Cisco MDS 9000 Series Licensing Guide, Release 7.3

Licensing Cisco MDS 9000 Family NX-OS Software Features

Licenses are available for all switches in the Cisco MDS 9000 Family. Licensing allows you to access specified premium features on the switch after you install the appropriate license for that feature. You can also obtain licenses to activate ports on the Cisco MDS 9250i Multiservice Fabric Switch, Cisco MDS 9148S Multilayer Fabric Switch, Cisco MDS 9148 Multilayer Fabric Switch, Cisco MDS 9124 Fabric Switch, the Cisco MDS 9134 Fabric Switch, the Cisco Fabric Switch for HP c-Class BladeSystem, the Cisco MDS 8G Fibre Channel Blade Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

Cisco MDS NX-OS Software Licenses

This section contains information related to licensing types, options, procedures, installation, and management for the Cisco MDS NX-OS software.

Licensing Terminology

The following terms are used in this document:

Licensed feature

Permission to use a particular feature through a license file, a hardware object, or a legal contract. This permission is limited to the number of users, number of instances, time span, and the implemented device.

Licensed application

A software feature that requires a license to be used.

License enforcement

A mechanism that prevents a feature from being used without first obtaining a license.

Node-locked license

A license that can only be used on a particular device using the device's unique host ID.

Host IDs

A unique chassis serial number that is specific to each device.

Software license claim certificate

A document entitling its rightful owner to use licensed features on one device as described in that document.

Product Authorization Key (PAK)

The PAK allows you to obtain a license key from one of the sites listed in the software license claim certificate document. After registering at the specified website, you will receive your license key file and installation instructions through e-mail.

License key file

A device-specific unique file that specifies the licensed features. Each file contains digital signatures to prevent tampering and modification. License keys are required to use a licensed feature. License keys are enforced within a specified time span.

Missing license

If the bootflash has been corrupted or a supervisor module replaced after you have installed a license, that license shows as missing. The feature still works. You should reinstall the license as soon as possible.

Evaluation license

A temporary license. Evaluation licenses are time bound (valid for a specified number of days) and are tied to a host ID (device serial number).

Permanent license

A license that is not time bound is called a permanent license.

Grace period

The amount of time the features in a license package can continue functioning without a license.

Support

If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco, contact Cisco Technical Support at this URL: http://www.cisco.com/en/US/support/tsd_cisco_worldwide_contacts.html

Licensing Model

Any feature not included in a license package is bundled with the Cisco MDS 9000 Family switches and is provided at no extra charge.

The licensing model defined for the Cisco MDS product line has two options:

• Feature-based licenses allow features that are applicable to the entire switch. The cost varies based on a per-switch usage.

• Module-based licenses allow features that require additional hardware modules. The cost varies based on a per-module usage. An example is the IPS-8 or IPS-4 module using the FCIP feature.

Note Each module requires its own separate license. If you replace a module that requires a license with a module of the same type (such as replacing a Storage Services Module (SSM) with another SSM), the existing license will support the new module.

Note The Cisco MDS 9250i Switch does not require a license for the SAN extension features and FCIP-related features. The Cisco MDS 9250i Switch does not require an enterprise package (ENTERPRISE_PKG) license for IVR. The Cisco MDS 9250i Switch does not support SME.

Note The Cisco MDS 9216i Switch and the Cisco MDS 9222i Switch enable SAN extension features on the two and four fixed IP services ports only. The features enabled on these ports are identical to the features enabled by the SAN extension over IP license on the Cisco MDS 14/2-port Multiprotocol Services (MPS-14/2) module. If you install a module with IP ports in the empty slot on the Cisco MDS 9216i Switch or the Cisco MDS 9222i Switch, a separate SAN extension over IP license is required to enable related features, such as FCIP, on the IP ports of the additional module.

Note Licensing on the Cisco MDS 9000 Storage Services Module (SSN-16) module has the following limitations:

- Only one licensed feature can run on an SSN-16 engine at a time.

- On a given SSN-16 module, you can "mix and match" the I/O acceleration (IOA) license and SAN Extension over IP license one the four service engines in any combination, for example 4+0, 1+3, 2+2, 3+1, or 0+4, respectively.

- The SSN-16 module does not support "mix and match" for the Storage Media Encryption (SME) license.

An SSN-16 has four separate Octeons. Each Octeon handles 4 ports. Ports 1-4, 5-8, 9-12, and 13-16 are grouped together.A single SAN_EXTN_OVER_IP_SSN16 license supports only one port group of 4 GE ports. You cannot activate a new Fibre Channel over IP (FCIP) interface that is in a different port group and which does not have a license. If you wish to re-allocate the license(s) to a different port group, you must delete the FCIP interface which is currently using the SSN16 license and then profile relationship and create the new FCIP interface and profile.

This table describes feature-based licenses.

Table 1: Feature-Based Licenses

Feature License	Features

Enterprise package
 	
(ENTERPRISE_PKG)
	• Enhanced security features:
	   ◦ LUN zoning
	   ◦ Read-only zones
	
	• FC Port security
	• VSAN-based access control
	• Fibre Channel Security Protocol (FC-SP) authentication
	• Advanced traffic engineering—quality of service (QoS)
	• IP security (IPsec) protocol for iSCSI and FCIP using the MPS-14/2 module or Cisco MDS 9216i Switch
	• IPsec and IKE for IPv4
	• IKE digital certificates
	• Extended credits using the MPS-14/2 module or the Cisco MDS 9216i Switch
	• Enhanced VSAN routing inter-VSAN routing (IVR) over Fibre Channel
	• IVR Network Address Translation (NAT) over Fibre Channel
	• Zone-based traffic prioritizing
	• Zone-based FC QoS
	• Extended BB_Credits
	• Fibre Channel write acceleration
	• SCSI flow statistics
	• FCIP encryption
	• Fabric binding for Fibre Channel
	• SAN device virtualization
	• Cisco TrustSec Fibre Channel Link Encryption

