Port' for MACAuthPort '1/1/2' in state 'NULL'
2020-08-02T06:01:26.919+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8465 logID=8465
macauthport SM State transition [INITIALIZED] -> [UP] for object with key '1/1/2'
2020-08-02T06:01:26.919+00:00 port-accessd[3250]: debug|LOG_
DEBUG|MSTR|1|PORTACCESS|PORTACCESS_MACAUTH_PROTOCOL|logID=8465 logID=8465 Event
handler of MACAuthPort '1/1/2' for event 'MAC-Auth Enabled on Port' in state
'NULL' returned 'OK'
```

Port access 802.1X authentication debugging and troubleshooting

Using show commands

Use command **`show aaa authentication port-access dot1x authenticator interface all client-status`** to help debug the client/server failure reason.

Example 1: Server timeout (typically caused when RADIUS server becomes unreachable):

```
switch# show aaa authentication port-access dot1x authenticator interface all
client-status

Client  FE:04:D7:50:89:37, userxx1, 1/1/1
==========================================

  Authentication Details
  ----------------------
    Status                        : Unauthenticated
    Type                          : Pass-Through
    EAP-Method                    : MD5

    Auth Failure reason           : Server-Timeout
    Time Since Last State Change  : 200s
```

```
  Authentication Statistics
  -------------------------
    Authentication                          : 0
    Authentication Timeout                  : 205
    EAP-Start While Authenticating          : 0
    EAP-Logoff While Authenticating         : 0
    Successful Authentication               : 0
    Failed Authentication                   : 1
    Re-Authentication                       : 0
    Successful Re-Authentication            : 0
    Failed Re-Authentication                : 0
    EAP-Start When Authenticated            : 0
    EAP-Logoff When Authenticated           : 0
    Re-Auths When Authenticated             : 0
    Cached Re-Authentication                : 0
...
```

Example 2: Server reject (typically caused by invalid user credentials):

```
switch# show aaa authentication port-access dot1x authenticator interface all
client-status

Client  FE:04:D7:50:89:37, userxx1, 1/1/1
==========================================

    Status                        : Unauthenticated
    Type                          : Pass-Through
    EAP-Method                    : MD5
    Auth Failure reason           : Server-reject
    Time Since Last State Change  : 30s

  Authentication Statistics
  -------------------------
    Authentication                          : 0
    Authentication Timeout                  : 33
    EAP-Start While Authenticating          : 0
    EAP-Logoff While Authenticating         : 0
    Successful Authentication               : 0
    Failed Authentication                   : 1
    Re-Authentication                       : 0
    Successful Re-Authentication            : 0
    Failed Re-Authentication                : 0
    EAP-Start When Authenticated            : 0
    EAP-Logoff When Authenticated           : 0
    Re-Auths When Authenticated             : 0
    Cached Re-Authentication                : 0
...
```

Example 3: Supplicant timeout (typically occurs when supplicant stops responding):

```
switch# show aaa authentication port-access dot1x authenticator interface all
client-status

Client  FE:04:D7:50:89:37, userxx1, 1/1/1
==========================================

    Status                        : Unauthenticated
    Type                          : Pass-Through
```

```
    EAP-Method                    : MD5
    Auth Failure reason           : Supplicant-Timeout
    Time Since Last State Change  : 576s

  Authentication Statistics
  -------------------------
    Authentication                          : 631
    Authentication Timeout                  : 631
    EAP-Start While Authenticating          : 0
    EAP-Logoff While Authenticating         : 0
    Successful Authentication               : 0
    Failed Authentication                   : 0
    Re-Authentication                       : 0
    Successful Re-Authentication            : 0
    Failed Re-Authentication                : 0
    EAP-Start When Authenticated            : 0
    EAP-Logoff When Authenticated           : 0
    Re-Auths When Authenticated             : 0
    Cached Re-Authentication                : 0
...
```

Show the EAP handshake statistics:

```
switch# show aaa authentication port-access dot1x authenticator interface all
port-statistics

Port 1/1/1
==========

  Authentication Details
  ----------------------
    Number of Clients                 : 2
    Number of Authenticated Clients   : 1
    Number of Unauthenticated Clients : 1
    Number of authenticating clients  : 0

  Authentication Statistics
  -------------------------
    EAPOL Frames Received                   : 25033
    EAPOL Frames Transmitted                : 36305
    EAPOL Start Frames Received             : 6012
    EAPOL Logoff Frames Received            : 0
    EAPOL Response ID Frames Received       : 18258
    EAPOL Response Frames Received          : 763
    EAPOL Request ID Frames Transmitted     : 34408
    EAPOL Request Frames Transmitted        : 1137
    EAPOL Invalid Frames Received           : 0
    EAPOL EAP Length Error Frames Received : 0
    EAPOL Last Received Frame Version       : 0
    EAPOL Last Received Frame Client MAC    : 0
...
```

Using other commands

The **`debug portaccess dot1x`** command:

```
# debug portaccess dot1x
  all       Enable all debug modules
  config    Enable 802.1X configuration handling logs
```

```
packet    Enable 802.1X packet handling logs
protocol  Enable 802.1X protocol handling logs
radius    Enable 802.1X RADIUS request/response logs
```

The **`show tech dot1x`** and **`show events -e|in port-accessd`** commands are also available.

Port access FAQ

1. What 802.1X (dot1x) version is supported?

AOS-CX switches support the 2010 version of 802.1X.

2. What is port access authentication mode client mode?

In client mode, all clients connecting to the port are sent for authentication.

The maximum number of clients allowed to connect to the port is limited by the client limit value configured with the `aaa authentication port-access client-limit` command.

3. What is port access authentication mode device mode?

In device mode, only the first client connecting to the port is sent for authentication. Once this client is authenticated, the port is considered as open and all subsequent clients trying to connect on that port are not sent for authentication.

4. What is default authentication precedence?

The default authentication precedence is 802.1X authentication then MAC authentication. This can be configured differently.

5. What special port access roles are supported?

AOS-CX switches support the following special port access roles:

- Critical role: the role that is applied when the RADIUS server is unreachable for authentication.
- Preauth role: the role that is applied when authentication is still in progress.
- Reject role: the role that is applied when authentication has failed.
- Auth role: the role that is applied to authenticated clients when a specific role is not assigned in the RADIUS server.

6. How do I log off specific interface clients?

Use command `port-access log-off client interface` to log-off any specific interface or all clients.

References

- AOS-CX Switch Simulator

Multidomain authentication

Multidomain authentication allows a combination of voice and data clients to be authenticated on a port. By default only one voice client and one data client is allowed for authentication. You can configure a maximum of five data clients for authentication. You can enable the multidomain authentication mode with the `aaa authentication port-access auth-mode` command. You can

configure only the number of data clients supported with the `aaa authentication port-access client-limit multi-domain` command.

Multidomain authentication requirements

Following are the requirements for multidomain authentication:

- You must configure the multidomain authentication mode by one of the following ways:
  - In the CLI with the `aaa authentication port-access auth-mode` command at the interface level
  - Configure `Aruba-Port-Auth-Mode` and `Aruba-Device-Traffic-Class` VSAs on the RADIUS server
  - In the CLI with the `auth-mode` command at the port access role level (`config-pa-role` context)
- In case the multidomain mode is not enabled on port in the CLI or the `Aruba-Port-Auth-Mode` VSA is not configured, then the switch operates as a client mode on that port, even if the `Aruba-Device-Traffic-Class` VSA is configured.
- To identify the client as a voice client, you must configure either the `device-traffic-class` parameter in the role or the `Aruba-Device-Traffic-Class` VSA (value=1) in the RADIUS server.
  - If both are configured, then the `device-traffic-class` configuration overrides the VSA attribute configuration.
  - If both are not configured, then the switch considers the client as a data client only.
- A role `critical-voice-role` is applied when an authenticated client fails to reauthenticate because the RADIUS server is unreachable.

This role is not applied when the multidomain authentication mode is not enabled and the client fails to reauthenticate because the RADIUS server is unreachable.

The voice client must first be authenticated successfully with the RADIUS server for the `criticial-voice-role` to be applied. If the client is never authenticated, then this role is not applied.

Scenarios with Aruba-Port-Auth-Mode and Aruba-Device-Traffic-Class VSAs

The following table lists the various scenarios when you configure the `Aruba-Port-Auth-Mode` and `Aruba-Device-Traffic-Class` VSAs, and the output in multidomain authentication .

Table 1: *Scenarios configuring authentication mode and traffic class VSAs*

Aruba VSA Configured	Output when Multidomain mode is disabled on port	Output when Multidomain mode is enabled on port
Only `Aruba-Device-Traffic-Class` VSA is configured	■ Port will be in client mode ■ Client will be authenticated as data or voice client based on `Aruba-Device-Traffic-Class` VSA	■ Port will be in multidomain mode ■ Client will be authenticated as data or voice client based on `Aruba-Device-Traffic-Class` VSA
Only `Aruba-Port-Auth-Mode` VSA configured with multidomain mode	■ Port will be in multidomain mode ■ Client will be authenticated as data client only	

Aruba VSA Configured	Output when Multidomain mode is disabled on port	Output when Multidomain mode is enabled on port
▪ `Aruba-Port-Auth-Mode` VSA configured with multidomain mode ▪ `Aruba-Device-Traffic-Class` VSA is configured	▪ Port will be in multidomain mode ▪ Client will be authenticated as data or voice client based on `Aruba-Device-Traffic-Class` VSA	
▪ `Aruba-Port-Auth-Mode` VSA configured with client or device mode ▪ `Aruba-Device-Traffic-Class` VSA is configured	▪ Port will be in client or device mode based on `Aruba-Port-Auth-Mode` VSA ▪ Client will be authenticated as data or voice client based on `Aruba-Device-Traffic-Class` VSA	
Only `Aruba-Port-Auth-Mode` VSA configured with client or device mode	Port will be in client or device mode based on `Aruba-Port-Auth-Mode` VSA	

Scenarios with device-traffic-class configuration in role

Following are some of the scenarios of configuring `device-traffic-class` in the role and the output in multidomain authentication.

- Scenario 1: When multidomain mode is enabled on port and the `auth-mode` is not configured in the role.
  - Port will be in multi-domain mode.
  - If `device-traffic-class` is configured in role, then the client will be authenticated as voice, else will be authenticated as data client.
- Scenario 2: When multidomain mode is enabled on port and the `auth-mode` is configured as client or device mode.
  - Port will be in client or device mode based on `auth-mode` configuration in role.
  - If `device-traffic-class` is configured in role, then the client will be authenticated as voice, else will be authenticated as data client.
- Scenario 3: When multidomain mode is not enabled on port and `auth-mode` is configured with multdomain mode in role.
  - Port will be in multi-domain mode.
  - If `device-traffic-class` is configured in role, then the client will be authenticated as voice, else will be authenticated as data client.
- When multidomain mode is not enabled on port and `auth-mode` is not configured in role.
  - Port will be in client mode.
  - If `device-traffic-class` is configured in role, then the client will be authenticated as voice, else will be authenticated as data client.

Port access security violation

A security violation state of a port indicates whether the port is in a state where its client limit has been violated. This state is reset in one of the following ways:

- When the port is shutdown administratively.
- When the port security or authentication method is disabled on the port.
- When the port comes up automatically because of auto recovery.
- When violation action configuration is changed on the port.

Port access security violation commands

port-access security violation action

```
port-access security violation action {notify | shutdown}
no port-access security violation action
```

Description

Configures the action that the switch must take whenever a security violation occurs at a port, such as the number of clients exceeding the configured client limit.

The `no` form of the command resets the action to the default action, notify.

Parameter	Description
`notify`	Specifies that the switch notifies any security violation as an event or log in the syslog server, and also sends an SNMP trap notification. This action is the default. The format of the event log that is generated for notifying the security violation is `Client limit exceeded on port <PORT>, caused by an unauthenticated client <MAC-ADDRESS>`.
`shutdown`	Specifies that the switch shuts down the port where the client limit has exceeded. A port that is shut down can be configured to auto-recover after a recovery period that can be configured with the `port-access security violation action shutdown auto-recovery` and `port-access security violation action shutdown recovery-timer` commands.

Examples

Configuring the shutdown security violation action for a port:

```
sswitch(config-if)# port-access security violation action shutdown
```

Resetting the security violation action to the default value:

```
switch(config-if)# no port-access security violation action
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

port-access security violation action shutdown auto-recovery

```
port-access security violation action shutdown auto-recovery {enable | disable}
no port-access security violation action shutdown auto-recovery {enable | disable}
```

Description

Configures auto-recovery of the port when the security violation action is configured as shutdown.

This configuration allows the port, that is shut down when a security violation occurs, to be automatically enabled after the recovery timer expires.

The `no` form of the command resets auto-recovery to the default, disable.

Parameter	Description
`enable`	Enables auto-recovery of port when the security violation action is configured as shutdown.
`disable`	Disables auto-recovery of port when the security violation action is configured as shutdown.

Examples

Enabling auto-recovery of port:

```
switch(config-if)# port-access security violation action shutdown auto-recovery
enable
```

Disabling auto-recovery of port:

```
switch(config-if)# no port-access security violation action shutdown auto-recovery
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

port-access security violation action shutdown recovery-timer

```
port-access security violation action shutdown recovery-timer <RECOVERY-TIME>
no port-access security violation action shutdown recovery-timer
```

Description

Configures security violation recovery timer for the port when the security violation action is configured as shutdown.

The `no` form of the command resets the shutdown recovery timer to the default, 10.

Parameter	Description
<RECOVERY-TIME>	Specifies the recovery timer (in seconds) after which the port, which is shut down because of security violation, is automatically enabled. Default: 10. Range: 10 to 600.

Examples

Configuring the shutdown recovery-timer on a port:

```
switch(config-if)# port-access security violation action shutdown recovery-timer
60
```

Resetting the shutdown recovery-timer to the default value:

```
switch(config-if)# no port-access security violation action shutdown recovery-
timer
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config-if	Administrators or local user group members with execution rights for this command.

show interface

```
show interface <INTERFACE-NAME>
```

Description

Displays active configurations and operational status information for interfaces including the reason for the port shutdown because of a security violation at the port.

Parameter	Description
<INTERFACE-NAME>	Specifies the interface name.

Examples

The following example shows the status of the interface when it is shutdown because of security violation:

```
switch# show interface 3/1/35

Interface 3/1/25 is down
 Admin state is up
 State information: Disabled by port-access
 Link state: down for 53 minutes (since Tue Jun 01 01:27:28 UTC 2021)
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
All platforms	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access aaa violation interface

`show port-access aaa violation interface {all|<INTERFACE>}`

Description

Shows information about violations that have occurred and the count of violations for port access authentication methods at the interfaces.

Parameter	Description
`all`	Specifies all interfaces
<INTERFACE>	Specifies the interface name or a comma-separated list of interfaces, or a hyphen-separated interface range.

Examples

Showing information for violations for all interfaces:

```
switch# show port-access aaa violation interface all

Client limit exceeded violation status

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                 0
   1/1/2       Yes                10
   1/1/5       No                 10
```

Showing information for violations on interfaces 1/1/1 to 1/1/2:

```
switch# show port-access aaa violation interface 1/1/1-1/1/2

Client limit exceeded violation status

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                 0
   1/1/2       Yes                10
```

Showing information when no violation action is configured:

```
switch# show port-access aaa violation interface 1/1/1

Port-access aaa violation is not configured
```

Command History

Release	Modification
10.09	Command introduced on the 8360.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access port-security violation client-limit-exceeded interface

```
show port-access port-security violation client-limit-exceeded interface
{all|<INTERFACE>}
```

Description

Shows information on the number of client-limit-exceeded security violations that have occurred. The output can be filtered by interface.

Parameter	Description
`all`	Specifies all interfaces
<INTERFACE>	Specifies the interface name or a comma-separated list of interfaces, or a hyphen-separated interface range.

Examples

Showing information for all ports:

```
switch# show port-access port-security violation client-limit-exceeded interface
all

Client limit exceeded violation status

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                0
   1/1/2       Yes               10
   1/1/5       No                10
```

Showing information for a port range:

```
switch# show port-access port-security violation client-limit-exceeded interface
1/1/1-1/1/2

Client limit exceeded violation status

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                0
   1/1/2       Yes               10
```

Command History

Release	Modification
10.09	Command introduced on the 8360.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access policy

Port access policy allows network administrators to define a set of rules. These rules are used to restrict or alter the passage of traffic for clients onboarding to a switch that has port security (802.1X, MAC authentication) enabled.

Unlike classifier policies, which are associated with individual front plane port, Link Aggregation Group (LAG), and VLAN or tunnel interface, port-access policies are associated with roles. Based on the role associated with a user after authentication, the policy is applied to the user.

The switch can obtain policies from any of the following sources:

- Local: Policies configured locally on the switch.
- RADIUS: Policies configured using the NAS-Filter-Rule or Aruba-NAS-Filter-Rule RADIUS attributes.

Both local and downloaded type of policies do not have any standards associated with them. Policies that are obtained from the RADIUS server must support all criteria that can be defined using the `NAS-Filter-Rule` attribute.

Classes and actions supported by port access policies

Port access policies support IPv4- and IPv6-based classes, and the following actions.

- `cir`: Set the bandwidth limit for guaranteed traffic.
- `drop`: Drop the packet.
- `dscp`: Remark the 6-bit field in the IP header for packet classification.
- `ip-precedence`: Remark the 3-bit field in the IP header which denotes the priority of the datagram.
- `local-priority`: Change the internal priority that is used to queue the packets for transmission.

Port access policy commands

port-access policy

```
port-access policy <POLICY-NAME>
   [<SEQUENCE-NUMBER>]
   class {ip|ipv6} <CLASS-NAME>
      action {<REMARK-ACTIONS> | <POLICE-ACTIONS> | <OTHER-ACTIONS>}
   [<SEQUENCE-NUMBER>]
   comment ...
```

Description

Creates or modifies policy and policy entries. A policy is made up of one or more policy entries ordered and prioritized by sequence numbers. Each entry has an IPv4/IPv6 class and one or more policy actions associated with it.

A policy must be applied to a role using the `associate policy` command.

The `no` form of the command can be used to delete either a policy (use `no` with the policy command) or an individual policy entry (use `no` with the sequence number).

Parameter	Description
<POLICY-NAME>	Specifies the policy name.

Parameter	Description
<SEQUENCE-NUMBER>	Specifies the policy entry sequence number. Range: 1 to 4294967295.
`class {ip|ipv6} <CLASS-NAME>`	Specifies the class type and name.

<REMARK-ACTIONS>	These remark actions are available:
	`ip-precedence <IP-PRECEDENCE-VALUE>`
	Specifies the numeric IP precedence value. Range: 0 to 7.
	`dscp <DSCP-VALUE>`
	Specifies a Differentiated Services Code Point (DSCP) value. Enter either a keyword or numeric value (0 to 63). See *DSCP keywords and corresponding values* below.
	`local-priority <LOCAL-PRIORITY-VALUE>`
	Specifies a local priority value. Range: 0 to 7.

<POLICE-ACTIONS>	These police actions are available:
	`cir kbps <RATE-KBPS>`
	Specifies a Committed Information Rate (CIR) value in kbps. Range: 1 to 4294967295.
	`cbs <BYTES>`
	Specifies a Committed Burst Size (CBS) value in bytes. Range: 1 to 4294967295.
	`exceed`
	Specifies the action to take on packets that exceed the rate limit.

<OTHER-ACTIONS>	These other actions are available: `drop` Selects drop of all traffic.
`comment`	Specifies a policy entry comment.

DSCP keywords and corresponding values

Keyword	Value	Description
AF11	10	DSCP 10 (Assured Forwarding Class 1, low drop probability)
AF12	12	DSCP 12 (Assured Forwarding Class 1, medium drop probability)
AF13	14	DSCP 14 (Assured Forwarding Class 1, high drop probability)
AF21	18	DSCP 18 (Assured Forwarding Class 2, low drop probability)
AF22	20	DSCP 20 (Assured Forwarding Class 2, medium drop probability)
AF23	22	DSCP 22 (Assured Forwarding Class 2, high drop probability)
AF31	26	DSCP 26 (Assured Forwarding Class 3, low drop probability)
AF32	28	DSCP 28 (Assured Forwarding Class 3, medium drop probability)

Keyword	Value	Description
AF33	30	DSCP 30 (Assured Forwarding Class 3, high drop probability)
AF41	34	DSCP 34 (Assured Forwarding Class 4, low drop probability)
AF42	36	DSCP 36 (Assured Forwarding Class 4, medium drop probability)
AF43	38	DSCP 38 (Assured Forwarding Class 4, high drop probability)
CS0	0	DSCP 0 (Class Selector 0: Default)
CS1	8	DSCP 8 (Class Selector 1: Scavenger)
CS2	16	DSCP 16 (Class Selector 2: OAM)
CS3	24	DSCP 24 (Class Selector 3: Signaling)
CS4	32	DSCP 32 (Class Selector 4: Real time)
CS5	40	DSCP 40 (Class Selector 5: Broadcast video)
CS6	48	DSCP 48 (Class Selector 6: Network control)
CS7	56	DSCP 56 (Class Selector 7)
EF	46	DSCP 46 (Expedited Forwarding)

Usage

- An applied policy processes the packet sequentially against policy and class entries in the list, until either the last policy entry in the list has been evaluated or the packet matches an entry. If there is no match, the packet will be dropped by one of the implicit `deny all` IPv4 and IPv6 entries.
- Entering an existing `<POLICY-NAME>` value will cause the existing policy to be modified, with any new `<SEQUENCE-NUMBER>` value creating an additional policy entry, and any existing *`<SEQUENCE-NUMBER>`* value replacing the existing policy entry with the same sequence number.
- If no sequence number is specified, a new policy entry will be appended to the end of the entry list with a sequence number equal to the highest policy entry currently in the list plus 10. The sequence numbers may be reordered with the `port-access policy <POLICY-NAME> resequence <STARTING-SEQ-NUM> <INCREMENT>` command.
- If a policy is configured without any action, the default action, `permit`, is applied for that policy.

Examples

Creating a policy with several class entries:

```
switch(config)# port-access policy POL1
switch(config-pa-policy)# 10 class ip dns
switch(config-pa-policy)# 20 class ip dhcp
switch(config-pa-policy)# 30 class ip test action cir kbps 1024 exceed drop
switch(config-pa-policy)# exit
switch(config)# show port-access policy POL1
```

```
Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ---------------------------------
10          dns                          ipv4 permit
20          dhcp                         ipv4 permit
30          test                         ipv4 cir kbps 1024 exceed drop
```

Adding a comment to an existing class entry:

```
switch(config)# port-access policy POL1
switch(config-pa-policy)# 20 comment DHCP-PERMIT
switch(config-pa-policy)# exit
switch(config)# show run port-access policy POL1

port-access policy POL1
    10 class ip dns
    20 class ip dhcp
    20 comment DHCP-PERMIT
    30 class ip test action cir kbps 1024 exceed drop
```

Removing a comment from an existing class entry:

```
switch(config)# port-access policy POL1
switch(config-pa-policy)# no 20 comment
switch(config-pa-policy)# exit
switch(config)# show run port-access policy POL1

port-access policy POL1
    10 class ip dns
    20 class ip dhcp
    30 class ip test action cir kbps 1024 exceed drop
```

Modifying a policy by replacing one class with another at the same sequence number:

```
switch(config)# port-access policy POL1
switch(config-pa-policy)# 10 class ip mds action dscp af21
switch(config-pa-policy)# exit
switch(config)# show port-access policy POL1

Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ---------------------------------
10          mds                          ipv4 dscp AF21
```

```
20          dhcp                          ipv4 permit
30          test                          ipv4 cir kbps 1024 exceed drop
```

Removing a class:

```
switch(config)# port-access policy POL1
switch(config-pa-policy)# no 10
switch(config-pa-policy)# exit
switch(config)# show port-access policy POL1

Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                         TYPE ACTION
----------- ----------------------------- ---- ---------------------------------
20          dhcp                          ipv4 permit
30          clearpass-web                 ipv4 cir kbps 1024 exceed drop
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config` The `policy` command takes you into the `config-pa-policy` context where you enter the policy entries.	Administrators or local user group members with execution rights for this command.

port-access policy copy

`port-access policy <POLICY-NAME> copy <DESTINATION-POLICY>`

Description

Copies an existing policy to a new policy.

Parameter	Description
<POLICY-NAME>	Specifies the existing policy name.
<DESTINATION-POLICY>	Specifies the destination policy name.

Examples

Copying a policy:

```
switch(config)# port-access policy POL1 copy POL1_copy
switch(config)# show port-access policy

Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ---------------------------------
20          dhcp                         ipv4 permit
30          test                         ipv4 cir kbps 1024 exceed drop

Policy Name   : POL1_copy
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ---------------------------------
20          dhcp                         ipv4 permit
30          test                         ipv4 cir kbps 1024 exceed drop
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

port-access policy resequence

`port-access policy <POLICY-NAME> resequence <STARTING-SEQ-NUM> <INCREMENT>`

Description

Resequences numbering in a policy.

Parameter	Description
<POLICY-NAME>	Specifies the policy to be resequenced.
<STARTING-SEQ-NUM>	Specifies the starting sequence number. Range: 1 to 4294967295.
<INCREMENT>	Specifies the sequence number increment.

Examples

Resequencing a policy starting at 5 with an increment of 10:

```
switch(config)# port-access policy POL1 resequence 5 10
switch(config)# show port-access policy POL1

Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ----------------------------------
5           dhcp                         ipv4 permit
15          test                         ipv4 cir kbps 1024 exceed drop
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

port-access policy reset

`port-access policy <POLICY-NAME> reset`

Description

Resets the policy configuration to match the current hardware configuration of the policy.

Parameter	Description
<POLICY-NAME>	Specifies the name of the policy to be reset.

Examples

Resetting a policy:

```
switch(config)# port-access policy POL2
switch(config-pa-policy)# 20 class ip dhcp
switch(config-pa-policy)# 40 class test2 action cir kbps 1024 exceed drop
switch(config-pa-policy)# exit
switch(config)# show port-access policy POL1-V2

Access Policy Details:
======================

Policy Name   : POL2
Policy Type   : Local
Policy Status : Applied
```

```
SEQUENCE    CLASS                          TYPE ACTION
----------- ------------------------------ ---- ----------------------------------
20          dhcp                           ipv4 permit
40          test2                          ipv4 cir kbps 1024 exceed drop

switch(config)# port-access policy POLV2
switch(config-pa-policy)# 50 class ip test3 action cir kbps 1024 exceed drop
switch(config-pa-policy)# no 20
switch(config-pa-policy)# exit
switch(config)# show port-access policy POL2

Access Policy Details:
======================

Policy Name   : POL2
Policy Type   : Local
Policy Status : Rejected

SEQUENCE    CLASS                          TYPE ACTION
----------- ------------------------------ ---- ----------------------------------
40          test2                          ipv4 cir kbps 1024 exceed drop
50          test3                          ipv4 cir kbps 1024 exceed drop

switch(config)# port-access policy POK2 reset
Following policy entries will be removed:
class ip test3 action cir kbps 1024 exceed drop

Following policy entries will be added:
20 class ip dhcp

Do you want to continue (y/n)? y
switch(config)# show port-access policy POL2

Access Policy Details:
======================

Policy Name   : POL1-V2
Policy Type   : Local
Policy Status : Applied

SEQUENCE    CLASS                          TYPE ACTION
----------- ------------------------------ ---- ----------------------------------
20          dhcp                           ipv4 permit
40          test2                          ipv4 cir kbps 1024 exceed drop
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

clear port-access policy hitcounts

`clear port-access policy <POLICY-NAME> hitcounts {port | client}`

Description

Clears statistics and conform rate of a policy applied on a port or client.

Parameter	Description
<POLICY-NAME>	Specifies the policy name.
`port`	Selects port mode.
`client`	Selects client mode.

Examples

Clearing policy hit counts:

```
switch# show port-access policy POL6 hitcounts port

Port Access Policy Hit-Counts Details:
======================================

Policy Name   : POL4
Policy Type   : Local
Policy Status : Applied

SEQUENCE CLASS             TYPE ACTION                           CUR-RATE(kbps)
-------- ----------------- ---- -------------------------------- --------------
3        test8             ipv4 cir kbps 1024 exceed drop        512

Class Name : dhcp
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                            HIT-COUNT
----------- ------------------------------------------------------ -----------
10          match icmp any any count                               0

Class Name : clearpass-web
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                            HIT-COUNT
----------- ------------------------------------------------------ -----------
15          match udp any any count                                15101830

Class Name : web-traffic
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                            HIT-COUNT
----------- ------------------------------------------------------ -----------
10          match any any any count                                241
20          match any 10.1.1.1 10.1.1.2 dscp AF11 count            50

Class Name : class6
Class Type : ipv6

SEQUENCE    CLASS-ENTRY                                            HIT-COUNT
----------- ------------------------------------------------------ -----------
10          match any any any count                                173
```

```
20          match icmpv6 2001:db8:a::123 2001:db8:a::125 dscp AF11
             count                                                  32
switch#
switch# clear port-access policy POL6 hitcounts port
switch#
switch# show port-access policy POL6 hitcounts port

Port Access Policy Hit-Counts Details:
======================================

Policy Name   : POL4
Policy Type   : Local
Policy Status : Applied

SEQUENCE CLASS             TYPE ACTION                          CUR-RATE(kbps)
-------- ----------------- ---- ------------------------------- --------------
3        test8             ipv4 cir kbps 1024 exceed drop       512

Class Name : dhcp
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                          HIT-COUNT
----------- ---------------------------------------------------- -----------
10          match icmp any any count                             0

Class Name : clearpass-web
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                          HIT-COUNT
----------- ---------------------------------------------------- -----------
15          match udp any any count                              0

Class Name : web-traffic
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                          HIT-COUNT
----------- ---------------------------------------------------- -----------
10          match any any any count                              0
20          match any 10.1.1.1 10.1.1.2 dscp AF11 count          0

Class Name : class6
Class Type : ipv6

SEQUENCE    CLASS-ENTRY                                          HIT-COUNT
----------- ---------------------------------------------------- -----------
10          match any any any count                              0
20          match icmpv6 2001:db8:a::123 2001:db8:a::125 dscp AF11
             count                                               0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access policy

```
show port-access policy [<POLICY-NAME>]
```

Description

Shows various aspects of policies and their current usage. Details of a policy including the content of a specific policy is shown.

