



## Configuring FC-SP and DHCHAP

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### About Fabric Authentication

Fibre Channel Security Protocol (FC-SP) capabilities provide switch-switch and host-switch authentication to overcome security challenges for enterprise-wide fabrics. Diffie-Hellman Challenge Handshake Authentication Protocol (DHCHAP) is an FC-SP protocol that provides authentication between Cisco MDS 9000 Family switches and other devices. DHCHAP consists of the CHAP protocol combined with the Diffie-Hellman exchange.



**Note**

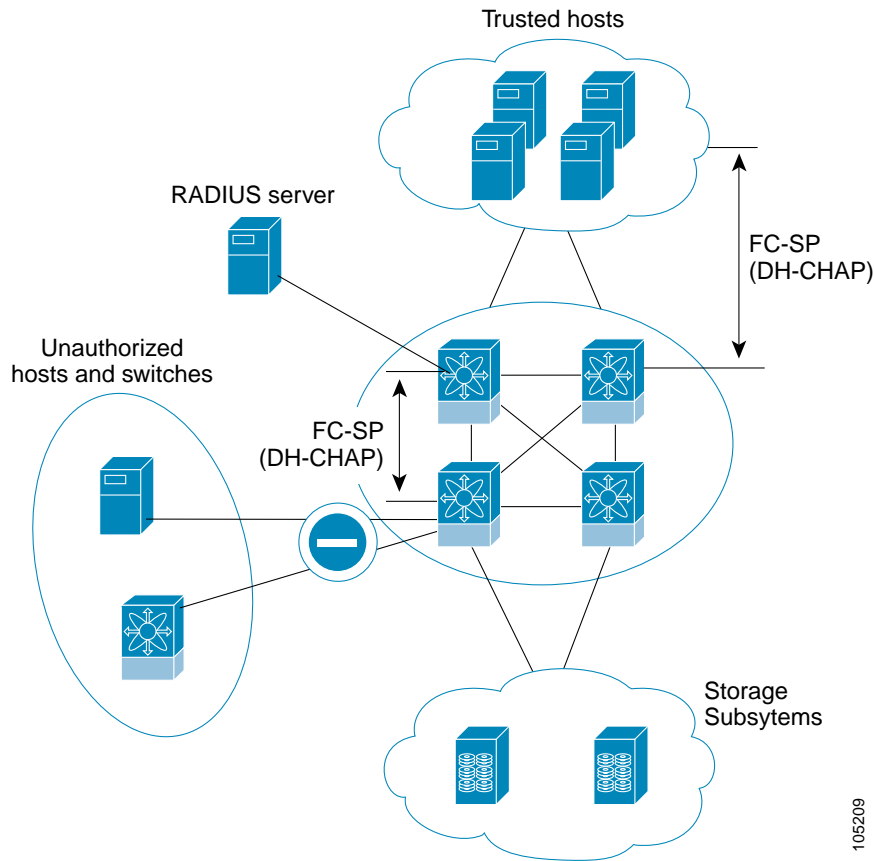
Cisco NX-OS Release 6.2(1) does not support the Fibre Channel Security Protocol (FC-SP) feature only on Cisco MDS 9710. Support for FC-SP on Cisco MDS 9710 begins in Cisco NX-OS Release 6.2(9).

To authenticate through VFC ports, FC-SP peers use the port VSAN for communication. Hence, the port VSAN needs to be the same and active on both the peers to send and receive authentication messages.

All switches in the Cisco MDS 9000 Family enable fabric-wide authentication from one switch to another switch, or from a switch to a host. These switch and host authentications are performed locally or remotely in each fabric. As storage islands are consolidated and migrated to enterprise-wide fabrics new security challenges arise. The approach of securing storage islands cannot always be guaranteed in enterprise-wide fabrics.

For example, in a campus environment with geographically distributed switches someone could maliciously interconnect incompatible switches or you could accidentally do so, resulting in Inter-Switch Link (ISL) isolation and link disruption. This need for physical security is addressed by switches in the Cisco MDS 9000 Family (see Figure 8-1).