Feature License	Features
SAN extension over IP package for IPS-8 modules (SAN_EXTN_OVER_IP) SAN extension over IP package for IPS-4 modules (SAN_EXTN_OVER_IP_IPS4)	The following features apply to IPS-8 and IPS-4 modules: • FCIP • FCIP compression • FCIP write acceleration • FCIP tape read acceleration • SAN extension tuner features • IVR over FCIP • IVR NAT over FCIP • Network Stimulator
SAN extension over IP package for MPS-14/2 modules (SAN_EXTN_OVER_IP_IPS2) **Note** The FCIP, IVR, and SAN extension tuner features are bundled with the Cisco MDS 9216i Switch and do not require the SAN extension over IP package to be installed for the fixed IP ports on the integrated supervisor module. You must install a SAN extension over IP package if you install an MPS-14/2, IPS-8, or IPS-4 module in the Cisco MDS 9216i Switch.	The following features apply to the MPS-14/2 module and the fixed Cisco MDS 9216i Switch IP ports: • FCIP • Hardware-based FCIP compression • FCIP write acceleration • FCIP tape read acceleration • SAN extension tuner features • IVR over FCIP • IVR NAT over FCIP
SAN extension over IP package for one MPS-18/4, one MPS-18/4 FIPS, or one SSN-16 engine in the Cisco MDS 9500 Series (SAN_EXTN_OVER_IP_18_4) (SAN_EXTN_OVER_IP_SSN16)	The following features apply to the MPS-18/4, MPS-18/4 FIPS, or SSN-16 modules: • FCIP • Hardware-based FCIP compression • FCIP write acceleration • FCIP tape read acceleration • SAN extension tuner features • IVR over FCIP • IVR NAT over FCIP
SAN extension over IP package (SAN_EXTN_9250)	This feature applies to the two fixed 1/10 Gigabit Ethernet IP storage services ports on the Cisco MDS 9250i Multiservice Fabric Switch. This is included by default.

Feature License	Features
Mainframe package (MAINFRAME_PKG)	• FICON protocol and CUP management • FICON VSAN and intermixing • Switch cascading • Fabric binding for FICON • IBM TotalStorage Virtual Tape Server (VTS) • IBM TotalStorage XRC application • FICON tape acceleration • FICON for the Cisco MDS 9100 Series Switches • FICON for the Cisco MDS 9250i Multiservice Fabric Switch • FICON for the Cisco MDS 9700 Series Switches • Persistent FCIDs for FICON • Configuration locking for FICON • Port swap, block, prohibit • FICON qualification

Feature License	Features
Fabric Manager Server package (FM_SERVER_PKG)	• Centralized, multiple physical fabric management • Fabric discovery services • Continuous Cisco MDS health and event monitoring • Long term historical Fibre Channel performance monitoring and reporting • Custom performance reports and charting for hotspot analysis • Historical performance monitoring • Performance prediction • Performance threshold monitoring • Fabric Manager Web Client for operational view • Fabric Manager server proxy services • Server performance summary report • Configurable RRD collection parameters • Data collection auto update • Event forwarding • Filtering by user-defined groups • Custom reports enhancements • Fabric analysis report • Threshold configuration flexibility • Web-based operational view • Roaming user profiles • Traffic Analyzer for SCSI flow statistics • Fabric Manager Server federation • Performance statistics in web client

Feature License	Features

Storage Services Enabler package
 	
(STORAGE_SERVICES_ENABLER_PKG)
 	
(STORAGE_SERVICES_184)
 	
(STORAGE_SERVICES_SSN16)
	• The underlying infrastructure and programmatic interface to enable network-hosted storage applications when used with the Storage Services Modules (SSMs) and the SSN-16.
	
	• The intelligent fabric applications running on the SSM that require the SSE license are as follows:
	
	   ◦ SANTap
	
	   ◦ Network-based Storage Virtualization
	
	   ◦ Third-party partner application

On-demand Port Activation Licensing package (PORT_ACTIVATION_PKG) (PORT_ACTIV_20P) (PORT_ACTIV_9396S_PKG) (PORT_ACTIV_9148S_PKG) **Note** The license manager does not prevent installing more port licenses than the available physical ports on the switch. The extra licenses if installed, will not affect the normal behavior of the licensed ports.	• Activates ports (in 8-port increments) on the Cisco MDS 9124 Fabric Switch, which has 24 ports. The first 8 ports are licensed by default. • Activates 8 ports of 4 Gbps on the Cisco MDS 9134 Fabric Switch. The switch has 32 ports, 24 of which are licensed by default. • On the Cisco Fabric Switch for HP c-Class BladeSystem, any eight internal ports and external ports ext1 through ext4 are licensed by default. • On the Cisco Fabric Switch for IBM BladeCenter, any seven internal ports and external ports ext0, ext15 and ext16 are licensed by default. • On the Cisco MDS 9250i Fabric Switch, 20 FC ports are active by default. Each PORT_ACTIV_20P enables 20 FC ports. • On Cisco MDS 9396S 16G Multilayer Fabric Switch, 48 ports are enabled by default. Each PORT_ACTIV_9396S_PKG enables 12 ports. • On Cisco MDS 9148S 16G Multilayer Fabric Switch, 12 ports are enabled by default. Each PORT_ACTIV_9148S_PKG enables 12 ports.
10-Gbps Port Activation Package (10G_PORT_ACTIVATION_PKG)	• Activates the two 10-Gbps ports on the Cisco MDS 9134 Multilayer Fabric Switch.

