



Configuring Port Security

All switches in the Cisco MDS 9000 Family provide port security features that reject intrusion attempts and report these intrusions to the administrator.

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Note

Port security is only supported for Fibre Channel ports.

Port Security Features

Typically, any Fibre Channel device in a SAN can attach to any SAN switch port and access SAN services based on zone membership. Port security features prevent unauthorized access to a switch port in the Cisco MDS 9000 Family:

- Login requests from unauthorized Fibre Channel devices (Nx ports) and switches (xE ports) are rejected.
- All intrusion attempts are reported to the SAN administrator through syslog messages.

Enforcing Port Security

To enforce port security, configure the devices and switch port interfaces through which each device or switch is connected.

- Use the port world wide name (pWWN) or the node world wide name (nWWN) to specify the Nx port connection for each device.
- Use the switch world wide name (sWWN) to specify the xE port connection for each switch.

Each Nx and xE port can be configured to restrict a single port or a range of ports.

Enforcement of port security policies are done on every activation and when the port tries to come up.

The port security feature requires all devices connecting to a switch to be part of the port security active database. The software uses this active database to enforce authorization.

About Auto-Learn

You can instruct the switch to automatically learn (auto-learn) the port security configurations over a specified period. This feature allows any switch in the Cisco MDS 9000 Family to automatically learn about devices and switches that connect to it. Use this feature to activate the port security feature for the first time as it saves tedious manual configuration for each port. Auto-learn is configured on a per-VSAN basis. If enabled, devices and switches that are allowed to connect to the switch are automatically learned, even if you have not configured any port access.

By default, the port security feature is not activated in any switch in the Cisco MDS 9000 Family.

Activating Port Security

When you activate the port security feature, the **auto-learn** option is also automatically enabled. You can choose to activate the port-security feature and disable **auto-learn** using the **port-security activate vsan number no-auto-learn** command. In this case, you need to manually populate the port security database by individually securing each port.

Learned entries on a port are cleaned up after you issue a **shutdown** command on that port.

To enable the port security feature, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security activate vsan 1	Activates the port security database for the specified VSAN, and automatically enables auto-learn.
	switch(config)# no port-security activate vsan 1	Deactivates the port security database for the specified VSAN, and automatically disables auto-learn.

To enable the port security feature, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security activate vsan 1 no-auto-learn	Disables the auto-learn feature for the port security database in VSAN 1.

Configuring Auto-Learn

The state of the auto-learning configuration depends on the state of the port security feature:

- If the port security feature is not activated, the **auto-learn** option is disabled by default.
- If the port security feature is activated, the **auto-learn** option is enabled by default (unless it is turned off using the **port-security activate vsan number no-auto-learn** command).

To enable the **auto-learn** option, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security auto-learn vsan 1	Enables auto-learn so the switch can learn about any device that is allowed to access VSAN 1. These devices are logged in the port security active database.
	switch(config)# no port-security auto-learn vsan 1	Disables auto-learn and stops the switch from learning about new devices accessing the switch. Enforces the database contents based on the devices learned up to this point.



Tip

If the **auto-learn** option is enabled on a VSAN, you cannot activate the database for that VSAN without the **force** option.

Table 18-1 summarizes the authorized connection for device requests.

Table 18-1 Auto-Learn Device Authorization

Device (pWWN, nWWN, sWWN)	Requests Connection to	Authorization	Condition
Configured with one or more switch ports	A switch on configured ports	Permitted	1
	A switch on other ports	Denied	2
Not configured	A port that is not configured	Permitted if auto-learn enabled	3
		Denied if auto-learn disabled	4
Configured or not configured	A switch port that allows any device	Permitted	5
Configured to log in to any switch port	Any port on the switch	Permitted	6
Not configured	A port configured with some other device	Denied	7

Authorization Scenario

Assume that the port security feature is activated and the following conditions are specified in the active database:

- A pWWN (P1) is allowed access through interface fc1/1 (F1).
- A pWWN (P2) is allowed access through interface fc1/1 (F1).
- A nWWN (N1) is allowed access through interface fc1/2 (F2).
- Any WWN is allowed access through interface fc1/3 (F3).
- A nWWN (N3) is allowed access through any interface.
- A pWWN (P3) is allowed access through interface fc1/4 (F4).
- A sWWN (S1) is allowed access through interface fc1/10-13 (F10 to F13).
- A pWWN (P10) is allowed access through interface fc1/11 (F11).

Table 18-2 summarizes the port security authorization results for this active database.