Figure 8-1 Switch and Host Authentication



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**Note**

Fibre Channel (FC) host bus adapters (HBAs) with appropriate firmware and drivers are required for host-switch authentication.

## DHCHAP

DHCHAP is an authentication protocol that authenticates the devices connecting to a switch. Fibre Channel authentication allows only trusted devices to be added to a fabric, which prevents unauthorized devices from accessing the switch.

**Note**

The terms FC-SP and DHCHAP are used interchangeably in this chapter.

DHCHAP is a mandatory password-based, key-exchange authentication protocol that supports both switch-to-switch and host-to-switch authentication. DHCHAP negotiates hash algorithms and DH groups before performing authentication. It supports MD5 and SHA-1 algorithm-based authentication.

Configuring the DHCHAP feature requires the ENTERPRISE\_PKG license (see the *Cisco MDS 9000 Family NX-OS Licensing Guide*).

To configure DHCHAP authentication using the local password database, follow these steps:

- 
- Step 1** Enable DHCHAP.
- Step 2** Identify and configure the DHCHAP authentication modes.
- Step 3** Configure the hash algorithm and DH group.
- Step 4** Configure the DHCHAP password for the local switch and other switches in the fabric.
- Step 5** Configure the DHCHAP timeout value for reauthentication.
- Step 6** Verify the DHCHAP configuration.
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## DHCHAP Compatibility with Existing Cisco MDS Features

This section identifies the impact of configuring the DHCHAP feature along with existing Cisco MDS features:

- PortChannel interfaces—If DHCHAP is enabled for ports belonging to a PortChannel, DHCHAP authentication is performed at the physical interface level, not at the PortChannel level.
- FCIP interfaces—The DHCHAP protocol works with the FCIP interface just as it would with a physical interface.
- Port security or fabric binding—Fabric binding policies are enforced based on identities authenticated by DHCHAP.
- VSANs—DHCHAP authentication is not done on a per-VSAN basis.
- High availability—DHCHAP authentication works transparently with existing HA features.

## About Enabling DHCHAP

By default, the DHCHAP feature is disabled in all switches in the Cisco MDS 9000 Family.

You must explicitly enable the DHCHAP feature to access the configuration and verification commands for fabric authentication. When you disable this feature, all related configurations are automatically discarded.

## Enabling DHCHAP

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

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>feature fcsp</b>	Enables the DHCHAP in this switch.
	switch(config)# <b>no feature fcsp</b>	Disables (default) the DHCHAP in this switch.

## About DHCHAP Authentication Modes

The DHCHAP authentication status for each interface depends on the configured DHCHAP port mode. When the DHCHAP feature is enabled in a switch, each Fibre Channel interface or FCIP interface may be configured to be in one of four DHCHAP port modes:

- **On**—During switch initialization, if the connecting device supports DHCHAP authentication, the software performs the authentication sequence. If the connecting device does not support DHCHAP authentication, the software moves the link to an isolated state.
- **Auto-Active**—During switch initialization, if the connecting device supports DHCHAP authentication, the software performs the authentication sequence. If the connecting device does not support DHCHAP authentication, the software continues with the rest of the initialization sequence.
- **Auto-Passive (default)**—The switch does not initiate DHCHAP authentication, but participates in DHCHAP authentication if the connecting device initiates DHCHAP authentication.
- **Off**—The switch does not support DHCHAP authentication. Authentication messages sent to such ports return error messages to the initiating switch.



**Note**

Whenever DHCHAP port mode is changed to a mode other than the Off mode, reauthentication is performed.



**Note**

Changing DHCHAP port mode for a VE link requires a port flap on both the ends.

[Table 8-1](#) identifies the switch-to-switch authentication behavior between two Cisco MDS switches in various modes.

Table 8-1 DHCHAP Authentication Status Between Two MDS Switches

Switch N DHCHAP Modes	Switch 1 DHCHAP Modes			
	on	auto-active	auto-passive	off
on	FC-SP authentication is performed.	FC-SP authentication is performed.	FC-SP authentication is performed.	Link is brought down. FC-SP authentication is not performed.
auto-Active			FC-SP authentication is <i>not</i> performed.	
auto-Passive				
off	Link is brought down.	FC-SP authentication is <i>not</i> performed.		