Feature License	Features
Storage Media Encryption (SME) (SME_FOR_IPS_184_PKG) (SME_FOR_SSN16_PKG) (SME_FOR_9222i_PKG)	• Activates SME for MSM-18/4 module. • Activates SME for a SSN-16 engine. • Activates SME for the Cisco MDS 9222i Switch.
Data Mobility Manager (DMM) (DMM_FOR_SSM_PKG) (DMM_9250) (DMM_184_PKG) (DMM_9222i_PKG)	• The Cisco MDS 9000 DMM feature runs on the Storage Service Module (SSM) in a Cisco MDS Series switch. This license will activate Data Mobility Manager (DMM) for Storage Service Module. • Online migration of heterogenous arrays • Simultaneous migration of multiple LUNs • Unequal size LUN migration • Rate adjusted migration • Verification of migrated data • Secure erasure of migrated data • Dual fabric support • Activates DMM on the Cisco MDS 9250i Fabric Switch. • Activates DMM for the Cisco MDS 9000 18/4-Port Multiservice Module. • Activates DMM for the Cisco MDS 9222i Multiservice Modular Switch.
Cisco I/O Acceleration (IOA) (IOA_184) (IOA_SSN16) (IOA_9222i) (IOA_9250)	• Activates IOA for the Cisco MDS 9000 18/4 Multiservice Module (MSM-18/4). • Activates IOA for a SSN-16. **Note** The SSN-16 requires a separate license for each engine on which you want to run IOA. Each SSN-16 engine you configure for IOA checks out a license from the pool managed at the chassis level. SSN-16 IOA licenses are available singly (the usual model) or in a four-pack. When you install a four-pack on your chassis, IOA four-pack license appears the same as four single IOA licenses. • Activates IOA for the MDS 9222i Multiservice Modular Switch. • Activates IOA for the Cisco MDS 9250i Fabric Switch.

Feature License	Features
Fibre Channel over Ethernet (FCoE) (FCOE_8P_9250_PKG)	Activates eight 10 Gigabit Ethernet Fibre Channel over Ethernet (FCoE) ports on the Cisco MDS 9250i Fabric Switch. This is included by default.
Extended Remote Copy (XRC) acceleration (XRC_ACCL)	• Activates FICON XRC acceleration on the Cisco MDS 9250i Multiservice Fabric Switch, Cisco MDS 9222i Switch, and on the MSM-18/4 in the Cisco MDS 9500 Series directors. **Note** You must install the Mainframe Package and the SAN Extension over FCIP Package before you install the XRC acceleration license. The Mainframe Package enables the underlying FICON support, and the FCIP license or licenses enable the underlying FCIP support.

Note License packages for Cisco DMM (Cisco Data Mobility Manager) and Cisco SME (Cisco Storage Media Encryption) are documented in the Cisco MDS 9000 Family Data Mobility Manager Configuration Guide, and the Cisco MDS 9000 Family Storage Media Encryption Configuration Guide.

Licensing High Availability

As with other Cisco NX-OS features, the licensing feature also maintains the following high-availability standards:

- Installing any license in the device is a nondisruptive process.

- Installing a license automatically saves a copy of permanent licenses to the chassis.

- If you have enabled the grace period feature, enabling a licensed feature that does not have a license key starts a counter on the grace period. You then have 120 days to install the appropriate license keys, disable the use of that feature, or disable the grace period feature. If at the end of the 120-day grace period the device does not have a valid license key for the feature, the Cisco NX-OS software automatically disables the feature and removes the configuration from the device.

  Note Some licenses, for example, Cisco TrustSec, do not have a grace period.

Devices with dual supervisors have the following additional high-availability features:

- The license software runs on both supervisor modules and provides failover protection.

- The license key file is mirrored on both supervisor modules. Even if both supervisor modules fail, the license file continues to function from the version that is available on the chassis.

License Installation

You can either obtain a factory-installed license (only applies to new device orders) or perform a manual license installation of the license (applies to existing devices in your network).

Obtaining a Factory-Installed License

You can obtain factory-installed licenses for a new Cisco NX-OS device.

Procedure

Step 1 Contact your reseller or Cisco representative and request this service.

Note If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco, contact Cisco Technical Support at this URL: http://www.cisco.com/en/US/support/tsd_cisco_worldwide_contacts.html

Your device is shipped with the required licenses installed in the system.

Step 2 Start using the device and the licensed features.

Performing a Manual Installation

If you have existing devices or if you wish to install the licenses on your own, you must first obtain the license key file and then install that file in the device.

This figure shows how to obtain a license key file.

