CHAPTER 11

Configuring Cisco TrustSec Fibre Channel Link Encryption

This chapter provides an overview of the Cisco TrustSec Fibre Channel (FC) Link Encryption feature and describes how to configure and set up link-level encryption between switches.

The chapter includes the following sections:

Cisco TrustSec FC Link Encryption Terminology

The following Cisco TrustSec FC Link Encryption-related terms are used in this chapter:

- Galois Counter Mode (GCM)—A block cipher mode of operation providing confidentiality and data-origin authentication.
- Galois Message Authentication Code (GMAC)—A block cipher mode of operation providing only data-origin authentication. It is the authentication-only variant of GCM.
- Security Association (SA)—A connection that handles the security credentials and controls how they propagate between switches. The SA includes parameters such as salt and keys.
- Key—A 128-bit hexadecimal string that is used for frame encryption and decryption. The default value is zero.
- Salt —A 32-bit hexadecimal number that is used during encryption and decryption. The same salt must be configured on both sides of the connection to ensure proper communication. The default value is zero.
- Security Parameters Index (SPI) number—A 32-bit number that identifies the SA to be configured to the hardware. The range is from 256 to 4,294,967,295.

Support for AES Encryption

The Advanced Encryption Standard (AES) is the symmetric cipher algorithm that provides a high-level of security, and can accept different key sizes.

The Cisco TrustSec FC Link Encryption feature supports the 128-bit AES for security encryption and enables either AES-GCM or AES-GMAC for an interface. The AES-GCM mode provides encryption and authentication of the frames and AES-GMAC provides only the authentication of the frames that are being passed between the two peers.

About Cisco TrustSec FC Link Encryption

Cisco TrustSec FC Link Encryption is an extension of the Fibre Channel-Security Protocol (FC-SP) feature and uses the existing FC-SP architecture to provide integrity and confidentiality of transactions. Encryption is now added to the peer authentication capability to provide security and prevent unwanted traffic interception. Peer authentication is implemented according to the FC-SP standard using the Diffie-Hellman Challenge Handshake Authentication Protocol (DHCHAP) protocol.

Note Cisco TrustSec FC Link Encryption is currently only supported between Cisco MDS switches. This feature is not supported when you downgrade to software versions which do not have the Encapsulating Security Protocol (ESP) support.

This section includes the following topics:

Supported Modules

The following modules are supported for the Cisco TrustSec FC Link Encryption feature:

- 1/2/4/8 Gbps 24-Port Fibre Channel switching module (DS-X9224-96K9)
- 1/2/4/8 Gbps 48-Port Fibre Channel switching module (DS-X9248-96K9)
- 1/2/4/8 Gbps 4/44-Port Fibre Channel switching module (DS-X9248-48K9)

Enabling Cisco TrustSec FC Link Encryption

By default, the FC-SP feature and the Cisco TrustSec FC Link Encryption feature are disabled in all switches in the Cisco MDS 9000 Family.

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

Configuring the Cisco TrustSec FC Link Encryption feature requires the ENTERPRISE_PKG license. For more information, refer to the *Cisco MDS 9000 Family NX-OS Licensing Guide*.

Setting Up Security Associations

To perform encryption between the switches, a security association (SA) needs to be set up. An administrator manually configures the SA before the encryption can take place. The SA includes parameters such as keys and salt, that are required for encryption. You can set up to 2000 SAs in a switch.

Note Cisco TrustSec FC Link Encryption is currently supported only on DHCHAP on and off modes.

Setting Up Security Association Parameters

To set up the SA parameters, such as keys and salt, using Fabric Manager, follow these steps:

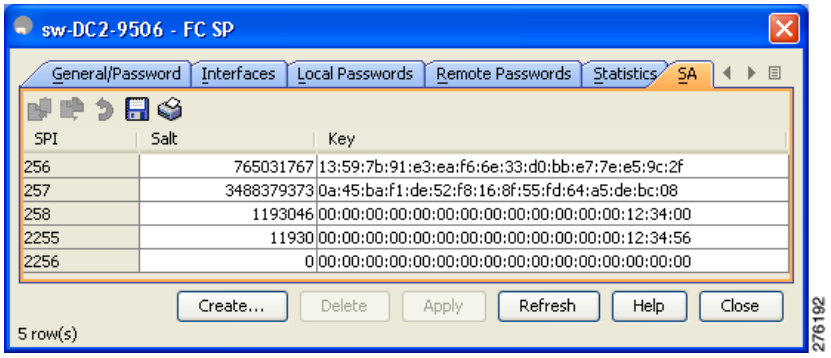
Step 1 Expand **Switches > Security** and then select **FC-SP (DHCHAP)**.