Table 18-2 Authorization Results for Scenario

Scenario	Device Connection Request	Authorization	Condition	Reason
1	P1, N2, F1	Permitted	1	No conflict.
2	P2, N2, F1	Permitted	1	No conflict.
3	P3, N2, F1	Denied	2	F1 is bound to P1/P2.
4	P1, N3, F1	Permitted	6	Wildcard match for N3.
5	P1, N1, F3	Permitted	5	Wildcard match for F3.
6	P1, N4, F5	Denied	2	P1 is bound to F1.
7	P5, N1, F5	Denied	2	N1 is only allowed on F2.

Table 18-2 Authorization Results for Scenario (continued)

Scenario	Device Connection Request	Authorization	Condition	Reason
8	P3, N3, F4	Permitted	1	No conflict.
9	S1, F10	Permitted	1	No conflict.
10	S2, F11	Denied	7	P10 is bound to F11.
11	P4, N4, F5 (auto-learn on)	Permitted	3	No conflict.
12	P4, N4, F5(auto-learn off)	Denied	4	No match.
13	S3, F5 (auto-learn on)	Permitted	3	No conflict.
14	S3, F5 (auto-learn off)	Denied	4	No match.
15	P1, N1, F6 (auto-learn on)	Denied	2	P1 is bound to F1.
16	P5, N5, F1 (auto-learn on)	Denied	7	P3 is bound to F1.
17	S3, F4 (auto-learn on)	Denied	7	P3 paired with F4.
18	S1, F3 (auto-learn on)	Permitted	5	No conflict.
19	P5, N3, F3	Permitted	6	Wildcard match for F3 and N3.
20	P7, N3, F9	Permitted	6	Wildcard match for N3.

Manually Configuring Port Security

To configure port security on any switch in the Cisco MDS 9000 Family, follow these steps:

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- Step 1** Identify the WWN of the ports that need to be secured.
 - Step 2** Secure the fWWN to an authorized nWWN or pWWN.
 - Step 3** Activate the port security database.
 - Step 4** Verify your configuration.
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Identifying WWNs to Configure Port Security

If you decide to manually configure port security, be sure to adhere to the following guidelines:

- Identify switch ports by the interface or by the fWWN.
- Identify devices by the pWWN or by the nWWN.
- If an Nx port:
 - is allowed to login to SAN switch port Fx, then that Nx port can only log in through the specified Fx port.
 - nWWN is bound to a Fx port WWN, then all pWWNs in the Nx port are implicitly paired with the Fx port.
- TE port checking is done on each VSAN in the allowed VSAN list of the trunk port.
- All PortChannel xE ports must be configured with the same set of WWNs in the same PortChannel.

- E port security is implemented in the port VSAN of the E port. In this case the sWWN is used to secure authorization checks.
- Once activated, the config database can be modified without any effect on the active database.
- By saving the running configuration, you save the configuration database and activated entries in the active database. Learned entries in the active database are not saved.

Securing Authorized Ports

After identifying the WWN pairs that need to be bound, add those pairs to the port security database.

To configure port security, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security database vsan 1 switch(config-port-security)#	Enters the port security database mode for the specified VSAN.
	switch(config)# no port-security database vsan 1 switch(config)#	Deletes the port security configuration database from the specified VSAN.
Step 3	switch(config-port-security)# swwn 20:01:33:11:00:2a:4a:66 interface port-channel 5	Configures the specified sWWN to only log in through PortChannel 5.
	switch(config-port-security)# any-wwn interface fc1/1 - fc1/8	Configures any WWN to log in through the specified interfaces.
	switch(config-port-security)# pwwn 20:11:00:33:11:00:2a:4a fwwn 20:81:00:44:22:00:4a:9e	Configures the specified pWWN to only log in through the specified fWWN.
	switch(config-port-security)# no pwwn 20:11:00:33:11:00:2a:4a fwwn 20:81:00:44:22:00:4a:9e	Deletes the specified pWWN configured in the previous step.
	switch(config-port-security)# nwwn 26:33:22:00:55:05:3d:4c fwwn 20:81:00:44:22:00:4a:9e	Configures the specified nWWN to log in through the specified fWWN.
	switch(config-port-security)# pwwn 20:11:33:11:00:2a:4a:66	Configures the specified pWWN to log in through any port on the local switch.
	switch(config-port-security)# any-wwn interface fc3/1	Configures any WWN to log in through the specified interface.
	switch(config-port-security)# no any-wwn interface fc2/1	Deletes the wildcard configured in the previous step.