Figure 1: Obtaining a License Key File
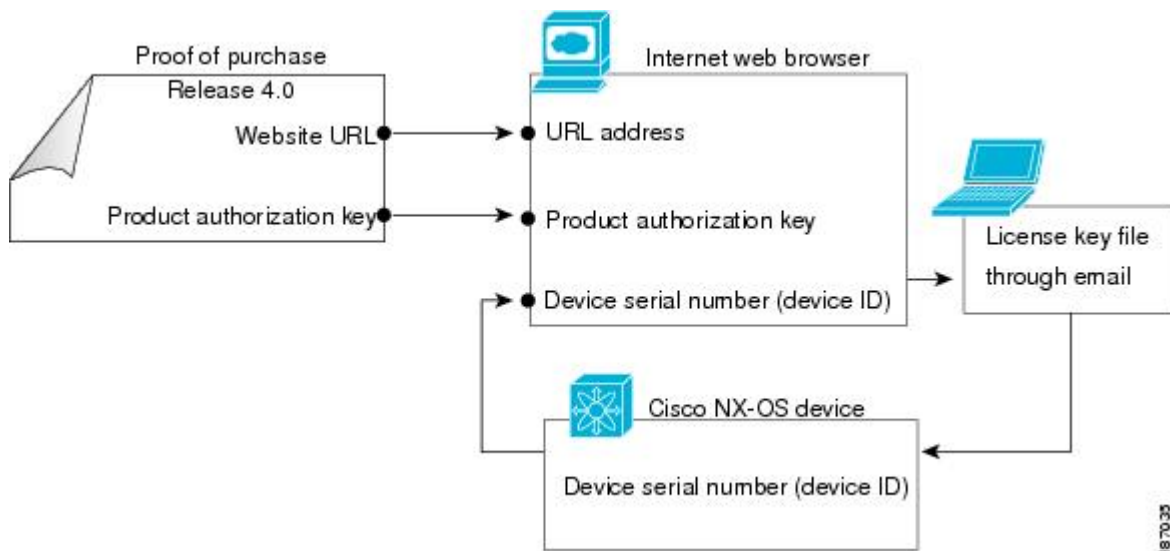
Obtaining the License Key File

You can obtain new or updated license key files.

Procedure

Step 1 Obtain the serial number for your device by entering the **show license host-id** command. The host ID is also referred to as the device serial number.

```
switch# show license host-id
License hostid: VDH=FOX064317SQ
```

> **Tip** Use the entire ID that appears after the equal sign (=). In this example, the host ID is FOX064317SQ.

Step 2 Obtain your claim software license certificate document. If you cannot locate your software license claim certificate, contact Cisco Technical Support at this URL: http://www.cisco.com/en/US/support/tsd_cisco_worldwide_contacts.html

Step 3 Locate the product authorization key (PAK) from the software license claim certificate document.

Step 4 Locate the website URL from the software license claim certificate document. You can access the Product License Registration website from the Software Download website at this URL: http://www.cisco.com/cisco/web/download/index.html

Step 5 Follow the instructions on the Product License Registration website to register the license for your device.
The license key file is sent to you by e-mail and is digitally signed to only authorize use on the requested device. The requested features are also enabled once the Cisco NX-OS software on the specified device accesses the license key file.

> **Caution** Do not make any modifications to the license key file. It will alter the digital signature and render the license invalid.

A license is permanent. If you do not have a license, the grace period for using a feature starts from the first time you start using a feature offered by a license.

> **Note** Cisco TrustSec does not have a grace period. You must obtain an Advanced Services license to use Cisco TrustSec.

Step 6 You can use the file transfer service (tftp, ftp, sftp, sfp, or scp) or use the Cisco Fabric Manger License Wizard under Fabric Manager Tools to copy a license to the switch.
For example,Copy tftp://a.b.c.d/<filename> bootflash:

Related Topics

Installing the License Key File

You can install the license to enable features on your device.

$\mathcal{Q}$

Tip   If you need to install multiple licenses in any device, be sure to provide unique filenames for each license key file.

$\mathcal{N}$

Note   If you have a single supervisor module on your Cisco NX-OS device and you replace the supervisor module, you must reinstall the license key file.

If you are currently running with a grace period license, to avoid service disruptions when you install your permanent license, do not disable the grace period by using the **no license grace-period** command. Instead, just install your new license. The license manager will automatically transition from grace licensing to the installed license.

Procedure

Step 1   Log into the device through the console port of the active supervisor.

Step 2   You can use the file transfer service (tftp, ftp, sftp, sfp, or scp) or use the Cisco Fabric Manger License Wizard under Fabric Manager Tools to copy a license to the switch.
For example,Copy tftp://a.b.c.d/<filename> bootflash:

Step 3   Perform the installation by using the **install license** command on the active supervisor module from the device console.

```
switch# install license bootflash:license_file.lic
Installing license ..done
```

> **Note**   If you provide a target name for the license key file, the file is installed with the specified name. Otherwise, the filename specified in the license key file is used to install the license.

Step 4   (Optional) Back up the license key file.

Step 5   Exit the device console and open a new terminal session to view all license files installed on the device using the **show license** command.
> **Note**   If the license meets all guidelines when the **install license** command is used, all features and modules continue functioning as configured.

You can use the **show license brief** command to display a list of license files installed on the device.

You can use the **show license file** command to display information about a specific license file installed on the device.

Related Topics

Backing Up Licenses

If the configuration or bootflash memory on your device becomes corrupted, you might need to reinstall your license. You can do a reinstallation from a backed up copy of the license key file. If you do not have a license key file, you can create a copy of the license key file from your installed license.

Note If you have a single supervisor module on your Cisco NX-OS device and you replace the supervisor module, you must reinstall the license key file. You cannot reinstall the license key file from the backed-up copy.

Caution If you erase any existing licenses installed on your device, you can only reinstall them by using the **install license** command using the license key file.

Backing Up the License Key File

You can back up your license key file to a remote server or to an external device by using the **copy** command.

This example shows how to save a license key file to a remote server:

```
switch# copy bootflash:license_file.lic tftp://10.10.1.1//license_file.lic
```

Some Cisco NX-OS platforms support external flash devices. This example shows how to save a license key file to an external Flash device:

```
switch# copy bootflash:license_file.lic slot0:license_file.lic
```

Backing Up an Installed License

You can back up your license key file to a remote server or to an external device by using the **copy** command.