You see the FC-SP configuration in the Information pane.

Step 2 Click the **SA** tab.

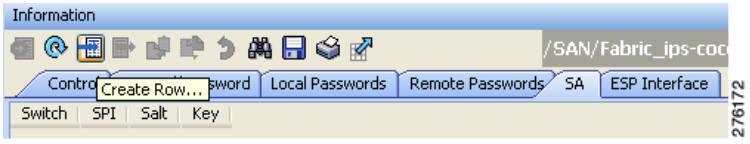
You see the SA parameters for each switch (see Figure 11-1).

Figure 11-1 SA Tab



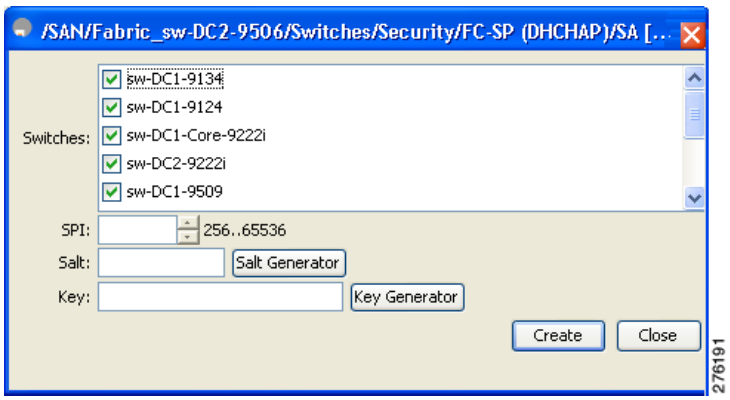
Step 3 Click the Create Row icon (see Figure 11-2).

Figure 11-2 Create Row Icon



You see the Create SA Parameters dialog box (see Figure 11-3).

Figure 11-3 Create SA Parameters



Step 4 Select the switches on which you want to perform an encryption.

Step 5 Select a value for the SP. The range is from 256 to 65536.

Step 6 Enter a value for the salt. Alternatively, click **Salt Generator** to select a value

Step 7 Enter a value for the key. Alternatively, click **Key Generator** to select a value.

Step 8 Click **Create** to save the changes.

To set up the SA parameters, such as keys and salt, using Device Manager, follow these steps:

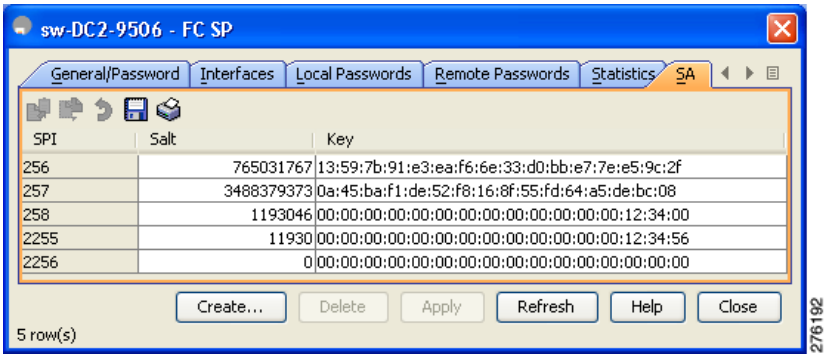
Step 1 Choose **Switches > Security** and then select **FC-SP**.

You see the FC-SP configuration dialog box.

Step 2 Click the **SA** tab.

You see the SA parameters for each switch (see Figure 11-4).

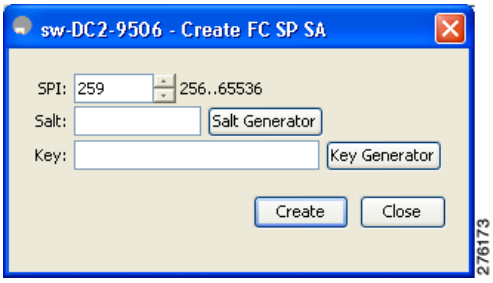
Figure 11-4 SA Parameters



Step 3 Click **Create** to create new parameters.