Policy type values:

- **Local**—User configured policy
- **Downloaded**—Downloaded user policy
- **RADIUS**—Policy obtained from the RADIUS server

Policy status values:

- **Applied**—Policy is successfully applied in the hardware.
- **Rejected**—Policy is not supported in the hardware.
- **In-Progress**—Policy is being processed in the hardware.
- **Failed**—Displayed when the switch fails to apply the policy configuration because the TCAM resources are unavailable or full.

Base Policy Values:

- **Name of the policy**—Policy associated with the RADIUS overridden base role.
- **N/A**—Non-RADIUS policy or policy derived from RADIUS attributes such as Filter ID or [Aruba-]NAS-Filter-Rule

ACL Names Values:

- **Name of the ACL**—Name of the ACL associated with the RADIUS policy derived from RADIUS Filter-ID attribute.
- **N/A**—Non-RADIUS policy or policy derived from [Aruba-]NAS-Filter-Rule RADIUS attribute.

If a policy is configured without any action, the `show` command will represent such an entry with the `permit` action .

Parameter	Description
<POLICY-NAME>	Specifies the policy name.

Examples

Showing information for all policies:

```
switch(config)# show port-access policy

Access Policy Details:
======================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied
Base Policy:  N/A
ACL Name:  N/A

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ----------------------------------
20          dhcp                         ipv4 permit
30          test                         ipv4 cir kbps 1024 exceed drop

Policy Name   : POL1_copy
Policy Type   : Local
Policy Status : Applied
Base Policy: N/A
ACL Name:  N/A

SEQUENCE    CLASS                        TYPE ACTION
----------- ---------------------------- ---- ----------------------------------
20          dhcp                         ipv4 permit
30          test                         ipv4 cir kbps 1024 exceed drop
```

Showing information for a particular policy:

```
switch(config)# show port-access policy RADIUS_115315236
Access Policy Details:
----------------------

Policy Name   : RADIUS_115315236
Policy Type   : Radius
Policy Status : Applied
Base Policy   : N/A
ACL Names     : DHCP, WebServices-Student

SEQUENCE    CLASS                         TYPE ACTION
----------- ----------------------------- ---- ----------
10          RADIUS_3241199543_2521983626 ipv4 permit


switch(config)# show port-access policy RADIUS_407949976
Access Policy Details:
----------------------

Policy Name   : RADIUS_407949976
Policy Type   : Radius
Policy Status : Applied
Base Policy   : test_policy_test_cppm_role-3006-1
ACL Names     : N/A


SEQUENCE    CLASS                         TYPE ACTION
----------- ----------------------------- ---- ----------
10          RADIUS_407949976_4016176641  ipv4 permit
```

Command History

Release	Modification
10.12	Command output modified to display **Base Policy** and **ACL Names**.
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access policy hitcounts

```
show port-access policy <POLICY-NAME> hitcounts {port | client}
```

Description

Shows port access hit count statistics.

Parameter	Description
<POLICY-NAME>	Specifies the policy name.
`port`	Selects port mode.
`client`	Selects client mode.

Examples

Showing policy hit counts (statistics) with current rate:

```
switch# show port-access policy POL6 hitcounts port

Port Access Policy Hit-Counts Details:
======================================

Policy Name   : POL1
Policy Type   : Local
Policy Status : Applied

SEQUENCE CLASS             TYPE ACTION                           CUR-RATE(kbps)
-------- ----------------- ---- -------------------------------- --------------
30       test8             ipv4 cir kbps 1024 exceed drop        512

Class Name : dhcp
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                            HIT-COUNT
----------- ------------------------------------------------------ -----------
10          match icmp any any count                               982150

Class Name : clearpass-web
Class Type : ipv4
```

```
SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
70          match udp any any count                                    15101830

Class Name : web-traffic
Class Type : ipv4

SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
4           match any any any count                                    3194
5           match any 10.1.1.1 10.1.1.2 dscp AF11 count                1716

Class Name : class6
Class Type : ipv6

SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
10          match any any any count                                    0
20          match icmpv6 2001:db8:a::123 2001:db8:a::125 dscp AF11
             count                                                     0
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access role

Every device that connects to a port is associated with a role. Roles are associated with all clients, both authenticated and unauthenticated, and applied to each user session. By default, roles are enabled on a switch.

Following are a few examples of user role names and the access privileges that can be configured:

- Employee—Provide complete access to network resources.
- Contractor—Provide limited access to network resources.
- Guest—Provide only Internet browsing access.

Each user role determines the client network privileges, frequency of reauthentication, applicable bandwidth contracts, and other permissions.

Active user roles applied on clients are created only on Ternary Content-Addressable Memory (TCAM) resource availability of the switch.

A user role consists of the following optional parameters:

- `Ingress user policy`

  L3 (IPv4 and/or IPv6) ordered list of classes with actions.
- `inactivity-timeout`

  The inactivity timeout period in seconds with a range of 300 to 4294967295 for the authenticated client for an implicit logoff.
- `reauth-period`

  Sets the reauthentication period in seconds or 0 to disable.
- `vlan access`

  Sets the untagged VLAN ID.
- `vlan trunk`

  Sets the tagged VLAN ID.
- `auth-mode`

  Configures the authentication mode for the clients that are associated with the current role. Available modes are: `client-mode`, `device-mode`, `multi-domain`.
- `poe-priority`

  Specifies the PoE priority for the interface.
- `mtu`

  Configures the MTU support for the client.
- `vlan trunk allowed`

  Specifies the list of tagged VLANs configured for the interface.
- `trust-mode`

  Configures the QoS trust mode for the client.
- *`private-vlan`*

  Configures PVLAN port type for a user role. The following are the attributes:
  - `promiscuous`

    Configures the port type as promiscuous.
  - `secondary`

    Configures the port type as secondary.

Operational notes

Following are some of the operational notes to be considered for port access roles:

- When roles are enabled, they are applied to all devices connected to ports where authentication is configured.
- Special roles, such as, critical, reject, pre-auth, and auth are applied depending on the authentication state of the device.
- Roles can be applied in one of the following two ways:
  - Vendor-Specific Attribute (VSA)-Derived Role

    Type: `RADIUS: Aruba`

    Name: `Aruba-User-Role`

    ID: `25`

    Value: *`<myUserRole>`*

    See Vendor-Specific Attributes supported in session authorization.

The RADIUS server (ClearPass Policy Manager server) determines how the VSA-Derived Role is applied to the user. The role is sent to the switch through a RADIUS VSA. The VSA derived role will have the same precedence order as the authentication type (802.1X, MAC authentication).

- User Derived Role (UDR)

The UDR is applied when the roles are enabled.

UDR will have the same precedence order as the authentication type (802.1X, MAC authentication).

Downloadable user roles

Downloadable user roles enable AOS-CX switches to download user roles, policy, and class from the ClearPass Policy Manager server. The download facilitates the configuration of policies and attributes for a specific user role which can then be stored locally on the switch. New users can then be assigned the same locally stored version of the user role in ClearPass Policy Manager server, enabling the administrator to save time in reconfiguring each user individually.

The command `radius-server host WORD clearpass-username WORD clearpass-password (plaintext | ciphertext)` can only be used if the user role is going to be downloaded from the ClearPass Policy Manager server.

Avoid unused classes or policies in a downloaded role, as a downloadable user role that contains one or more unused classes or policies can cause client authorization to fail.

Mixed roles

Mixed roles enable users to create a new RADIUS overridden role by overriding client-role attributes such as VLANs, in one of the following scenarios:

- Combination of LUR (Local User Role) and RADIUS attributes received from the RADIUS server.
- Combination of DUR (Downloadable User Role) and RADIUS attributes received from the RADIUS server.

The new RADIUS overridden role contains the attributes present in both LUR/DUR and RADIUS attributes. If any of the attributes are present in both the RADIUS attributes list, and Local User Role or Downloadable User Role, the RADIUS attributes will take precedence and applied to the clients.

You can use the `aaa authentication port-access radius-override enable` command at the interface context to enable the mixed role feature. With this feature enabled, users can have basic configurations that are common to most of the clients as a LUR/DUR and specify only the client-specific attribute as RADIUS attributes from the server as part of the access response.

If this feature is disabled, when a combination of LUR/DUR along with RADIUS attributes is received from the server, the user roles such as LUR or DUR take precedence and are applied to the clients. The RADIUS attributes in the list are not considered.

Important points to note

- Any changes made to LUR after the creation of a mixed role will not affect the mixed roles. Also, the mixed roles will not be affected even on LUR deletion.
- If LUR/DUR contains VLAN ID and RADIUS attribute contains VLAN name or VLAN group, then the final role will contain both VLAN ID and VLAN name or VLAN group. In this case, VLAN ID takes precedence. If both VLAN ID and VLAN name or group are present, VLAN ID takes precedence.
- The description of the LUR will not be copied to the mixed role during an override.

Limitations

Mixed roles cannot be used in the following scenarios:

- A group-based policy (GBP) is present along with LUR or DUR.
- LUR or DUR with more than 1024 class entries.
- DURs with radius-overridden policy. For example: Aruba-Clearpass-User-Role + (NAS-Filter-Rule/Filter-ID) is not supported.

Supported RADIUS attributes in mixed roles

Following are the RADIUS attributes supported in mixed roles:

The RADIUS attributes that are not supported in mixed roles can be still used for testing purposes.

Supported Radius Attributes in mixed roles	Local User Role	Downloadable User Role
Egress-VLAN-ID	Yes	Yes
Aruba-POE-priority	Yes	Yes
Aruba-QOS-trustmode	Yes	Yes
Framed MTU	Yes	Yes
Session timeout	Yes	Yes
Termination-Action	Yes	Yes

Cached-critical role

The cached-critical role allows the authorization of authenticated clients with the previously applied roles when the RADIUS server is unreachable. When the cached-critical user role feature support is enabled, the MAC address of clients and their applied roles are cached in the system during the client log-off or re-authentication. When the RADIUS server is unreachable, the cached-critical role is applied as a special role to the client. Once the RADIUS server is reachable, cache details are cleared from the switch. The cached-critical role can be enabled at the global or per-interface level.

The cached-critical role can be applied only to the authentication-enabled ports. A maximum of 1024 client entries can be cached in the switch. You can configure a timeout period during which the client details remain cached. On a timeout, the cached entry is removed from the switch within the buffer time of 30 minutes. When the number of clients exceeds the maximum limit of 1024, the first in, first out (fifo) replace mode can be used to replace the oldest cached entry in the switch with a new entry. When the maximum limit of 1024 is reached, the following event log is generated: `Reached the maximum cached-clients limit of 1024 on the switch for Limited Auth-Survivability`.

The cached-critical role feature is not supported when the RADIUS server is not configured in the switch.

By enabling the `persistent-storage` configuration, the cached-critical role support for the clients will be available across switch reboots. With this configuration enabled, the client information is cached in the persistent memory of the switch. The information stored in the persistent storage is updated periodically and the interval between the updates is configurable using the `write-interval` CLI option,

with a default interval of 3600 seconds. The update to the persistent storage is only done if there is a difference in the client information since the last write.

- For the cached-critical role feature to work across all types of roles such as LUR, DUR, and RADIUS, it is required to configure the `aaa authentication port-access cached-critical-role persistent-storage enable` command before onboarding clients. If the `persistent-storage` configuration is disabled and re-enabled after client onboarding, the cached-critical role feature will not work specifically for clients with DUR and RADIUS roles.
- Enabling `persistent-storage` on the switch might reduce the lifespan of persistent memory.

The cached details are cleared in one of the following scenarios:

- When the client connects back and received a server response.
- When the client is assigned with the cached-critical role and the server becomes reachable.
- When the client attempts for the authentication request and received a response.
- When the client connects back through different on-boarding methods such as device-profile and port-security.
- When the cached-critical role is disabled at the global level.
- When the cached client details are cleared using the `port-access clear cached-client` command.
- When the cached duration exceeds the configured cached-interval timeout period.
- When the number of clients exceeds the maximum limit of 1024.
- When the role is deleted in the case of LUR.

- Clients with roles such as DUR, VSA, LUR, and mixed roles can be cached.
- Cached-critical role can be applied to UBT clients.

For information on this feature, see the related video on the Aruba AirHeads Broadcasting Channel.

Cached-critical role tasks

The cached-critical role tasks are as follows:

Task	Command name	Example
Entering into the cached-critical role (config-aaa-ccr) context at the global level	`aaa authentication port-access cached-critical-role`	`switch(config)# aaa authentication port-access cached-critical-role`

Task	Command name	Example
Enabling the cached-critical role (global) (disabled by default)	`enable`	`switch(config-aaa-ccr)# enable`
Disabling the cached-critical role (global)	`disable`	`switch(config-aaa-ccr)# disable`
Setting the cache-timeout (global)	`cache-timeout <HOURS>`	`switch(config-aaa-ccr)# cache-timeout 72`
Setting the cached replace mode (global)	`cache-replace-mode {fifo | none}`	`switch(config-aaa-ccr)# cache-replace-mode fifo`

Configuring the persistent storage for cached clients.	`persistent-storage {enable |write-interval <900-86400>}`	`switch(config)#aaa authentication port-access cached-critical-role`
		`switch(config-aaa-ccr)# persistent-storage`
		`switch(config-aaa-ccr-ps)# enable`
		`switch(config-aaa-ccr-ps)# write-interval 7200`

Clearing the cached-critical role clients	`port-access clear cached-client [all|mac <MACADDR>| role <ROLENAME>]`	`switch(config)# port-access clear cached-client ap_role` `switch(config)# port-access clear cached-client mac 00:0a:0b:0c:0d:0e`
Showing summarized information of all cached port-access	`show aaa authentication cached-clients [mac <MAC-ADDRESS>][role <ROLE-NAME>]`	`switch# show port-access cached-clients`

Task	Command name	Example
clients		
Enabling or disabling cached-critical role at the per-interface level (enabled by default)	`[no] aaa authentication port-access cached-critical-role`	`switch(config)# interface 1/1/1` `switch(config-if)# [no] aaa authentication port-access cached-critical-role`

Restrictions

The cached-critical role restrictions are as follows:

- Clients with a role associated with the captive portal profile or MACsec policy cannot be cached. If the captive portal clients have a full access role, then the clients can be cached.
- If the cached-critical role is modified with any of the roles such as critical, reject, pre-auth, fallback, critical voice, or auth, then the client details will not be cached.
- When the cached critical role is modified, then the latest role will get applied.
- Accounting is not supported when the cached-critical role is applied to the clients.
- If captive portal clients have a full access role, then the client details can be cached.
- If the client is assigned with the auth role and the radius override is enabled, then the mixed role will have both VSA and auth roles. In this case, the mixed role will be cached with all the attributes of auth role except the description.
- Client details can be cached only when the clients are fully authenticated. In the interim (auth-success), client details will not be cached upon log-off.

Troubleshooting

If the cached-critical role is not applied to a client:

- Check clients MAC using the `show port-access cached-clients` command.
- Check if the client was authenticated successfully and placed in the final authentication state before logging off.
- Check if the client is in the cached-reauthentication state.
- Check if cache limit has reached and cache-replace mode is configured
- Check if the cached interval configured duration has timed out.
- Check if the client has a captive portal profile or MACsec profile in the role.
- Check if the client is applied with any special roles.
- Check whether the client is onboarded with the device profile if local mac-match is enabled.
- Check if the client is replaced when the cached replace mode is set to FIFO.
- Check if the feature is enabled on the particular interface.
- Check if the feature is enabled globally.
- Check if the client is present on any other port.

Special roles

Special roles are always local roles that are created to support instances when the deployments are not yet complete. They are also helpful when any network issues occur during authentication of devices. Special roles are always purpose-based, that is, they are applied only in instances such as the RADIUS server is not reachable for authentication or when a single role has to be applied across all switches.

The following special roles are available:

- Critical role
- Reject role
- Pre-authentication role
- Auth-role
- Fallback role

Critical role

The critical role is applied to devices when the RADIUS server is unreachable during the first authentication process or during reauthentication. This role helps ensure that the devices have limited access to the network even though the authentication is not completed. Once the RADIUS server is available for authentication, the devices are authenticated and the ultimate role is applied.

Reject role

The reject role is applied when the RADIUS server rejects a device during authentication. The reject role gives restricted access to the device compared to a full access role.

Pre-authentication role

The pre-authentication (pre-auth) role allows a device, such as an IP phone, to have network access before the device is authenticated. The pre-auth role is triggered when a MAC-based client is connected to a switch before being authenticated by the RADIUS server. Devices must be assigned a VLAN to provide network connectivity. Two new VLANs are created for pre-auth role functionality, one for voice traffic and one for data traffic. Pre-auth role VLANs can be configured on the switch individually or within a user-role. Devices that can be connected to the switch without authentication are divided into two categories:

- Devices that send voice traffic.
- Devices that send data traffic.

Either one of pre-auth role VLANs (voice and/or data) or a pre-auth role can be configured for a port. However, both a VLAN and role cannot coexist for an interface. Initial traffic on the port is restricted only by Access Control Lists (ACLs) configured for the port or for VLANs or ACLs in the role.

Impact of pre-auth role on existing features

Unauthenticated devices

Configuring pre-auth role VLAN will change the behavior of unauthenticated devices. Normally, authentication-enabled ports will not provide unauthenticated client any network access until the device is authenticated by the RADIUS server. With pre-auth role VLAN configured, the client will be assigned to the pre-auth role VLAN until the RADIUS server authenticates the device.

Unauthenticated clients will be placed into the VLAN specified in the pre-auth role. After authenticated by the RADIUS server, the client will be placed into the VLAN specified in the RADIUS authentication command string or as specified in the RADIUS authentication accept string.

LLDP-bypass

When LLDP-bypass is enabled on the switch, Aruba APs are not authenticated. Therefore pre-auth role VLAN is not applicable.

Bypass using device-identity

Pre-auth role VLAN is not applicable to VoIP devices because they do not need authentication. It is applicable to PCs that need authentication.

ACLs applied on an interface

If an ACL rule is applied on an interface, which is part of a pre-auth role VLAN, traffic coming through that interface will be affected. Traffic will be affected based on the rule in the ACL.

ACLs applied on a VLAN

If an ACL rule is applied on a pre-auth role VLAN, traffic entering that VLAN will be affected. Traffic will be affected based on the rule in the ACL.

Rate-limiting on an interface

If the traffic is rate-limited on an interface as part of a pre-auth role VLAN, the traffic will be impacted. The traffic will be affected based on the rule in the rate-limiting configuration command.

Authenticated or rejected clients

Clients that are authenticated or rejected by the RADIUS server are given different VLANs. These clients are moved from pre-auth role to new VLANs based on the authentication by the RADIUS server.

MAC pinning

Clients whose MAC addresses are pinned and have undergone authentication will always be treated as authenticated. Pre-auth role VLAN is not applicable in this scenario.

Effect of RADIUS tracking on pre-auth role

If RADIUS tracking is enabled and no RADIUS server is available for authentication, the port will be changed from a pre-auth role VLAN to a critical VLAN. The time taken to move from pre-auth role VLAN to critical VLAN depends on the time it takes for RADIUS tracker to inform the subsystem.

Restrictions

The pre-auth role restrictions are as follows:

- It will not support more than one tagged or untagged VLAN membership either through direct VLAN configuration or through user-roles.
- It is not applicable for authentication methods other than MAC-based.
- It is not available to be configured from WebUI, Menu, or REST.

Auth-role

After the RADIUS server authenticates a device, if no role is configured on the server, it sends an empty access accept packet to the switch. The switch translates this empty packet to assign an auth-role to the device. The switch then checks if an auth-role is configured on that port and assigns this role to the device.

Fallback role

The fallback role is applied to onboarding devices when there is no derived role available for the devices. Following are the conditions for the fallback role to be applied on onboarding devices:

- The device profile local MAC match feature with block-until-profile-applied mode is configured.
- Device profile along with AAA is configured but no match was found for the device profile client.

- AAA method with no reject or critical role is configured, and the connection to RADIUS server failed.
- 802.1X authentication is enabled on the port, but the supplicant of the device timed out to respond to the authentication request.

Port access role commands

associate macsec-policy

```
associate macsec-policy <POLICY-NAME>
no associate macsec-policy [<POLICY-NAME>]
```

Description

Associates a MACsec policy with a role. When a role that has a MACsec policy associated is applied to a port, all data traffic is blocked on the port until a secure channel is successfully established.

If a MACsec policy is associated with a role that is applied on a non-MACsec capable interface, the client will be in an unauthorized state and the port will remain in a blocked state.

The `no` form of this command disassociates the policy from the role.

Parameter	Description
<POLICY-NAME>	Specifies the MACsec policy name. Range: Up to 128 characters.

Examples

Associating a MACsec policy with a role.:

```
switch(config)# port-access role role01
switch(config-pa-role)# associate macsec-policy Client-Connect
```

Disassociating a MACsec policy from a role:

```
switch(config-pa-role)# no associate macsec-policy
```

Command History

Release	Modification
10.10	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

associate policy

```
associate policy <POLICY-NAME>
no associate policy <POLICY-NAME>
```

Description

Associates the policy with the current role.

The `no` form of this command dissociates the policy from the role.

Parameter	Description
<POLICY-NAME>	Specifies the policy name to associate with the current role. Range: Up to 64 characters. **NOTE:** Only those policies created by using the `port-access policy` command are allowed to be associated with a role. Policies created using the `policy` command are not allowed to be associated with a role. Policies that are of the downloaded type are not allowed to be associated with a role.

Examples

Associating a policy with a role:

```
switch(config)# port-access role role01
switch(config-pa-role)# associate policy policy01
```

Dissociating a policy from the role:

```
switch(config-pa-role)# no associate policy poilcy01
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

auth-mode

```
auth-mode {client-mode | device-mode | multi-domain}
```

Description

Configures the authentication mode for the clients that are associated with the current role.

Parameter	Description
`client-mode`	Selects client mode. In this mode, all clients connecting to the port are sent for authentication.
`device-mode`	Selects device mode. In this mode, only the first client connecting to the port is sent for authentication. Once this client is authenticated, the port is considered as open and all subsequent clients trying to connect on that port are not sent for authentication.
`multi-domain`	Selects multidomain mode. In this mode only one voice device is allowed to be authenticated in addition to the configured data devices on a port. By default only one data device is allowed to be authenticated on the multidomain mode along with one voice device. You can configure the maximum number of data devices allowed with the `aaa authentication port-access client-limit multi-domain` command. If a second voice device or a data device greater than the configured data client limit onboards, a violation is triggered. You must configure a voice VLAN for IP phones to onboard a voice device in the multidomain authentication mode. To authorize a voice device, you must perform one of the following: ▪ Configure the AAA server to send the `Aruba-Device-Traffic-Class` Aruba VSA with value `1`. ▪ Configure the `device-traffic-class` parameter in the role to be applied to indicate a voice device. Without this VSA value or the device type in the role, the switch considers the voice device as a data device.

Examples

Configuring the client authentication mode:

```
switch(config-pa-role)# auth-mode client-mode
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

cached-reauth-period

```
cached-reauth-period [<PERIOD>]
no cached-reauth-period
```

Description

Enables cached reauthentication, setting the period after which clients that associated with the current role must be reauthenticated.

The `no` form of this command disables cached authentication.

Parameter	Description
<PERIOD>	Specifies the cached reauthentication period (in seconds) for clients associated with the role. Default: 30. Range: 30 to 4294967295.

Examples

Enabling cached reauthentication and setting its period to 200 seconds:

```
switch(config-pa-role)# cached-reauth-period 200
```

Disabling cached reauthentication:

```
switch(config-pa-role)# no cached-reauth-period
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

client-inactivity timeout

```
client-inactivity timeout {<CLIENT-INACTIVITY-PERIOD> | none}
no client-inactivity timeout
```

Description

Configures the period that the switch waits for a response from a client after which it removes the client from the role.

The `no` form of the command resets the timeout period to the default.

Parameter	Description
<CLIENT-INACTIVITY-PERIOD>	Specifies the client inactivity time (in seconds). Default: 300. Range: 300 to 4294967295
`none`	Selects no client deletion due to inactivity.

Examples

Configuring client inactivity timer for a role:

```
switch(config-pa-role)# client-inactivity timeout 3600
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

device-traffic-class

```
device-traffic-class voice
no device-traffic-class [voice]
```

Description

Configures the voice class of client to associate with the role.

This attribute is applicable only to `critical-voice-role` role. It is not applicable to other special roles such as, `preauth-role`, `reject-role`, and `fallback-role`.

The `no` form of the command resets the class of client to the default, data.

Usage

Traffic class of a client will not be considered as voice unless `device-traffic-class` is set to `voice` the role. In the multidomain mode, clients with a role that do not have the value of the `device-traffic-class` attribute set to voice will be considered as data device.

Examples

Configuring voice device traffic class for role **role01**:

```
switch(config)# port-access role role01
switch(config-pa-role)# device-traffic-class voice
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

description

`description <ROLE-DESCRIPTION>`

Description

Configures the role description.

Parameter	Description
<ROLE-DESCRIPTION>	Specifies the role description. Range: Up to 255 characters.

Examples

Configuring the role description:

```
switch(config-pa-role)# description student role
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

mtu

```
mtu <MTU-SIZE>
```

Description

Configures the MTU (maximum transmission unit) size of a client for a role.

Parameter	Description
<MTU-SIZE>	Specifies the MTU size in bytes. Range: 68 to 9198.

Examples

Configuring client MTU size:

```
switch(config-pa-role)# mtu 9198
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

poe-priority

```
poe-priority {critical | high | low}
no poe-priority
```

Description

Configures the power distribution priority for the port access roles. High power consumption can be prevented using the `poe-priority` control mechanism.

The `no` form of this command restores the power distribution to its default priority.

Parameter	Description
`critical`	Selects critical priority.
`high`	Selects high priority.
`low`	Selects low priority.

Examples

Configuring PoE priority for a new role:

```
switch(config)# port-access role role01
switch(config-pa-role)# poe-priority critical
```

Resetting PoE priority for the role to its default:

```
switch(config)# port-access role role01
switch(config-pa-role)# no poe-priority
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

port-access role

```
port-access role <ROLE-NAME>
no port-access role <ROLE-NAME>
```

Description

Creates a new port access role or modifies an existing role. This command takes you into the `config-pa-role` context. A maximum of 32 port access roles can be created.

The `no` form of this command deletes a role.

Parameter	Description
<ROLE-NAME>	Specifies the role name. Range: Up to 64 characters.

Examples

Creating a new role:

```
switch(config)# port-access role basic01
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

reauth-period

```
reauth-period <PERIOD>
no reauth-period
```

Description

Configures the period after which clients that associated with the current role must be reauthenticated.

The reauthentication period configured here takes precedence over the reauthentication period configured at the port level.

Parameter	Description
<PERIOD>	Specifies the reauthentication period (in seconds) for clients associated with the role. Default: None. Range: 1 to 4294967295. A reauthentication period of less than 60 seconds is not recommended.

Examples

Configuring reauthentication period:

```
switch(config-pa-role)# reauth-period 3000
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

session timeout

```
session-timeout <SESSION-TIMEOUT>
no session-timeout
```

Description

Configures the session timeout for the role. After the timeout period, the session is disconnected.

Parameter	Description
<SESSION-TIMEOUT>	Specifies the session timeout (in seconds). Range: 1 to 4294967295. A timeout of less than 60 seconds is not recommended.

Examples

Configuring session timeout for a role:

```
switch(config-pa-role)# session timeout 3600
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

show aaa authentication port-access interface client-status

```
show aaa authentication port-access interface {all | <IF-NAME>}
client-status [mac <MAC-ADDRESS>]
```

Description

Shows information about the status of the role applied on ports.