This example saves all licenses installed on your device to a .tar file and copies it to a remote UNIX-based server:

```
switch# copy licenses bootflash:Enterprise.tar
Backing up license done
switch# copy bootflash:lEnterprise.tar tftp://10.10.1.1//Enterprise.tar
```

You can uncompress the .tar file on the remote UNIX-based server to create one or more backup license key files, depending on how many licenses you have installed. You can also extract the license files on your Cisco NX-OS device by using the **tar extract** command.

This example shows how to extract license files from a .tar file:

```
switch# tar extract bootflash:Enterprise.tar
```

Identifying License Features in Use

When you enable a Cisco NX-OS software feature, it can activate a license grace period.

Note The Cisco MDS 9250i Switch does not use the enterprise license for the IVR feature.

Use the **show license usage** command to identify all of the active features.

Uninstalling Licenses

You can only uninstall a permanent license that is not in use. If you try to delete a permanent license that is currently being used, the software rejects the request and issues an error message. Uninstalling an unused license causes the grace period to come into effect. The grace period is counted from the first use of the feature without a license and is reset when a valid license file is installed.

Note Permanent licenses cannot be uninstalled if they are currently being used. Features turned on by permanent licenses must first be disabled, before that license is uninstalled.

Tip If you are using an evaluation license and would like to install a new permanent license, you can do so without service disruption and before the evaluation license expires. Removing an evaluation license immediately triggers a grace period without service disruption.

Caution You must disable the features that are related to the feature before uninstalling a license. The delete procedure fails if the license is in use.

Procedure

Step 1 Save your running configuration to a remote server by using the **copy** command.

```
switch# copy running-config tftp://server/path/filename
```

Step 2 Display a list of all installed license key files and identify the file to be uninstalled by using the **show license brief** command. In this example, the file to be uninstalled is the Enterprise.lic file.

Step 3 Disable the features provided by the license to be uninstalled. Use the **show license usage** *package_name* command to view the enabled features for a specified package.

Step 4 Uninstall the Enterprise.lic file by using the **clear license** *filename* command, where *filename* is the name of the installed license key file.

```
switch# clear license Enterprise.lic
Clearing license Enterprise.lic:
SERVER this_host ANY
VENDOR cisco
```

Step 5 Continue uninstalling the license by entering **y** for yes.

```
Do you want to continue? (y/n) y
Clearing license ..done
```

The Enterprise.lic license key file is now uninstalled.

Updating Licenses

If your license is time bound, you must obtain and install an updated license. Contact technical support to request an updated license.

✎

Note   If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco, contact Cisco Technical Support at this URL: http://www.cisco.com/en/US/ support/tsd_cisco_worldwide_contacts.html

Procedure

Step 1   Obtain the updated license file.

Step 2   Save your running configuration to a remote server by using the **copy** command.

Step 3   Verify the name of the file to be updated by using the **show license brief** command.

```
switch# show license brief
Enterprise.lic
```

Step 4   Update the license file by using the **update license** *url* command, where *url* specifies the bootflash:, slot0:, usb1:, or usb2: location of the updated license file.

```
switch# update license bootflash:Enterprise1.lic Enterprise.lic
```

Step 5   Continue with the license update by entering **y** (yes is the default).

```
Do you want to continue? (y/n) y
Updating license ..done
switch#
```

The Enterprise.lic license key file is now updated.

Related Topics

Configuring the Grace Period Feature

The grace period feature allows you to use licensed features that do not have a license key. By default, the license period feature is disabled. While the grace period feature is disabled, users cannot accidentally enable licensed features.

Enabling the License Grace Period

Enable the grace period feature by using the **license grace-period** command:

```
switch# configure terminal
switch(config)# license grace-period
```

You might have to enable a licensed feature to configure it. To enable a licensed feature, use the **feature** *feature-name* command in global configuration mode. For example, you can enable the Inter-VSAN Routing (IVR) feature as follows:

```
switch# configure terminal
switch(config)# feature ivr
```

Related Topics

Licensing Model, on page 3

Disabling the License Grace Period

To disable the grace period, you must disable all features that use the license grace period. Otherwise, the Cisco NX-OS software rejects the request and issues an error message.

> ✎ **Note**   To avoid service disruptions, you should not disable the grace period before you install a permanent license.

Procedure

Step 1   Display the licenses using the grace period by using the **show license usage** command.

```
switch# show license usage

Feature                     Ins    Lic    Status     Expiry Date  Comments
                                   Count
--------------------------------------------------------------------------------
FM_SERVER_PKG               Yes    -      Unused       never       -
ENTERPRISE_PKG              Yes    -      In use       never       -
PORT_ACTIVATION_PKG         No     8      In use       never       -
10G_PORT_ACTIVATION_PKG     No     0      Unused                   -
--------------------------------------------------------------------------------
```

Step 2   Disable the features provided by the license using the grace period. Display the enabled features for a specified package by using the **show license usage** *package_name* command. .

Step 3   Disable the grace period.
```
switch# configure terminal
switch(config)# no license grace-period
```

Grace Period Alerts

The Cisco NX-OS software gives you a 120-day grace period. This grace period starts or continues when you are evaluating a feature for which you have not installed a license.

The grace period stops if you disable a feature that you are evaluating, but if you enable that feature again without a valid license, the grace period countdown continues where it left off.

Note When you install the permanent license, to avoid service disruptions, do not disable the grace period by using the **no license grace-period** command. Instead, just install your new license. The license manager will automatically transition from grace licensing to the installed license.

Once the license manager is using your installed license, the grace period alerts will cease.

The grace period operates across all features in a license package. License packages can contain several features. If you disable a feature during the grace period and there are other features in that license package that are still enabled, the countdown does not stop for that license package. To suspend the grace period countdown for a license package, you must disable every feature in that license package.