You see the Create FC-SP SA dialog box (see Figure 11-5).

Figure 11-5 Create FC-SP SA



Step 4 Select a value for the SP. The range is from 256 to 65536.

Step 5 Enter a value for the salt. Alternatively, click **Salt Generator** to select a value

Step 6 Enter a value for the key. Alternatively, click **Key Generator** to select a value.

Step 7 Click **Create** to save the changes.

Configuring ESP Settings

Note To apply the SA to the ingress and egress hardware of an interface, the interface needs to be in the admin shut mode.

Note The ESP modes are set only after a SA is configured to either the ingress or the egress hardware. If SA has not been configured, ESP is turned off and encapsulation does not occur.

Note An ESP mode change always needs a port flap because the change is not seamless if it is done after you configure the port; although the configurations are not rejected.

To configure ESP settings using Fabric Manager, follow these steps:

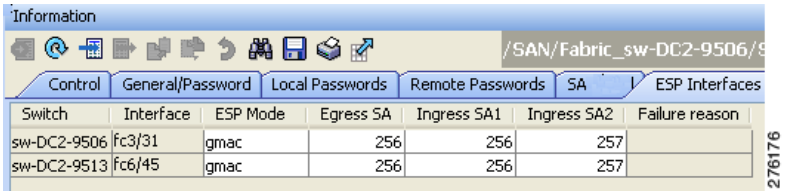
Step 1 Expand **Switches > Security** and then select **FC-SP (DHCHAP)**.

You see the FC-SP configuration in the Information pane.

Step 2 Click the **ESP Interfaces** tab.

You see the Interface details for each switch (see Figure 11-6).

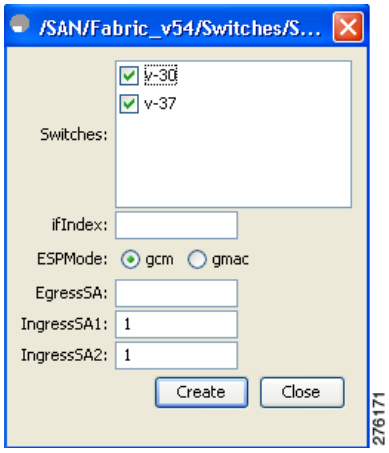
Figure 11-6 ESP Interfaces Tab



Step 3 Click the **Create Row** icon.

You see the Create ESP Interfaces dialog box (see Figure 11-7).

Figure 11-7 Create ESP Interfaces



Step 4 Select the switches on which you want to perform an encryption.

Step 5 Enter an interface for the selected switch.

Step 6 Select the appropriate ESP mode for the encryption.

Step 7 Enter the appropriate egress port for the encryption.

Step 8 Enter the appropriate ingress port for the encryption.

Step 9 Click **Create** to save the changes.

To configure ESP settings using Device Manager, follow these steps:

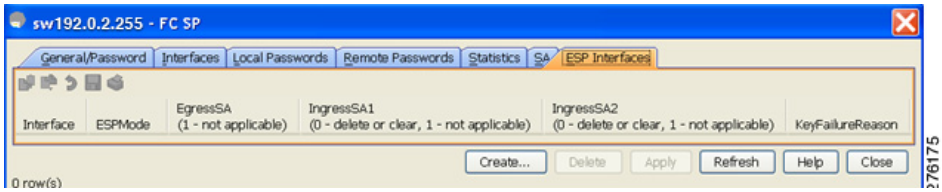
Step 1 Expand **Switches > Security** and then select **FC-SP**.

You see the FC-SP configuration dialog box.

Step 2 Click the **ESP Interfaces** tab.

You see the Interface details for each switch (see Figure 11-8).