Parameter	Description
`all`	Specifies all interfaces.
<IF-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing information about a client:

```
switch# show aaa authentication port-access interface all client-status mac
00:00:00:00:00:01
```

```
Port Access Client Status Details

Client 00:00:00:00:00:01
============================
  Session Details
  ---------------
    Port         : 1/7/24
    Session Time : 151s

  Authentication Details
  ----------------------
    Status          : mac-auth Authenticated
    Auth Precedence : mac-auth - Authenticated, dot1x - Not attempted

  Authorization Details
  ---------------------
    Role   : UserRole_1
    Status : Applied
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access role

`show port-access role {local | radius | name <ROLE-NAME>}`

Description

Shows information about roles configured locally, or downloaded from the RADIUS server.

Displays information only about the attributes defined for the role. The base policy name will be suffixed with * for RADIUS overridden roles.

Parameter	Description
`local`	Shows information about locally configured roles.
`radius`	Shows information about roles downloaded from the RADIUS server.
<ROLE-NAME>	Specifies the role name.

Examples

Showing locally configured role information:

```
switch# show port-access role local

Role Information

  Name  : local_role_01
  Type  : local
  ---------------------------------------------
    Reauthentication Period             : 333 secs
    Authentication Mode                 :
    Session Timeout                     :
    Client Inactivity Timeout           :
    Tunneled Node Server Zone           :
    Tunneled Node Server Secondary Role :
    Access VLAN                         :
    Native VLAN                         :
    Allowed Trunk VLANs                 :
    MTU                                 :
    QoS Trust Mode                      :
    PoE Priority                        : low
    PoE Allocation method               : class
    Captive Portal Profile              :
    Policy                              :
```

```
switch# show port-access role local

Role Information

  Name  : local_role_01
  Type  : local
-----------------------------------------------
    Reauthentication Period             : 333 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     :
    Client Inactivity Timeout           :
    Description                         :
    Access VLAN                         :
    Native VLAN                         :
    Allowed Trunk VLANs                 :
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
    VLAN Group Name                     :
    MTU                                 :
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
    Policy                              :
    GBP                                 :
    Device Type                         :
```

Showing information for roles downloaded from ClearPass Policy Manager:

```
June 2020: Replaced original ClearPass example with a new one from Girish G.
switch# show port-access role clearpass

Role Information:
```

```
Name  : CP_GIRI_DUR_GUEST_ROLE-3058-7
Type  : clearpass
Status: Completed
-------------------------------------------
    Reauthentication Period             : 300 secs
    Authentication Mode                 :
    Session Timeout                     : 1000000 secs
    Client Inactivity Timeout           :
    Description                         : Guest role for CP6
    Gateway Zone                        :
    UBT Gateway Role                    :
    Access VLAN                         : 20
    Native VLAN                         :
    Allowed Trunk VLANs                 :
    Access VLAN Name                    : vlan20
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :
    MTU                                 :
    QOS Trust Mode                      :
    STP Administrative Edge Port        : true
    PoE Priority                        :
    Captive Portal Profile              : CP6_CP_GIRI_DUR_GUEST_ROLE-3058-7
    Policy                              : CP6_CP_GIRI_DUR_GUEST_ROLE-3058-7
```

Showing information for roles downloaded from a RADIUS server:

```
switch# show port-access role radius

Role Information:
Attributes overridden by RADIUS are prefixed by '*'.

Name      : RADIUS_Overridden_3598790787
Type      : radius
Base Role : MixedRole_XX00_LUR_1, local, Fri Jul 09 14:34:29 IST 2021
-------------------------------------------------------------------------------
    Reauthentication Period             : 600 secs
    Cached Reauthentication Period      :
    Authentication Mode                 :
    Session Timeout                     : 800 secs
    Client Inactivity Timeout           : 1000 secs
    Description                         :
    Access VLAN                         :
    Native VLAN                         :
   *Allowed Trunk VLANs                 : 5
    Access VLAN Name                    :
    Native VLAN Name                    :
    Allowed Trunk VLAN Names            :

   *MTU                                 : 9198
    QOS Trust Mode                      :
    STP Administrative Edge Port        :
    PoE Priority                        :
    Policy                              :
    GBP                                 :
    Device Type                         :
```

Showing locally configured role information:

```
switch# show port-access role local

Role Information:

   Name  : local_role_01
   Type  : local
   ---------------------------------------------
     Reauthentication Period             : 333 secs
     Cached Reauthentication Period      : 300 secs
     Access VLAN Name                    : Hpe
     VLAN Group Name                     : group1
     PoE Priority                        : low
     Policy                              : deny-http-policy
     Private-VLAN Port-Type              : secondary
```

Showing information for roles downloaded from a RADIUS server:

```
switch# show port-access role radius
Role Information:
Attributes overridden by RADIUS are prefixed by '*'.

Name : RADIUS_21963402
Type : radius
---------------------------------------------
Reauthentication Period: 333 secs
Access VLAN: 10
VLAN Group Name: group1
STP Administrative Edge Port : true
PoE Priority : low
Captive Portal Profile : testcpprof_29451201
Policy : PERMIT-ALL_87364653
Private-VLAN Port-Type : secondary
```

Command History

Release	Modification
10.12	The following changes were introduced: ■ Command output updated to display information only about the attributes defined for the role. ■ The base policy name will be suffixed with * for RADIUS overridden roles.
10.09	Command introduced on the 8360.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

stp-admin-edge-port

```
stp-admin-edge-port
no stp-admin-edge-port
```

Description

Configures the port as a spanning tree administrative edge port for the role. This configuration removes the port participation from STP interactions when onboarding devices. This in turn helps in faster onboarding of devices.

The `no` form of the command disables STP edge port functionality.

If the port receives STP BPDU on the STP administrative edge configured port, the port will move to the STP state. You must configure the port as an STP administrative edge port only if you are sure that the connected device will not participate in STP interactions.

Example

Configuring STP edge port for a role:

```
switch(config)# port-access role role01
switch(config-pa-role)# stp-admin-edge-port
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

trust-mode

```
trust-mode [dscp | cos | none]
no trust-mode
```

Description

Configures QoS trust mode for the role.

The `no` form of this command configures the default trust mode for the role.

Parameter	Description
`dscp`	Selects trust DSCP and retain 802.1p priority.

Parameter	Description
`cos`	Selects trust 802.1p and retain DSCP or IP-ToS.
`none`	Selects no trusting of priority fields.

Examples

Configuring DSCP trust mode for a role:

```
switch(config)# port-access role role01
switch(config-pa-role)# trust-mode dscp
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

vlan

```
vlan {access | trunk native | trunk allowed} <VLAN-ID>
no vlan {access | trunk native | trunk allowed} <VLAN-ID>

vlan {access name | trunk native name | trunk allowed name} <VLAN-NAME>
no vlan {access name | trunk native name | trunk allowed name} [<VLAN-NAME>]
```

Description

Configures VLAN IDs or VLAN names, and VLAN modes for a port access role. You can configure either VLAN IDs or VLAN names, or a combination of both for a role.

The `no` form of the command deletes the VLAN configuration from the role. For trunk allowed VLAN names, you can delete the VLAN names individually or all names at once.

Parameter	Description
`access <VLAN-ID>`	Specifies the VLAN ID for the access VLAN. Supports a single VLAN ID in the range 1 to 4094.
`trunk native <VLAN-ID>`	Specifies the native VLAN ID on the trunk interface. Supports a single VLAN ID. Range: 1 to 4094.
`trunk allowed <VLAN-ID>`	Specifies the list of tagged or allowed VLANs on the trunk

Parameter	Description
	interface. Supports a list of VLAN IDs. Range: 1 to 4094.
`access name <VLAN-NAME>`	Specifies the VLAN name for the access VLAN. Supports a single VLAN name. Range: Up to 32 characters.
`trunk native name <VLAN-NAME>`	Specifies the native VLAN name on the trunk interface. Supports a single VLAN name. Range: Up to 32 characters
`trunk allowed name <VLAN-NAME>`	Specifies the tagged or allowed VLAN name on the trunk interface. Supports a single VLAN name. Range: Up to 32 characters. The switch supports a maximum of 50 trunk allowed VLAN names.

Usage

Note the following points when configuring the VLAN IDs and names for a role:

- For VLAN access and VLAN trunk native respectively, it is recommended to configure only one of either VLAN ID or name for a role. In case both VLAN ID and name are configured, then VLAN ID takes precedence and is applied with the role.
- For VLAN trunk allowed, you can collectively configure a maximum of 50 names and 1024 VLAN IDs. In case this limit is exceeded in the role, then that role is rejected when applying it to an onboarding device.

Platform	Maximum VLAN IDs per role	Maximum VLAN Namesper role	Total VLANs (ID + Name) per role
8360	1024	50	1024
8100	1024	50	1024

Examples

Configuring VLAN modes and VLAN IDs for a new role:

```
switch(config)# port-access role role01
switch(config-pa-role)# vlan trunk native 10
switch(config-pa-role)# vlan trunk allowed 11-15
switch(config-pa-role)# vlan access 50
```

Configuring VLAN modes and VLAN names for a new role:

```
switch(config)# port-access role role10
switch(config-pa-role)# vlan trunk native name hpe01
switch(config-pa-role)# vlan trunk allowed name data
switch(config-pa-role)# vlan trunk allowed name voice
switch(config-pa-role)# vlan trunk allowed name video
```

Deleting VLAN configuration from a role:

```
switch(config-pa-role)# no vlan trunk native 10
switch(config-pa-role)# no vlan trunk allowed 10-15
switch(config-pa-role)# no vlan access 50
```

Deleting trunk allowed VLAN names from a role individually:

```
switch(config-pa-role)# no vlan trunk native name hpe01
switch(config-pa-role)# no vlan trunk allowed name data
switch(config-pa-role)# no vlan trunk allowed name voice
switch(config-pa-role)# no vlan trunk allowed name video
```

Deleting trunk allowed VLAN names from a role all at once:

```
switch(config-pa-role)# no vlan trunk native name hpe01
switch(config-pa-role)# no vlan trunk allowed name
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-role` The `port-access role` command takes you into the `config-pa-role` context.	Administrators or local user group members with execution rights for this command.

Port access cached-critical role commands

aaa authentication port-access cached-critical-role (global)

```
aaa authentication port-access cached-critical-role
   enable
   disable
   cache-timeout <HOURS>
   cache-replace-mode {fifo|none}
   no ...
   persistent-storage {enable |write-interval <INTERVAL>}
```

Description

Enters the cached-critical role context (shown in the switch prompt as config-aaa-ccr). The cached-critical role allows the authorization of authenticated clients with the previously applied roles when the RADIUS server is unreachable.

By default, the cached-critical role is disabled at the global level. When the cached-critical user role is enabled, the MAC address of clients and their applied roles are cached in the following cases:

- During the client log-off.
- When a client fails to reach the server during reauthentication.
- All the RADIUS servers in the server group are not reachable. In this case, the details of the clients authenticated with the server group are cached.

When the RADIUS server is unreachable, the cached-critical role is applied as a special role. The cached-critical role can be applied only on authentication-enabled ports.

By enabling the `persistent-storage` configuration, the cached-critical role support for the clients will be available across switch reboots. With this configuration enabled, the client information is cached in the persistent memory of the switch. The information stored in the persistent storage is updated periodically and the interval between the updates is configurable using the `write-interval` CLI option, with a default interval of 3600 seconds. The update to the persistent storage is only done if there is a difference in the client information since the last write.

The `no` form of the command disables the cached-critical role. This is the default.

- If the cached-critical user role needs to be modified to add a captive portal profile, use the `port-access clear cached-client role <ROLE>` command to clear the cached clients on the role before it is modified.
- Enabling `persistent-storage` on the switch might reduce the lifespan of persistent memory.

Parameter	Description
`enable`	Enables the cached-critical role on the authentication-enabled ports.
`disable`	Disables the cached-critical role. (Default)
`cache-timeout <HOURS>`	Specifies the timeout period for the client details to be cached in the switch. A timer runs for every 30 minutes interval to check whether the client is valid to stay cached. On a timeout, the cached entry is removed from the switch within the buffer time of 30 minutes. Default: 96 hours. Range: 1 to 168 hours.
`cache-replace-mode {fifo|none}`	Sets the cache replacement mode. ■ **fifo**: Sets the cache replace mode to **fifo** (First in, first out). If the number of cached clients in the system exceeds the limit of 1024, the oldest cache entry of the client is replaced with a new entry. ■ **none**: Sets the cache replace mode to **none**. If the number of cached clients in the system exceeds the limit of 1024, the new client details will not be cached. This is the default.
`no ...`	Negates any existing parameter.
`persistent-storage {enable |write-interval <900-86400>}`	Configures the persistent storage for cached clients. ■ **enable**: Enables persistent storage for the cached clients. ■ **write-interval**: Configures the interval between

Parameter	Description
	consecutive writes to persistent storage in seconds. Range: 900 to 86400 seconds. Default: 3600 seconds.

Examples

Enabling the cached-critical-role at the global level with a cache timeout period of **72** hours and cache replace mode as **fifo**:

```
switch(config)# aaa authentication port-access cached-critical-role
switch(config-aaa-ccr)# enable
switch(config-aaa-ccr)# cache-timeout 72
switch(config-aaa-ccr)# cache-replace-mode fifo
```

Disabling the cached-critical role at the global level:

```
switch(config)# aaa authentication port-access cached-critical-role
switch(config-aaa-ccr)# disable
```

Enabling and configuring persistent storage:

```
switch(config)#aaa authentication port-access cached-critical-role
switch(config-aaa-ccr)# persistent-storage
switch(config-aaa-ccr-ps)# enable
switch(config-aaa-ccr-ps)# write-interval 7200
```

Command History

Release	Modification
10.11.1000	The `persistent-storage` parameter is added.
10.10	Command introduced on the 4100i, 6200, 6300, 6400, 8100, 8360.

Command Information

Platforms	Command context	Authority
8360	`config` `config-aaa-ccr`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access cached-critical-role (per interface)

```
aaa authentication port-access cached-critical-role
no aaa authentication port-access cached-critical-role
```

Description

Enables or disables cached-critical role feature on a specific interface. The cached-critical role allows the authenticated client to be authorized with the previously applied roles when the RADIUS server is unreachable.

By default, the cached-critical role feature is enabled at the port level if the cached-critical role is already enabled globally. This command can be used to configure the cached-user role on the specific ports where the caching is needed.

The `no` form of the command disables the cached-critical role on a specific interface.

Examples

Enabling the cached-critical role on the specific port:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access cached-critical-role
```

Disabling the cached-critical role on the specific port:

```
switch(config)# interface 1/1/1
switch(config-if)# no aaa authentication port-access cached-critical-role
```

Command History

Release	Modification
10.10	Command introduced on the 4100i, 6200, 6300, 6400, 8100, 8360.

Command Information

Platforms	Command context	Authority
8100 8360	`config-if`	Administrators or local user group members with execution rights for this command.

port-access clear cached-client

`port-access clear cached-client [all | mac <MACADDR> | role <ROLENAME>]`

Description

Clears all the cached clients or clears cached clients based on the MAC address or role name.

Parameter	Description
`all`	Clears all the cached clients.
`mac <MACADDR>`	Clears cached clients based on the MAC address.
`role <ROLENAME>`	Clears cached clients based on the role.

Examples

Clearing all the cached clients:

```
switch# port-access clear cached-client all
```

Clearing the cached clients based on the MAC address:

```
switch# port-access clear cached-client mac 00:0a:0b:0c:0d:0e
```

Clearing the cached clients based on the role:

```
switch# port-access clear cached-client ap_role
```

Command History

Release	Modification
10.10	Command introduced on the 4100i, 6200, 6300, 6400, 8100, 8360.

Command Information

Platforms	Command context	Authority
8100 8360	config	Administrators or local user group members with execution rights for this command.

show port-access cached-clients

```
show port-access cached-clients [mac <MAC-ADDRESS>][role <ROLE-NAME>]
```

Description

Shows summarized information of all cached port-access clients on the system. The output can be filtered by MAC address or role.

The role name is not displayed for clients that use a RADIUS role without a base role.

Parameter	Description
<MAC-ADDRESS>	Specifies the MAC address of the client.
<ROLE-NAME>	Specifies the role of the client.

Examples

Showing summarized information for all cached port-access clients on the system:

```
switch# show port-access cached-clients

Port Access Cached-Clients

-------------------------------------------------------------------------
MAC-Address        Role              Cached-Duration
-------------------------------------------------------------------------
00:50:56:bd:04:c8  ap-role           3 Days, 22 Hours, 33 Minutes, 44 Seconds
00:50:56:bd:32:07  RADIUS_773420618  1 Day, 1 Hour, 1 Minute, 1 Second
00:50:56:bd:32:08  RADIUS_773420618  12 Hours, 34 Minutes, 56 Seconds
00:50:56:cd:32:09  ap-role           12 Hours, 56 Seconds
00:50:56:bd:50:43  employee          12 Hours
00:50:56:bd:50:45  printer           34 Minutes
08:97:34:ad:e4:00  role_01_Student   56 Seconds
```

Showing information for a specific client based on the MAC address:

```
switch# show port-access cached-clients clients mac 00:50:56:bd:32:08

Port Access Cached-Clients

 ------------------------------------------------------------
  MAC-Address        Role              Cached-Time
 ------------------------------------------------------------
  00:50:56:bd:32:08  RADIUS_773420618  12 Hours, 34 Minutes, 56 Seconds
```

Showing information for a specific client based on the role:

```
switch# show port-access cached-clients role ap-role

Port Access Cached-Clients

------------------------------------------------------------
  MAC-Address        Role              Cached-Time
 ------------------------------------------------------------
  00:50:56:bd:04:c8  ap-role           3 Days, 22 Hours, 33 Minutes, 44 Seconds
  00:50:56:cd:32:09  ap-role           12 Hours, 56 Seconds
```

Showing summarized information for all cached port-access clients on the system:

```
switch# show port-access cached-clients
Port Access Cached-Clients
RADIUS overridden user roles are suffixed with '*'
--------------------------------------------------------------------------------
MAC-Address        Role              Cached-Duration
--------------------------------------------------------------------------------
00:50:56:bd:04:c8  ap-role           3 Days, 22 Hours, 33 Minutes, 44 Seconds
00:50:56:bd:32:07                    1 Day, 1 Hour, 1 Minute, 1 Second
00:50:56:bd:32:08                    12 Hours, 34 Minutes, 56 Seconds
00:50:56:cd:32:09  ap-role           12 Hours, 56 Seconds
00:50:56:bd:50:43  employee          12 Hours
00:50:56:bd:50:45  printer           34 Minutes
08:97:34:ad:e4:00  role_01_Student   56 Seconds
10:2f:09:89:00:35  A-Role*           54 Minutes, 26 Seconds
```

Showing information for a specific client based on the MAC address:

```
switch# show port-access cached-clients clients mac 00:50:57:bd:32:09
Port Access Cached-Clients
RADIUS overridden user roles are suffixed with '*'
--------------------------------------------------------------------------------
MAC-Address        Role              Cached-Duration
--------------------------------------------------------------------------------
00:50:56:bd:32:08                    12 Hours, 34 Minutes, 56 Seconds
```

Showing information for a specific client based on the role:

```
switch# show port-access cached-clients role
ROLE  The role name.
switch# show port-access cached-clients role intern
```

```
No port-access cached-clients found
switch# show port-access cached-clients role ap-role
Port Access Cached-Clients
RADIUS overridden user roles are suffixed with '*'
------------------------------------------------------------------------
MAC-Address        Role              Cached-Duration
------------------------------------------------------------------------
00:50:56:bd:04:c8  ap-role           3 Days, 22 Hours, 33 Minutes, 44 Seconds
00:50:56:cd:32:09  ap-role           12 Hours, 56 Seconds
```

Command History

Release	Modification
10.12	Command output modified to be suffixed with * for RADIUS overridden user roles. The role name will not displayed for clients that use a RADIUS role without a base role.
10.10	Command introduced on the 4100i, 6200, 6300, 6400, 8100, 8360.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access cached-critical-role info

`show port-access cached-critical-role info`

Description

Shows summarized information of port-access cached-critical role configuration.

Examples

Showing summarized information of the cached-critical role configuration with the status of cached-critical role `Disabled`:

```
switch# show port-access cached-critical-role info

Port Access Cached-Critical-Role
================================

  Cached-Critical-Role Status         : Disabled
  Cache-Timeout                       : 96 Hours
  Cache Replace Mode                  : None
  Cached-Critical-Role Disabled Ports :
  Persistent Storage Status           : Disabled
  Persistent Storage Write Interval   : 900 Seconds
  Last Write To Persistent Storage    : N/A
```

Showing summarized information of the cached-critical role configuration with the status of cached-critical role `Enabled`:

```
switch# show port-access cached-critical-role info

Port Access Cached-Critical-Role
================================

  Cached-Critical-Role Status         : Enabled
  Cache-Timeout                       : 100 Hours
  Cache Replace Mode                  : FIFO
  Cached-Critical-Role Disabled Ports : 1/1/1-1/1/5,1/1/10
  Persistent Storage Status           : Enabled
  Persistent Storage Write Interval   : 7200 Seconds
  Last Write To Persistent Storage    : Mon Aug 08 04:40:49 UTC 2022
```

Command History

Release	Modification
10.11.1000	The output is updated to display persistent storage related information.
10.10	Command introduced on the 4100i, 6200, 6300, 6400, 8100, 8360.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access VLAN groups

VLAN grouping enables user distribution across VLANs in a VLAN group to reduce the size of broadcast domains. This supports dynamic load balancing of users across VLANs by onboarding new users on the least populated VLAN in the group.

A VLAN group is a configuration construct, which contains multiple VLANs allocated to that group. VLAN group leverages the existing standard attribute Tunnel-Group-Private-ID(81). This standard attribute is overloaded to be interpreted as the VLAN group name, if the VLAN name does not exist on the switch with that name. VLAN group is supported only through RADIUS attributes; there is no support available through local roles or downloadable user roles.

VLAN grouping limitations

The following limitations apply to VLAN grouping:

- VLANs must be created to be allocated. Any VLAN that does not exist on the switch is ignored from allocation.
- When a VLAN is allocated from a VLAN group, and is subsequently removed from the VLAN group, no change is performed on the client, until the client expires or a role change is performed. Re-authentication has no effect.
- Deleting a VLAN group after a VLAN from that group is allocated to a client, does not affect the client.

- It is not recommended to use reserved VLANs in the pool. Any VLAN that is reserved for another purpose, is allocated, but fails authorization.
- When the VLAN group and VLAN name are configured with the same name on the switch; upon authentication, the VLAN name takes precedence and clients are applied to the VLAN name.

VLAN group load balancing

VLAN grouping provides distribution of clients across the VLANs in the switch to reduce the broadcast domain of secure clients. This feature enables allocating a VLAN from a preconfigured list of pool, thus reducing the need for the administrator to load balance the network.

Load balancing between VLANs adheres to the following rules:

- A global port access per VLAN client count is maintained.
- For a newly authenticated client with the attribute of a VLAN group, the switch iterates through all VLANs in the VLAN group and assigns the VLAN with the lowest number of clients.
- In cases where more than one VLAN has the same least client count, the switch assigns the VLAN with the lowest VLAN ID to the authenticated client.
- VLAN group load-balancing can be viewed with the *show port-access clients detail* command output, which shows the VLAN association and VLAN group name for each authenticated client.
- The following example configuration shows a VLAN group and 4 VLANs associated with it:

```
port-access vlan-group vgp1
associate-vlan 10,20,30,40
```

For eight newly authenticated clients, the VLAN assignment order is as follows:

Client	VLAN Assignment
Client 1	VLAN 10
Client 2	VLAN 20
Client 3	VLAN 30
Client 4	VLAN 40
Client 5	VLAN 10
Client 6	VLAN 20
Client 7	VLAN 30
Client 8	VLAN 40

- The VLAN client count is across multiple VLAN groups and multiple interfaces.
  - **Example 1**: Client 1 authenticates with group vgp1 containing VLANs 10, 20 where both VLANs have a client count of zero. Client 1 is assigned VLAN 10 since both VLANs have the same client count of zero, and VLAN 10 has the lower VLAN ID. Next, client 2 authenticates with group vgp2 and is assigned VLAN 20 since VLAN 20 has the lower client count, even though it lies within a different VLAN group.

- **Example 2**: Client 1 authenticates on interface 1/1/1 with group vgp1 containing VLANs 10, 20. Next, client 2 authenticates on interface 1/1/2 on the same or different VLAN group. The order of VLAN assignment for client 1 and client 2 is VLAN 10 and VLAN 20, respectively.

Port access VLAN group commands

associate-vlan

```
associate-vlan <VLAN-ID>
no associate-vlan <VLAN-ID>
```

Description

Associates VLANs with an existing VLAN group.

The `no` form of this command removes the association of the VLAN with the specified VLAN group.

Parameter	Description
<VLAN-ID>	Specifies the VLAN or a specific set of VLANs. Range 1 to 4094.

Examples

Associating VLANs with **group1**:

```
switch(config)# port-access vlan-group group1
switch(config-pa-vlan-group)# associate-vlan 5,10-15,20,21
```

Associating additional VLANs with **group1**:

```
switch(config)# port-access vlan-group group1
switch(config-pa-vlan-group)# associate-vlan 30-40
```

Dissociating VLANs 10-15 from VLAN **group1**:

```
switch(config-pa-vlan-group)# no associate-vlan 10-15
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-pa-vlan-group`	Administrators or local user group members with execution rights for this command.

port-access vlan-group

```
port-access vlan-group <NAME>
```

`no port-access vlan-group <NAME>`

Description

Creates the specified VLAN group (if it does not already exist) and then enters its context `config-pa-vlan-group`. For an existing VLAN group, this command enters the context of the specified VLAN group.

The `no` form of this command removes the specified VLAN group.

In order for the group to be applied to a client, VLANs associated to the group should be configured on the switch. If not, the role displays an error.

Parameter	Description
<NAME>	Specifies the name of the VLAN group. Range 2 to 32 characters.