## Configuring the DHCHAP Mode

To configure the DHCHAP mode for a particular interface, follow these steps:

	Command	Purpose
Step 1	switch# <b>configure terminal</b>	Enters configuration mode.
Step 2	switch(config)# <b>interface fc2/1-3</b> switch(config-if)#	Selects a range of interfaces and enters the interface configuration submenu.
Step 3	switch(config-if)# <b>fcsp on</b>	Sets the DHCHAP mode for the selected interfaces to be in the on state.
	switch(config-if)# <b>no fcsp on</b>	Reverts to the factory default of auto-passive for these three interfaces.
Step 4	switch(config-if)# <b>fcsp auto-active 0</b>	Changes the DHCHAP authentication mode for the selected interfaces to auto-active. Zero (0) indicates that the port does not perform reauthentication.
	switch(config-if)# <b>fcsp auto-active 120</b>	Changes the DHCHAP authentication mode to auto-active for the selected interfaces and enables reauthentication every two hours (120 minutes) after the initial authentication.
	switch(config-if)# <b>fcsp auto-active</b>	Changes the DHCHAP authentication mode to auto-active for the selected interfaces. Reauthentication is disabled (default).

## About DHCHAP Hash Algorithm

Cisco MDS switches support a default hash algorithm priority list of MD5 followed by SHA-1 for DHCHAP authentication.



### Tip

If you change the hash algorithm configuration, then change it globally for all switches in the fabric.

**Caution**

If AAA authentication for `fcsp dhchap` is enabled, the MD5 hash algorithm must be set if AAA authentication uses RADIUS or TACACS+. This is because RADIUS and TACACS+ applications do not support other hash algorithms.

## Configuring the DHCHAP Hash Algorithm

To configure the hash algorithm, follow these steps:

	Command	Purpose
Step 1	<code>switch# configure terminal</code>	Enters configuration mode.
Step 2	<code>switch(config)# fcsp dhchap hash sha1</code>	Configures the use of only the SHA-1 hash algorithm.
	<code>switch(config)# fcsp dhchap hash MD5</code>	Configures the use of only the MD5 hash algorithm.
	<code>switch(config)# fcsp dhchap hash md5 sha1</code>	Defines the use of the default hash algorithm priority list of MD5 followed by SHA-1 for DHCHAP authentication.
	<code>switch(config)# no fcsp dhchap hash sha1</code>	Reverts to the factory default priority list of the MD5 hash algorithm followed by the SHA-1 hash algorithm.

## About DHCHAP Group Settings

FC-SP supports multiple DHCHAP groups. The allowed groups may be changed from the default list. The list is configured in the order of highest to lowest priority to be used when negotiating with the FC-SP peer. Each side compares the list of groups received with the local group list and the highest priority group is used. Each group should be specified no more than once in the configuration command.

Refer to the `fcsp dhchap` command in the *Cisco MDS 9000 Series NX-OS Command Reference Guide* for details about the groups.

**Tip**

If you change the DH group configuration, change it globally for all switches in the fabric.

## Configuring the DHCHAP Group Settings

To change the DH group settings, follow these steps:

	Command	Purpose
Step 1	<code>switch# configure terminal</code>	Enters configuration mode.
Step 2	<code>switch(config)# fcsp dhchap dhgroup 2 3 4</code>	Specifies the list of DH groups to be use. The list is specified in order of descending priority. Unspecified groups are excluded from use by DHCHAP.
	<code>switch(config)# no fcsp dhchap dhgroup 2 3 4</code>	Reverts to the DHCHAP default order.

## About DHCHAP Password

DHCHAP authentication in each direction requires a shared secret password between the connected devices. To do this, you can use one of three approaches to manage passwords for all switches in the fabric that participate in DHCHAP.