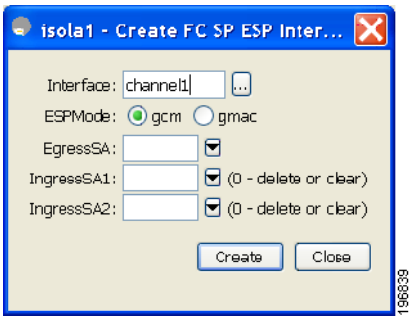
Figure 11-8 ESP Interfaces Tab



Step 3 Click **Create.**

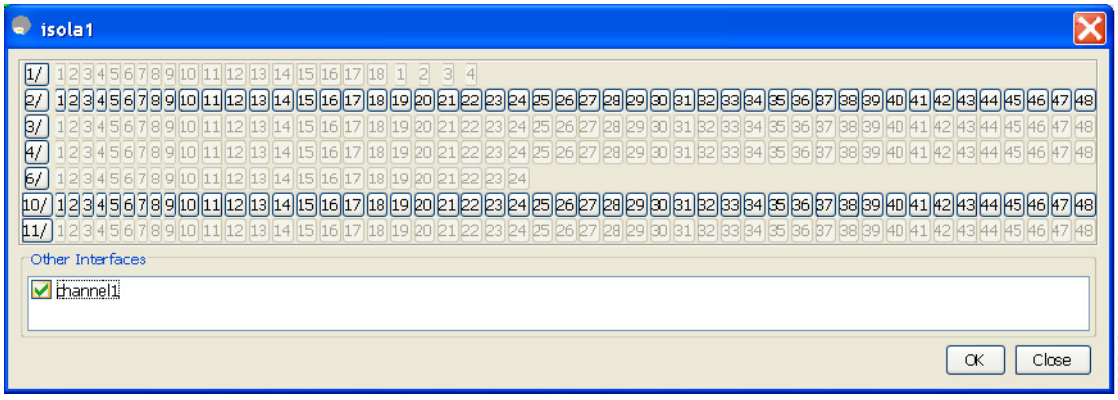
You see the Create FC-SP ESP Interfaces dialog box (see Figure 11-9).

Figure 11-9 Create ESP Interfaces



Step 4 Enter an interace or PortChannel for any switch for encryption. Alternatively, you can select values from the available interfaces for the selected switch (see Figure 11-10).

Figure 11-10 Available Interfaces



Step 5 Select the appropriate ESP mode for the encryption.

Step 6 Enter the appropriate egress port for the encryption.

Step 7 Enter the appropriate ingress port for the encryption.

Step 8 Click **Create** to save the changes.

Configuring ESP Using ESP Wizard

You can configure and set up link-level encryption between switches, using Fabric Manager. You can configure an existing Inter-Switch Link (ISL) as a secure ISL or edit an existing secure ingress SPI and egress SPI using this wizard.

The wizard allows you to configure PortChannels or individual links, depending on what version of NX-OS software is running on the switches:

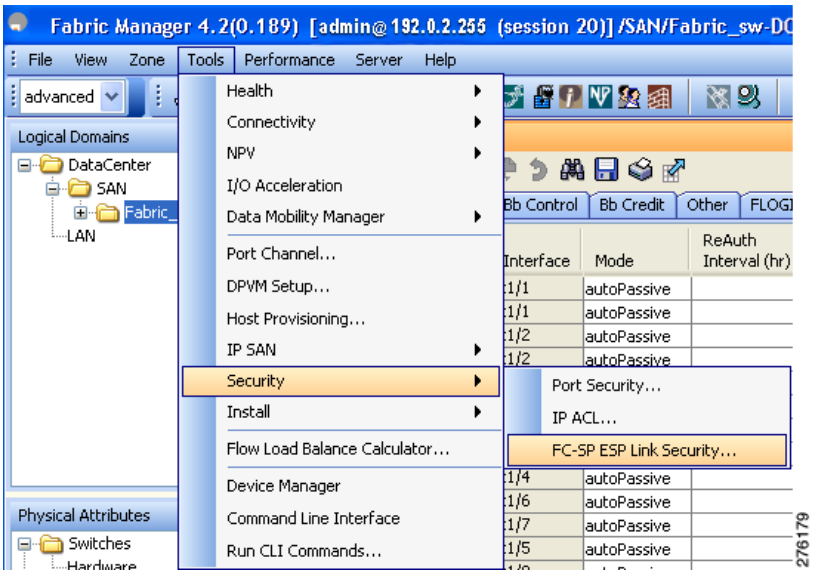
- A PortChannel is displayed if the PortChannel is between two switches that are both running NX-OS Release 5.0(x) or if the PortChannel is between two switches where one is running NX-OS Release 5.0(x) and the other is running NX-OS Release 4.2(x).
- The individual port links are displayed if the PortChannel is between two switches that are both running NX-OS Release 4.2(x).