Examples

Creating VLAN **group1** and associating VLANs with it:

```
switch(config)# port-access vlan-group group1
switch(config-pa-vlan-group)# associate-vlan 5,10-15,20,21
```

Dissociating VLANs 10-15 from VLAN **group1**:

```
switch(config-pa-vlan-group)# no associate-vlan 10-15
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

show running-config port-access vlan-group

`show running-config port-access vlan-group`

Description

Shows information for all configured VLAN groups.

Example

Showing the port access VLAN group configuration:

```
switch# show running-config port-access vlan-group
...
```

```
port-access vlan-group group1
    associate-vlan 5,20,21,30-40
port-access vlan-group group2
    associate-vlan 50-60,75-85
...
```

Command History

Release	Modification
10.09	Command introduced on the 8360

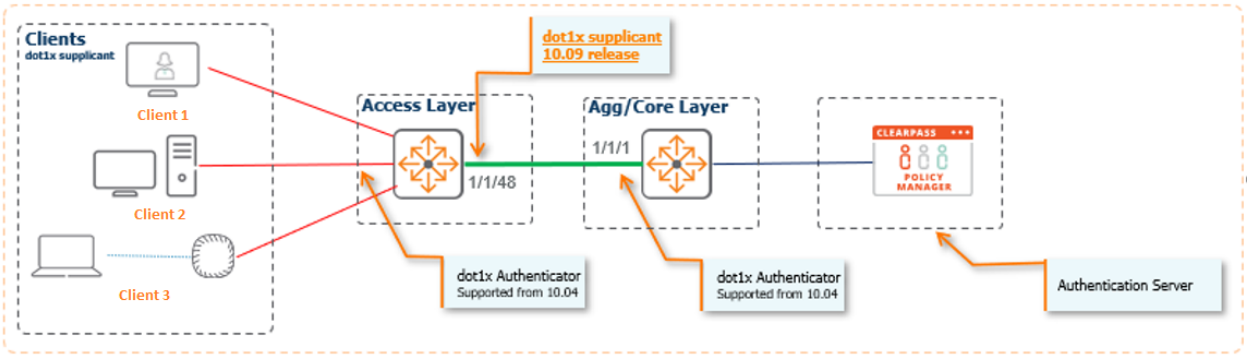
Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Port access 802.1X authentication involves three entities:

- A **supplicant**, such as a PC client, AP, or access switch
- An **authenticator**, which is the Aruba AOS-CX switch
- An **authentication server**, such as Aruba ClearPass

Figure 10 *802.1X supplicant overview*



Feature details

The following tables list the 802.1X supplicant details.

Table 1: *Feature details and limitations*

Dot1x Supplicant Features	Supported by AOS-CX
IEEE Standard	802.1X - 2010
EAP Methods	EAP-TLS EAP-MD5
Certificate Types	User Defined EST enrollment
Interface Type	Only L2 Physical Interface
MIB	N/A
Mutual Exclusion Feature	Same interface supports dot1x supplicant and dot1x authenticator

Table 2: *802.1X supplicant support on AOS-CX vs. AOS-Switch*

AOS-SW dot1x supplicant	AOS-CX dot1x supplicant
Implements the dot1x 2004 standard.	Implements the dot1x 2010 standard.
Only support EAP-MD5 for authentication.	Supports EAP-TLS and EAP-MD5 for authentication.
Designed to use only base mac address	Designed to use only interface MAC address
eapol-protocol-version 2	eapol-protocol-version 2 & 3(default)

Sub-features

The 802.1X supplicant includes the following sub-features and related packet captures:

- `eap-method` (Default: eap-tls)
- `canned-eap-success` (Default: disabled)
- `eapol-force-multicast` (Default: disabled)
- `fail-mode` (Default: fail-open)
- `start-mode` (Default: start-open)
- `eapol-protocol-version` (Default: 3)

Figure 11 *Packet capture: 802.1X supplicant—eapol-force-multicast*

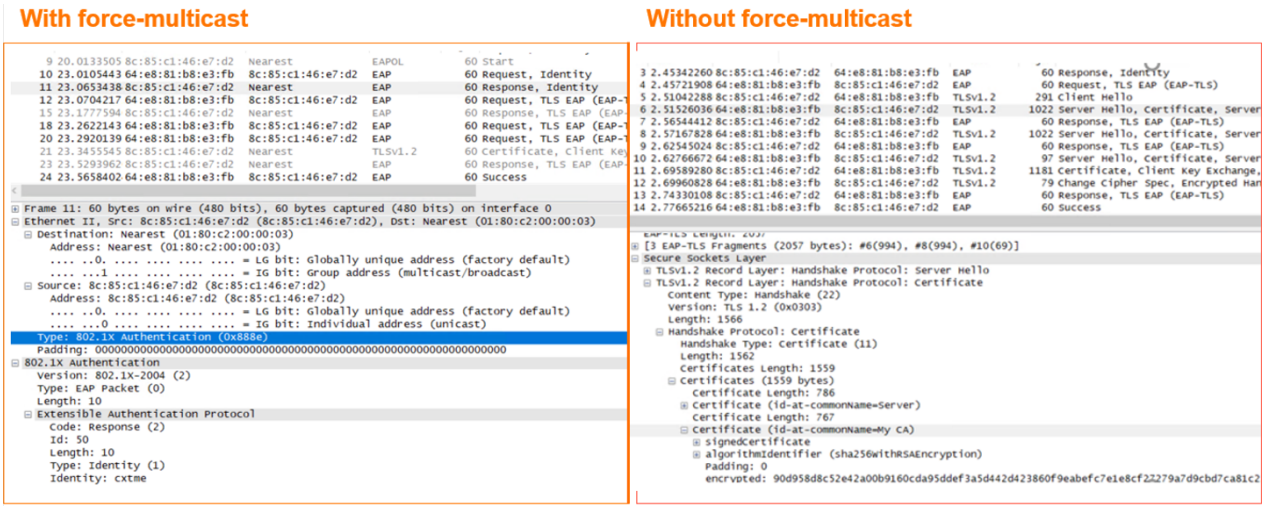
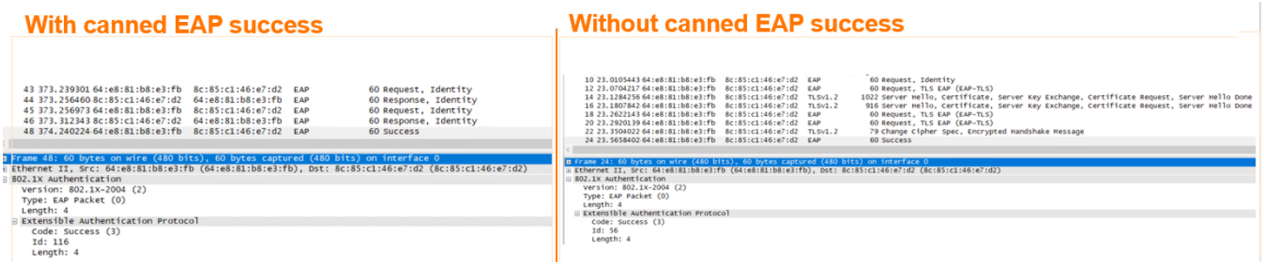


Figure 12 *Packet capture: 802.1X supplicant—canned EAP success*



Note: Canned EAP success configuration required on both dot1x supplicant and authenticator

Figure 13 *Packet capture: 802.1X supplicant EAP-Method—EAP-TLS EST enrollment certificate*

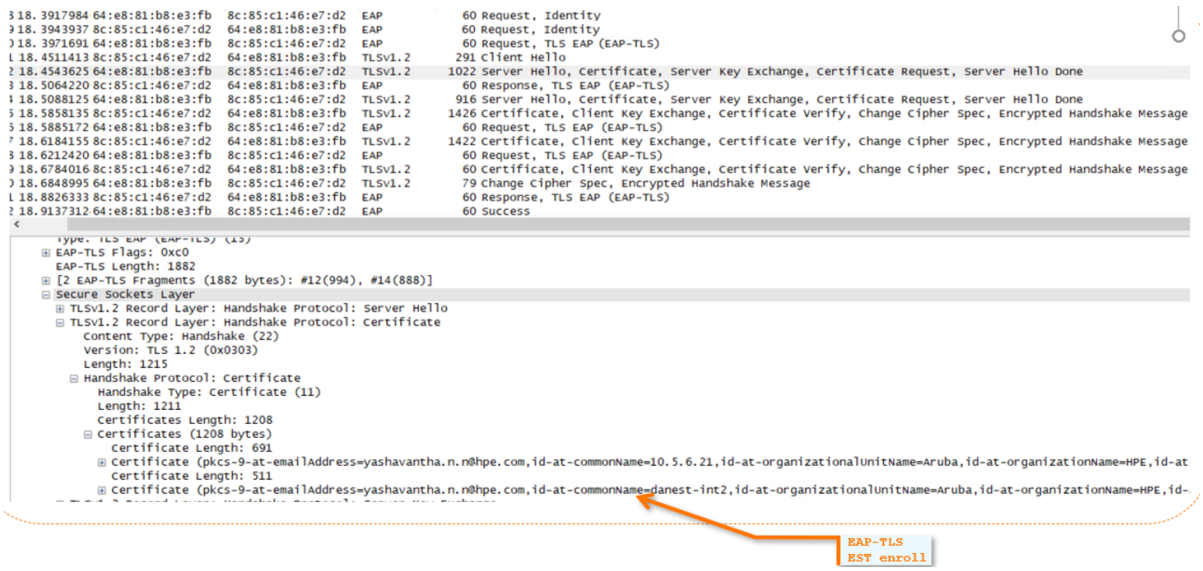
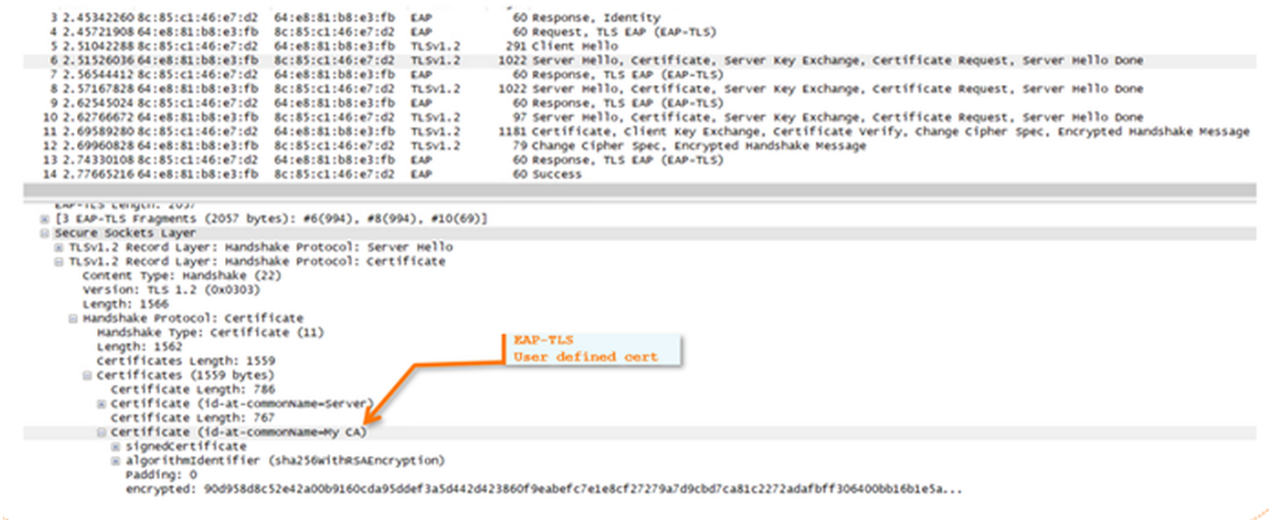


Figure 14 *Packet capture: 802.1X supplicant EAP-Method—EAP-TLS - User defined certificate*



Validate the same certificate with “show crypto pki certificate client | in Issuer”

Supported platforms

The 802.1X supploicant feature is supported on the 4100i, 6000, 6100 6200, 6300, 6400, and 8360 Switch Series.

802.1X supplicant policy configuration and considerations

802.1X supplicant policy commands include:

- `canned EAP success`
- `discovery timeout`

- `EAPoL force multicast`
- `EAP identity`
- `EAP method`
- `EAPoL protocol version`
- `EAPoL timeout`
- `fail mode`
- `held period`
- `max retries`
- `start-mode`

The following general considerations apply to the 802.1X supplicant configuration:

- The 802.1X supplicant only uses the switch interface MAC address for EAP handshake.
- Modifying some policy parameters results in a restart of the 802.1X supplicant state in the interfaces (this does not apply to `EAPoL force multicast`, `max-retries`, or `held period`).
- The IDEVID certificate is not supported by the 802.1X supplicant.

Recommended configuration

The recommended configuration for the 802.1X supplicant is shown below:

```
aaa authentication port-access dot1x supplicant
   enable
   policy cx_dot1x_supplicant_uplink_1
       eap-identity identity cxtme
       eap-identity password plaintext setpasswd ###(EAP-MD5)
       discovery-timeout 60
       start-mode start-closed
       fail-mode fail-closed
       interface 1/1/48
aaa authentication port-access dot1x supplicant
   associate policy cx_dot1x_supplicant_uplink_1
   enable
```

Port access 802.1X supplicant commands

aaa authentication port-access dot1x supplicant (global)

`aaa authentication port-access dot1x supplicant`

Description

Enters the 802.1X supplicant global configuration context.

Example

Enter the 802.1X supplicant configuration context:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)#
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-dot1x-supp`	Administrators or local user group members with execution rights for this command.

aaa authentication port-access dot1x supplicant (port)

```
aaa authentication port-access dot1x supplicant
```

Description

Enters the 802.1X supplicant port context.

The 802.1X supplicant is only supported on L2 physical interfaces that are not members of a LAG.

Example

Enter the 802.1X supplicant port context:

```
switch(config)# interface 1/1/1
switch(config-if)# no routing
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)#
```

When entering the context on a L3 port, an error message displays:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
The operation is allowed only on a L2 physical interface.
```

When entering the context on a LAG, an error message displays:

```
switch(config)# interface lag 1
switch(config-if)# aaa authentication port-access dot1x supplicant
The operation is allowed only on a L2 physical interface.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-if`
	`config-dot1x-supp`
		Administrators or local user group members with execution rights for this command.

associate policy

```
associate policy <POLICY-NAME>
no associate policy <POLICY-NAME>
```

Description

Associates a supplicant policy with the port.

The no form of the command dissociates the policy from the port and reverts to the default policy.

If an 802.1X supplicant is enabled on the port without associating a policy or dissociating a policy from the port, it results in the port using the default policy.

Parameter	Description
<POLICY-NAME>	Specifies the name of the policy. (Maximum 32 characters).

Examples

Associating a supplicant policy with the port:

```
switch(config)# interface 1/1/1
switch(config)# no routing
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# associate policy CX_Policy
```

Removing the supplicant policy on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# no associate policy
OR

switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# no associate policy CX_Policy
```

When the policy being associated does not exist:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# associate policy New_Supp_Policy
The policy does not exist.
```

When the policy being dissociated is not the one configured on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# associate policy New_Supp_Policy
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

canned-eap-success

```
canned-eap-success
no canned-eap-success
```

Description

Configures the switch to accept an EAP success from the authenticator without going through the complete authentication cycle. Default: disabled.

The `no` form of the command resets it to the default.

Examples

Configuring the switch to accept a canned EAP success:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# canned-eap-success
```

Resetting the allow canned EAP success configuration to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)#policy CX_Policy
switch(config-dot1x-supp-policy)# no canned-eap-success
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

clear dot1x supplicant statistics

`clear dot1x supplicant statistics [interface <IFRANGE>]`

Description

Clears the 802.1X supplicant statistics associated with the interface. If no interface is specified, the statistics are cleared for all 802.1X supplicant-enabled interfaces.

Parameter	Description
<IFRANGE>	Specifies the range of VLAN interfaces for which the supplicant statistics are cleared.

Examples

Clearing authenticator statistics on a specific interface:

```
switch# clear dot1x supplicant statistics 1/1/1
```

Clearing authenticator statistics on all interfaces:

```
switch# clear dot1x supplicant statistics
```

Showing the message when the feature is not enabled on any interface of the system:

```
switch# clear dot1x supplicant statistics
802.1X supplicant is not configured.
```

Showing the message when the feature is not enabled on the interface:

```
switch# clear dot1x supplicant statistics 1/1/1
802.1X supplicant is not configured.
```

Showing the message when there are no 802.1X supplicants on the system:

```
switch# clear dot1x supplicant statistics
No 802.1X supplicants found.
```

Showing the message when there are no 802.1X supplicants on the interface:

```
switch# clear dot1x supplicant statistics 1/1/1
No 802.1X supplicants found.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

discovery-timeout

```
discovery-timeout <DISCOVERY-TIMEOUT>
no discovery-timeout <DISCOVERY-TIMEOUT>
```

Description

Configures the time period (in seconds) to wait for a potential 802.1X authenticator on the other end before considering the link to be non-802.1X-capable and opening the interface on the data-plane. On a timeout, the switch will not use the authentication result to determine the forwarding behavior of the interface until a link flap. If not set, the switch will wait for the 802.1X authentication cycle to complete before determining the forwarding state of the interface.

The `no` form of the command removes the configuration.

Parameter	Description
<DISCOVERY-TIMEOUT>	Specifies discovery timeout in seconds. Range: 0-300 seconds.

Examples

Configuring a discovery timeout of 15 seconds in the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# discovery-timeout 15
```

Removing the discovery timeout from the policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no discovery-timeout

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no discovery-timeout 15
```

When the value entered does not match the currently configured non-default value for EAPoL timeout, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# discovery-timeout 15
switch(config-dot1x-supp-policy)# no discovery-timeout 5
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

eap-identity

```
eap-identity identity <IDENTITY>
no eap-identity identity <IDENTITY>
eap-identity password {plaintext [<PLAINTEXT-PASSWORD>] | ciphertext <CIPHERTEXT-PASSWORD>}
no eap-identity password {plaintext [<PLAINTEXT-PASSWORD>] | ciphertext <CIPHERTEXT-PASSWORD>}
```

Description

Configures the EAP identity to use for authentication including an identity name and an optional password.

The `no` form of the command removes the configuration.

Parameter	Description
<IDENTITY>	Specifies the EAP identity name. Maximum: 64 characters.
<PLAINTEXT-PASSWORD>	Specifies the password associated with the EAP identity in plaintext. Maximum: 32 characters. Specifies the password without prompting. The password is visible as cleartext when entered but is encrypted thereafter. Command history does show the password as cleartext.
<CIPHERTEXT-PASSWORD>	Specifies a ciphertext password. No password prompts are provided and the ciphertext password is validated before the configuration is applied for the user. The variable *<CIPHERTEXT-PASSWORD>* is Base64 and is typically copied from another switch using the `show running-config` command output and then pasted into this command.

Parameter	Description
	NOTE: The administrator cannot construct ciphertext passwords themselves. The ciphertext is only created by an AOS-CX switch. The ciphertext is created by setting a password for a user with the `user` command. The ciphertext is available for copying from the `show running-config` output and pasting into the configuration on any other AOS-CX switch. The target switch must have the same export password (default or otherwise) as the source switch.

Examples

Configuring the EAP identity and password:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-identity identity John Doe
switch(config-dot1x-supp-policy)# eap-identity password plaintext johndoe

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-identity identity John Doe
switch(config-dot1x-supp-policy)# eap-identity password plaintext
Enter password: ******
Confirm password: ******

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-identity identity John Doe
switch(config-dot1x-supp-policy)# eap-identity password ciphertext
AQBapUwNK5Uf+r1vmhBIncQPw1YPVH0V1nYr7Yjm/bPn3bBVCgAAAHFKt8mcSv/A/g8=
```

Removing the EAP identity configuration:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no eap-identity identity

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eap-identity identity John Doe
```

Removing the EAP identity password configuration:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eap-identity password

OR
```

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eap-identity ciphertext
AQBapUwNK5Uf+r1vmhBIncQPw1YPVH0V1nYr7Yjm/bPn3bBVCgAAAHFKt8mcSv/A/g8=
```

When the EAP identity string is longer than 64 characters, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-identity identity This is a really long
string with more than sixty four characters in it
The EAP identity string is more than 64 characters long.
```

When the EAP identity password string is longer than 32 characters, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-identity password plaintext This is a
password with more than 32 characters
The password is more than 32 characters long.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

eapol-force-multicast

```
eapol-force-multicast
no eapol-force-multicast
```

Description

Configures the switch to send only multicast EAPoL packets irrespective of receiving unicast EAPoL packets from the authenticator. Default: disabled.

The `no` form of the command resets it to the default.

Examples

Configuring the switch to always send EAPoL multicast packets:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-force-multicast
```

Resetting the EAPoL force multicast setting to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eapol-force-multicast
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

eapol-method

```
eapol-method {eap-tls | eap-md5}
no eapol-method {eap-tls | eap-md5}
```

Description

Configures the Extensible Authentication Protocol (EAP) method to use for authentication.

The `no` form of the command resets it to the default. The default is EAP-TLS.

Parameter	Description
`eapol-method`	Specifies the EAPoL method to use for authentication. Default: eap-tls.
`eap-tls`	Specifies the EAP method as EAP with TLS (EAP with transport layer security)
`eap-md5`	Specifies the EAP method as EAP with MD5 digest.

Examples

Configuring the EAP method as EAP-MD5:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-method eap-md5
```

Resetting the EAP method to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no eap-method

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eap-method eap-md5
```

When the value entered does not match the currently configured non-default value for EAP method, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eap-method eap-md5
switch(config-dot1x-supp-policy)# no eap-method eap-tls
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

eapol-protocol-version

```
eapol-protocol-version
no eapol-protocol-version
```

Description

Configures the EAPoL protocol version to use in EAPoL frames transmitted by the supplicant.

The `no` form of the command resets it to the default.

When the EAPoL protocol version is modified while the policy is in use on one or more ports, all the supplicant sessions on such ports are restarted.

Parameter	Description
`protocol-version`	Required. Specifies the protocol-version. Options: 2 or 3. Default: 3.

Examples

Configuring the EAPoL protocol version as 2 in the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-protocol-version 2
```

Reset the EAPoL protocol version to the default value:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no eapol-protocol-version

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eapol-protocol-version 2
```

When the value entered does not match the currently configured non-default value for EAPoL protocol version, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-protocol-version 2
switch(config-dot1x-supp-policy)# no eapol-protocol-version 3
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

eapol-source-mac

```
eapol-source-mac (interface-mac | system-mac)
no eapol-source-mac (interface-mac | system-mac)
```

Description

Configures the source MAC address to use in the EAPoL frames transmitted by the 802.1X supplicant. The default is interface MAC address.

The no form of the command resets to its default EAPoL source MAC value.

Parameter	Description
`interface-mac`	Specifies the interface MAC address.
`system-mac`	Specifies the system MAC address.

Examples

Configuring the EAPoL source MAC as system MAC address:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-source-mac system-mac
```

Resetting the EAPoL source MAC to its default address:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eapol-source-mac system-mac
```

Removing the source MAC address that is not configured for EAPoL source MAC:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-source-mac system-mac
switch(config-dot1x-supp-policy)# no eapol-source-mac interface-mac
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.10.1000	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

eapol-timeout

`eapol-timeout` *<EAPOL-TIMEOUT>*
`no eapol-timeout` *<EAPOL-TIMEOUT>*

Description

Configures the time period (in seconds) to wait for a response from an authenticator before reattempting authentication.

The `no` form of the command resets it to the default.

Parameter	Description
<EAPOL-TIMEOUT>	Specifies EAPoL timeout in seconds. Default: 30 seconds.

Examples

Configuring an EAPoL timeout of 10 seconds in the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-timeout 10
```

Resetting the EAPoL timeout to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no eapol-timeout

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no eapol-timeout 10
```

When the value entered does not match the currently configured non-default value for EAPoL timeout, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# eapol-timeout 10
switch(config-dot1x-supp-policy)# no eapol-timeout 5
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

enable

```
enable
no enable
```

Description

Enables the 802.1X supplicant on the port. By default, the 802.1X supplicant is disabled on the port. The no form of the command disables the 802.1X supplicant on the port.

Example

Enable the 802.1X supplicant on the port:

```
switch(config)# interface 1/1/1
switch(config)# no routing
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# enable
```

Disable the 802.1X supplicant on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# no aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# no enable
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp	Administrators or local user group members with execution rights for this command.

enable

```
enable
no enable
```

Description

Enables the 802.1X supplicant on the system. By default, 802.1X supplicant is disabled on the system. The no form of the command disables the 802.1X supplicant on the system.

Example

Enable the 802.1X supplicant on the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# enable
```

Disable the 802.1X supplicant on the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# no enable
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-dot1x-supp`	Administrators or local user group members with execution rights for this command.

fail-mode

```
fail-mode [fail-closed | fail-open]
no fail-mode [fail-closed | fail-open]
```

Description

Configures the forwarding behavior of the when the 802.1X authentication fails. Default: fail-open.

The `no` form of the command resets it to the default.

Examples

Configuring the fail mode as fail-closed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# fail-mode fail-closed
```

Resetting the fail mode to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)#policy CX_Policy
switch(config-dot1x-supp-policy)# no fail-mode

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)#policy CX_Policy
switch(config-dot1x-supp-policy)# no fail-mode fail-closed
```

When the fail-mode value entered does not match the currently configured non-default value:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# fail-mode fail-closed
switch(config-dot1x-supp-policy)# no fail-mode fail-open
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

held-period

`held-period` *<HELD-PERIOD>*
`no held-period` *<HELD-PERIOD>*

Description

Configure the time period (in seconds) to wait after a failed authentication attempt before another attempt is permitted.

The `no` form of the command resets it to default.

Parameter	Description
<HELD-PERIOD>	Specifies the held period in seconds. Default: 60 seconds.

Usage

When the value entered does not match the currently configured non-default value for held-period, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# held-period 30
switch(config-dot1x-supp-policy)# held-period 50
The input value does not match the currently configured value.
```

Examples

Configuring a held period of 30 seconds in the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# held-period 30
```

Resetting the held period to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no held-period

OR
```

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no held-period 30
```

When the value entered does not match the currently configured non-default value for held-period, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# held-period 30
switch(config-dot1x-supp-policy)# held-period 50
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

macsec

```
macsec
no macsec
```

Description

Enables the switch to provision a MACsec channel dynamically when the 802.1X supplicant is authenticated using an EAP method that supports mutual authentication. By default, MACsec is disabled on the port.

The no form of the command disables MACsec for an 802.1X supplicant on the port.

A MACsec policy must be associated with the supplicant policy attached to the port with MACsec enabled. Otherwise, a MACsec channel will not be established and the port will be blocked on the data plane.

Example

Enabling MACsec using EAP for an 802.1X supplicant on the port:

```
switch(config)# interface 1/1/1
switch(config)# no routing
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# macsec
```

Disabling MACsec using EAP for an 802.1X supplicant on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# no macsec
```

Attempting to enable MACsec on a port that is not MACsec capable:

```
switch(config)# interface 1/1/10
switch(config)# no routing
switch(config-if)# aaa authentication port-access dot1x supplicant
switch(config-if-dot1x-supp)# macsec
MACsec is not supported on the interface.
```

Command History

Release	Modification
10.10	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config-if-dot1x-supp	Administrators or local user group members with execution rights for this command.

macsec-policy

```
macsec-policy <POLICY-NAME>
no macsec-policy <POLICY-NAME>
```

Description

Associates a MACsec policy with a supplicant policy for the supplicant to use when the supplicant is running MACsec on a port.

The no form of the command disassociates the MACsec policy from the supplicant policy.

Parameter	Description
<POLICY-NAME>	Specifies the name of the MACsec policy. (Maximum 128 characters).

Examples

Associating a MACsec policy with the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy Supp_Policy
switch(config-dot1x-supp-policy)# macsec-policy MSec_Policy1
```

Disassociating a MACsec policy from the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy Supp_Policy
switch(config-dot1x-supp-policy)# no macsec-policy
```

Command History

Release	Modification
10.10	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

max-retries

```
max-retries <MAX-RETRIES>
no max-retries <MAX-RETRIES>
```

Description

Configures the maximum number of authentication attempts before authentication fails.

The no form of the command resets it to the default.

Parameter	Description
<MAX-RETRIES>	Specifies the maximum retry attempts allowed. Range: 1-5. Default: 2.

Examples

Configuring the maximum retries to 5 in the supplicant policy:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# max-retries 5
```

Resetting the max retries to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp)# no max-retries

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no max-retries 5
```

When the value entered does not match the currently configured non-default value for max-retries, the following message is displayed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# max-retries 5
switch(config-dot1x-supp-policy)# max-retries 3
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	config config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

mka cak-length

```
mka cak-length {16|32}
no mka cak-length {16|32}
```

Description

Configures the length of the Connectivity Association Key (CAK) to generate for EAP based MACsec.

The `no` form of this command resets it to the default length of 32 bytes.

Parameter	Description
{16|32}	Specifies the CAK length. Default: 32.

Examples

Configuring the CAK length to 16 bytes:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# mka cak-length 16
```

Configuring the CAK length to default:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no mka cak-length
OR
switch(config)# aaa authentication port-access dot1x supplicant
```

```
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no mka cak-length 16
```

Command History

Release	Modification
10.10.1000	Command introducedand on the 8360 switch series.

Command Information

Platforms	Command context	Authority
8100 8360	config-dot1x-supp config-dot1x-supp-policy	Administrators or local user group members with execution rights for this command.

policy (supplicant)

```
policy <POLICY-NAME>
no policy <POLICY-NAME>
```

Description

Creates an 802.1X supplicant policy on the system.

The no form of the command deletes the 802.1X supplicant policy on the system.

Parameter	Description
<POLICY-NAME>	Specifies the name of the policy. (Maximum 32 characters).

Usage

Configure an 802.1X supplicant policy on the system:

Examples

Configure an 802.1X supplicant policy on the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)#
```

Delete the 802.1X supplicant policy from the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# no policy CX_Policy
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

port-access dot1x supplicant restart

`port-access dot1x supplicant restart [interface <IFRANGE>]`

Description

Restarts the 802.1X supplicant on the specified interface. The current authentication state is discarded and the supplicant restarts the authentication process.

Parameter	Description
<IFRANGE>	Optional. Specifies the range of physical interfaces for which the supplicant is restarted.