- Approach 1—Use the same password for all switches in the fabric. This is the simplest approach. When you add a new switch, you use the same password to authenticate that switch in this fabric. It is also the most vulnerable approach if someone from the outside maliciously attempts to access any one switch in the fabric.
- Approach 2—Use a different password for each switch and maintain that password list in each switch in the fabric. When you add a new switch, you create a new password list and update all switches with the new list. Accessing one switch yields the password list for all switches in that fabric.
- Approach 3—Use different passwords for different switches in the fabric. When you add a new switch, multiple new passwords corresponding to each switch in the fabric must be generated and configured in each switch. Even if one switch is compromised, the password of other switches are still protected. This approach requires considerable password maintenance by the user.



**Note**

All passwords are restricted to 64 alphanumeric characters and can be changed, but not deleted.



**Tip**

We recommend using RADIUS or TACACS+ for fabrics with more than five switches. If you need to use a local password database, you can continue to do so using Approach 3 and using the Cisco MDS 9000 Family Fabric Manager to manage the password database.

## Configuring DHCHAP Passwords for the Local Switch

To configure the DHCHAP password for the local switch, follow these steps:

	Command	Purpose
Step 1	switch# <code>config t</code>	Enters configuration mode.

	Command	Purpose
Step 2	<code>switch(config)# fcsp dhchap password 0 mypassword</code>	Configures a clear text password for the local switch.
	<code>switch(config)# fcsp dhchap password 0 mypassword 30:11:bb:cc:dd:33:11:22</code>	Configures a clear text password for the local switch to be used for the device with the specified WWN.
	<code>switch(config)# no fcsp dhchap password 0 mypassword 30:11:bb:cc:dd:33:11:22</code>	Removes the clear text password for the local switch to be used for the device with the specified WWN.
	<code>switch(config)# fcsp dhchap password 7 sfsfdf</code>	Configures a password entered in an encrypted format for the local switch.
	<code>switch(config)# fcsp dhchap password 7 sfsfdf 29:11:bb:cc:dd:33:11:22</code>	Configures a password entered in an encrypted format for the local switch to be used for the device with the specified WWN.
	<code>switch(config)# no fcsp dhchap password 7 sfsfdf 29:11:bb:cc:dd:33:11:22</code>	Removes the password entered in an encrypted format for the local switch to be used for the device with the specified WWN.
	<code>switch(config)# fcsp dhchap password mypassword1</code>	Configures a clear text password for the local switch to be used with any connecting device.

To configure the DHCHAP password for the local switch using Fabric Manager, follow these steps:

- 
- Step 1** Expand **Switches > Security** and then select **FC-SP**.  
You see the FC-SP configuration in the Information pane.
- Step 2** Click the **Local Passwords** tab.
- Step 3** Click the **Create Row** icon to create a new local password.  
You see the Create Local Passwords dialog box.
- Step 4** (Optional) Check the switches that you want to configure the same local password on.
- Step 5** Select the switch WNN and fill in the Password field.
- Step 6** Click **Create** to save the updated password.
- 

## About Password Configuration for Remote Devices

You can configure passwords in the local authentication database for other devices in a fabric. The other devices are identified by their device name, which is also known as the switch WWN or device WWN. The password is restricted to 64 characters and can be specified in clear text (0) or in encrypted text (7).



### Note

The switch WWN identifies the physical switch. This WWN is used to authenticate the switch and is different from the VSAN node WWN.



## Configuring DHCHAP Passwords for Remote Devices

To locally configure the remote DHCHAP password for another switch in the fabric, follow these steps:

	Command	Purpose
Step 1	switch# <code>config t</code>	Enters configuration mode.
Step 2	switch(config)# <code>fcsp dhchap devicename 00:11:22:33:44:aa:bb:cc password NewPassword</code>	Configures a password for another switch in the fabric that is identified by the switch WWN device name.
	switch(config)# <code>no fcsp dhchap devicename 00:11:22:33:44:aa:bb:cc password NewPassword</code>	Removes the password entry for this switch from the local authentication database.
	switch(config)# <code>fcsp dhchap devicename 00:11:55:66:00:aa:bb:cc password 0 NewPassword</code>	Configures a clear text password for another switch in the fabric that is identified by the switch WWN device name.
	switch(config)# <code>fcsp dhchap devicename 00:11:22:33:55:aa:bb:cc password 7 asdfkjh</code>	Configures a password entered in an encrypted format for another switch in the fabric that is identified by the switch WWN device name.