The Cisco NX-OS license counter keeps track of all licenses on a device. If you are evaluating a feature and the grace period has started, you will receive console messages, SNMP traps, system messages, and Call Home messages on a daily basis.

Beyond that, the frequency of these messages become hourly during the last seven days of the grace period. For example, if you enabled a licensed feature on January 30, you will receive grace period ending messages as follows:

- Daily alerts from January 30 to May 21.

- Hourly alerts from May 22 to May 30.

On May 31, the grace period ends, and the licensed feature is automatically disabled. You will not be allowed to use the licensed feature until you purchase a valid license.

Note You cannot modify the frequency of the grace period messages.

Caution After the final seven days of the grace period, the feature is turned off and your network traffic may be disrupted. Any future upgrade to Cisco NX-OS will enforce license requirements and the 120-day grace period.

Use the **show license usage** command to display grace period information for a device.

License Transfers Between Devices

A license is specific to the physical device for which it is issued and is not valid on any other physical device. The license cannot be transferred.

Note If you have a single supervisor module on your Cisco NX-OS device and you replace the supervisor module, you must reinstall the license key file.

If you are evaluating a license when you replace the supervisor module, the grace period of the license is usually set to 120 days. On a dual supervisor system, the grace period of the license will be overwritten from the existing active supervisor module to the new stand-by supervisor module.

Note If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco, contact Cisco Technical Support at this URL: http://www.cisco.com/en/US/ support/tsd_cisco_worldwide_contacts.html

Verifying the License Configuration

To display the license configuration information, perform one of the following tasks:

Command	Purpose
show license [**brief**]	Displays information for all installed license files.
show license file	Displays information for a specific license file.
show license host-id	Displays the host ID for the physical device.
show license usage	Displays the usage information for installed licenses.

For detailed information about the fields in the output from these commands, see the for your platform.

On-Demand Port Activation Licensing

This section describes how to use the on-demand port activation licensing feature on the Cisco MDS 9124 Fabric Switch, the Cisco MDS 9134 Fabric Switch, the Cisco MDS 9148 Fabric Switch, the Cisco MDS 9250i Multiservice Fabric Switch, Cisco MDS 8G Fibre Channel Blade Switch for HP c-Class BladeSystem, the Cisco Fabric Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

About On-Demand Port Activation Licensing

You can expand your SAN connectivity as needed by enabling users to purchase and install additional port licenses. By default, all ports are eligible for license activation. On the Cisco MDS 9124 Fabric Switch, licenses are allocated sequentially. However, you can move or reassign licenses to any eligible port on the switch.

On the Cisco MDS 9134 Fabric Switch, the first 32 ports operate at 1 Gbps, 2 Gbps, or 4 Gbps. The switch has two ports that operate at 10 Gbps. Licenses are allocated sequentially.

On the Cisco Fabric Switch for HP c-Class BladeSystem and the Cisco Fabric Switch for IBM BladeCenter, licenses for internal ports are allocated as the ports come up. Licenses for external ports are allocated sequentially.

Port-Naming Conventions

This table describes the port-naming conventions for the Cisco Fabric switches.

Table 2: Port-Naming Conventions for Cisco Fabric Switches

Cisco MDS 9124 Switch	fc1/1 through fc1/24
Cisco MDS 9134 Switch	fc1/1 through fc1/34
Cisco MDS 9148 Switch	fc1/1 through fc1/48
Cisco MDS 9148S Switch	fc1/1 through fc1/48
Cisco MDS 9250i Switch	fc1/1 through fc1/40 and IPS 1/1-2 ETH 1/1-8
Cisco MDS 9396S Switch	fc1/1 through fc1/96
Cisco MDS 8G FC Blade Switch for HP BladeCenter	Internal ports: bay1 through bay16
	External ports: ext1 through ext8
Cisco Fabric Switch for IBM BladeCenter	Internal ports: bay1 through bay14
	External ports: ext0 and ext15 through ext19

Port Licensing

On the Cisco MDS 9124 Switch, the first eight ports are licensed by default. You are not required to perform any tasks beyond the default configuration unless you prefer to immediately activate additional ports, make ports ineligible, or move port licenses.

This figure shows the ports that are licensed by default for the Cisco MDS 9124 Switch.

Figure 2: Cisco MDS 9124 Switch Default Port Licenses (fc1/1 - fc1/8)
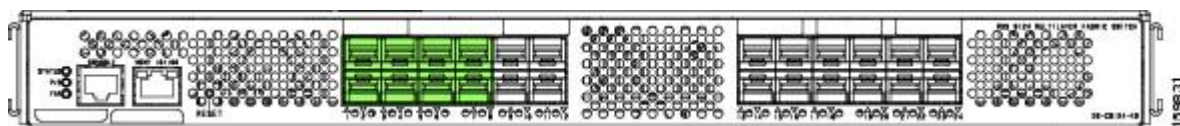
If you need additional connectivity, you can activate additional ports in 8-port increments with each on-demand port activation license, up to a total of 24 ports.

On the Cisco MDS 9134 Switch, the first 24 ports that can operate at 1 Gbps, 2 Gbps, or 4 Gbps are licensed by default. If you need additional connectivity, you can activate the remaining eight ports with one on-demand port activation license. A separate 10 G license file is required to activate the remaining two 10-Gbps ports.