Examples

Restarting the 802.1X supplicant on a specific interface:

```
switch# port-access dot1x supplicant restart interface 1/1/1
switch#
```

Restarting the 802.1X supplicant on all interfaces:

```
switch# port-access dot1x supplicant restart
switch#
```

Showing the message when the feature is not enabled on any interface of the system:

```
switch# port-access dot1x supplicant restart
802.1X supplicant is not configured.
```

Showing the message when the feature is not enabled on the given interface:

```
switch# port-access dot1x supplicant restart 1/1/1
802.1X supplicant is not configured.
```

Showing the message when there are no 802.1X supplicants on the system:

```
switch# port-access dot1x supplicant restart
No 802.1X supplicants found.
```

Showing the message when there are no 802.1X supplicants on the interface:

```
switch# port-access dot1x supplicant restart 1/1/1
No 802.1X supplicants found.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access dot1x supplicant policy

`show aaa authentication port-access dot1x supplicant policy <POLICY-NAME>`

Description

Shows information about the 802.1X supplicant policies on the system.

Parameter	Description
<POLICY-NAME>	Specifies the name of the policy. (Maximum 32 characters).

Examples

Showing all 802.1X supplicant policies on the system:

```
switch# show aaa authentication port-access dot1x supplicant policy

802.1X Supplicant Policy Details

  Policy Name: default
  ------------------------------------------------------------------------------
  Type                      : Default
  EAP Method                : EAP-TLS
  Held Period               : 60 seconds
  Maximum Retries           : 2
  EAPoL Timeout             : 30 seconds
  EAP Identity              : --
  EAP Identity Password     : --
  EAPoL Force Multicast     : False
  EAPoL Source MAC          : Interface-MAC
  EAPoL Protocol Version    : 3
  Canned EAP Success        : False
  Discovery Timeout         : --
  Start Mode                : Start-Open
  Fail Mode                 : Fail-Open
  MKA CAK Length            : 32
```

```
  MACsec Policy            : --

  Policy Name: CX_Policy
  ------------------------------------------------------------------------------
  Type                     : Static
  EAP Method               : EAP-MD5
  Held Period              : 30 seconds
  Maximum Retries          : 5
  EAPoL Timeout            : 10 seconds
  EAP Identity             : John Doe
  EAP Identity Password    :
QBapUwNK5Uf+r1vmhBIncQPw1YPVH0V1nYr7Yjm/bPn3bBVCgAAAHFKt8mcSv/A/g8=
  EAPoL Force Multicast    : True
  EAPoL Source MAC         : Interface-MAC
  EAPoL Protocol Version   : 2
  Canned EAP Success       : True
  Discovery Timeout        : 15 seconds
  Start Mode               : Start-Closed
  Fail Mode                : Fail-Closed
  MKA CAK Length           : 16
  MACsec Policy            : Aggregator-Connect
```

Showing a specific 802.1X supplicant policy:

```
switch# show aaa authentication port-access dot1x supplicant policy CX_Policy

802.1X Supplicant Policy Details

  Policy Name: CX_Policy
  ------------------------------------------------------------------------------
  Type                     : Static
  EAP Method               : EAP-MD5
  Held Period              : 30 seconds
  Maximum Retries          : 5
  EAPoL Timeout            : 10 seconds
  EAP Identity             : John Doe
  EAP Identity Password    :
AQBapUwNK5Uf+r1vmhBIncQPw1YPVH0V1nYr7Yjm/bPn3bBVCgAAAHFKt8mcSv/A/g8=
  EAPoL Force Multicast    : True
  EAPoL Source MAC         : Interface-MAC
  EAPoL Protocol Version   : 2
  Canned EAP Success       : True
  Discovery Timeout        : 15 seconds
  Start Mode               : Start-Closed
  Fail Mode                : Fail-Closed
  MKA CAK Length           : 16
  MACsec Policy            : Aggregator-Connect
```

If the policy with given name does not exist:

```
switch# show aaa authentication port-access dot1x supplicant policy New_CX_Policy
The policy does not exist.
```

Command History

Release	Modification
10.10.1000	Added EAPoL source MAC address and MKA CAK length.
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access dot1x supplicant statistics

```
show aaa authentication port-access dot1x supplicant statistics
[interface {<IFRANGE> | vlan <VLAN-ID>}]
```

Description

Shows the 802.1X supplicant statistics on each 802.1X supplicant-enabled interface.

Parameter	Description
<IFRANGE>	Specifies the range of VLAN interfaces for which the supplicant status is shown.
`vlan` *<VLAN-ID>*	Specifies a VLAN interface for which the supplicant status is shown.

Examples

Showing the 802.1X supplicant statistics on all enabled interfaces:

```
switch# show aaa authentication port-access dot1x supplicant statistics

802.1X Supplicant Statistics

Interface 1/1/1
====================

  EAPOL Frames Received                  : 4
  EAPOL Frames Transmitted               : 3
  EAPOL Start Frames Transmitted         : 1
  EAPOL Logoff Frames Transmitted        : 0
  EAPOL Invalid Frames Received          : 0
  EAPOL EAP Length Error Frames Received : 0
  Authentication                         : 0
  Authentication Timeout                 : 0
  EAP-Logoff While Authenticating        : 0
  Successful Authentication              : 0
  Failed Authentication                  : 0
  Re-Authentication                      : 0
  EAP-Logoff When Authenticated          : 0
```

```
Interface 1/1/2
===================

  EAPOL Frames Received                  : 0
  EAPOL Frames Transmitted               : 1
  EAPOL Start Frames Transmitted         : 1
  EAPOL Logoff Frames Transmitted        : 0
  EAPOL Invalid Frames Received          : 0
  EAPOL EAP Length Error Frames Received : 0
  Authentication                         : 0
  Authentication Timeout                 : 0
  EAP-Logoff While Authenticating        : 0
  Successful Authentication              : 0
  Failed Authentication                  : 0
  Re-Authentication                      : 0
  EAP-Logoff When Authenticated          : 0
```

Showing the 802.1X supplicant status on a specific interface:

```
switch# show aaa authentication port-access dot1x supplicant statistics interface
1/1/1

802.1X Supplicant Statistics

Interface 1/1/1
===================

  EAPOL Frames Received                  : 4
  EAPOL Frames Transmitted               : 3
  EAPO Start Frames Transmitted          : 1
  EAPOL Logoff Frames Transmitted        : 0
  EAPOL Invalid Frames Received          : 0
  EAPOL EAP Length Error Frames Received : 0
  Authentication                         : 0
  Authentication Timeout                 : 0
  EAP-Logoff While Authenticating        : 0
  Successful Authentication              : 0
  Failed Authentication                  : 0
  Re-Authentication                      : 0
  EAP-Logoff When Authenticated          : 0
```

Showing the message when the feature is not enabled on any interface of the system:

```
switch# show aaa authentication port-access dot1x supplicant statistics
802.1X supplicant is not configured.
```

Showing the message when the feature is not enabled on the interface:

```
switch# show aaa authentication port-access dot1x supplicant statistics interface
1/1/1
802.1X supplicant is not configured.
```

Showing the message when there are no 802.1X supplicants on the system:

```
switch# show aaa authentication port-access dot1x supplicant status
No 802.1X supplicants found.
```

Showing the message when there are no 802.1X supplicants on the interface:

```
switch# show aaa authentication port-access dot1x supplicant status interface
1/1/1
No 802.1X supplicants found.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show aaa authentication port-access dot1x supplicant status

```
show aaa authentication port-access dot1x supplicant status
[interface {<IFRANGE> | vlan <VLAN-ID>}]
```

Description

Shows the 802.1X supplicant status on each 802.1X supplicant-enabled interface.

Parameter	Description
<IFRANGE>	Specifies the range of VLAN interfaces for which the supplicant status is shown.
`vlan` *<VLAN-ID>*	Specifies a VLAN interface for which the supplicant status is shown.

Usage

- Physical Address Extension (PAE) state:
  - **Initialize**—Authentication is yet to start for the PAE.
  - **Authenticating**—Authentication is in-progress for the PAE.
  - **Authenticated**—Authentication is succesful for the PAE.
  - **Held**—Authentication has failed for the PAE and no further authentication attempts will be made till the held period expires.
  - **Unauthenticated**—Authentication has failed for the PAE and no further authentication attempts will be made.
  - **Logoff**—The PAE no longer wishes to be authenticated.

- Status and forwarding state (FS):
  - **Open**—The PAE did not find a 802.1X authenticator within the discovery period. FS: Forwarding
  - **Blocked**—The PAE is currently authenticating and the port is operating in start-mode start-closed or has failed authentication and the port is operating in fail-mode fail-closed. FS: Blocked
  - **Disabled**—The port to which the interface is attached is not ready or has an invalid configuration. FS: Blocked
  - **Secured**—The PAE is authenticated. FS: Forwarding
  - **Start-Open**—The PAE is currently authenticating and the port is operating in start-mode start-open.FS:Forwarding
  - **Fail-Open**—The PAE has failed authentication and the port is operating in fail-mode fail-open. FS: Forwarding

Examples

Showing the 802.1X supplicant status on all enabled interfaces:

```
switch# show aaa authentication port-access dot1x supplicant status

802.1X Supplicant Status

 Interface  Policy          PAE State        Authenticator      EAP Method  Status
 -------- --------------- ---------------- ------------------ ----------- --------
--
 1/1/1     CX_Policy_01    Authenticated    38:21:c7:59:ad:27  EAP-TLS     Secured
 1/1/2     CX_Policy_02    Authenticating   38:21:c7:59:ad:28  EAP-MD5     Blocked
 1/1/3     CX_Policy_01    Unauthenticated  38:21:c7:59:ad:29  EAP-TLS     Fail-
Open
 1/1/4     CX_Policy_03    Unauthenticated  --                 --          Open
```

Showing the 802.1X supplicant status on a specific interface:

```
switch# show aaa authentication port-access dot1x supplicant status interface
1/1/1

802.1X Supplicant Status

 Interface  Policy           PAE State        Authenticator      EAP Method  Status
 ---------- --------------- --------------- ------------------ ----------- -------
---
 1/1/1      CX_Policy_01    Authenticated    38:21:c7:59:ad:27  EAP-TLS
Secured
```

Showing the message when the feature is not enabled on any interface of the system:

```
switch# show aaa authentication port-access dot1x supplicant status
802.1X supplicant is not configured.
```

Showing the message when the feature is not enabled on the interface:

```
switch# show aaa authentication port-access dot1x supplicant status interface
1/1/1
802.1X supplicant is not configured.
```

When an interface range is entered, this message is displayed only if the 802.1X supplicant is disabled either globally or on each interface specified in the user input.

Showing the message when there are no 802.1X supplicants on the system:

```
switch# show aaa authentication port-access dot1x supplicant status
No 802.1X supplicants found.
```

Showing the message when there are no 802.1X supplicants on the interface:

```
switch# show aaa authentication port-access dot1x supplicant status interface
1/1/1
No 802.1X supplicants found.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

start-mode

```
start-mode[start-closed | start-open]
no start-mode [start-closed | start-open]
```

Description

Configures the forwarding behavior of the interface on the data-plane when the authentication is in-progress during the first run of the supplicant. Default: start-open.

The `no` form of the command resets it to the default.

Examples

Configuring the start mode as start-closed:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# start-mode start-closed
```

Resetting the start mode to the default value in the system:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# no start-mode

OR

switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)#policy CX_Policy
switch(config-dot1x-supp-policy)# no start-mode start-closed
```

When the value does not match the currently configured non-default value for start-mode:

```
switch(config)# aaa authentication port-access dot1x supplicant
switch(config-dot1x-supp)# policy CX_Policy
switch(config-dot1x-supp-policy)# start-mode start-closed
switch(config-dot1x-supp-policy)# no start-mode start-open
The input value does not match the currently configured value.
```

Command History

Release	Modification
10.09	Command introduced.

Command Information

Platforms	Command context	Authority

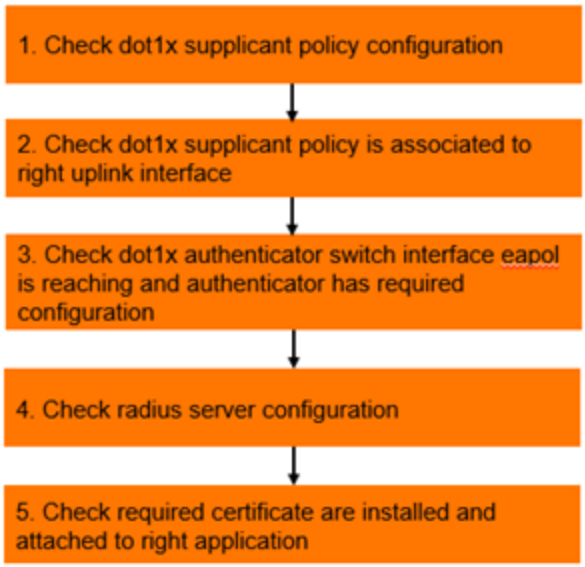
8100
8360
	`config`
	`config-dot1x-supp`
	`config-dot1x-supp-policy`
		Administrators or local user group members with execution rights for this command.

Troubleshooting

Prerequisites

- Create a diagram for your network topology that includes IP addresses and interface details.
- Check physical cabling.
- Check network status using the `show LLDP neighbor` command, and validate the RADIUS server and authenticator network works by issuing the `ping` and `traceroute` command between loopbacks and interfaces.
- Issue the `show tech` command and save the output prior to contacting customer support, as the output will help support identify issues.

Figure 15 *Recommended 802.1X troubleshooting flow*



Packet capture

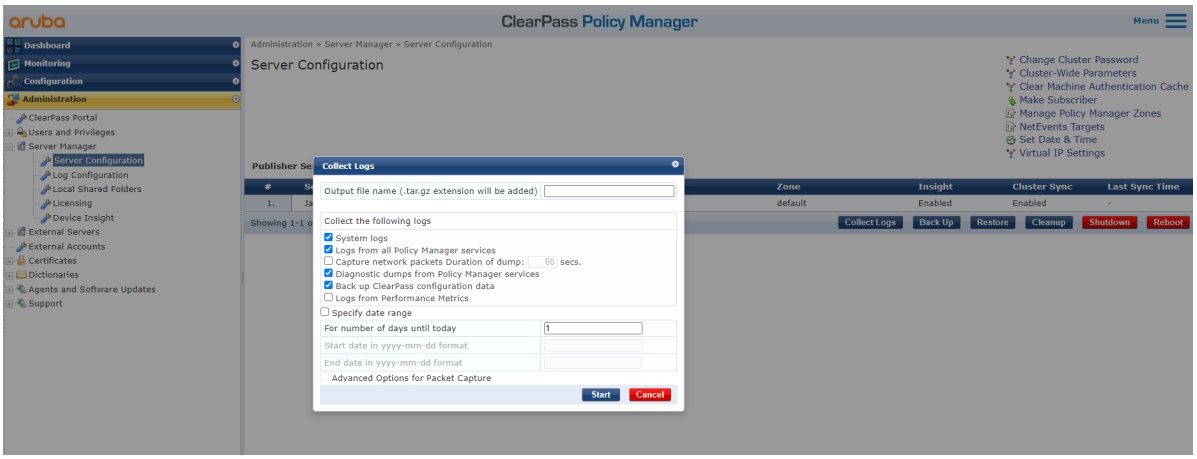
Use the `mirror session` commands for packet capture, as shown in the figure below:

```
mirror session 1
    enable
    destination interface 1/1/40
    source interface 1/1/51 both
```

```
Mirror session 1
Source interface 1/1/1 both
Destination CPU
enable
diag utilities tshark file
copy tshark-pcap tftp://10.80.2.187/supplicant.pcap vrf mgmt
```

If packet capture is required on Aruba ClearPass Policy Manager, navigate to **Administration > Server Manager > Server Configuration** in the Policy Manager WebUI, click **Collect Logs**, then select the following options:

- System logs
- Logs from all Policy Manager services
- Diagnostic dumps from Policy Manager services
- Back up ClearPass configuration data



FAQ

1. What are the EAP methods supported on the 802.1X supplicant?

The following EAP methods are supported on AOS-CX switches:

- eap-md5
- eap-tls

2. How many 802.1X supplicant policies can be configured?

There is exact limit on policies; the maximum number of policies required on an AOS-CX switch is equal to total number of physical L2 interfaces.

3. Can 802.1X authenticator and 802.1X supplicant co-exist?

Yes, the 802.1X supplicant on uplink and 802.1X authenticator on access link can co-exist on a switch.

4. Does the 802.1X supplicant support canned eap success?

Yes, the 802.1X supplicant supports `canned-eap-success`.

5. Does the 802.1X supplicant support both the 2004 and 2010 standards?

Yes, the 802.1X supplicant is based on the 2010 standard and it is backward compatible.

RADIUS access request and accounting request packets are sent to a RADIUS server during authentication and accounting of port access clients respectively. These access request packets contain various AVPs (Attribute Value Pairs) that carry the information about the RADIUS server and the client. For example, these AVPs include items such as username and RADIUS server identifier (host name). Similar kinds of details are included in accounting request packets which are sent to accounting servers. Including these attributes in access request packets helps administrators assign appropriate access policies to the clients.

Several commands are provided for configuring RADIUS attributes per RADIUS server group for use with port access client authentication by RADIUS.

Configurable RADIUS attribute commands

aaa radius-attribute group

```
aaa radius-attribute group <GROUP-NAME>
no aaa radius-attribute group <GROUP-NAME>
```

Description

Configures an existing RADIUS server group for which the configured RADIUS attributes will be included in request packets. Enters the `config-radius-attr` context.

The `no` form of this command unconfigures the RADIUS server group for the configured RADIUS attributes.

Nas-id and tunnel-private-group-id attributes only apply to port access requests. Nas-ip-addr attributes only apply to management user requests.

Parameter	Description
<GROUP-NAME>	Specifies an existing RADIUS server group name.

Examples

Configuring port access request RADIUS attributes for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# nas-id value ARUBA_NAS-01
switch(config-radius-attr)# nas-id request-type authentication
switch(config-radius-attr)# tunnel-private-group-id value static
switch(config-radius-attr)# tunnel-private-group-id request-type authentication
```

Configuring management user request RADIUS attributes for **rad_group2**:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# nas-ip-addr request-type authentication
switch(config-radius-attr)# nas-ip-addr service-type user-management
```

Unconfiguring RADIUS attributes for **rad_group1**:

```
switch(config)# no aaa radius-attribute group rad_group1
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

nas-id request-type

```
nas-id request-type {authentication | accounting | both}
no nas-id request-type {authentication | accounting | both}
```

Description

For the selected (by context) RADIUS server group, configures the Network Access Server (NAS) ID request type for which the attribute configured with command `nas-id value` will be included.

The no form of this command unconfigures the specified request type.

Nas-id attributes only apply to port access requests.

Parameter	Description
`authentication`	Selects the authentication request type.
`accounting`	Selects the accounting request type.
`both`	Selects both the authentication and accounting request types.

Examples

Configuring the authentication request type for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# nas-id request-type authentication
```

Configuring both the authentication and accounting request types for **rad_group2**:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# nas-id request-type both
```

Unconfiguring the authentication request type for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# no nas-id request-type authentication
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

nas-id value

```
nas-id value <NAS-ID>
no nas-id [value <NAS-ID>]
```

Description

For the selected (by context) RADIUS server group, configures the Network Access Server Identifier (NAS ID) (type 32, RFC 2865). The NAS ID is sent in the RADIUS access request and accounting packets to notify the source of the RADIUS access request.

The `no` form of this command unconfigures the specified NAS ID.

Nas-id attributes only apply to port access requests.

Parameter	Description
<NAS-ID>	Specifies the FQDN or other unique identifying name of the Network Access Server (NAS). Range 1 to 253 characters.

Examples

Configuring the Network Access Server (NAS) ID for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# nas-id value ARUBA_NAS-01
```

Unconfiguring the NAS ID for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# no nas-id value ARUBA_NAS-01
```

Unconfiguring both the NAS-ID value and the request type for **rad_group2**:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# no nas-id
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

nas-ip-addr request-type authentication

```
nas-ip-addr request-type authentication
no nas-ip-addr request-type authentication
```

Description

For the selected (by context) RADIUS server group, configures the `NAS-IP-Address` attribute for inclusion in management user request packets.

The no form of this command unconfigures the `NAS-IP-Address` attribute for inclusion in management user request packets.

Nas-ip-addr attributes only apply to management user requests.

Examples

Configuring the `NAS-IP-Address` attribute for inclusion in management user request packets for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# nas-ip-addr request-type authentication
```

Unconfiguring the `NAS-IP-Address` attribute for inclusion in management user request packets for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# no nas-ip-addr request-type authentication
```

Command History

Release	Modification
10.09	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

nas-ip-addr service-type user-management

```
nas-ip-addr service-type user-management
no nas-ip-addr service-type user-management
```

Description

For the selected (by context) RADIUS server group, configures the `NAS-IP-Address` attribute for inclusion in management user service type request packets.

The no form of this command unconfigures the `NAS-IP-Address` attribute for inclusion in management user service type request packets.

Nas-ip-addr attributes only apply to management user requests.

Examples

Configuring the `NAS-IP-Address` attribute for inclusion in management user service type request packets for **rad_group1:**

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# nas-ip-addr service-type user-management
```

Unconfiguring the `NAS-IP-Address` attribute for inclusion in management user service type request packets for **rad_group1:**

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# no nas-ip-addr service-type user-management
```

Command History

Release	Modification
10.09	Command introduced

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

tunnel-private-group-id request-type

```
tunnel-private-group-id request-type {authentication | accounting | both}
no tunnel-private-group-id request-type {authentication | accounting | both}
```

Description

For the selected (by context) RADIUS server group, configures the request type for which the attribute configured with command `tunnel-private-group-id value` will be included.

The no form of this command unconfigures the specified request type.

Tunnel-private-group-id attributes only apply to port access requests.

Parameter	Description
`authentication`	Selects the authentication request type.
`accounting`	Selects the accounting request type.
`both`	Selects both the authentication and accounting request types.

Examples

Configuring the authentication request type for **rad_group1**:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# tunnel-private-group-id request-type authentication
```

Configuring both the authentication and accounting request types for **rad_group2**:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# tunnel-private-group-id request-type both
```

Unconfiguring the authentication request type for **rad_group2**:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# no tunnel-private-group-id request-type authentication
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

tunnel-private-group-id value

```
tunnel-private-group-id value {static | dynamic}
no tunnel-private-group-id value {static | dynamic}
```

Description

For the selected (by context) RADIUS server group, configures the `tunnel-private-group-id` value (type 81, RFC 2868) that will be sent in RADIUS access-request packets. This is used for VLAN identification.

The no form of this command unconfigures specified `tunnel-private-group-id` value.

Tunnel-private-group-id attributes only apply to port access requests.

Parameter	Description
`static`	Causes the switch to send (as an attribute value) the native VLAN of the client port.
`dynamic`	Causes the switch to send (as an attribute value) the client VLAN assigned by server. This is applicable during re-authentication scenarios.

Examples

Configuring **rad_group1** for the RADIUS attribute to identify the native VLAN of the client port:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# tunnel-private-group-id value static
```

Configuring **rad_group2** for the RADIUS attribute to identify the client VLAN assigned by the server:

```
switch(config)# aaa radius-attribute group rad_group2
switch(config-radius-attr)# tunnel-private-group-id value dynamic
```

Unconfiguring (for **rad_group1**) the RADIUS attribute to identify the native VLAN of the client port:

```
switch(config)# aaa radius-attribute group rad_group1
switch(config-radius-attr)# no tunnel-private-group-id value static
```

Unconfiguring (for **rad_group3**) both the group-ID value and request type:

```
switch(config)# aaa radius-attribute group rad_group3
switch(config-radius-attr)# no tunnel-private-group-id
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-radius-attr`	Administrators or local user group members with execution rights for this command.

AOS-CX supports various RADIUS server attributes to be applied during authentication of clients. This section lists the attributes supported in the following features:

- 802.1X authentication
- MAC authentication
- Dynamic authorization
- Session authorization in 802.1X and MAC authentication, and CoA
- RADIUS server tracking
- RADIUS network accounting

The following terms are used in the list of attributes:

- `Tx`: Attribute added in the request packets that are sent to the RADIUS server.
- `Rx`: Attribute processed in the response packets received from the RADIUS server.

Attributes supported in 802.1X authentication

Following are the RADIUS attributes supported in 802.1X authentication:

Attribute name	Tx	Rx	Notes
User-name	Y	N	RFC2865
Calling-station-id	Y	N	RFC2865/3580
Called-station-id	Y	N	RFC2865/3580
NAS-port-id	Y	N	RFC2869
NAS-port	Y	N	RFC2865
Service-Type	Y	N	RFC2865
EAP-Message	Y	N	RFC2869
State	Y	Y	RFC2865
Session-Timeout	N	Y	RFC2865 - Used as EAP timeout in Challenge packet
NAS-IP-Address	Y	N	RFC2865
NAS-Identifier	Y	N	RFC2865
NAS-Ipv6-Address	Y	N	RFC3162
Message-Authenticator	Y	Y	RFC2869

Attributes supported in MAC authentication

Following are the RADIUS attributes supported in MAC authentication:

Attribute name	Tx	Rx	Notes
User-name	Y	N	RFC2865
Calling-station-id	Y	N	RFC2865/3580
Called-station-id	Y	N	RFC2865/3580
NAS-port-id	Y	N	RFC2869
NAS-port	Y	N	RFC2865
Service-Type	Y	N	RFC2865
State	Y	Y	RFC2865
NAS-IP-Address	Y	N	RFC2865

NAS-Identifier	Y	N	RFC2865
NAS-Ipv6-Address	Y	N	RFC3162
Message-Authenticator	Y	Y	RFC2869
Chap-Challenge	Y	N	RFC2865
Chap-Password	Y	N	RFC2865
User-Password	Y	N	RFC2865

Attributes supported in dynamic authorization

Following are the RADIUS attributes supported in dynamic authorization:

Attribute name	Tx	Rx	Notes
User-name	N	Y	RFC2865
Calling-station-id	N	Y	RFC2865/3580
Called-station-id	N	Y	RFC2865/3580
NAS-port-id	N	Y	RFC2869
NAS-port	N	Y	RFC2865
NAS-IP-Address	N	Y	RFC2865
NAS-Identifier	N	Y	RFC2865
NAS-Ipv6-Address	N	Y	RFC3162
Error-cause	Y	N	RFC5176
Acct-Terminate-Cause	Y	Y	RFC2866
Acct-Session-Id	N	Y	RFC2866
Message-Authenticator	N	Y	RFC2869
Event-Timestamp	N	Y	RFC2869

- One or more of the following attributes, `NAS-IP-Address`, `NAS-Identifier`, `NAS-IPv6-Address`, is mandatory for processing Change of Authorization (CoA) requests from dynamic authorization clients.
- Either `Acct-Session-Id` attribute, or one or both of `NAS-port` and `NAS-port-id` attributes and the `Calling-station-id` attribute is mandatory to identify the user session for processing CoA requests from dynamic authorization clients.
- The `User-name` attribute is mandatory for processing all CoA requests.
- The `Acct-Terminate-Cause` attribute is used in the CoA disconnect request and response messages.
- All session authorization attributes (both VSA and standard) are supported in the CoA message only, including `Aruba-Port-Bounce`.

Session authorization attributes supported in 802.1X and MAC authentication, and CoA

Standard session attributes supported

Following are the standard session attributes supported in 802.1X and MAC authentication, and CoA:

Attribute name	ID	Type	Notes
Filter-Id	11	String	RFC3580
Egress-VLANID	56	Octet	RFC4675
Egress-VLAN-Name	58	String	RFC4675
Tunnel-Type	64	Octet	RFC2868
Tunnel-Medium-Type	65	Octet	RFC2868
Tunnel-Private-Group-ID	81	String	RFC2868
NAS-Filter-Rule	92	String	RFC4849
Framed-MTU	12	Octet	RFC2865
Session-Timeout	27	Octet	RFC2865
Terminate-Action	29	Octet	RFC2865
Idle-Timeout	28	Octet	RFC2865

When multiple clients request a different MTU value using the `Framed-MTU` attribute, the highest MTU value requested among the clients will be programmed on the port.

Vendor-Specific Attributes supported in session authorization

Following are the Vendor-Specific Attributes (VSAs) supported in session authorization:

Attribute Name	Length	Type	Aruba Vendor ID	Aruba Attribute Type
Aruba-PoE-Priority	4	integer	14823	49
Aruba-Port-Auth-Mode	4	integer	14823	50
Aruba-NAS-Filter-Rule	<=247	string	14823	51
Aruba-QoS-Trust-Mode	4	integer	14823	52
Aruba-User-Role	<=63	string	14823	1
Aruba-Port-Bounce	4	Integer	14823	40
Aruba-STP-Admin-Edge-Port	4	Integer	14823	55
Aruba-PoE-Allocate-By-Method	4	Integer	14823	70

- Change of Authorization of specific attributes in the user role is not supported. Only entire role can be changed.
- Similarly if the session is using RADIUS attributes, CoA can change only the RADIUS session attributes.
- Change of Authorization to user role for a session using RADIUS attributes is not supported either. If this action is attempted, a NAK message is sent.

Description of VSAs

`Aruba-PoE-Priority`

Specifies the PoE priority of onboarding devices post authentication. Following are the supported values:

- `0`: Critical
- `1`: Medium
- `2`: Low

This attribute overrides the PoE priority configured on the port where the device onboards. This attribute is typically used for infrastructure devices. When multiple clients request different priorities, the critical priority takes precedence over medium priority and the medium priority takes precedence over low priority setting.

`Aruba-Port-Auth-Mode`

Specifies the authentication mode of the port post authentication. Following are the supported values:

- `1`: Device mode—In this mode, an infrastructure device, for example, switch or access point, is authenticated first, and all devices connecting to this authenticated device are allowed access.

Here, the policy and VLAN attributes are applied at the port-level. In device mode, it is expected that only one device is active and authenticated at any instant. Untagged VLAN will override the port VLAN ID and the tagged VLANs will override the tagged VLANs that are configured on the port using the CLI.

- `2`: Client mode—In this mode, all devices trying to onboard on that port are authenticated. Here, the policy and VLAN attributes are applied per client. Untagged VLAN is configured using MAC-based VLAN. Tagged VLANs are arbitrated among all clients and the result is applied to the port.

`Aruba-NAS-Filter-Rule`

This attribute is similar to the NAS-Filter-Rule RFC attribute but with additional functionality to support vendor-specific actions in the rule. This attribute can be used to perform actions such as count and rate-limiting. Multiple instances of this attribute are supported, however, the maximum number of filter rules (including this VSA and `NAS-Filter-Rule`) supported per client is 128. A single `NAS-Filter-Rule` attribute split across multiple VSAs is not supported as servers such as FreeRadius and ClearPass Policy Manager do not terminate filter rule with '\0' value. Most policy servers use one filter rule per VSA.

`Aruba-QoS-Trust-Mode`

Specifies how the switch assigns local priority values to ingress packets. Following are the supported values:

- `0`: Trust mode DSCP
- `1`: Trust mode QoS
- `2`: No trust mode configuration

This attribute overrides the trust mode configured on the port where the device onboards. This attribute is typically used for infrastructure devices. When multiple clients request different trust modes, the DSCP trust mode takes precedence over QoS trust mode and the QoS trust mode takes precedence over no trust mode configuration setting.

`Aruba-User-Role`

Specifies the role that must be applied for the devices post authentication. The role must be defined on the switch. All the session attributes can be defined in the role. Session authorization attributes (both standard and VSAs) sent with this attribute are ignored.

`Aruba-Port-Bounce`

Used in the CoA message to signal the switch to shut down the port for the duration specified.

`Aruba-STP-Admin-Edge-Port`

When enabled, the port will be treated as STP edge port. Even if STP is configured on the port, it will not be executed. Traffic forwarding will occur immediately when a device connects to the port and completes authentication. Following are the supported values:

- `0`: Disable STP admin edge port.
- `1`: Enable STP admin edge port.

`Aruba-PoE-Allocate-By-Method`

This attribute is used to set the PoE power allocation method for onboarding devices post authentication. Following are the supported values:

- `1`: Class
- `2`: Usage

This feature allows you to change the default PoE allocation method on the port. If multiple clients connected to the same port request different allocation methods, `Class` is given priority.