## About DHCHAP Timeout Value

During the DHCHAP protocol exchange, if the MDS switch does not receive the expected DHCHAP message within a specified time interval, authentication failure is assumed. The time ranges from 20 (no authentication is performed) to 1000 seconds. The default is 30 seconds.

When changing the timeout value, consider the following factors:

- The existing RADIUS and TACACS+ timeout values.
- The same value must also be configured on all switches in the fabric.

## Configuring the DHCHAP Timeout Value

To configure the DHCHAP timeout value, follow these steps:

	Command	Purpose
Step 1	switch# <code>config t</code>	Enters configuration mode.
Step 2	switch(config)# <code>fcsp timeout 60</code>	Configures the reauthentication timeout to be 60 seconds.
	switch(config)# <code>no fcsp timeout 60</code>	Reverts to the factory default of 30 seconds.

## Configuring DHCHAP AAA Authentication

You can individually set authentication options. If authentication is not configured, local authentication is used by default.

To configure the AAA authentication refer to the Chapter 4, “Configuring Security Features on an External AAA Server.” Follow these steps:

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>aaa authentication dhchap default group TacacsServer1</b>	Enables DHCHAP to use the TACACS+ server group (in this example, TacacsServer1) for authentication.
	switch(config)# <b>aaa authentication dhchap default local</b>	Enables DHCHAP for local authentication.
	switch(config)# <b>aaa authentication dhchap default group RadiusServer1</b>	Enables DHCHAP to use the RADIUS server group (in this example, RadiusServer1) for authentication.

## Displaying Protocol Security Information

Use the **show fcsp** commands to display configurations for the local database (see Example 8-1 through 8-6).

### Example 8-1 Displays DHCHAP Configurations in FC Interfaces

```
switch# show fcsp interface fc1/9

fc1/9:
  fcsp authentication mode:SEC_MODE_ON
  Status: Successfully authenticated
```

### Example 8-2 Displays DHCHAP Statistics for an FC Interface

```
switch# show fcsp interface fc1/9 statistics

fc1/9:
  fcsp authentication mode:SEC_MODE_ON
  Status: Successfully authenticated
  Statistics:
  FC-SP Authentication Succeeded:5
  FC-SP Authentication Failed:0
  FC-SP Authentication Bypassed:0
```

### Example 8-3 Displays the FC-SP WWN of the Device Connected through a Specified Interface

```
switch# show fcsp interface fc 2/1 wwn

fc2/1:
  fcsp authentication mode:SEC_MODE_ON
  Status: Successfully authenticated
  Other device's WWN:20:00:00:e0:8b:0a:5d:e7
```

### Example 8-4 Displays Hash Algorithm and DHCHAP Groups Configured for the Local Switch

```
switch# show fcsp dhchap
Supported Hash algorithms (in order of preference):
DHCHAP_HASH_MD5
DHCHAP_HASH_SHA_1
```

```
Supported Diffie Hellman group ids (in order of preference):
DHCHAP_GROUP_NULL
DHCHAP_GROUP_1536
DHCHAP_GROUP_1024
DHCHAP_GROUP_1280
DHCHAP_GROUP_2048
```

**Example 8-5** *Displays the DHCHAP Local Password Database*

```
switch# show fcsp dhchap database
DHCHAP Local Password:
  Non-device specific password:*****
  Password for device with WWN:29:11:bb:cc:dd:33:11:22 is *****
  Password for device with WWN:30:11:bb:cc:dd:33:11:22 is *****

Other Devices' Passwords:
  Password for device with WWN:00:11:22:33:44:aa:bb:cc is *****
```

**Example 8-6** *Displays the ASCII Representation of the Device WWN*

```
switch# show fcsp asciwwn 30:11:bb:cc:dd:33:11:22
Ascii representation of WWN to be used with AAA servers:Ox_3011bbccdd331122
```