Port Security Database Activation

When you activate the port security database, all entries in the configured database are copied to the active database. After the database is activated, subsequent device login is subject to the activated port bound WWN pairs. Additionally, all devices that have already logged into the VSAN at the time of activation are also learned and added to the active database. If the auto-learn feature is already enabled in a VSAN, you will not be allowed to activate the database.

See the [“About Auto-Learn” section on page 18-2](#).

Activating the Port Security Database

To activate the port database, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security activate vsan 1 switch(config-port-security)#	Activates the port security database for the specified VSAN, and automatically turns on the auto-learn feature.
	switch(config)# no port-security activate vsan 1	Deactivates port security, deletes the active database, and disables auto-learn.

Database Activation Rejection

Database activation is rejected in the following cases:

- Missing or conflicting entries exist in the configuration database but not in the active database.
- If the auto-learn feature was enabled before the activation. To reactivate a database in this state.
- The exact security is not configured for each PortChannel member.
- The configured database is empty but the active database is not.

If the database activation is rejected due to one or more conflicts listed in the previous section, you may decide to proceed by forcing the port security activation.

Forcing Port Security Activation

You can view missing or conflicting entries using the **port-security database diff active vsan** command.

If the **auto-learn** option was enabled before the activation, reactivate the database (see the [“Forcing Port Security Activation”](#) section on page 18-7).

If the database activation is rejected due to one or more conflicts listed in the previous section, you may decide to proceed with the activation by using the **force** option.



Note An activation using the **force** option logs out existing devices if they violate the active database.

To forcefully activate the port security database, follow these steps:

	Command	Purpose
Step 1	switch# config t switch(config)#	Enters configuration mode.
Step 2	switch(config)# port-security activate vsan 1 force	Forces the VSAN 1 port security database to activate despite conflicts.
	switch(config)# no port-security activate vsan 1 force	Reverts to the previously configured state or to the factory default (if no state is configured).

Reactivating the Database


Tip

If the **auto-learn** option is enabled and you activate the database, you will not be allowed to proceed.

To reactivate the database, follow these steps:

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- Step 1** Disable the **auto-learn** option using the **no port-security auto-learn vsan *number*** command.
 - Step 2** Copy the active database to the configured database using the **port-security database copy vsan** command). This command overwrites the configuration database with the active database.
 - Step 3** Activate the database using the **port-security activate vsan *number*** command.
-

Copying the Port Security Database

Use the **port-security database copy vsan** command to copy from the active to the configured database. If the active database is empty, this command is not accepted.

```
switch# port-security database copy vsan 1
switch#
```

Use the **port-security database diff active vsan** command to view the differences between the active database and the configuration database. This command can be used when resolving conflicts.

```
switch# port-security database diff active vsan 1
```

Use the **port-security database diff config vsan** command to obtain information on the differences between the configuration database and the active database.

```
switch# port-security database diff config vsan 1
```

Database Scenarios

Table 18-3 lists the differences and interactiona between the active and configuration databases.