This figure shows the ports that are licensed by default for the Cisco MDS 9134 Switch

Figure 3: Cisco MDS 9134 Switch Default Port Licenses (fc1/1 - fc1/24)
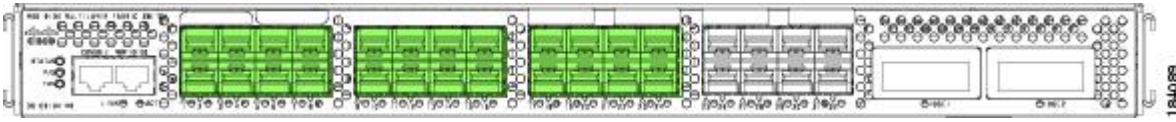
Cisco MDS 9148 Switch is provided by the Cisco MDS 9148 On-Demand Port Activation license, , which allows the addition of eight 8-Gbps ports. You have the option of purchasing preconfigured models of 16, 32, or 48 ports and upgrading the 16- and 32-port models onsite all the way to 48 ports by adding these license

On the Cisco MDS 9250i Switch, 20 16-Gbps Fibre Channel ports are active by default. To enable the other 20 16-Gbps Fibre Channel ports, you must obtain a license. The 8 10-Gbps FCoE ports are active by default. The two fixed 10-Gbps IP storage services ports do not require additional license

The Cisco MDS 8G Fibre Channel Blade Switch for HP c-Class BladeSystem has two models: a base 12-port model and a 24-port model. A 12-port license upgrade is available to upgrade the 12-port model from 12 ports to 24 ports.

This figure shows the external ports that are licensed by default for the Cisco Fabric Switch for HP c-Class BladeSystem.

Figure 4: Cisco Fabric Switch for HP c-Class BladeSystem Default Port Licenses (ext1 - ext4)
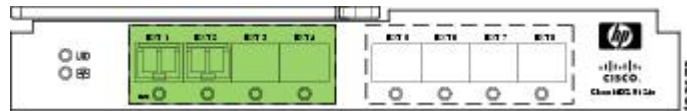
On the Cisco Fabric Switch for HP c-Class BladeSystem, any eight internal ports and the external ports (ext1 through ext4) are licensed by default. A single on-demand port activation license is required to use the remaining eight internal and four external ports.

On the Cisco Fabric Switch for IBM BladeCenter, any seven internal ports and the external ports (ext0, ext15 and ext16) are licensed by default. A single on-demand port activation license is required to use the remaining seven internal and three external ports.

This figure shows the external ports that are licensed by default for the Cisco Fabric Switch for IBM BladeCenter.

Figure 5: Cisco Fabric Switch for IBM BladeCenter Default Port Licenses (ext0, ext15 - ext16)
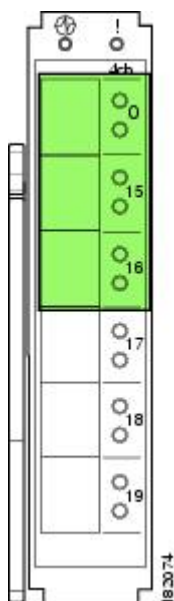
Default Configuration

The following example shows the default port license configuration for the Cisco MDS 9124 Switch:

```
switch# show port-license
Available port activation licenses are 0
----------------------------------------------------
  Interface    Cookie       Port Activation License
----------------------------------------------------
    fc1/1      16777216              acquired
    fc1/2      16781312              acquired
    fc1/3      16785408              acquired
    fc1/4      16789504              acquired
    fc1/5      16793600              acquired
    fc1/6      16797696              acquired
    fc1/7      16801792              acquired
    fc1/8      16805888              acquired
    fc1/9      16809984              eligible
    fc1/10     16814080              eligible
    fc1/11     16818176              eligible
    fc1/12     16822272              eligible
    fc1/13     16826368              eligible
    fc1/14     16830464              eligible
    fc1/15     16834560              eligible
    fc1/16     16838656              eligible
    fc1/17     16842752              eligible
    fc1/18     16846848              eligible
    fc1/19     16850944              eligible
    fc1/20     16855040              eligible
    fc1/21     16859136              eligible
    fc1/22     16863232              eligible
    fc1/23     16867328              eligible
    fc1/24     16871424              eligible
```

```
switch# show license usage PORT_ACTIVATION_PKG
Application
-----------
16777216
16797696
16781312
16793600
16785408
16805888
16789504
16801792
-----------
```

The following example shows the default port license configuration for the Cisco MDS 9134 Switch:

```
switch# show port-license
Available port activation licenses are 0
Available 10G port activation licenses are 0
-------------------------------------------------
  Interface    Cookie      Port Activation License
-------------------------------------------------
   fc1/1      16777216          acquired
   fc1/2      16781312          acquired
   fc1/3      16785408          acquired
   fc1/4      16789504          acquired
   fc1/5      16793600          acquired
   fc1/6      16797696          acquired
   fc1/7      16801792          acquired
   fc1/8      16805888          acquired
   fc1/9      16809984          acquired
   fc1/10     16814080          acquired
   fc1/11     16818176          acquired
   fc1/12     16822272          acquired
   fc1/13     16826368          acquired
   fc1/14     16830464          acquired
   fc1/15     16834560          acquired
   fc1/16     16838656          acquired
   fc1/17     16842752          acquired
   fc1/18     16846848          acquired
   fc1/19     16850944          acquired
   fc1/20     16855040          acquired
   fc1/21     16859136          acquired
   fc1/22     16863232          acquired
   fc1/23     16867328          acquired
   fc1/24     16871424          acquired
   fc1/25     16875520          eligible
   fc1/26     16879616          eligible
   fc1/27     16883712          eligible
   fc1/28     16887808          eligible
   fc1/29     16891904          eligible
   fc1/30     16896000          eligible
   fc1/31     16900096          eligible
   fc1/32     16904192          eligible
   fc1/33     16908288          eligible
   fc1/34     16912384          eligible
```

```
switch# show license usage PORT_ACTIVATION_PKG
Application
-----------
16777216
16797696
16781312
16793600
16785408
16805888
16789504
16801792
16809984
16859136
16814080
16826368
16838656
16834560
16842752
16818176
16822272
16830464
16855040
16850944
16846848
16867328
16871424
16863232
-----------
```