Attributes supported in RADIUS network accounting

Following are the attributes supported in RADIUS network accounting:

Attribute name	Tx	Rx	Notes
User-name	N	N	RFC2865
Calling-station-id	Y	N	RFC2865
Calling-station-id	Y	N	RFC2865
NAS-port-id	Y	N	RFC2869
NAS-port	Y	N	RFC2865
NAS-port-Type	Y	N	RFC2865
Service-Type	Y	N	RFC2865
NAS-IP-Address	Y	N	RFC2865
NAS-Identifier	Y	N	RFC2865
NAS-Ipv6-Address	Y	N	RFC3162
Acct-Authentic	Y	N	RFC2866
Acct-Session-Id	Y	N	RFC2866
Acct-Status-Type	Y	N	RFC2866
Acct-Input-Octets	Y	N	RFC2866 - In Interim and Stop packets
Acct-Output-Octets	Y	N	RFC2866 - In Interim and Stop packets
Acct-Input-Packets	Y	N	RFC2866 - In Interim and Stop packets
Acct-Output-Packets	Y	N	RFC2866 - In Interim and Stop packets
Acct-Input-Gigawords	Y	N	RFC2869 - In Interim and Stop packets
Acct-Output-Gigawords	Y	N	RFC2869 - In Interim and Stop packets
Acct-Session-Time	Y	N	RFC2866 - In Interim and Stop packets
Acct-Terminate-Cause	Y	N	RFC2866 - in Stop packet
Class	Y	N	RFC2865

Attributes supported in RADIUS server tracking

Following are the attributes supported in RADIUS server tracking:

Attribute name	Tx	Rx	Notes
User-name	Y	N	RFC2865
NAS-IP-Address	Y	N	RFC2865
NAS-Identifier	Y	N	RFC2865
NAS-Ipv6-Address	Y	N	RFC3162
Chap-Challenge	Y	N	RFC2865
Chap-Password	Y	N	RFC2865
User-Password	Y	N	RFC2865

Port security enables you to configure each switch port with a unique list of the MAC addresses of devices that are authorized to access the network through that port. This security enables individual ports to detect, prevent, and log attempts by unauthorized devices to communicate through the switch.

MAC Lockdown, also known as Static Addressing, is used to prevent station movement and MAC address hijacking, by allowing a given MAC address to use only an assigned port on the switch. MAC Lockdown also restricts the client device to a specific VLAN.

MAC Lockout enables blocking a specific MAC address so that the switch drops all traffic to or from the specified address.

Port security does not prevent intruders from receiving broadcast and multicast traffic. MAC Lockdown has a higher priority over port security.

Port-security sticky MAC

Sticky MAC is a port security feature that learns MAC addresses on an interface and retains the MAC information. When sticky learning is enabled on a port, all non-static MAC addresses are considered as sticky MACs. Also, all newly on-boarded clients are considered as sticky MACs. The sticky authorized clients are not affected by a switch reboot or link-flap once the MAC addresses are learnt. When disabled, all sticky MACs on the port are made as dynamic clients.

Sticky MACs can be configured statically (sticky-static) and also be learned dynamically (sticky-dynamic) on a sticky-learn enabled port.

- If the same MAC address is configured as sticky-static and static on a sticky learning port, sticky MAC configuration takes precedence.
- Static non-sticky MAC addition is supported on a sticky learning enabled port.
- Existing static port-security MACs on a port are not changed to sticky MAC on enabling the sticky MAC feature.

- Moving sticky MAC clients from one port to another is a violation. You can view the violation information using the `show port-access security violation sticky-mac-client-move interface` command. Also, the following event log message will be displayed: `Port security sticky client move violation triggered on port {port} for client with MAC address {mac_addr}.`
- Downgrading AOS-CX from 10.07 or later versions to earlier versions after learning port-security sticky MACs and upgrading it back to 10.07 or later versions might cause unstable behavior of sticky MACs. So, it is recommended to disable port-security configuration at the global context during migration of software image back to 10.07 or later versions in such scenarios.

Basic operation

Default port security operation

The default port security setting for each port is dynamic mode in which the switch learns addresses from inbound traffic from any connected device.

Intruder protection

A port that detects an intruder blocks the intruding device from transmitting to the network through that port.

General operation for port security

On a per-port basis, you can configure security measures to block unauthorized devices, and to send notice of security violations. Once port security is configured, you can then monitor the network for security violations through one or more of the following:

- Alert flags captured by network management tools.
- Alert Log entries in the WebAgent
- Event Log entries in the console interface

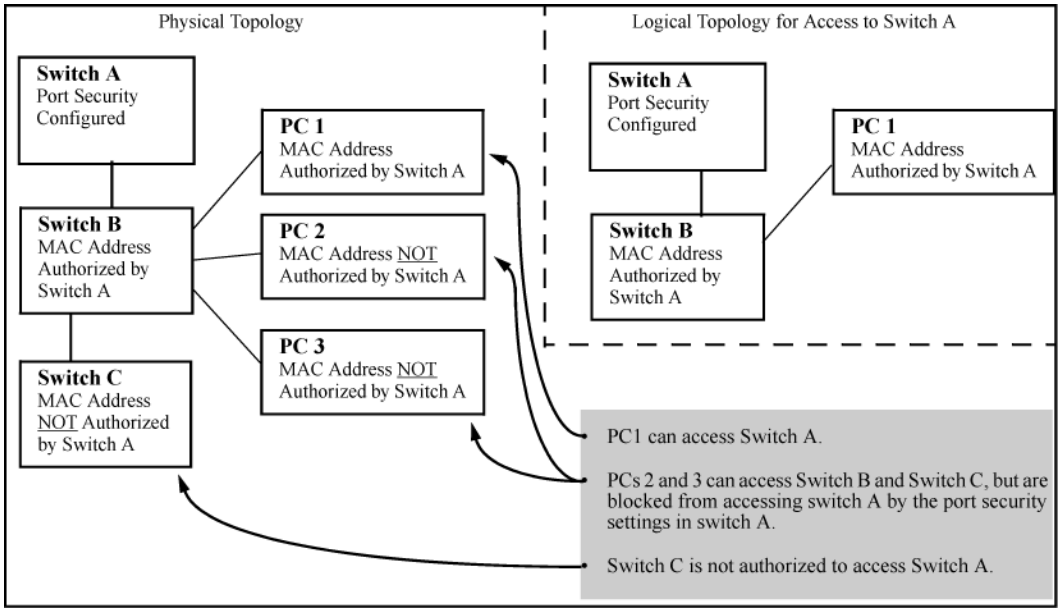
For any port, you can configure the following:

- Action—Used when a port detects an intruder. Specifies whether to send an SNMP trap to a network management station and whether to disable the port.
- Address limit—Sets the number of authorized MAC addresses allowed on the port.
- Static—Enables you to set a fixed limit on the number of MAC addresses authorized for the port and to specify some or all the authorized addresses. (If you specify only some of the authorized addresses, the port learns the remaining authorized addresses from the traffic it receives from connected devices.)
- Configured—Requires that you specify all MAC addresses authorized for the port. The port is not allowed to learn addresses from inbound traffic.
- Authorized (MAC) Addresses—Specify up to eight devices (MAC addresses) that are allowed to send inbound traffic through the port. This feature:
  - Closes the port to inbound traffic from any unauthorized devices that are connected to the port.
  - Provides the option for sending an SNMP trap notifying of an attempted security violation to a network management station and, optionally, disables the port.
- Port Access—Allows only the MAC address of a device authenticated through the switch 802.1X Port-Based access control.

Blocking unauthorized traffic

Unless you configure the switch to disable a port on which a security violation is detected, the switch security measures block unauthorized traffic without disabling the port. This implementation enables you to apply the security configuration to ports on which hubs, switches, or other devices are connected, and to maintain security while also maintaining network access to authorized users.

Figure 16 *How port security controls access*



Broadcast and Multicast traffic is always allowed, and can be read by intruders connected to a port on which you have configured port security.

Trunk group exclusion

Port security does not operate on either a static or dynamic trunk group. If you configure port security on one or more ports that are later added to a trunk group, the switch resets the port security parameters for those ports to the factory default configuration. Ports configured for either Active or Passive LACP, and which are not members of a trunk, can be configured for port security.

Port security commands

port-access port-security

```
port-access port-security {enable | disable}
no port-access port-security {enable | disable}
```

Description

Enables or disables port security globally or at the port level.

Examples

Enabling port security globally:

```
switch(config)# port-access port-security enable
```

Disabling port security globally:

```
switch(config)# port-access port-security disable
```

Enabling port security on a port:

```
switch(config-if)# port-access port-security enable
```

Disabling port security on a port:

```
switch(config-if)# port-access port-security disable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config` `config-if`	Administrators or local user group members with execution rights for this command.

port-access port-security client-limit

```
port-access port-security client-limit <CLIENTS>
no port-access port-security client-limit
```

Description

Configures the maximum number of clients that are allowed on a port. After configuring the maximum clients limit, the MAC addresses of the clients can be learned by one of the following methods:

- User can manually configure all MAC addresses by using the `mac-address` command.
- User can allow the port to dynamically learn all MAC addresses.
- User can configure a fixed number of MAC addresses and allow the switch to learn the remaining addresses dynamically.

The `no` form of the command resets the number of clients to the default, 1.

Parameter	Description
<CLIENTS>	Specifies the maximum number of clients. Default: 1. Range: **NOTE:** If client limit is configured to 0, the port will not learn any MAC address from inbound traffic and will be blocked indefinitely. An administrator can use this along with the port-access security violation configuration to get notified of a client attempting to connect to a port.

Examples

Configuring client limit on a port:

```
switch(config-if)# port-access port-security enable
switch(config-if-port-security)# client-limit 24
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if-port-security`	Administrators or local user group members with execution rights for this command.

port-access port-security mac-address

`port-access port-security mac-address` *`<MAC-ADDRESS>`*
`no port-access port-security mac-address` *`<MAC-ADDRESS>`*

Description

Configures a static client (current interface (port) context) MAC address.

The `no` form of this command removes an authorized static client from the port.

Parameter	Description
`<MAC-ADDRESS>`	Specifies the static client MAC address.

Examples

Configuring a static client on a port:

```
switch(config-if)# port-access port-security
switch(config-if-port-security)# mac-address aa:bb:cc:dd:ee:ff
```

Deleting a static client on a port:

```
switch(config-if)# port-access port-security
switch(config-if-port-security)# no mac-address aa:bb:cc:dd:ee:ff
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if-port-security`	Administrators or local user group members with execution rights for this command.

show port-access port-security interface client-status

```
show port-access port-security interface {all|<IF-NAME>}
     client-status [mac <MAC-ADDRESS>]
```

Description

Shows port security clients status information for the ports. The output can be filtered by interface or MAC address.

Parameter	Description
`all`	Selects all interfaces.
<IF-NAME>	Specifies the interface name.
<MAC-ADDRESS>	Specifies the client MAC address.

Examples

Showing client status information for all ports:

```
switch# show port-access port-security interface all client-status

Port Security Client Status Details

  Authorized-Clients    Type           Port
  ------------------------------------------
  AB:CD:DE:FF:AA:BB     static         1/1/1
  DD:CD:AB:CD:EE:O1     dynamic        1/1/2
  00:50:56:96:7e:fc     sticky-dynamic 1/3/2
```

Showing client status information with sticky-learning enabled for all ports:

```
switch# show port-access port-security interface all client-status

Port Security Client Status Details

  Authorized-Clients    Type              Port
  ------------------------------------------------
  AB:CD:DE:FF:AA:BB     sticky-static     1/1/1
  DD:CD:AB:CD:EE:O1     sticky-dynamic    1/1/2
  DE:CD:AB:BB:EE:O2     sticky-dynamic    1/1/2
```

Showing client status information for a client:

```
switch# show port-access port-security interface 1/3/2 client-status mac
00:50:56:96:7e:fc

Port Security Client Status Details
```

```
  Authorized-Clients       Type           Port
  -------------------------------------------------
  00:50:56:96:7e:fc        sticky-dynamic 1/3/2
```

Showing client status information for a port:

```
switch# show port-access port-security interface 1/3/2 client-status

Port Security Client Status Details

  Authorized-Clients       Type           Port
  -------------------------------------------------
  00:50:56:96:7e:fc        sticky-dynamic 1/3/2
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show port-access port-security interface port-statistics

`show port-access port-security interface {all|<IF-NAME>} port-statistics`

Description

Shows port security statistics for the ports in a switch. The output can be filtered by interface.

Parameter	Description
`all`	Selects all interfaces.
<IF-NAME>	Specifies the interface name.

Examples

Showing information for all ports.

```
switch# show port-access port-security interface all port-statistics

Port 1/1/1
==========

  Client Details
```

```
--------------
  Number of authorized clients            : 0
  Number of sticky authorized clients     : 2
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

sticky-learn enable

```
sticky-learn enable
no sticky-learn enable
```

Description

Enables sticky learning on the port. All the existing and new MACs learned on the port are made sticky.

The `no` form of this command disables the sticky learning on the port.

Examples

Enabling sticky learning on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# port-access port-security
switch(config-if-port-security)# sticky-learn enable
```

Disabling sticky learning on the port:

```
switch(config)# interface 1/1/1
switch(config-if)# port-access port-security
switch(config-if-port-security)# no sticky-learn enable
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if-port-security`	Administrators or local user group members with execution rights for this command.

sticky-learn mac

```
sticky-learn mac <MAC-ADDRESS> [vlan <VLAN-ID>]
no sticky-learn mac <MAC-ADDRESS> [vlan <VLAN-ID>]
```

Description

Configures the MAC addresses of sticky static clients. After configuring, clients are directly added to the MAC address table.

The `no` form of this command removes an authorized sticky static client from the port.

Parameter	Description
<MAC-ADDRESS>	Specifies the static sticky client MAC address.
`vlan` *<VLAN-ID>*	Specifies the static sticky client VLAN ID.

Examples

Configuring a sticky static client on a port:

```
switch(config)# interface 1/1/1
switch(config-if)# port-access port-security
switch(config-if-port-security)# sticky-learn mac-address aa:bb:cc:dd:ee:ff
```

Configuring a sticky static client with a VLAN ID on a port:

```
switch(config)# interface 1/1/1
switch(config-if)# port-access port-security
switch(config-if-port-security)# sticky-learn mac-address aa:bb:cc:dd:ee:ff vlan 4
```

Removing a sticky static client from a port:

```
switch(config)# interface 1/1/1
switch(config-if)# port-access port-security
switch(config-if-port-security)# no sticky-learn mac-address aa:bb:cc:dd:ee:ff
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	`config-if-port-security`	Administrators or local user group members with execution rights for this command.

show port-access security violation sticky-mac-client-move interface

`show port-access security violation sticky-mac-client-move interface {all|<IF-NAME>}`

Description

Shows information about the sticky-mac client move violation. The output can be filtered by interface.

Parameter	Description
`all`	Selects all interfaces.
<IF-NAME>	Specifies the interface name.

Examples

Showing information for all ports.

```
switch# show port-access port-security violation sticky-mac-client-move
        interface all

Sticky MAC Client Move Violation Status Details

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                0
   1/1/2       Yes               10
   1/1/5       No                10
```

Showing information for a particular port.

```
switch# show port-access port-security violation sticky-mac-client-move
        interface 1/1/1

Sticky MAC Client Move Violation Status Details

-----------------------------------------------------
   Port      Violation      Violation-Count
-----------------------------------------------------
   1/1/1       No                10
```

Command History

Release	Modification
10.09	Command introduced on the 8360

Command Information

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

AOS-CX switches include automatic detection and control for certain link errors and excessive traffic conditions. Fault monitor can be used to log an event or send SNMP traps for these conditions and temporarily disable the port to protect the network. Monitoring can be enabled for all recognized faults or for individual faults, and actions and thresholds for each fault can be configured.

Fault monitor applies only to physical ports and not to LAGs, tunnels, VSF links, or other types of interfaces. Fault monitoring can be applied to the individual members of a LAG.

Fault monitoring conditions

The following fault conditions are available for monitoring:

Excessive broadcasts

An excessive broadcast (broadcast storm) fault is reported when the average ingress traffic rate of broadcast packets exceeds the configured threshold in a 20 second interval.

The default threshold level is configured as a percentage of the bandwidth of the port. Larger the frame size, smaller the converted threshold value in PPS. Hence larger frames require lower threshold percent configurations to hit the fault.

Excessive multicasts

An excessive multicasts (multicast storm) fault is reported when the average ingress traffic rate of multicast packets exceeds the configured threshold in a 20 second interval.

Excessive link flaps

An excessive link flaps fault is reported when the count of transitions between link-up and link-down state exceeds the configured threshold in a 10 second interval.

Excessive oversize packets

An excessive oversized packet fault is reported when the number of ingress oversized frames per 10,000 received frames exceeds the configured threshold value in a 20 second interval. In an oversize packet fault, the packets size is more than the configured MTU on the interface with good cyclic redundancy check (CRC).

Excessive jabbers

An excessive jabbers fault is reported when the number of ingress jabber frames per 10,000 received frames exceeds the configured threshold value in a 20 second interval. In a jabbers fault, the packets size is more than the configured MTU on the interface with bad CRC.

Excessive fragments

An excessive fragments fault is reported when the number of ingress fragment frames per 10,000 received frames exceeds the configured threshold value in a 20 second interval. In a fragments fault, the packet size is less than 64 bytes with bad CRC.

Excessive CRC errors

An excessive CRC errors fault is reported when the number of ingress `crc-error` frames per 10,000 received frames exceeds the configured threshold value in a 20 second interval.

Excessive TX drops

An excessive TX drops fault is reported when egress dropped packets per 10,000 transmitted frames exceeds the configured threshold value in a 20 second interval.

Fault monitor commands

(Fault enabling/disabling)

```
{all | <FAULT>}
no {all | <FAULT>}
```

Description

Within the selected fault monitor profile context, enables all faults or specific faults for monitoring.

By default, all faults are disabled in a profile and remain disabled until enabled as described here. Configuring the action and threshold does not enable the fault.

Faults enabled with this command use default actions and thresholds unless the actions and thresholds are configured. For information on configuring actions and thresholds for a fault, respectively see action and threshold.

The `no` form of this command disables faults for monitoring.

Parameter	Description
`all`	Selects all faults.

<FAULT>	Selects a specific fault. Available fault names:
	`excessive-broadcasts`
	`excessive-multicasts`
	`excessive-link-flaps`
	`excessive-oversize-packets`
	`excessive-jabbers`
	`excessive-fragments`
	`excessive-crc-errors`
	`excessive-tx-drops`

Examples

Enabling all faults:

```
switch(config-fault-monitor-profile)# all
```

Disabling all faults:

```
switch(config-fault-monitor-profile)# no all
```

Enabling individual faults:

```
switch(config-fault-monitor-profile)# excessive-broadcasts
switch(config-fault-monitor-profile)# excessive-multicasts
switch(config-fault-monitor-profile)# excessive-link-flaps
switch(config-fault-monitor-profile)# excessive-oversize-packets
switch(config-fault-monitor-profile)# excessive-jabbers
switch(config-fault-monitor-profile)# excessive-fragments
switch(config-fault-monitor-profile)# excessive-crc-errors
switch(config-fault-monitor-profile)# excessive-tx-drops
```

Disabling individual faults:

```
switch(config-fault-monitor-profile)# no excessive-broadcasts
switch(config-fault-monitor-profile)# no excessive-multicasts
switch(config-fault-monitor-profile)# no excessive-link-flaps
switch(config-fault-monitor-profile)# no excessive-oversize-packets
switch(config-fault-monitor-profile)# no excessive-jabbers
switch(config-fault-monitor-profile)# no excessive-fragments
switch(config-fault-monitor-profile)# no excessive-crc-errors
switch(config-fault-monitor-profile)# no excessive-tx-drops
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	`config-fault-monitor-profile`	Administrators or local user group members with execution rights for this command.

action

`{all | <FAULT>} action {notify | notify-and-disable [auto-enable <TIMEOUT>]}`
`no {all | <FAULT>} action {notify | notify-and-disable [auto-enable <TIMEOUT>]}`

Description

Within the selected fault monitor profile context, configures the fault monitoring action for the specified fault. Default action: `notify` with `auto-enable` disabled.

The no form of this command removes the action and disables `auto-enable`.

Parameter	Description
`all`	Selects all faults.

<FAULT>	Selects a specific fault. Available fault names:
	`excessive-broadcasts`
	`excessive-multicasts`
	`excessive-link-flaps`
	`excessive-oversize-packets`
	`excessive-jabbers`
	`excessive-fragments`
	`excessive-crc-errors`
	`excessive-tx-drops`

`notify`	Selects the `notify` action. Notifies through events, DLOGs, and SNMP trap. This action is enabled by default.
`notify-and-disable`	Selects the action as `notify-and-disable`. Notifies through events, DLOGs, and SNMP trap, and then disables the port.
`auto-enable` *<TIMEOUT>*	Sets the number of seconds after which a port disabled by the `notify-and-disable` action is automatically re-enabled. Range: 1 to 604800 seconds.

The fault parameter values are saved even after a fault is disabled in the profile. The saved values will be used if the fault is later re-enabled in the profile again.

Examples

Configuring the `notify` action for all faults within a given profile:

```
switch(config-fault-monitor-profile)# all action notify
```

Configuring the `notify-and-disable` action for all faults within a given profile:

```
switch(config-fault-monitor-profile)# all action notify-and-disable
```

Configuring the `notify-and-disable` action for all faults with `auto-enable` within a given profile:

```
switch(config-fault-monitor-profile)# all action notify-and-disable auto-enable 80
```

Disabling all fault monitoring for this profile:

```
switch(config-fault-monitor-profile)# no all
```

Restoring all fault monitoring to the default action `notify` within a given profile:

```
switch(config-fault-monitor-profile)# no all action
```

Unconfiguring the auto-enable timer for all fault monitoring within a given profile:

```
switch(config-fault-monitor-profile)# no all action notify-and-disable auto-enable
```

Configuring the `notify` action for specific faults within a given profile:

```
switch(config-fault-monitor-profile)# excessive-oversize-packets action notify
```

Configuring the `notify-and-disable` action for specific faults within a given profile:

```
switch(config-fault-monitor-profile)# excessive-link-flaps action notify-and-
disable
switch(config-fault-monitor-profile)# excessive-fragments action notify-and-
disable
switch(config-fault-monitor-profile)# excessive-crc-errors action notify-and-
disable
```

Configuring the `notify-and-disable` action with `auto-enable` for specific faults within a given profile:

```
switch(config-fault-monitor-profile)# excessive-broadcasts action notify-and-
disable auto-enable 80
switch(config-fault-monitor-profile)# excessive-multicasts action notify-and-
disable auto-enable 100
switch(config-fault-monitor-profile)# excessive-tx-drops action notify-and-disable
auto-enable 70
switch(config-fault-monitor-profile)# excessive-jabbers action notify-and-disable
auto-enable 60
```

Restoring fault monitoring to the default action `notify` within a given profile:

```
switch(config-fault-monitor-profile)# no excessive-oversize-packets action
switch(config-fault-monitor-profile)# no excessive-jabbers action
switch(config-fault-monitor-profile)# no excessive-oversize-packets action notify-
and-disable
```

Unconfiguring the auto-enable timer within a given profile:

```
switch(config-fault-monitor-profile)# no excessive-jabbers action notify-and-
disable auto-enable
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	config-fault-monitor-profile	Administrators or local user group members with execution rights for this command.

apply fault-monitor profile

```
apply fault-monitor profile <PROFILE-NAME>
no apply fault-monitor profile [<PROFILE-NAME>]
```

Description

Applies a fault monitoring profile to the selected interface or interface range.

The no form of this command removes the fault monitoring profile from the selected interface or interface range.

Parameter	Description
<PROFILE-NAME>	Specifies the fault monitor profile name. Range: Up to 64 alphanumeric and special characters.

Examples

Applying the fault monitoring profile to a interface:

```
switch(config)# interface 1/1/1
switch(config-if)# apply fault-monitor profile noisy-ports
```

Applying the fault monitoring profile to a interface range:

```
switch(config)# interface 1/1/2-1/1/24
switch(config-if)# apply fault-monitor profile quiet-ports
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	config-if	Administrators or local user group members with execution rights for this command.

fault-monitor profile

```
fault-monitor profile <PROFILE-NAME>
no fault-monitor profile <PROFILE-NAME>
```

Description

Creates a fault monitoring profile and enters its context which is indicated as `(config-fault-monitor-profile)`. If the profile already exists, this command enters the profile context. A maximum of 16 fault monitoring profiles are supported.

For information on enabling a fault within a fault monitor profile, see (Fault enabling/disabling).

For information on configuring actions and thresholds for a fault, respectively see action and threshold.

For information on applying a fault monitor profile to a interface or interface range, see apply fault-monitor profile.

The `no` form of this command deletes the fault monitoring profile.

By default, all faults are disabled in a profile.

Parameter	Description
<PROFILE-NAME>	Specifies the fault monitor profile name. Range: Up to 64 alphanumeric and special characters.

Examples

Creating a fault monitor profile and entering its context:

```
switch(config)# fault-monitor profile noisy-ports
switch(config-fault-monitor-profile)#
```

Deleting a fault monitor profile:

```
switch(config)# no fault-monitor profile noisy-ports
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

show fault-monitor profile

`show fault-monitor profile <PROFILE-NAME>`

Description

Shows fault monitoring profile information for all profiles or a specific profile.

Parameter	Description
<PROFILE-NAME>	Specifies the fault monitor profile name. Range: Up to 64 alphanumeric and special characters.

Example

Showing information for all fault monitoring profiles:

```
switch# show fault-monitor profile
-------------------------------------------------------------------------------
Fault monitor profile: noisy-ports
-------------------------------------------------------------------------------
Auto
Fault                          Enabled  Threshold   Action              Enable
-------------------------------------------------------------------------------
excessive-broadcasts           yes      5%          notify-and-disable  --
excessive-multicasts           yes      1000 pps    notify-and-disable  --
excessive-link-flaps           yes      7           notify-and-disable  --
excessive-oversize-packets     yes      25          notify-and-disable  --
excessive-jabbers              yes      25          notify-and-disable  --
excessive-fragments            yes      25          notify-and-disable  --
excessive-crc-errors           yes      25          notify-and-disable  --
excessive-tx-drops             yes      25          notify-and-disable  --
-------------------------------------------------------------------------------
Fault monitor profile: quiet-ports
-------------------------------------------------------------------------------
Auto
Fault                          Enabled  Threshold   Action              Enable
-------------------------------------------------------------------------------
excessive-broadcasts           yes      20%         notify-and-disable  --
excessive-multicasts           yes      25000 pps   notify-and-disable  40
excessive-link-flaps           yes      7           notify              --
excessive-oversize-packets     yes      30          notify-and-disable  --
excessive-jabbers              no       30          notify-and-disable  100
excessive-fragments            yes      30          notify-and-disable  --
excessive-crc-errors           yes      30          notify-and-disable  --
excessive-tx-drops             yes      30          notify-and-disable  --
```

Showing information for a particular fault monitoring profile:

```
switch# show fault-monitor profile noisy-ports
-------------------------------------------------------------------------------
Fault monitor profile: noisy-ports
-------------------------------------------------------------------------------
Auto
Fault                          Enabled  Threshold   Action              Enable
-------------------------------------------------------------------------------
excessive-broadcasts           yes      5%          notify-and-disable  --
excessive-multicasts           yes      1000 pps    notify-and-disable  --
excessive-link-flaps           yes      7           notify-and-disable  --
excessive-oversize-packets     yes      25          notify-and-disable  --
excessive-jabbers              yes      25          notify-and-disable  --
excessive-fragments            yes      25          notify-and-disable  --
excessive-crc-errors           yes      25          notify-and-disable  --
excessive-tx-drops             yes      25          notify-and-disable  --
-------------------------------------------------------------------------------
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show interface fault-monitor profile

```
show interface [<INTERFACE>|<IF-RANGE>] fault-monitor profile
```

Description

Shows fault monitoring profile configuration information for all or specific interfaces.

Parameter	Description
<INTERFACE>	Specifies a single interface.
<IF-RANGE>	Specifies a interface range,

Example

Showing all interfaces with applied fault monitoring profiles:

```
switch# show interface fault-monitor profile
--------------------------------------------------------------------------------
Port     Fault Monitor Profile
--------------------------------------------------------------------------------
1/1/1    noisy-ports
1/1/2    quiet-ports
1/1/4    quiet-ports
1/1/5    noisy-ports
1/1/6    noisy-ports
1/1/7    quiet-ports
```

Showing a range of interfaces with applied fault monitoring profiles:

```
switch# show interface 1/1/1-1/1/2,1/1/6 fault-monitor profile
--------------------------------------------------------------------------------
Port     Fault Monitor Profile
--------------------------------------------------------------------------------
1/1/1    noisy-ports
1/1/2    quiet-ports
1/1/6    noisy-ports
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show interface fault-monitor status

```
show interface [<INTERFACE>|<IF-RANGE>] fault-monitor status
```

Description

Shows active fault information for all or specific interfaces.