If the individual links are displayed, then you must select each link to configure the security information.

To configure ESP using ESP wizard, follow these steps:

Step 1 Right-click **Tools > Security> FC-SP ESP Link Security** to launch the ESP wizard from Fabric Manager (see Figure 11-11).

Figure 11-11 Launching FC-SP ESP Wizard

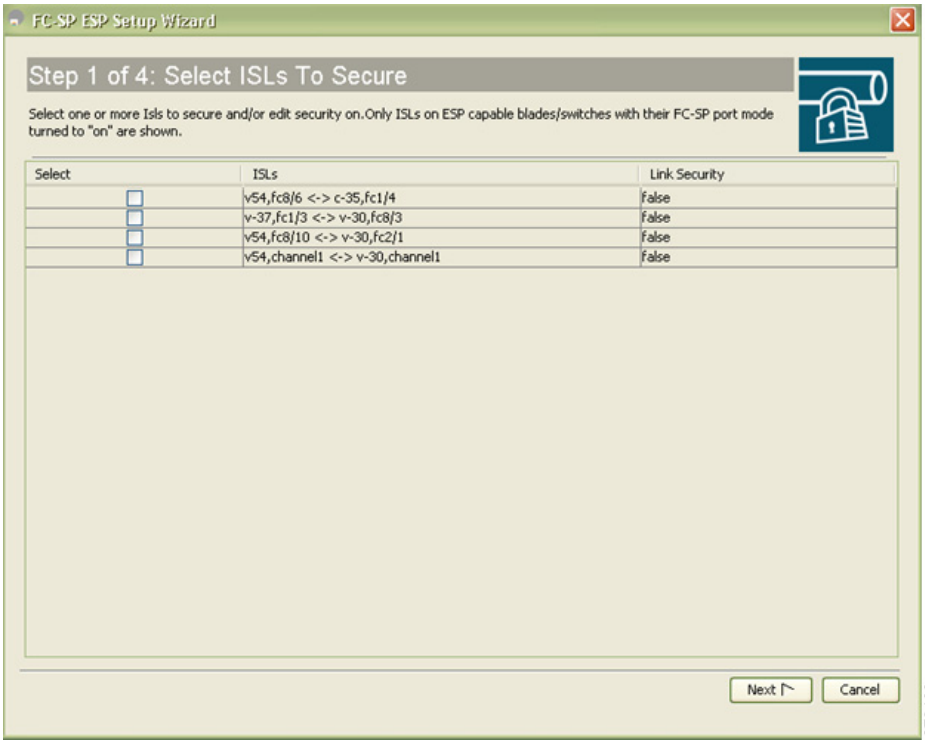


Step 2 Select the appropriate ISL to secure or edit security (see Figure 11-12).

Note Only ISLs with FC-SP port mode turned on and available on ESP capable switches or blades are displayed.

