



CHAPTER 31

Configuring FC-SP and DHCHAP

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Information About Fabric Authentication

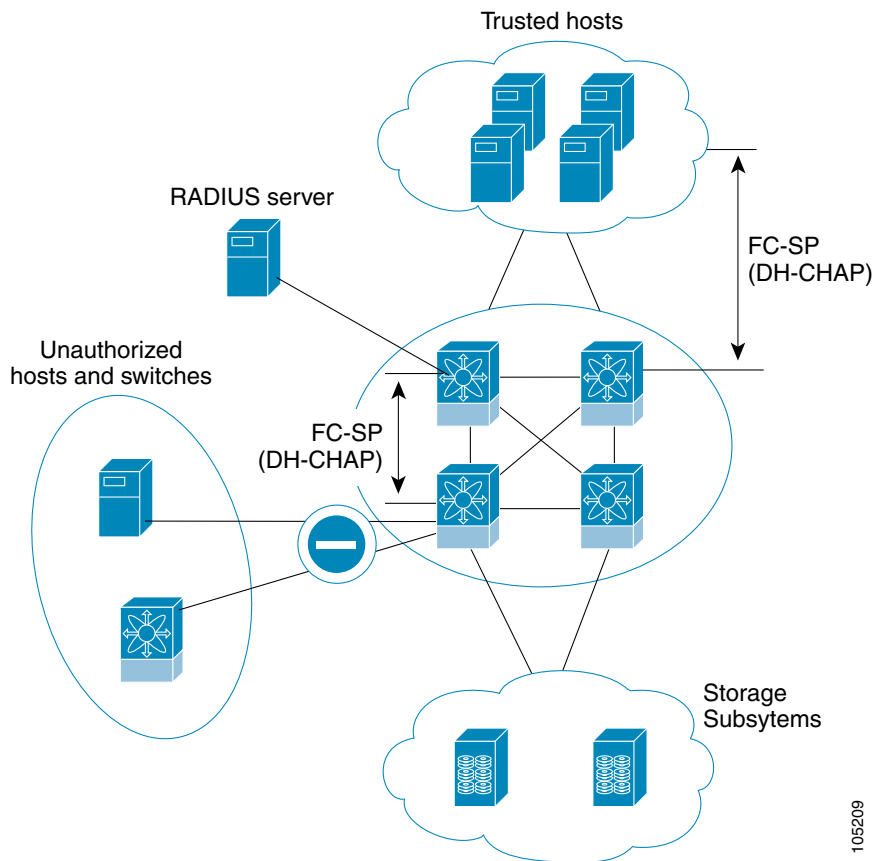
Fibre Channel Security Protocol (FC-SP) capabilities provide switch-switch and host-switch authentication to overcome security challenges for enterprise-wide fabrics. Diffie-Hellman Challenge Handshake Authentication Protocol (DHCHAP) is an FC-SP protocol that provides authentication between Cisco MDS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

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 31-1](#)).

Figure 31-1 Switch and Host Authentication



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*).

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.

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.

[Table 31-1](#) identifies the switch-to-switch authentication behavior between two Cisco MDS switches in various modes.

Table 31-1 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 <i>not</i> 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.		

About the 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

RADIUS and TACACS+ protocols always use MD5 for CHAP authentication. Using SHA-1 as the hash algorithm may prevent RADIUS and TACACS+ usage—even if these AAA protocols are enabled for DHCHAP authentication.

About the DHCHAP Group Settings

All switches in the Cisco MDS Family support all DHCHAP groups specified in the standard: 0 (null DH group, which does not perform the Diffie-Hellman exchange), 1, 2, 3, or 4.



Tip

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

About the 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 DCNM-SAN to manage the password database.

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.

About the 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.

Enabling FC-SP on ISLs

There is an ISL pop-up menu in DCNM-SAN called Enable FC-SP that enables FC-SP on switches at either end of the ISL. You are prompted for an FC-SP generic password, then asked to set FC-SP interface mode to ON for affected ports. Right-click an ISL and click **Enable FC-SP** to access this feature.

**Note**

FC-SP DHCHAP mode requires port-flap on both end of the ISL.

Default Settings

Table 31-2 lists the default settings for all fabric security features in any switch.