Parameter	Description
<INTERFACE>	Specifies a single interface.
<IF-RANGE>	Specifies a interface range,

Example

Showing active fault information for all interfaces with applied fault monitoring profiles:

```
switch# show interface fault-monitor status
                                                                    Port  Time
Port   Fault                        Fault Elapsed Time             State Left
-------------------------------------------------------------------------------
1/1/1  excessive-broadcasts         Tue Apr 14 14:29:09 UTC 2020   down  60
       excessive-jabbers            Tue Apr 15 14:29:09 UTC 2020   --    --
1/1/2  excessive-oversize-packets   Tue Apr 16 14:29:09 UTC 2020   down  --
```

Showing active fault information for a range of interfaces with applied fault monitoring profiles:

```
switch# show interface 1/3/1,1/3/3 fault-monitor status
                                                                    Port  Time
Port   Fault                        Occurring Since                State Left
-------------------------------------------------------------------------------
1/1/4  excessive-broadcasts         Tue Apr 14 14:29:09 UTC 2020   down  60
       excessive-jabbers            Tue Apr 15 14:29:09 UTC 2020   --    100
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

show running-config

```
show running-config [interface <IFNAME> | current-context | all]
```

Description

Shows the running configuration including any fault-monitor profile configurations and profile-names applied to an interface. The below examples focus on fault monitor-related configuration items. Other configuration items that may be present are represented by an ellipsis (. . .).

Parameter	Description
`interface <IFNAME>`	Shows running configuration information for only the specified interface.
`current-context`	Shows running configuration information for only the current context.
`all`	Shows all running configuration information.

Examples

Showing the running configuration for a particular interface:

```
switch# show running-config interface 1/1/1
interface 1/1/1
   ...
    apply fault-monitor profile noisy-ports
   ...
```

Showing the running configuration for a particular fault monitor profile current context:

```
switch# fault-monitor profile noisy-ports
switch(config-fault-monitor-profile)# show running-config current-context
fault-monitor profile noisy-ports
    excessive-broadcasts
    excessive-broadcasts threshold pps 10000
    excessive-broadcasts action notify-and-disable auto-enable 2000
    excessive-multicasts
    excessive-multicasts threshold pps 10000
    excessive-link-flaps
    excessive-link-flaps action notify-and-disable auto-enable 2000
```

Showing all running configuration:

```
switch# show running-config all
...
fault-monitor profile noisy-ports
    excessive-broadcasts
    excessive-broadcasts threshold pps 10000
```

```
    excessive-broadcasts action notify-and-disable auto-enable 2000
    excessive-multicasts
    excessive-multicasts threshold pps 10000
    excessive-multicasts action notify
    excessive-link-flaps
    excessive-link-flaps threshold count 7
    excessive-link-flaps action notify-and-disable auto-enable 2000
    no excessive-oversize-packets
    excessive-oversize-packets threshold value 25
    excessive-oversize-packets action notify
    no excessive-jabbers
    excessive-jabbers threshold value 25
    excessive-jabbers action notify
    no excessive-fragments
    excessive-fragments threshold value 25
    excessive-fragments action notify
    no excessive-crc-errors
    excessive-crc-errors threshold value 25
    excessive-crc-errors action notify
    no excessive-tx-drops
    excessive-tx-drops threshold value 25
    excessive-tx-drops action notify
...
interface 1/1/1
   ...
    apply fault-monitor profile noisy-ports
   ...
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	Manager (#)	Administrators or local user group members with execution rights for this command.

threshold

```
<FAULT> threshold value <VALUE>
no <FAULT> threshold [value <VALUE>]

excessive-link-flaps threshold count <COUNT>
no excessive-link-flaps threshold [count <COUNT>]

excessive-fc-watchdog-triggers threshold count <COUNT>
no excessive-fc-watchdog-triggers threshold [count <COUNT>]

{excessive-broadcasts | excessive-multicasts}
   threshold {percent <BW-PERCENT> | pps <PPS>}
no {excessive-broadcasts | excessive-multicasts}
   threshold [{percent <BW-PERCENT> | pps <PPS>}]

no all threshold
```

Description

Within the selected fault monitor profile context, sets the specified fault threshold.

The `no` form of this command resets the threshold to its default value.

Parameter	Description

<FAULT> `threshold value` *<VALUE>*
 	
With `<FAULT>` set to any of these names:
`excessive-oversize-packets`
`excessive-jabbers`
`excessive-fragments`
`excessive-crc-errors`
`excessive-tx-drops`
	Sets the threshold number of bad frames per 10000 good frames received or per 10000 good frames sent (depending on the fault), to be considered a fault. Range: 1 to 10000. Default: 25.

`excessive-link-flaps` `threshold count` *<COUNT>*	Sets the threshold count of interface link flaps, during a 10 second sampling interval, to be considered a fault. Range: 1 to 100. Default: 7.

`{excessive-broadcasts |`
`excessive-multicasts}`
`threshold percent` *<BW-PERCENT>*
	Sets the fault threshold as a percentage of port bandwidth for minimum sized packets that is considered to be a fault. Range: 1 to 100. Default 5.

`{excessive-broadcasts |`
`excessive-multicasts}`
`threshold pps` *<PPS>*
	Sets the fault threshold in packets per second. Range: 1 to 195312500.

If excessive-broadcast or excessive-multicast faults are configured with the threshold higher than the `rate-limit` threshold, the following occurs:

- Fault reporting still happens as the port has actually received packets at a rate that violated its threshold.
- Traffic gets shaped as per `rate-limit` configuration and any packet exceeding the `rate-limit` threshold gets dropped.

Examples

Setting thresholds:

```
switch(config-fault-monitor-profile)# excessive-oversize-packets threshold value
40
switch(config-fault-monitor-profile)# excessive-jabbers threshold value 30
switch(config-fault-monitor-profile)# excessive-fragments threshold value 50
switch(config-fault-monitor-profile)# excessive-crc-errors threshold value 35
switch(config-fault-monitor-profile)# excessive-tx-drops threshold value 20

switch(config-fault-monitor-profile)# excessive-link-flaps threshold count 14
switch(config-fault-monitor-profile)# excessive-broadcasts threshold percent 40
switch(config-fault-monitor-profile)# excessive-multicasts threshold pps 7500
```

Resetting all thresholds to their defaults:

```
switch(config-fault-monitor-profile)# no all threshold
```

Resetting individual thresholds to their defaults:

```
switch(config-fault-monitor-profile)# no excessive-oversize-packets threshold
switch(config-fault-monitor-profile)# no excessive-jabbers threshold
switch(config-fault-monitor-profile)# no excessive-fragments threshold
switch(config-fault-monitor-profile)# no excessive-crc-errors threshold
switch(config-fault-monitor-profile)# no excessive-tx-drops threshold

switch(config-fault-monitor-profile)# no excessive-link-flaps threshold

switch(config-fault-monitor-profile)# no excessive-broadcasts threshold
switch(config-fault-monitor-profile)# no excessive-multicasts threshold
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
All platforms	`config-fault-monitor-profile`	Administrators or local user group members with execution rights for this command.

vsx-sync (fault monitor)

```
vsx-sync
no vsx-sync
```

Description

Within the selected fault monitor profile context, configures VSX synchronization for the selected fault monitoring profile.

The `no` form of this command removes the VSX synchronization for a fault monitoring profile.

Example

Configuring VSX synchronization for a fault monitoring profile:

```
switch(config-fault-monitor-profile)# vsx-sync
```

Command History

Release	Modification
10.11.1000	Command introduced on the 8320, 8325, 8360, 9300 and 10000.

Command Information

Platforms	Command context	Authority
8100 8360	`config-fault-monitor-profile`	Administrators or local user group members with execution rights for this command.

The 8360 Switch Series supports the core and edge for relaying the GBP tag. Access is not supported. For core and edge to support GBP relay, you must enable GBP with command `gbp enable`.

Group Based Policies (GBP) are used to segment user traffic in a network by grouping the users into roles based on user authentication at the source or ingress VXLAN tunnel endpoint (VTEP). Source-based roles will remain effective even if a device authenticates at a different location, or if the device is assigned a different IP address. Users can be local authenticated, MAC authenticated, or 802.1X authenticated clients. After authentication a Group Policy ID is mapped based on the role applied.

Dynamic Segmentation or Virtual Network Based Tunneling (VNBT) helps in segmentation of user traffic over a VXLAN overlay based network and GBP helps by providing segmentation of user traffic in the same domain based on user role (determined during authentication). Segmentation using GBP feature performs the following actions:

- Allows micro-segmentation of the user traffic on the same VLAN by classifying the user traffic based on user role. The role is then converted into Group Policy IDs and carried in the VXLAN header.
- At egress, the switch determines if the traffic from the source role (as carried in the Group Policy ID) is permitted to the destination role (as determined from the destination MAC) and accordingly either forwards or drops the traffic.
- In a gateway scenario, the traffic on a VXLAN tunnel may get terminated and enter another VXLAN tunnel. In such scenarios, the Group Policy ID must be transported to the new tunnel for the final destination to enforce role-based policies.
- Since 6200 Switch Series connected leaf uses only static vxlan , the traffic on a VXLAN tunnel may get terminated and enter another VXLAN tunnel. In such scenarios, the Group Policy ID must be transported to the new tunnel for the final destination to enforce role-based policies.
- GBP tag is transmitted from one tunnel to another on the leaf connected to the 6200 Switch Series and you must enable `inter-vxlan-bridging-mode ( deny | static-evpn | static-all)` command on leaf to support this.

Enabling inter-VXLAN bridging with the `inter-vxlan-bridging-mode {deny | static-evpn | static-all}` command under the VXLAN interface is a prerequisite for GBP on edge and wherever 6200 is connected to leaf. This applies to 6300, 6400 and 8360 Switch Series.

The port-access group-based policies support GBP-MAC, GBP-IPv4 and GBP-IPv6 based classes. These classes cannot be configured under classifier or port-access policies as match criteria. All the destination roles in the class entries match condition should be the same role.

Group based port-access policies (GBP) are configured and applied globally via local user roles (LUR) to the clients. GBP does not support downloadable user roles (DUR). Classes in group based policies should have a destination role that is the same as the associated user role. If the associated role is not the same, the clients will not be onboarded.

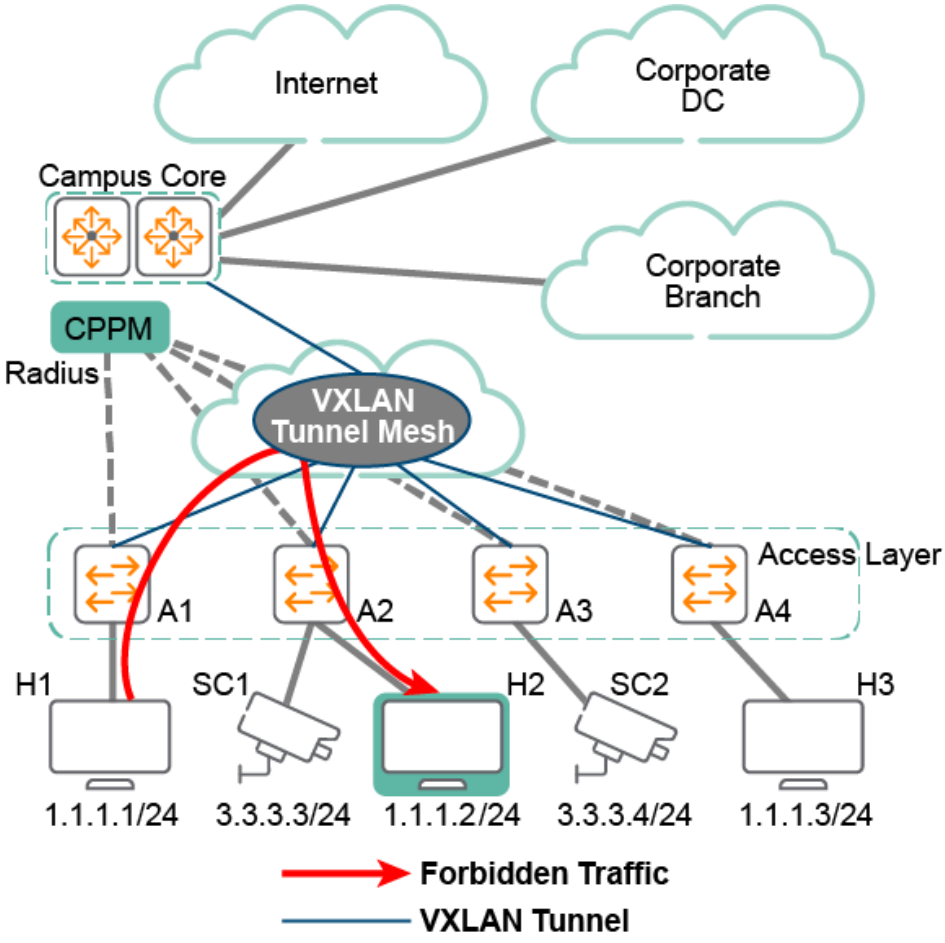
GBP scenarios

Group Policy ID-based segmentation in the wired network

The following figure depicts a distributed routing scenario. Consider the following for traffic segmentation:

- Macro segmentation—Disallow all traffic from the security cameras to guests.
- Micro segmentation—Disallow all traffic from guests to the admin.

Example for Group Policy ID-based segmentation



Client	MAC	VLAN/Subnet	L2-VNI	Role
H1	M1	100/1.1.1.0/24	1000	Guest
H2	M2	100/1.1.1.0/24	1000	Admin
H3	M3	100/1.1.1.0/24	1000	Guest
SC1	M4	300/3.3.3.0/24	3000	Security Camera
SC2	M5	300/3.3.3.0/24	3000	Security Camera

The access clients are assigned the respective roles and each switch knows the roles of the clients directly connected to them.

Macro segmentation

A simple subnet ACL having a destination prefix of 3.3.3.0/24 can be associated with the guest role and help in enforcing prohibition of any traffic from security cameras towards guests. Switches A1 and A4 enforce this ACL on such traffic originating from H1 and H3 respectively.

Micro segmentation

A subnet ACL cannot enforce similar prohibition of traffic from guests to the admin as guest and admin clients are on the same subnet. Consider a packet originated form H1 flowing towards H2:

1. Switch A1 identifies the source role (guest) based on source MAC and inserts an integer ID (Group Policy ID) that represents the guest role into the VXLAN-GBP bits and forwards the packet over VXLAN to switch A2. The forwarding mechanism is regular VXLAN bridging.
2. When the packet arrives at A2, it determines the destination role (admin) from the destination MAC (M2). Now A2 has information about both roles, the source role tag arriving over VXLAN and the locally-determined destination role. It can now enforce the guest to admin traffic prohibition.

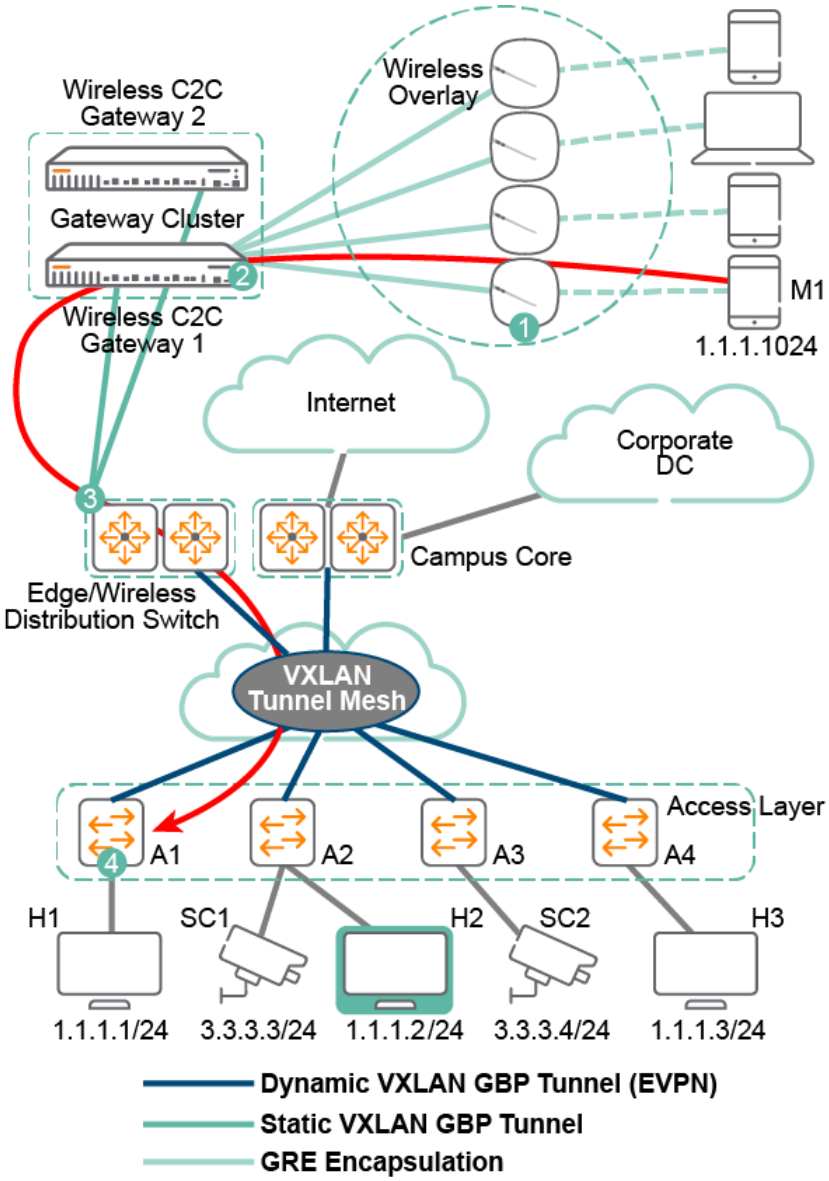
TCAM size

Platform	TCAM Size
6300	16K
6400	16K
8360	16K
6200	4K
8100	4K

Group Policy ID-based segmentation between wired and wireless clients

The Group Policy ID-based segmentation can also be implemented between a wired and wireless network using micro segmentation between wired and wireless clients.

Micro segmentation between wired and wireless clients



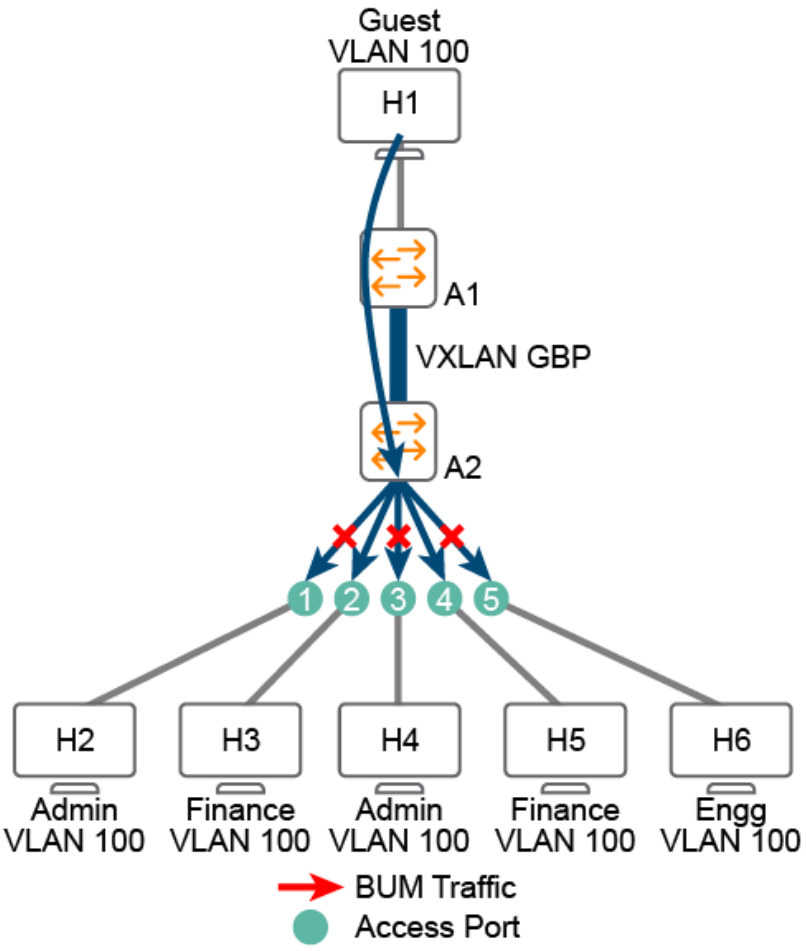
The following actions occur when a role-to-role ACL must be applied on the traffic from role of mobile device M1 to the role of H2.

1. The AP forwards the packet from M1 to gateway 1.
2. Gateway 1 forwards the traffic over the static VXLAN tunnel to the edge switch (8360). This packet carries the Group Policy ID corresponding to the role of M1.
3. The edge switch acts as the intermediate node and transfers the Group Policy ID over a static VXLAN to a dynamic VXLAN tunnel and forwards the packet to switch A1.
4. Switch A1 determines the destination role based on destination MAC or destination IP, and enforces role-to-role ACLs. This is similar to the case of wired network segmentation described earlier.

Group Policy ID-based segmentation for multicast traffic

Role-to-role ACLs must be enforced on multicast traffic, including broadcast, unknown unicast, and multicast (BUM) traffic. This is crucial for micro segmentation use cases where multiple roles are configured on the same VLAN. This scenario has all clients placed on a single VLAN.

Role-to-role ACL enforcement on multicast traffic



Source	Destination	Ethtype	Action
Guest	Admin	Any	Deny
Guest	Finance	Any	Permit
Guest	Engg	Any	Deny

In the above scenario all clients are placed on VLAN 100. The clients on A2 are connected over different access ports. When an ARP request packet originated from H1 arrives at A2 over VXLAN, the natural VLAN multicast mechanism is to send a copy of the packet out of all the five ports. However, given the role-to-role ACL configurations, the packet is sent out only to the finance clients out of ports 2 and 4.

Consider that A2 implements IGMP snooping, and multicast group joins are received from ports 1, 2, and 5. As per the role-to-role ACL configuration, the allowed port list is 2 and 4. Therefore, when the multicast stream for the group arrives from H1 at A2, it is sent out of the intersection of the two sets of ports, that is, port 2 only.

Multicast traffic limitations

If both permitted clients and denied clients are connected to the same exit port, the switch lets the traffic out of the port, ignoring the presence of denied clients. The downstream hub or non-learning switch broadcasts the packets to both the clients.

In the above scenario, if H2 and H3 both are connected to port 1 on A2, and the role-to-role ACL configuration prohibits H1 to H2 multicast traffic where as H1 to H3 traffic is allowed, the permit action takes precedence at the port and the traffic is sent to both H2 and H3.

GBP limitations

- Only local user roles (LUR) are supported for GBP.
- Source roles must be created at the ingress VTEP.
- Source and destination roles must be created at the egress VTEP.
- Authentication is required to assign roles to devices and implement role-based policies.
- Reauthentication will fail If you configure a GBP MAC policy to allow only ARP using the `class gbp-mac` command. You must allow reauthentication traffic for reauthentication to be successful.

Group based policy commands

gbp enable

```
gbp enable
no gbp enable
```

Description

Enables group based policy (GBP).

The `no` form of this command disables group based policy (GBP).

Examples

Enabling group based policy:

```
switch(config)# gbp enable
```

Disabling group based policy:

```
switch(config)# no gbp enable
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch Series.
10.10	Added support for the 8360 Switch Series.
10.08	Command introduced.

Command Information

Platforms	Command context	Authority
8360 8100	`config` `config-class-<CLASS-TYPE>`	Administrators or local user group members with execution rights for this command.

gbp role

```
gbp role <ROLE_NAME> <ROLE_ID>
no gbp role <ROLE_NAME> <ROLE_ID>
```

Description

Maps the role name to the role ID. This mapping is used in the GBP encapsulation.

The `no` form of this command removes the mapping between the role name and ID.

Parameter	Description
<ROLE_NAME>	Specifies the role name to be mapped.
<ROLE_ID>	Specifies the role ID. Range: 100 to 8191.

Examples

Mapping the **employee** role to the role ID **130**:

```
switch(config)# gbp role employee 130
```

Removing the mapping for the role **employee**:

```
switch(config)# no gbp role employee 130
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	`config` `config-class-`*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

gbp role infra

```
gbp role infra <TAG-VALUE>
no gbp role infra [<TAG-VALUE>]
```

Description

Sets the GBP infra (infrastructure) role tag value for CPU-generated packets. Prior to AOS-CX 10.09, CPU generated traffic and non-secure port traffic was tagged with a default tag of 0.

This does not apply to CPU re-forwarded packets (DHCP snooping (v4, v6), ND snooping, RA guard, IGMP, MLD, and mDNS).

The `no` form of this command resets the GBP infra tag value to its default of 2.

The same GBP infra role tag value must be used across the VXLAN network fabric.

Parameter	Description
<TAG-VALUE>	Specifies the infra tag value to use for CPU-generated packets. Range: 1 to 8191. Default: 2.

Examples

Setting the GBP infra tag value to 10:

```
switch(config)# gbp role infra 10
```

Resetting the GBP infra tag value to its default of 2:

```
switch(config)# no gbp role infra
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series.
10.08	Command introduced.

Command Information

Platforms	Command context	Authority
8100 8360	`config`	Administrators or local user group members with execution rights for this command.

class gbp-ip

```
class gbp-ip <CLASS-NAME>
         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [count]

         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {sctp | tcp | udp}
         {any | <SRC-ROLE-NAME> | default}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         {any | <DST-ROLE-NAME>}
```

```
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         [count]

         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {icmp}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [icmp-type {echo | echo-reply | <ICMP-TYPE-VALUE>}] [icmp-code <ICMP-CODE-
VALUE>]
         [count]

         [<SEQUENCE-NUMBER>] comment <TEXT-STRING>

class gbp-ip <CLASS-NAME> resequence <STARTING-SEQUENCE-NUMBER> <INCREMENT>

class gbp-ip <CLASS-NAME> copy <DESTINATION-CLASS>

no class gbp-ip <CLASS-NAME>
      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [count]

      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {sctp | tcp | udp}
         {any | <SRC-ROLE-NAME> | default}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         {any | <DST-ROLE-NAME>}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         [count]

      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {icmp}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [icmp-type {echo | echo-reply | <ICMP-TYPE-VALUE>}] [icmp-code <ICMP-CODE-
VALUE>]
         [count]

      no [<SEQUENCE-NUMBER>] comment <TEXT-STRING>
```

Description

Creates, deletes, or modifies class to match specified protocol packets. A class consists of one or more class entries ordered and prioritized by sequence numbers. Each class can classify traffic based on IPv4 protocol header information.

The `no` keyword deletes either a class or an individual class entry.

Usage

- Entering an existing *<CLASS-NAME>* value modifies the existing class.
- Any new *<SEQUENCE-NUMBER>* value creates an additional class entry.
- Any existing *<SEQUENCE-NUMBER>* value replaces the existing class entry with the same sequence number.
- If no sequence number is specified, a new class entry will be appended with a sequence number equal to the highest policy entry currently in the list plus 10.

- Copying a class to an existing class overwrites the existing entries with new entries.
- Removing a GBP class with entries removes all its entries as well. If a GBP class, that is currently associated with a GBP policy, is attempted to be removed, then a warning message is presented to remove the association before removing the class.
- You can reorder the sequence numbers with the `class resequence` command.
- You can also create redundant class entries in a class that have the same match criteria and action. However, each redundant copy of the class entry will consume additional resources.

Parameter	Description
<CLASS-NAME>	Specifies the class name.
<SEQUENCE-NUMBER>	Specifies the class entry sequence number. Range: `1` to `4294967295`.
{match | ignore}	Creates a rule to ignore or match specified IPv4 packets.
<SRC-ROLE-NAME>	Specifies the source role name.
<DST-ROLE-NAME>	Specifies the destination role name.
<PORT-NUMBER>	Specifies the layer 4 port number. Range: `0` to `65535`.
<MIN-PORT>	Specifies the start port number in the range. Range: `0` to `65535`.
<MAX-PORT>	Specifies the end port number in the range. Range: `0` to `65535`.
<ICMP-TYPE-VALUE>	Specifies a valid ICMP type number. Range: `0` to `255`.
<ICMP-CODE-VALUE>	Specifies a valid ICMP code number. Range: `0` to `255`.