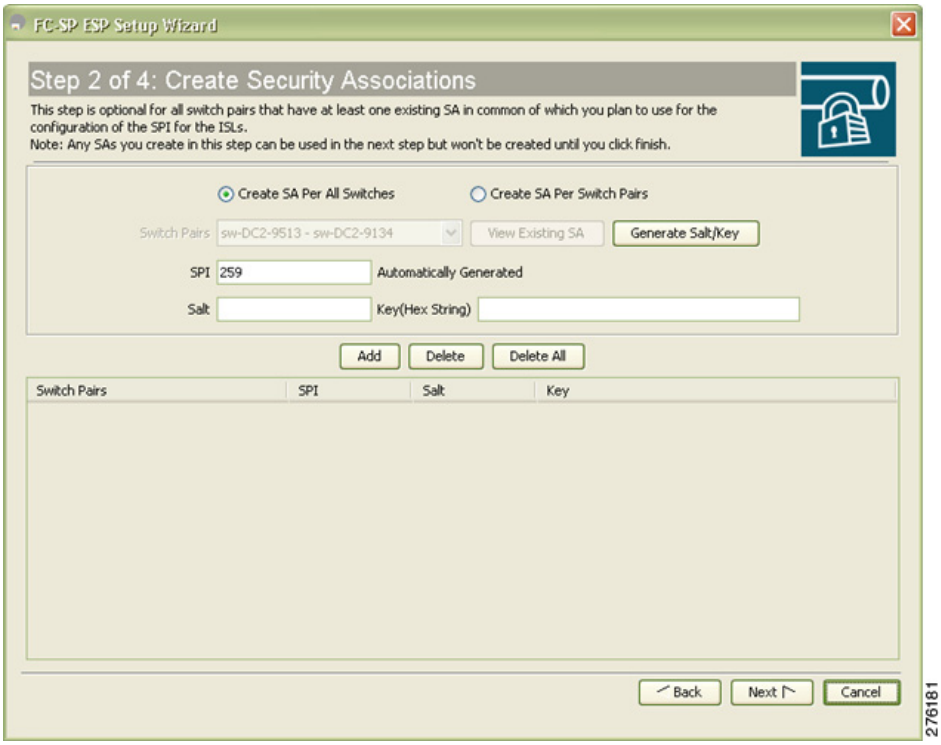
PortChannels and individual port links are displayed in the list of ISLs.

Figure 11-12 Select ISL To Secure



Step 3 Create new Security Associations (SAs) (see Figure 11-13).

Figure 11-13 Create Security Associations



You can create a new SA for each switch or use the existing SAs. You can click **View Existing SA** to view the existing SAs.

Note The existing list of SAs displays all existing SAs for a switch. The wizard runs only when a pair of switches have a common SA. The wizard checks for this requirement when you select **Next** and a warning message is displayed if a pair of switches do not have a common SA. You must create a common SA on the pair of the switches to run this wizard.

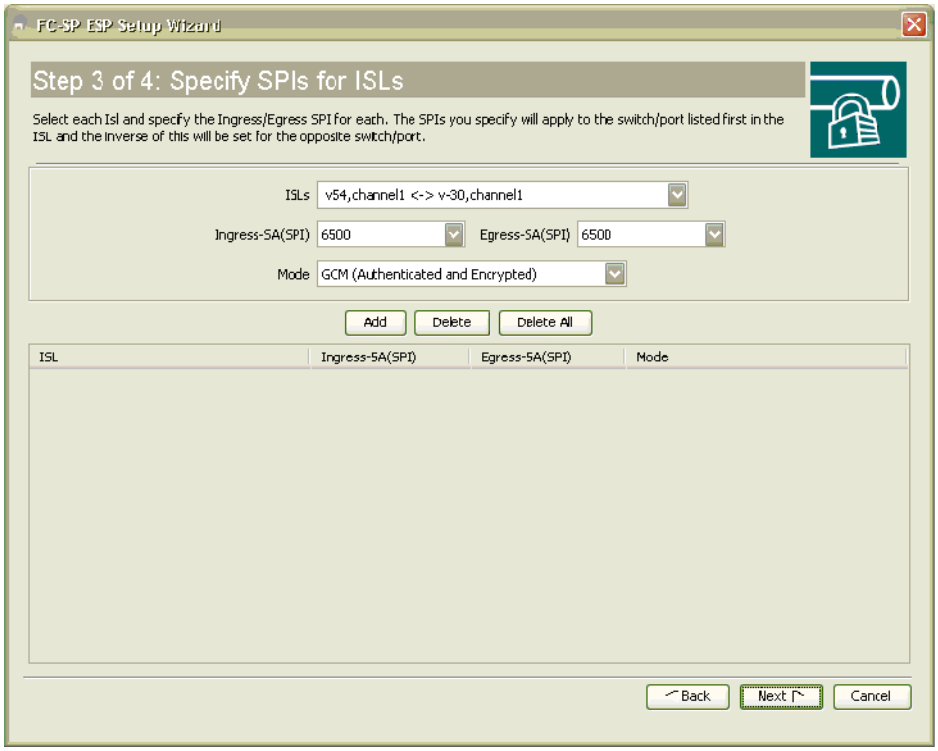
Step 4 Specify the Egress port, Ingress port, and ESP mode for the selected ISL, as seen in Figure 11-14.