Table 31-2 Default Fabric Security Settings

Parameters	Default
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

Configuring DHCHAP

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.
-

Enabling DHCHAP

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

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

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

-
- Step 1** Expand **Switches**, expand **Security** and then select **FC-SP**.
The **Control** tab is the default. You see the FC-SP enable state for all switches in the fabric.
 - Step 2** Set the Command drop-down menu to enable for all switches that you want to enable FC-SP on.

- Step 3** Click the **Apply Changes** icon to enable FC-SP and DHCHAP on the selected switches.

Configuring the DHCHAP Mode

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

	Command	Purpose
Step 1	switch# config t	Enters configuration mode.
Step 2	switch(config)# interface fc2/1-3 switch(config-if)#	Selects a range of interfaces and enters the interface configuration submenu.
Step 3	switch(config-if)# fcsp on	Sets the DHCHAP mode for the selected interfaces to be in the on state.
	switch(config-if)# no fcsp on	Reverts to the factory default of auto-passive for these three interfaces.
Step 4	switch(config-if)# fcsp auto-active 0	Changes the DHCHAP authentication mode for the selected interfaces to auto-active. Zero (0) indicates that the port does not perform reauthentication. Note The reauthorization interval configuration is the same as the default behavior.
	switch(config-if)# fcsp auto-active 120	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)# fcsp auto-active	Changes the DHCHAP authentication mode to auto-active for the selected interfaces. Reauthentication is disabled (default). Note The reauthorization interval configuration is the same as setting it to zero (0).

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

- Step 1** Expand **Switches**, expand **Interfaces**, and then select **FC Physical**.
You see the interface configuration in the Information pane.
- Step 2** Click the **FC-SP** tab.
- Step 3** Set the **Mode** drop-down menu to the DHCHAP authentication mode you want to configure for that interface.
- Step 4** Click the **Apply Changes** icon to save these DHCHAP port mode settings.

Configuring the DHCHAP Hash Algorithm

To configure the hash algorithm, follow these steps:

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

To configure the hash algorithm, follow these steps:

-
- Step 1** Choose **Switches > Security**, and then select **FC-SP**.
 - Step 2** Click the **General/Password** tab.
You see the DHCHAP general settings mode for each switch.
 - Step 3** Change the DHCHAP HashList for each switch in the fabric.
 - Step 4** Click the **Apply Changes** icon to save the updated hash algorithm priority list.
-

Configuring the DHCHAP Group Settings

To change the DH group settings, follow these steps:

	Command	Purpose
Step 1	switch# config t	Enters configuration mode.
Step 2	switch(config)# fcsp dhchap group 2 3 4	Prioritizes the use of DH group 2, 3, and 4 in the configured order.
	switch(config)# no fcsp dhchap group 0	Reverts to the DHCHAP factory default order of 0, 4, 1, 2, and 3.

To change the DH group settings, follow these steps:

-
- Step 1** Expand **Switches > Security**, and then select **FC-SP**.
 - Step 2** Click the **General/Password** tab.
 - Step 3** Change the DHCHAP GroupList for each switch in the fabric.
 - Step 4** Click the **Apply Changes** icon to save the updated hash algorithm priority list.
-

Configuring DHCHAP Passwords for the Local Switch

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

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

Configuring DHCHAP Passwords for Remote Devices

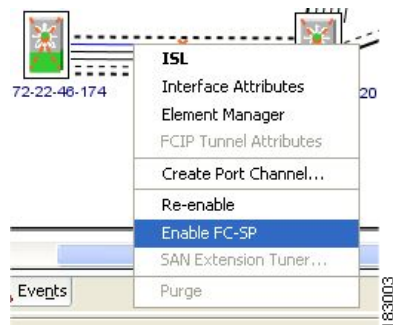
To locally configure the remote DHCHAP password for another switch in the fabric, follow these steps:

	Command	Purpose
Step 1	switch# config t	Enters configuration mode.
Step 2	switch(config)# fcsp dhchap devicename 00:11:22:33:44:aa:bb:cc password NewPassword	Configures a password for another switch in the fabric that is identified by the switch WWN device name.
	switch(config)# no fcsp dhchap devicename 00:11:22:33:44:aa:bb:cc password NewPassword	Removes the password entry for this switch from the local authentication database.
	switch(config)# fcsp dhchap devicename 00:11:55:66:00:aa:bb:cc password 0 NewPassword	Configures a clear text password for another switch in the fabric that is identified by the switch WWN device name.
	switch(config)# fcsp dhchap devicename 00:11:22:33:55:aa:bb:cc password 7 asdf1kjh	Configures a password entered in an encrypted format for another switch in the fabric that is identified by the switch WWN device name.