Table 18-3 Active and Configuration Port Security Databases

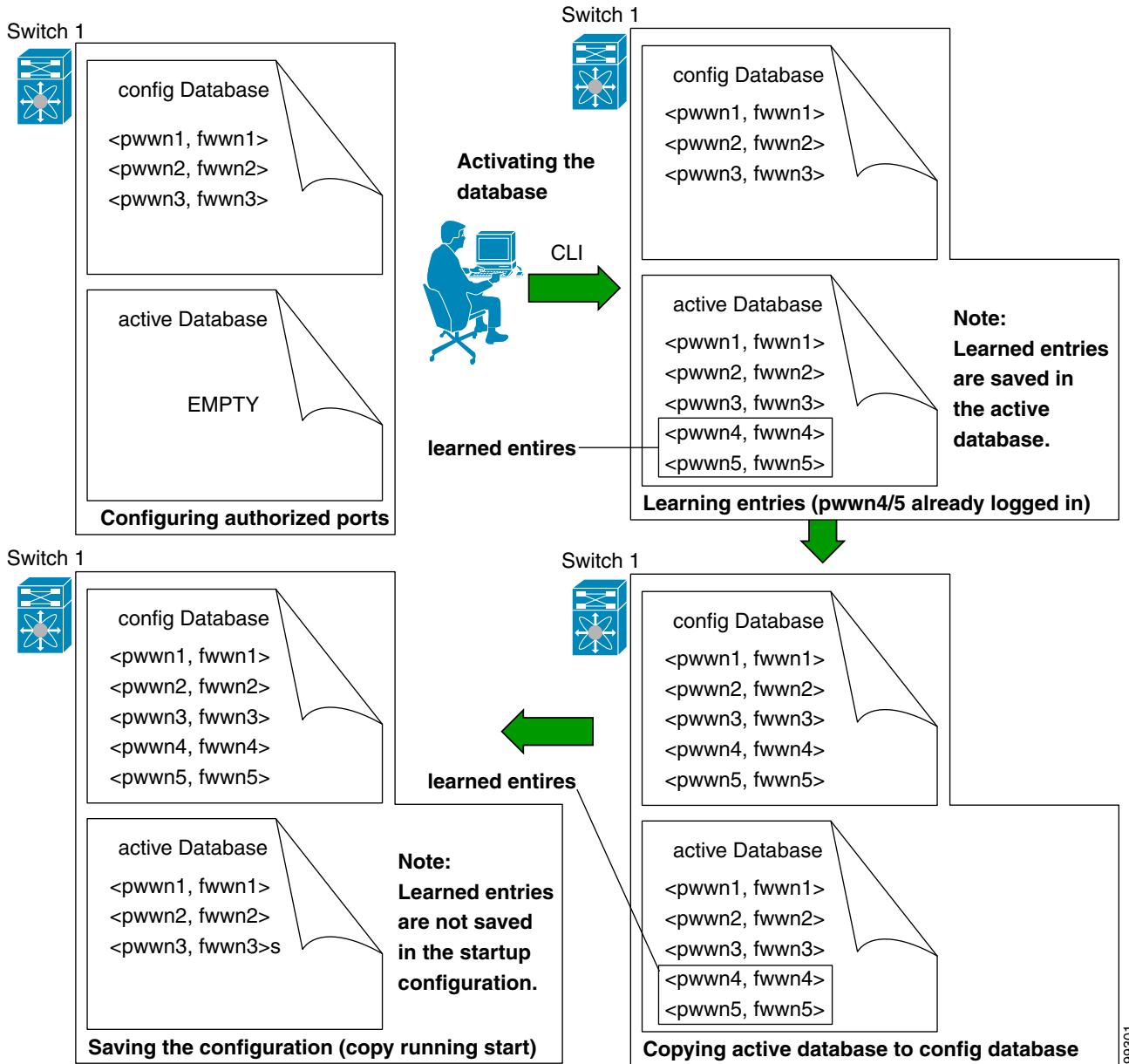
Configuration Database	Active Database
Read-write.	Read-only.
Saving the configuration saves all the entries in the configuration database.	Saving the configuration only saves the activated entries. Learned entries are not saved.
Once activated, the configuration database can be modified without any effect on the active database.	Once activated, all devices that have already logged into the VSAN are also learned and added to the active database.
You can overwrite the configuration database with the active database.	You can overwrite the active database with the configured database by activating the port security database. Forcing an activation may violate the entries already configured in the active database.

Note

You can overwrite the configuration database with the active database using the **port-security database copy vsan** command. The **port-security database diff active vsan** command lists the differences between the active database and the configuration database.

Figure 18-1 depicts various scenarios to depict the active database and the configuration database status based on port security configurations.

Figure 18-1 Port Security Database Scenarios



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Clearing the Port Security Database

Use the **clear port-security statistics** command to clear all existing statistics from the port security database for a specified VSAN.

```
switch# clear port-security statistics vsan 1
```

Use the **clear port-security database auto-learn interface** command to clear any learned entries in the active database for a specified interface within a VSAN. The active database is read-only and this command can be used when resolving conflicts.

```
switch# clear port-security database auto-learn interface fc1/1 vsan 1
```

Use the **clear port-security database auto-learn** command to clear any learned entries in the active database up to for the entire VSAN. The active database is read-only and this command can be used when resolving conflicts.

```
switch# clear port-security database auto-learn vsan 1
```

Deleting the Port Security Database

Use the **no port-security** command in configuration mode to delete the configured database for a specified VSAN

```
switch(config)# no port-security database vsan 1
switch(config)#
```

Displaying Port Security Commands

The **show port-security database** commands display the configured port security information (see Examples 18-1 to 18-9).

Example 18-1 Displays the Contents of the Port Security Database

```
switch# show port-security database
-----
VSAN      Logging-in Entity          Logging-in Point(      Interface)
-----
1         21:00:00:e0:8b:06:d9:1d(pwwn) 20:0d:00:05:30:00:95:de(fc1/13)
1         50:06:04:82:bc:01:c3:84(pwwn) 20:0c:00:05:30:00:95:de(fc1/12)
2         20:00:00:05:30:00:95:df(swgn) 20:0c:00:05:30:00:95:de(port-channel 128)
3         20:00:00:05:30:00:95:de(swgn) 20:01:00:05:30:00:95:de(fc1/1)
[Total 4 entries]
```

You can optionally specify a fWWN and a VSAN, or an interface and a VSAN in the **show port-security** command to view the output of the activated port security (see Example 18-2).