The ISLs list will display either a PortChannel or individual links, depending on the software version. For PortChannels between switches that are both running NX-OS Release 5.0(x), or between switches where one is running NX-OS 5.0(x) and the other is running NX-OS Release 4.2(x), the PortChannel is displayed. For PortChannels on switches that are both running NX-OS Release 4.2(x) or earlier, then the individual port links are displayed.

The Egress and Ingress ports are auto populated with SPIs of the SAs common to a pair of switches incase of a secured ISL.

In this scenario, the mode is disabled and you cannot edit the modes for a secured ISL.

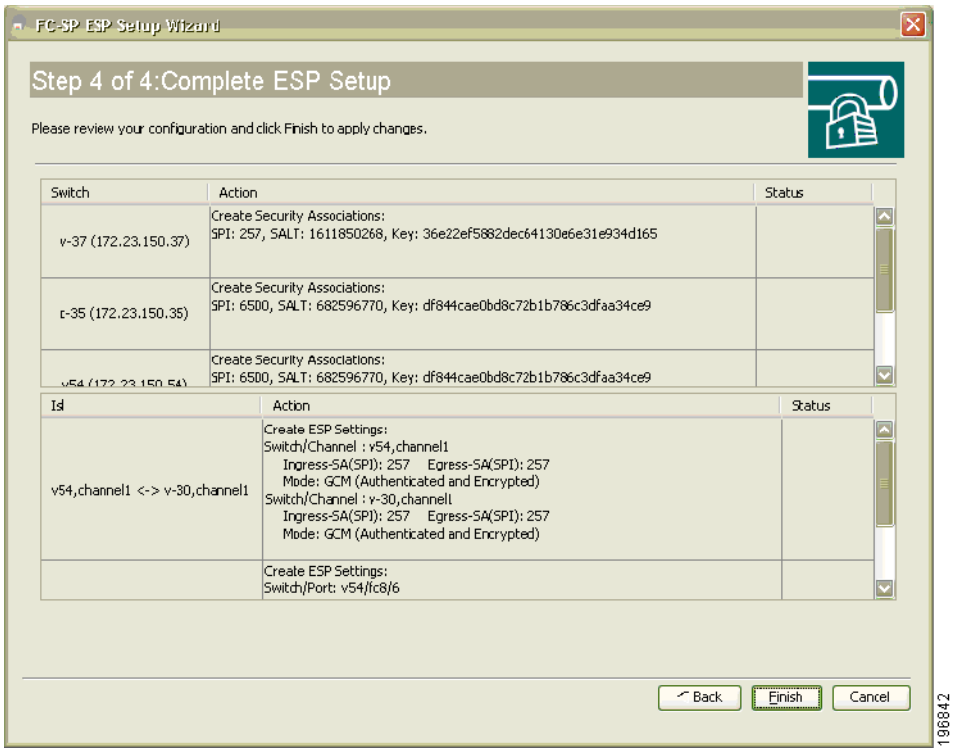
Figure 11-14 Specify SPIs for ISLs



Note You can modify an existing ESP configuration provided the selected ISLs are enabled.

Step 5 Review your configuration as seen in Figure 11-15.

Figure 11-15 Complete ESP Setup



Step 6 Click **Finish** to start the configuration for the ESP setup. You can view the status of the configuration in the status column.

Viewing Cisco TrustSec FC Link Encryption Information

You can view information about the Cisco TrustSec FC Link Encryption feature using the **show** commands Fabric Manager or Device Manager.

This section covers the following topics:

Viewing FC-SP Interace Statistics Using Fabric Manager

You can view the statistics data that displays the Encapsulating Security Protocol-ESP Security Parameter (SPI) mismatches and Interface-Encapsulating Security Protocol authentication failures information using Fabric Manager.