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

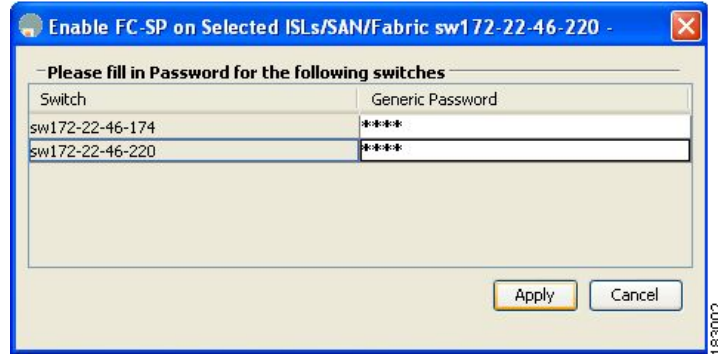
- Step 1** Right-click an ISL and select **Enable FC-SP** from the drop-down list (see [Figure 31-2](#)).

Figure 31-2 Enable FC-SP



You see the Enable FC-SP dialog box.

Figure 31-3 Enable FC-SP Dialog Box



Step 2 Click **Apply** to save the updated password.

Configuring the DHCHAP Timeout Value

To configure the DHCHAP timeout value, follow these steps:

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

To configure the DHCHAP timeout value, 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 **General/Password** tab.
You see the DHCHAP general settings mode for each switch.
- Step 3** Change the DHCHAP timeout value for each switch in the fabric.
- Step 4** Click the **Apply Changes** icon to save the updated information.

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 29, “Configuring Security Features on an External AAA Server.”](#) Follow these steps:

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

Verifying FC-SP and DHCHAP Configuration

To display FC-SP and DHCHAP configuration information, perform one of the following tasks:

Command	Purpose
show fcsp interface fc1/9	Displays DHCHAP Configurations in FC Interfaces.
show fcsp interface fc1/9 statistics	Displays DHCHAP Statistics for an FC Interface.
show fcsp interface fc 2/1 wwn	Displays the FC-SP WWN of the Device Connected through a Specified Interface.
show fcsp dhchap	Displays Hash Algorithm and DHCHAP Groups Configured for the Local Switch.
show fcsp dhchap database	Displays the DHCHAP Local Password Database.
show fcsp asciwwn 30:11:bb:cc:dd:33:11:22	Displays the ASCII Representation of the Device WWN.

For detailed information about the fields in the output from these commands, refer to the *Cisco DC-OS Command Reference*.

This section includes the following topics:

- [Displaying Protocol Security Information section, page 31-172](#)

Displaying Protocol Security Information

Use the **show fcsp** commands to display configurations for the local database (see [Example 31-1](#) through [31-6](#)).

Example 31-1 Displays DHCHAP Configurations in FC Interfaces

```
switch# show fcsp interface fc1/9

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

Example 31-2 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 31-3 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 31-4 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 31-5 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 31-6 Displays the ASCII Representation of the Device WWN

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

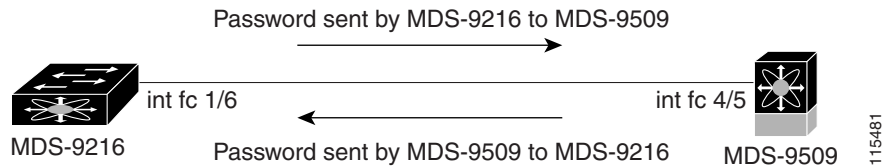
**Tip**

Use the ASCII representation of the device WWN (identified in bold in [Example 31-6](#)) to configure the switch information on RADIUS and TACACS+ servers.

Configuration Example for DHCHAP

This section provides the steps to configure the example illustrated in [Figure 31-4](#).

Figure 31-4 Sample DHCHAP Authentication



To configure the authentication setup shown in [Figure 31-4](#), 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 31-4](#).