Examples

Creating a group based policy IPv4 class with three entries:

```
switch(config)# class gbp-ip my_gbp_ip_class
switch(config-class-gbp-ip)# 1 match icmp any any
switch(config-class-gbp-ip)# 2 ignore udp default any
switch(config-class-gbp-ip)# 3 match tcp guest admin
switch(config-class-gbp-ip)# 4 count
```

Adding a comment to an existing GBP IPv4 class entry:

```
switch(config)# class gbp-ip my_gbp_ip_class
switch(config-class-gbp-ip)# 3 comment mygbpipClass
```

Removing a comment from an existing class entry:

```
switch(config)# class gbp-ip my_gbp_ip_class
switch(config-class-gbp-ip)# no 3 comment
```

Replacing an IPv4 class entry in an existing GBP IPv4 class:

```
switch(config)# class gbp-ip my_gbp_ip_class
switch(config-class-gbp-ip)# 1 match igmp any any
```

Resequencing a GBP IPv4 class:

```
switch(config)# class gbp-ip my_gbp_ip_class resequence 1 10
```

Removing a GBP IPv4 class entry:

```
switch(config)# class gbp-ip my_gbp_ip_class
switch(config-class-gbp-ip)# no 1
```

Copying a GBP class entries from the source to the destination:

```
switch(config)# class gbp-ip my_gbp_ip_class copy my_gbp_ip_class2
```

Removing a GBP IPv4 class:

```
switch(config)# no class gbp-ip my_gbp_ip_class
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

class gbp-ipv6

```
class gbp-ipv6 <CLASS-NAME>
         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [count]
```

```
         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {sctp | tcp | udp}
         {any | <SRC-ROLE-NAME> | default}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         {any | <DST-ROLE-NAME>}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         [count]

         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {icmpv6}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [icmp-type {echo | echo-reply | <ICMP-TYPE-VALUE>}] [icmp-code <ICMP-CODE-
VALUE>]
         [count]

         [<SEQUENCE-NUMBER>] comment <TEXT-STRING>

class gbp-ipv6 <CLASS-NAME> resequence <STARTING-SEQUENCE-NUMBER> <INCREMENT>

class gbp-ipv6 <CLASS-NAME> copy <DESTINATION-CLASS>

no class gbp-ipv6 <CLASS-NAME>
      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [count]

      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {sctp | tcp | udp}
         {any | <SRC-ROLE-NAME> | default}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         {any | <DST-ROLE-NAME>}
         [{eq | gt | lt} <PORT-NUMBER> | range <MIN-PORT> <MAX-PORT>]
         [count]

      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {icmpv6}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         [icmp-type {echo | echo-reply | <ICMP-TYPE-VALUE>}] [icmp-code <ICMP-CODE-
VALUE>]
         [count]

      no [<SEQUENCE-NUMBER>] comment <TEXT-STRING>
```

Description

Creates, deletes, or modifies class to match specified protocol packets. A class consists of one or more class entries ordered and prioritized by sequence numbers. Each class can classify traffic based on IPv6 protocol header information.

The `no` keyword deletes either a class or an individual class entry.

Usage

- Entering an existing *<CLASS-NAME>* value modifies the existing class.
- Any new *<SEQUENCE-NUMBER>* value creates an additional class entry.
- Any existing *<SEQUENCE-NUMBER>* value replaces the existing class entry with the same sequence number.
- If no sequence number is specified, a new class entry will be appended with a sequence number equal to the highest policy entry currently in the list plus 10.
- Copying a class to an existing class overwrites the existing entries with new entries.
- Removing a GBP class with entries removes all its entries as well. If a GBP class, that is currently associated with a GBP policy, is attempted to be removed, then a warning message is presented to remove the association before removing the class.
- You can reorder the sequence numbers with the `class resequence` command.
- You can also create redundant class entries in a class that have the same match criteria and action. However, each redundant copy of the class entry will consume additional resources.

Parameter	Description
<CLASS-NAME>	Specifies the class name.
<SEQUENCE-NUMBER>	Specifies the class entry sequence number. Range: `1` to `4294967295`.
{match | ignore}	Creates a rule to ignore or match specified IPv6 packets.
<SRC-ROLE-NAME>	Specifies the source role name.
<DST-ROLE-NAME>	Specifies the destination role name.
<PORT-NUMBER>	Specifies the layer 4 port number. Range: `0` to `65535`.
<MIN-PORT>	Specifies the start port number in the range. Range: `0` to `65535`.
<MAX-PORT>	Specifies the end port number in the range. Range: `0` to `65535`.
<ICMP-TYPE-VALUE>	Specifies a valid ICMP type number. Range: `0` to `255`.
<ICMP-CODE-VALUE>	Specifies a valid ICMP code number. Range: `0` to `255`.

Examples

Creating a group based policy IPv6 class with three entries:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class
switch(config-class-gbp-ipv6)# 10 match icmpv6 any any
switch(config-class-gbp-ipv6)# 20 ignore udp default any
```

Adding a comment to an existing GBP IPv6 class entry:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class
switch(config-class-gbp-ipv6)# 10 match icmpv6 any any
switch(config-class-gbp-ipv6)# 20 ignore udp default any
switch(config-class-gbp-ipv6)# 20 comment myipv6Class
```

Removing a comment from an existing class entry:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class
switch(config-class-gbp-ipv6)# no 20 comment
```

Replacing an IPv6 class entry in an existing GBP IPv6 class:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class
switch(config-class-gbp-ipv6)# 10 match any any admin
```

Resequencing a GBP IPv6 class:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class resequence 1 1
```

Removing a GBP IPv6 class entry:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class
switch(config-class-gbp-ipv6)# no 1
```

Copying a GBP class entries from the source to the destination:

```
switch(config)# class gbp-ipv6 my_gbp_ipv6_class copy my_gbp_ipv6_class2
```

Removing a GBP IPv6 class:

```
switch(config)# no class gbp-ipv6 my_gbp_ipv6_class
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

class gbp-mac

```
class gbp-mac <CLASS-NAME>
         [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         {any | aarp | appletalk | arp | fcoe | fcoe-init | ip | ipv6 | ipx-arpa | ipx-
non-arpa |
          is-is | lldp | mpls-multicast | mpls-unicast | q-in-q | rbridge | trill |
          wake-on-lan | <NUMERIC-ETHERTYPE>}
         [count]

         [<SEQUENCE-NUMBER>] comment <TEXT-STRING>

class gbp-mac <CLASS-NAME> resequence <STARTING-SEQUENCE-NUMBER> <INCREMENT>

class gbp-mac <CLASS-NAME> copy <DESTINATION-CLASS>

no class gbp-mac <CLASS-NAME>
      no [<SEQUENCE-NUMBER>]
         {match | ignore}
         {any | <SRC-ROLE-NAME> | default}
         {any | <DST-ROLE-NAME>}
         {any | aarp | appletalk | arp | fcoe | fcoe-init | ip | ipv6 | ipx-arpa | ipx-
non-arpa |
          is-is | lldp | mpls-multicast | mpls-unicast | q-in-q | rbridge | trill |
          wake-on-lan | <NUMERIC-ETHERTYPE>}
         [count]

      no [<SEQUENCE-NUMBER>] comment <TEXT-STRING>
```

Description

Creates, deletes, or modifies class to match specified protocol packets. A class consists of one or more class entries ordered and prioritized by sequence numbers. Each class can classify traffic based on MAC information.

The `no` keyword deletes either a class or an individual class entry.

Usage

- Entering an existing *<CLASS-NAME>* value modifies the existing class.
- Any new *<SEQUENCE-NUMBER>* value creates an additional class entry.
- Any existing *<SEQUENCE-NUMBER>* value replaces the existing class entry with the same sequence number.
- If no sequence number is specified, a new class entry will be appended with a sequence number equal to the highest policy entry currently in the list plus 10.
- Copying a class to an existing class overwrites the existing entries with new entries.
- Removing a GBP class with entries removes all its entries as well. If a GBP class, that is currently associated with a GBP policy, is attempted to be removed, then a warning message is presented to remove the association before removing the class.
- You can reorder the sequence numbers with the `class resequence` command.
- You can also create redundant class entries in a class that have the same match criteria and action. However, each redundant copy of the class entry will consume additional resources.

Parameter	Description
<CLASS-NAME>	Specifies the class name.
<SEQUENCE-NUMBER>	Specifies the class entry sequence number. Range: `1` to `4294967295`.
{match | ignore}	Creates a rule to ignore or match specified packets.
<SRC-ROLE-NAME>	Specifies the source role name.
<DST-ROLE-NAME>	Specifies the destination role name.
<NUMERIC-ETHERTYPE>	Specifies the EtherType number. Range: `0x600` to `0xffff`.

Examples

Creating a GBP MAC class with three entries:

```
switch(config)# class gbp-mac my_gbp_mac_class
switch(config-class-gbp-mac)# 1 match any any lldp
switch(config-class-gbp-mac)# 2 ignore default any arp
```

Adding a comment to an existing GBP MAC class entry:

```
switch(config)# class gbp-mac my_gbp_mac_class
switch(config-class-gbp-mac)# 10 comment myGbpMacClass
```

Removing a comment from an existing class entry:

```
switch(config)# class gbp-mac my_gbp_mac_class
switch(config-class-gbp-mac)# no 10 comment myGbpMacClass
```

Replacing a MAC class entry in an existing GBP MAC class:

```
switch(config)# class gbp-mac my_gbp_mac_class
switch(config-class-gbp-mac)# 10 match any any any
```

Resequencing a GBP MAC class:

```
switch(config)# class gbp-mac my_gbp_mac_class resequence 1 1
```

Removing a GBP MAC class entry:

```
switch(config)# class gbp-mac my_gbp_mac_class
switch(config-class-gbp-mac)# no 1
```

Copying a GBP class entries from the source to the destination:

```
switch(config)# class gbp-mac my_gbp_mac_class copy my_gbp_mac_class2
```

Removing a GBP MAC class:

```
switch(config)# no class gbp-mac my_gbp_mac_class
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

port-access gbp

```
port-access gbp <POLICY-NAME>
         [<SEQUENCE-NUMBER>]
         class {gbp-ip | gbp-ipv6 | gbp-mac} <CLASS-NAME> [action {drop}]
         [<SEQUENCE-NUMBER>] comment <TEXT-STRING>

port-access gbp <POLICY-NAME> resequence <STARTING-SEQUENCE-NUMBER> <INCREMENT>
port-access gbp <POLICY-NAME> copy <DESTINATION-POLICY>
port-access gbp <POLICY-NAME> reset

no port-access gbp <POLICY-NAME>
    [no] [<SEQUENCE-NUMBER>]
         class {gbp-ip | gbp-ipv6 | gbp-mac} <CLASS-NAME> [action {drop}]
    [no] [<SEQUENCE-NUMBER>] comment <TEXT-STRING>
```

Description

Creates, deletes, or modifies a group based policy and its entries. Group based policy consists of one or more policy entries that are ordered and prioritized by sequence numbers. Each entry has a GBP-IPv4, GBP-IPv6, or a GBP-MAC class, and corresponding drop or permit policy actions associated with it.

The `no` form of the command deletes either a group based policy or an individual policy entry.

When configuring GBP-MAC class along with other classes, you must configure the GBP-MAC class entry at the end. For example, if you configure as shown below:

```
port-access gbp gbp1
          class gbp-mac class1
          class gbp-ip class2 action drop
```

Although, you would want to drop GBP-IPv4 traffic, it will be allowed because traffic will be allowed because of the MAC rule. In order to drop traffic, you must configure as show below:

```
port-access gbp gbp1
```

```
class gbp-ip class2 action drop
class gbp-mac class1
```

Usage

To use a GBP, you must associate the policy with a role using the `associate gbp` command.

- A group based policy that is in use cannot be removed from the configuration. To remove, the policy must be unassociated with the roles currently using the policy.
- Entering an existing *<POLICY-NAME>* value modifies the existing policy, with any new sequence number creating an additional policy entry, and any existing sequence number replacing the existing policy entry with the same sequence number.
- If no sequence number is specified, a new policy entry will be appended with a sequence number equal to the highest policy entry currently in the list plus 10.
- You can reorder the sequence numbers with the `class resequence` command.

Parameter	Description
<POLICY-NAME>	Specifies the class name.
<SEQUENCE-NUMBER>	Specifies the policy entry sequence number. Range: `1` to `4294967295`.
`class-type`	Specifies the type of class to associate with the policy.
<CLASS-NAME>	Specifies the class name.
`action`	Specifies the action for the class. The default action is to permit all traffic.

Examples

Creating a policy and associating it with GBP IPv4 class to permit all traffic:

```
switch(config)# port-access gbp policy01
switch(config-pa-role)# 10 class my_gbp_ip_class
```

Creating a policy and associating it with GBP MAC class to deny all traffic:

```
switch(config)# port-access gbp policy01
switch(config-pa-role)# 10 class my_gbp_mac_class action drop
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

port-access role associate gbp

```
port-access role <ROLE-NAME>
       associate gbp <POLICY-NAME>
no port-access role <ROLE-NAME>
    no associate gbp <POLICY-NAME>
```

Description

Associates a group based policy with a role.

The no form of this command dissociates the policy from the role.

Parameter	Description
<ROLE-NAME>	Specifies the role name.
<POLICY-NAME>	Specifies the group based policy name to associate with the role.

Examples

Associating a policy with a role:

```
switch(config)# port-access role EMPLOYEE
switch(config-pa-role)# associate gbp GROUPPOLICY
```

Dissociating a policy from the role:

```
switch(config)# port-access role EMPLOYEE
switch(config-pa-role)# no associate GBP
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

clear port-access gbp hitcounts

```
clear port-access gbp [<POLICY-NAME>] hitcounts {client}
```

Description

Clears the statistics of the group based policy applied on the client.

Parameter	Description
<TLV-NUMBER>	Specifies the CDP TLV number. Supported values are 1 to 6, 10, and 11.

Examples

Clearing statistics of GBP applied on the client:

```
switch(config)# clear port-access gbp policy01 hitcounts {client}
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

show gbp role-mapping

```
show gbp role-mapping
```

Description

Shows the list of default and configured mappings between role name and role ID.

Examples

Showing details of role name to role iD mapping:

```
switch (config)# show gbp role-mapping
GBP status : Enabled
GBP_ROLE                    GBP_ROLE_ID
-------------               ---------------
default                     0
infra                       2
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch Series.
10.08	Command introduced

Command Informations

Platforms	Command context	Authority
8100 8360	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

show class

`show class {gbp-ip | gbp-ipv6 | gbp-mac} <CLASS-NAME> [commands] [configuration]`

Description

Shows details of class configuration and its entries. Displays the active configuration providing the list of classes that have been configured and accepted by the system.

Usage

The `show class` command along with the `configuration` option displays the classes that are configured. The output of this command may not be the same as what is active due to unsupported command parameters or if the class was modified after the GBP policy was applied and might have been unsuccessful due to a lack of hardware resources. To determine if there is a discrepancy between what was configured and what is active, compare the output of the `show class` and the `show class configuration` commands. If the active class configuration and the configured class is not the same, a warning message is displayed to help troubleshoot the difference.

Parameter	Description
<CLASS-NAME>	Specifies the class name.

Examples

Showing configured GBP classes:

```
switch# show class
Type Name
    Sequence Comment
           action                       L3 Protocol
           Source Role Name             Source L4 Port(s)
           Destination Role Name        Destination L4 Port(s)
           Additional Parameters
-----------------------------------------------------------------
ip  my_gbpipv4class
        10 my first class entry comment
           match                        icmp
           guest
           admin
        20 my second class entry comment
           ignore                       tcp
           guest                        < 3000
           finance                      > 2000
```

Showing commands in the GBP class:

```
switch# show class
Type Name
    Sequence Comment
           action                       L3 Protocol
           Source Role Name             Source L4 Port(s)
           Destination Role Name        Destination L4 Port(s)
           Additional Parameters
-----------------------------------------------------------------
ip  my_gbpipv4class
        10 my first class entry comment
           match                        icmp
           guest
           admin
        20 my second class entry comment
           ignore                       tcp
           guest                        < 3000
           finance                      > 2000
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	`config` `config-class-<CLASS-TYPE>`	Administrators or local user group members with execution rights for this command.

show port-access gbp

`show port-access gbp [<POLICY-NAME>]`

Description

Shows details of the group based policies and its current usage.

Parameter	Description
<POLICY-NAME>	Specifies the GBP policy name.

Examples

Showing details of group based policy:

```
switch (config)# show port-access gbp

Port Access GBP Details:
========================

GBP Name   : plcy
GBP Type   : Local
GBP Status : Rejected

SEQUENCE    CLASS                          TYPE     ACTION
----------- ------------------------------ -------- --------------------------------
--
10          cs                             gbp-ipv4 drop
20          cls6                           gbp-ipv6 permit
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
8360 8100	config config-class-*<CLASS-TYPE>*	Administrators or local user group members with execution rights for this command.

show port-access gbp hitcounts

`show port-access gbp [<POLICY-NAME>] hitcounts {client}`

Description

Shows statistics of the group based policy applied on the client. The output of this command helps to identify the group based policy entries that are currently matched.

Parameter	Description
<POLICY-NAME>	Specifies the GBP policy name.

Examples

Showing GBP statistics:

```
switch (config)# show port-access gbp gbp2000 hitcounts

Port Access GBP Hit-Counts Details:
===================================

GBP Name : gbp2000
GBP Type : Local
GBP Status : Applied

SEQUENCE    CLASS                           TYPE     ACTION
----------- ------------------------------- -------- ----------------------
10          class2000                       gbp-ipv4 permit
15          classinfra                      gbp-ipv4 permit
30          classmacinfra                   gbp-mac  permit

Class Name : class2000
Class Type : gbp-ipv4

SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
10          match tcp Role6 Role1 count                                10
20          match udp default Role1 count                              0

Class Name : classinfra
Class Type : gbp-ipv4

SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
10          match udp infra Role1 count                                4
20          match icmp infra Role1 count                               5

Class Name : classmacinfra
Class Type : gbp-mac

SEQUENCE    CLASS-ENTRY                                                HIT-COUNT
----------- ---------------------------------------------------------- -----------
10          match arp infra Role1 count                                0
```

Command History

Release	Modification
10.12	Added support for the 8100 Switch series
10.10	Added support for the 8360 Switch series
10.08	Command introduced

Command Information

Platforms	Command context	Authority
	Operator (>) or Manager (#)	Operators or Administrators or local user group members with execution rights for this command. Operators can execute this command from the operator context (>) only.

Several measures can be taken to enhance switch security, including setting secure mode to enhanced in the Service OS. For maximum security, perform all the configuration described in this chapter.

Configuring enhanced security

Prerequisites

If you have switch configuration that you want to retain, create a backup. This procedure erases all configuration, including the current running configuration, the startup configuration, and all historical configuration checkpoints.

Procedure

1. Set enhanced security mode:
   a. Reboot the switch into the Service OS with command `boot system serviceos`. If on an 8400 Switch with both Management Modules:
      i. Issue the `boot` command only on the active Management Module. This command ensures that both Management Modules are booted into the Service OS.
      ii. Perform steps b to e on both modules starting with the active module.
   b. Log in to the Service OS as `admin`.
   c. Enter command `secure-mode enhanced`.
   d. When prompted about the mode change, respond with `y` for "yes."
   e. Wait for the reboot and zeroization to complete. The switch firmware boots automatically.

2. Ensure adequate password requirements:
   a. Before adding users, enable and configure password complexity as described in password complexity. To maintain enhanced security, configure the `password complexity` subcommand settings no smaller than their defaults.
   b. Configure passwords for all users, including `admin`. To make your password complexity settings applicable to the default admin user, change the admin password after enabling password complexity. The new admin password must respect your password complexity settings.

3. Ensure proper login management as follows:
   a. Configure local user session management as described in CLI user session management commands using `cli-session` and its subcommands `max-per-user`, `timeout`, and `tracking-range` to achieve the wanted configuration. To maintain enhanced security, configure `cli-session` subcommand settings no smaller than their defaults.
   b. Restrict remote SSH connections to only use certified crypto algorithms using `ssh certified-algorithms-only`.
   c. Configure pre- and post-login banners using respectively, `banner motd`, and `banner exec`.

4. Ensure that the switch date and time is accurately set using `clock datetime <DATE> <TIME>`.
5. When logging to a remote syslog server is required, ensure that the connection to the server is cryptographically secure. See Configuring remote logging using SSH reverse tunnel.

To ensure that enhanced security is maintained, also respect these requirements:

- Do not configure remote logging with a remote server directly without setting up an SSH tunnel.
- Do not configure passwords and secret keys using the plaintext option.

When in enhanced security mode, the switch (Product OS) `start-shell` command is disabled for security purpose. If you attempt to use this command while in enhanced security mode, it is rejected and the following error message is displayed:

```
The start-shell command is not available in enhanced secure mode.
```

When in enhanced security mode, the following Service OS commands are disabled for security purposes: `config-clear`, `password`, `sh`, and `update`. If you attempt to use any of these Service OS commands while in enhanced security mode, the command is rejected and an error message is displayed.

Configuring remote logging using SSH reverse tunnel

Logging to a remote syslog server can be made cryptographically secure by using SSH reverse tunnel. The `syslog` daemon on the switch forwards log messages to the SSH tunnel, and the SSH tunnel endpoint on the remote server host forwards messages to the listening `syslog` server.

This procedure includes sample configuration commands for a user-supplied syslog server based on Ubuntu 14.04.5 LTS with `rsyslog`. It is up to the user to check their server documentation and adjust the sample commands as required. Optionally see your server documentation for information on how to use the `systemd` and `autossh` services to automatically restore the SSH tunnel after system reboot.

Prerequisites

The user-supplied remote syslog server must be on a network that can reach the switch management interface.

Procedure

1. Configure SSH server on the switch.
   a. Enter these commands (although this example uses the mgmt VRF, other VRFs can be used):
   ```
   switch(config)# interface mgmt
   switch(config-if-mgmt)# no shutdown
   switch(config-if-mgmt)# ip address <switch_mgmt_IP>
   switch(config-if-mgmt)# exit
   switch(config)# ssh server vrf mgmt
   ```
   b. If public key authentication is desired for remote SSH users, configure it on the switch:
   ```
   switch(config)# user admin authorized-key <PUBKEY>
   ```
2. Configure logging on the switch to forward to localhost:
   ```
   switch(config)# logging localhost tcp <switch_tcp_port> vrf mgmtinclude-auditable-events
   ```

3. Configure the `rsyslog` server on the remote host:
   a. Make `rsyslog` accept TCP connections and specify the log file, by adding the following to `/etc/rsyslog.conf`:
   ```
   $ModLoad  imtcp
   $InputTCPServerRun <server_tcp_port>
   $template RemoteLogs,"/var/log/remote.log"
   *.* ?RemoteLogs
   ```
   b. To activate the added configuration, restart the `rsyslog` server:
   ```
   root@Ubuntu4479:~#sudo service rsyslog restart
   ```
4. Establish an SSH reverse tunnel from the remote host to the switch:
   ```
   root@Ubuntu4479:~#ssh -nNTx -R
   <switch_tcp_port>:127.0.0.1:<server_tcp_port>
   admin@<switch_mgmt_IP>
   ```

CLI user session management commands

cli-session

```
cli-session
no cli-session
```

Description

Enters the CLI session context (shown in the switch prompt as `config-cli-session`) for the purpose of configuring CLI user session management. Session management enhances security by enforcing specific CLI user session requirements. The following information is provided at time of successful login:

- When applicable, the number of failed login attempts since the most recent successful login.
- The date, time, and location (console or IP address or hostname) of the most recent previous successful login.
- The count of successful logins within the past (configurable) time period.

For example:

```
switch login: admin
Password:

There were 3 failed login attempts since the last successful login
Last login: 2019-04-20 08:51:33 from the console
User "admin" has logged in 73 times in the past 30 days
```

The no form of this command disables concurrent CLI user session restrictions and reverts `timeout` and `tracking-range` to their default values.

To ensure that enhanced security is maintained, it is recommended that you keep CLI user session management fully enabled by setting `max-per-user` to a nondefault value.

The `cli-session` command applies only to SSH/console login connection types. It does not apply to other connection types such as REST.

Subcommands

These subcommands are available within the CLI session context.

```
[no] max-per-user  <SESSIONS>
```

Specifies the maximum number of concurrent CLI sessions per user. The no form of this subcommand disables concurrent CLI user session restrictions. Default: Disabled (no value). Range: 1 to 5.

When the same user name is configured for both local and remote authentication, both users, regardless of privilege level, are considered to be the same user for the purpose of counting concurrent CLI sessions. For example, with `max-per-user` set to 1 and user `admin1` configured for local and remote authentication, only the local user `admin1` or the remote user `admin1` can be logged in at any given moment. Both `admin1` users cannot be logged in simultaneously unless `max-per-user` is increased to at least 2.

`[no] timeout <MINUTES>`

Specifies the number of minutes a CLI session can be idle before the session is automatically terminated and the user is logged out. A value of 0 minutes disables the session timeout. The no form of this subcommand sets the timeout value to the default. Default 30: Range 0 to 4320.

This subcommand is the recommended replacement for the `session-timeout` command.

`[no] tracking-range <DAYS>`

Specifies the maximum number of days to track CLI user session logins. The no form of this subcommand resets the value to its default. Default 30: Range 1 to 30.

`exit`

Exits the CLI session context.

`end`

Exits the CLI session context and then the config context.

Examples

Configuring CLI user session settings for a maximum of one concurrent session, a 20-minute timeout, and tracking for a maximum of 25 days.

```
switch(config)# cli-session
switch(config-cli-session)# max-per-user 1
switch(config-cli-session)# timeout 20
switch(config-cli-session)# tracking-range 25
switch# exit
```

After successful earlier logins, logging in from the console without any intervening unsuccessful logins.

```
switch login: admin1
Password:

Last login: 2019-04-15 14:10:21 from the console
User 'admin1' has logged in 65 times in the past 25 days
```

Attempting to log in as `admin1` when already logged in as `admin1` from elsewhere.

```
switch login: admin1
Password:
Too many logins for 'admin1'
```

After successful earlier logins, attempting to log in twice with an invalid password, followed by a successful login.

```
switch login: admin1
Password:

Login incorrect
switch login: admin1
Password:

Login incorrect
switch login: admin1
Password:

There were 2 failed login attempts since the last successful login
Last login: 2019-04-15 17:22:45 from 192.168.1.1
User 'admin1' has logged in 72 times in the past 25 days
```

Command History

Release	Modification
10.07 or earlier	--

Command Information

Platforms	Command context	Authority
All platforms	`config`	Administrators or local user group members with execution rights for this command.

The `auditors` group enables administrators to create users that can perform auditing tasks without allowing those users the authority to view or change the switch configuration.

As is the case for other users, auditors can access the switch using the Web UI, REST API, or the CLI.

Auditing tasks (CLI)

When you log on to the switch CLI as a user with auditor rights, you have access to the auditor command context only.

```
auditor>
```

The tasks that can be performed by auditors are as follows. The commands listed are the only commands auditors can execute other than session commands like `print`, `list`, and `exit`. However, auditors can use all command options except as noted. See the command description for each command for complete information about the command.

Task	Command name	Example
Show event log contents	`show events`	`show events -a -r`
Show local accounting log contents	`show accounting log`	`show accounting log last 10`
Copy command output to a remote server or to a local USB drive.	`copy command-output`	`copy command-output "show events -a -r" tftp://10.100.0.12/file`

When using the `copy command-output command`, users with auditor rights can specify the following commands only:

`show accounting log`

`show events`

Auditing tasks (Web UI)

Auditors have access to the Log page only. When you log on to the switch Web UI as a user with auditor rights, the Log page is displayed.

From the Log page, you can view and export event log entries.

The Web UI does not provide access to the accounting logs.

REST requests and accounting logs

All REST requests—including GET requests—are logged to the accounting (audit) log.

The URI of the REST API resource for accounting logs is the following:
`/rest/v10.04/logs/audit`

In an accounting log entry for a REST request:

- `service=https-server` indicates that the log entry is a result of a REST API request or a Web UI action.
- The string value of `data` identifies the REST API request that was executed.

For more information about accounting log entries, see the description of the `show accounting log` CLI command.

Accessing Aruba Support

Aruba Support Services	https://www.arubanetworks.com/support-services/
AOS-CX Switch Software Documentation Portal	https://www.arubanetworks.com/techdocs/AOS-CX/help_portal/Content/home.htm
Aruba Support Portal	https://asp.arubanetworks.com/
North America telephone	1-800-943-4526 (US & Canada Toll-Free Number) +1-408-754-1200 (Primary - Toll Number) +1-650-385-6582 (Backup - Toll Number - Use only when all other numbers are not working)
International telephone	https://www.arubanetworks.com/support-services/contact-support/

Be sure to collect the following information before contacting Support:

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Other useful sites

Other websites that can be used to find information:

Airheads social forums and Knowledge Base	https://community.arubanetworks.com/
AOS-CX Switch Software Documentation Portal	https://www.arubanetworks.com/techdocs/AOS-CX/help_portal/Content/home.htm
Aruba Hardware Documentation and Translations	https://www.arubanetworks.com/techdocs/hardware/DocumentationPortal/Content/home.htm

Portal	
Aruba software	https://asp.arubanetworks.com/downloads
Software licensing	https://lms.arubanetworks.com/
End-of-Life information	https://www.arubanetworks.com/support-services/end-of-life/
Aruba Developer Hub	https://developer.arubanetworks.com/

Accessing Updates

You can access updates from the Aruba Support Portal or the HPE My Networking Website.

Aruba Support Portal

https://asp.arubanetworks.com/downloads

If you are unable to find your product in the Aruba Support Portal, you may need to search My Networking, where older networking products can be found:

My Networking

https://www.hpe.com/networking/support

To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

https://support.hpe.com/portal/site/hpsc/aae/home/

Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HP Passport set up with relevant entitlements.

Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.

To subscribe to eNewsletters and alerts:

https://asp.arubanetworks.com/notifications/subscriptions (requires an active Aruba Support Portal (ASP) account to manage subscriptions). Security notices are viewable without an ASP account.

Warranty Information

To view warranty information for your product, go to https://www.arubanetworks.com/support-services/product-warranties/.

Regulatory Information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at https://www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Aruba is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements, environmental data (company programs, product recycling, energy efficiency), and safety information and compliance data, (RoHS and WEEE). For more information, see https://www.arubanetworks.com/company/about-us/environmental-citizenship/.

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