To view the ESP statistics for an interface using Fabric Manager, follow these steps:

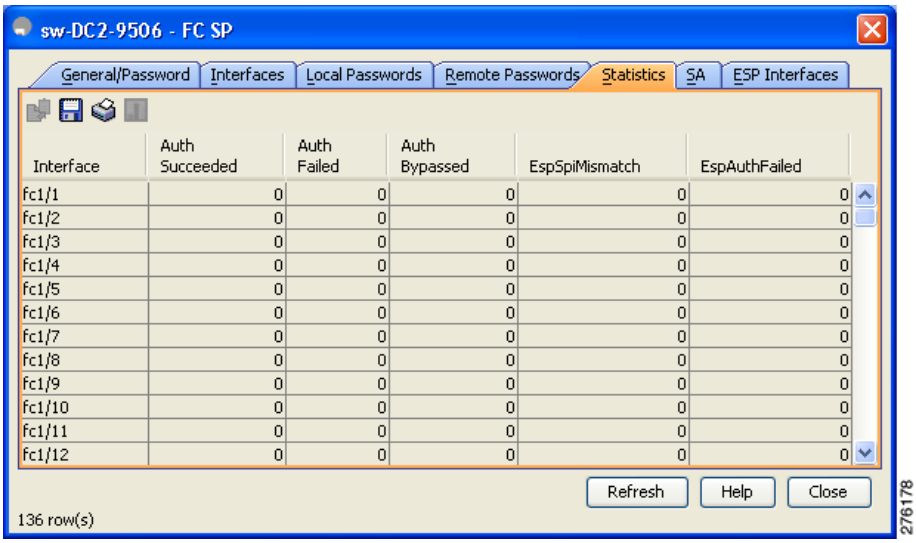
Step 1 Expand **Interfaces > FC Physical** and then select **FC-SP**.

You see the FC-SP configuration in the Information pane.

Step 2 Click the **FC-SP** tab.

You see view the FC-SP statistics data in the Information pane (see Figure 11-16).

Figure 11-16 FC-SP Statistics in Fabric Manager



Step 3 Click **Refresh** to refresh the statistics data.

Viewing FC-SP Interface Statistics Using Device Manager

To view the ESP statistics for an interface using Device Manager, follow these steps:

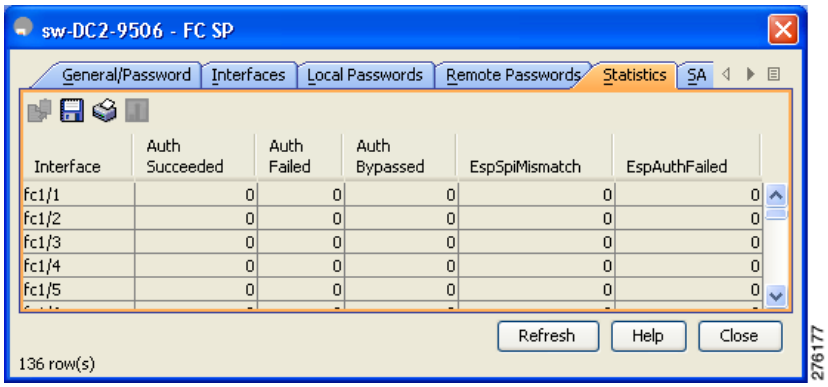
Step 1 Choose **Security > FC Physical** and then select **FC-SP**.

You see the FC-SP configuration in the Information pane.

Step 2 Click the **Statistics** tab.

You see the statistics in the Information pane (see Figure 11-17).

Figure 11-17 FC-SP Statistics in Device Manager



Step 3 Click Refresh to refresh the statistics data.

Cisco TrustSec FC Link Encryption Best Practices

Best practices are the recommended steps that should be taken to ensure the proper operation of Cisco TrustSec FC Link Encryption.

This section covers the following topics:

General Best Practices

This section lists the general best practices for Cisco TrustSec FC Link Encryption:

- Ensure that Cisco TrustSec FC Link Encryption is enabled only between MDS switches. This feature is supported only on E-ports or the ISLs, and errors will result if non-MDS switches are used.
- Ensure that the peers in the connection have the same configurations. If there are differences in the configurations, a “port re-init limit exceeded” error message is displayed.
- Before applying the SA to the ingress and egress hardware of a switch interface, ensure that the interface is in the admin shut mode.

Best Practices for Changing Keys

After the SA is applied to the ingress and egress ports, you should change the keys periodically in the configuration. The keys should be changed sequentially to avoid traffic disruption.