Example 18-2 Displays the Port Security Database in VSAN 1

```
switch# show port-security database vsan 1
-----
Vsan      Logging-in Entity          Logging-in Point      (Interface)
-----
1         *                          20:85:00:44:22:00:4a:9e (fc3/5)
```

```
1      20:11:00:33:11:00:2a:4a(pwwn)  20:81:00:44:22:00:4a:9e (fc3/1)
[Total 2 entries]
```

Example 18-3 Displays the Activated Database

```
switch# show port-security database active
```

```
-----
VSAN   Logging-in Entity           Logging-in Point(   Interface)   Learnt
-----
1      21:00:00:e0:8b:06:d9:1d(pwwn) 20:0d:00:05:30:00:95:de(fc1/13)      Yes
1      50:06:04:82:bc:01:c3:84(pwwn) 20:0c:00:05:30:00:95:de(fc1/12)      Yes
2      20:00:00:05:30:00:95:df(swwn) 20:0c:00:05:30:00:95:de(port-channel 128) Yes
3      20:00:00:05:30:00:95:de(swwn) 20:01:00:05:30:00:95:de(fc1/1)
[Total 4 entries]
```

The access information for each port can be individually displayed. If you specify the fwwn or interface options, all devices that are paired in the active database (at that point) with the given fWWN or the interface are displayed (see Examples 18-4 to 18-6).

Example 18-4 Displays the Wildcard fWWN Port Security in VSAN 1

```
switch# show port-security database fwwn 20:85:00:44:22:00:4a:9e vsan 1
Any port can login thru' this fwwn
```

Example 18-5 Displays the Configured fWWN Port Security in VSAN 1

```
switch# show port-security database fwwn 20:01:00:05:30:00:95:de vsan 1
20:00:00:0c:88:00:4a:e2(swwn)
```

Example 18-6 Displays the Interface Port Information in VSAN 2

```
switch# show port-security database interface fc 1/1 vsan 2
20:00:00:0c:88:00:4a:e2(swwn)
```

The port security statistics are constantly updated and available at any time (see Example 18-7).

Example 18-7 Displays the Port Security Statistics

```
switch# show port-security statistics
Statistics For VSAN: 1
-----
Number of pWWN permit: 2
Number of nWWN permit: 2
Number of sWWN permit: 2
Number of pWWN deny   : 0
Number of nWWN deny   : 0
Number of sWWN deny   : 0

Total Logins permitted : 4
Total Logins denied    : 0
Statistics For VSAN: 2
-----
Number of pWWN permit: 0
Number of nWWN permit: 0
Number of sWWN permit: 2
Number of pWWN deny   : 0
Number of nWWN deny   : 0
Number of sWWN deny   : 0
```

...

To verify the status of the active database and the auto-learn configuration, use the **show port-security status** command (see [Example 18-8](#)).

Example 18-8 Displays the Port Security Status

```
switch# show port-security status
VSAN 1 :Activated database, auto-learning is enabled
VSAN 2 :No Active database, auto-learning is disabled
...
```

The **show port-security** command displays the previous 100 violations by default (see [Example 18-9](#)).

Example 18-9 Displays the Violations in the Port Security Database

```
switch# show port-security violations
```

```
-----
VSAN      Interface      Logging-in Entity      Last-Time      [Repeat count]
-----
1         fc1/13         21:00:00:e0:8b:06:d9:1d(pwwn) Jul  9 08:32:20 2003  [20]
          20:00:00:e0:8b:06:d9:1d(nwwn)
1         fc1/12         50:06:04:82:bc:01:c3:84(pwwn) Jul  9 08:32:20 2003  [1]
          50:06:04:82:bc:01:c3:84(nwwn)
2         port-channel 1 20:00:00:05:30:00:95:de(swwn) Jul  9 08:32:40 2003  [1]
[Total 2 entries]
```

The **show port-security** command issued with the **last number** option displays only the specified number of entries that appear first.

Default Settings

[Table 18-4](#) lists the default settings for all security features in any switch.

Table 18-4 Default Security Settings

Parameters	Default
Auto-learn	Enabled if port security is enabled.
Port security	Disabled.