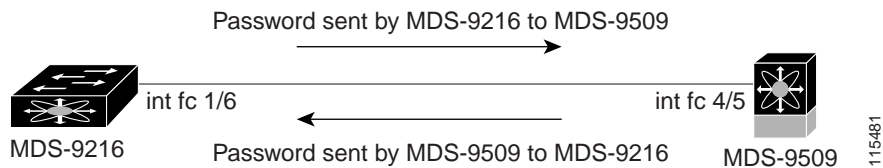
**Tip**

Use the ASCII representation of the device WWN (identified in bold in Example 8-6) to configure the switch information on RADIUS and TACACS+ servers.

## Sample Configuration

This section provides the steps to configure the example illustrated in Figure 8-2.

**Figure 8-2** *Sample DHCHAP Authentication*



To configure the authentication setup shown in Figure 8-2, follow these steps:

- Step 1** Obtain the device name of the MDS 9216 Switch in the fabric. The MDS 9216 Switch in the fabric is identified by the switch WWN.

```
MDS-9216# show wwn switch
Switch WWN is 20:00:00:05:30:00:54:de
```

- Step 2** Explicitly enable DHCHAP in this switch.




---

**Note** When you disable DHCHAP, all related configurations are automatically discarded.

---

```
MDS-9216(config)# feature fcsp
```

**Step 3** Configure a clear text password for this switch. This password will be used by the connecting device.

```
MDS-9216(config)# fcsp dhchap password rtp9216
```

**Step 4** Configures a password for another switch in the fabric that is identified by the switch WWN device name.

```
MDS-9216(config)# fcsp dhchap devicename 20:00:00:05:30:00:38:5e password rtp9509
```

**Step 5** Enable the DHCHAP mode for the required Fibre Channel interface.




---

**Note** Whenever DHCHAP port mode is changed to a mode other than the Off mode, reauthentication is performed.

---

```
MDS-9216(config)# interface fc 1/16
MDS-9216(config-if)# fcsp on
```

**Step 6** Verify the protocol security information configured in this switch by displaying the DHCHAP local password database.

```
MDS-9216# show fcsp dhchap database
DHCHAP Local Password:
    Non-device specific password:*****
Other Devices' Passwords:
    Password for device with WWN:20:00:00:05:30:00:38:5e is *****
```

**Step 7** Display the DHCHAP configuration in the Fibre Channel interface.

```
MDS-9216# show fcsp interface fc 1/6
fc1/6
    fcsp authentication mode:SEC_MODE_ON
    Status:Successfully authenticated
```

**Step 8** Repeat these steps on the connecting MDS 9509 Switch.

```
MDS-9509# show wwn switch
Switch WWN is 20:00:00:05:30:00:38:5e
MDS-9509(config)# feature fcsp
MDS-9509(config)# fcsp dhchap password rtp9509
MDS-9509(config)# fcsp dhchap devicename 20:00:00:05:30:00:54:de password rtp9216
MDS-9509(config)# interface fc 4/5
MDS-9509(config-if)# fcsp on
MDS-9509# show fcsp dhchap database
DHCHAP Local Password:
    Non-device specific password:*****
Other Devices' Passwords:
    Password for device with WWN:20:00:00:05:30:00:54:de is *****
MDS-9509# show fcsp interface fc 4/5
Fc4/5
    fcsp authentication mode:SEC_MODE_ON
    Status:Successfully authenticated
```

You have now enabled and configured DHCHAP authentication for the sample setup in Figure 8-2.

---

# Default Settings

Table 8-2 lists the default settings for all fabric security features in any switch.

*Table 8-2 Default Fabric Security Settings*

<b>Parameters</b>	<b>Default</b>
DHCHAP feature	Disabled
DHCHAP hash algorithm	A priority list of MD5 followed by SHA-1 for DHCHAP authentication
DHCHAP authentication mode	Auto-passive
DHCHAP group default priority exchange order	0, 4, 1, 2, and 3 respectively
DHCHAP timeout value	30 seconds