The following example shows the default port license configuration for the Cisco MDS 9148 Switch:

```
switch# show port-license
Available port activation licenses are 0
----------------------------------------------
  Interface   Cookie   Port Activation License
----------------------------------------------
  fc1/1       16777216         acquired
  fc1/2       16781312         acquired
  fc1/3       16785408         acquired
  fc1/4       16789504         acquired
  fc1/5       16793600         acquired
  fc1/6       16797696         acquired
  fc1/7       16801792         acquired
  fc1/8       16805888         acquired
  fc1/9       16809984         acquired
  fc1/10      16814080         acquired
  fc1/11      16818176         acquired
  fc1/12      16822272         acquired
  fc1/13      16826368         acquired
  fc1/14      16830464         acquired
  fc1/15      16834560         acquired
  fc1/16      16838656         acquired
  fc1/17      16842752         eligible
  fc1/18      16846848         eligible
  fc1/19      16850944         eligible
  fc1/20      16855040         eligible
  fc1/21      16859136         eligible
  fc1/22      16863232         eligible
  fc1/23      16867328         eligible
  fc1/24      16871424         eligible
  fc1/25      16875520         eligible
  fc1/26      16879616         eligible
  fc1/27      16883712         eligible
```

```
fc1/28      16887808        eligible
fc1/29      16891904        eligible
fc1/30      16896000        eligible
fc1/31      16900096        eligible
fc1/32      16904192        eligible
fc1/33      16908288        eligible
fc1/34      16912384        eligible
fc1/35      16916480        eligible
fc1/36      16920576        eligible
fc1/37      16924672        eligible
fc1/38      16928768        eligible
fc1/39      16932864        eligible
fc1/40      16936960        eligible
fc1/41      16941056        eligible
fc1/42      16945152        eligible
fc1/43      16949248        eligible
fc1/44      16953344        eligible
fc1/45      16957440        eligible
fc1/46      16961536        eligible
fc1/47      16965632        eligible
fc1/48      16969728        eligible
```

Note   The cookie is used to acquire a license. Use the **show license usage PORT_ACTIVATION_PKG** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIVATION_PKG
Application
-------------------------------------------------------------------------------
Port Manager (fc1/1)
Port Manager (fc1/2)
Port Manager (fc1/3)
Port Manager (fc1/4)
Port Manager (fc1/5)
Port Manager (fc1/6)
Port Manager (fc1/7)
Port Manager (fc1/8)
Port Manager (fc1/9)
Port Manager (fc1/10)
Port Manager (fc1/11)
Port Manager (fc1/12)
Port Manager (fc1/13)
Port Manager (fc1/14)
Port Manager (fc1/15)
Port Manager (fc1/16)
-------------------------------------------------------------------------------
```

The following example shows the default port license configuration for the Cisco MDS 9148S Switch:

```
switch# show port-license
 Available port activation licenses are 36
------------------------------------------------
  Interface   Cookie    Port Activation License
------------------------------------------------
  fc1/1       16777216        acquired
  fc1/2       16781312        acquired
  fc1/3       16785408        acquired
  fc1/4       16789504        acquired
  fc1/5       16793600        acquired
  fc1/6       16797696        acquired
  fc1/7       16801792        acquired
  fc1/8       16805888        acquired
  fc1/9       16809984        acquired
  fc1/10      16814080        acquired
  fc1/11      16818176        acquired
  fc1/12      16822272        acquired
  fc1/13      16826368        eligible
  fc1/14      16830464        eligible
```

```
fc1/15      16834560       eligible
fc1/16      16838656       eligible
fc1/17      16842752       eligible
fc1/18      16846848       eligible
fc1/19      16850944       eligible
fc1/20      16855040       eligible
fc1/21      16859136       eligible
fc1/22      16863232       eligible
fc1/23      16867328       eligible
fc1/24      16871424       eligible
fc1/25      16875520       eligible
fc1/26      16879616       eligible
fc1/27      16883712       eligible
fc1/28      16887808       eligible
fc1/29      16891904       eligible
fc1/30      16896000       eligible
fc1/31      16900096       eligible
fc1/32      16904192       eligible
fc1/33      16908288       eligible
fc1/34      16912384       eligible
fc1/35      16916480       eligible
fc1/36      16920576       eligible
fc1/37      16924672       eligible
fc1/38      16928768       eligible
fc1/39      16932864       eligible
fc1/40      16936960       eligible
fc1/41      16941056       eligible
fc1/42      16945152       eligible
fc1/43      16949248       eligible
fc1/44      16953344       eligible
fc1/45      16957440       eligible
fc1/46      16961536       eligible
fc1/47      16965632       eligible
fc1/48      16969728       eligible
```

✎

Note   The cookie is used to acquire a license. Use the **show license usage PORT_ACTIV_9148S_PKG** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIV_9148S_PKG
Application
---------------------------------------------------------------------------
Port Manager (fc1/1)
Port Manager (fc1/2)
Port Manager (fc1/3)
Port Manager (fc1/4)
Port Manager (fc1/5)
Port Manager (fc1/6)
Port Manager (fc1/7)
Port Manager (fc1/8)
Port Manager (fc1/9)
Port Manager (fc1/10)
Port Manager (fc1/11)
Port Manager (fc1/12)
---------------------------------------------------------------------------
```
The following example shows the default port license configuration for the Cisco MDS 9250i Switch:

```
switch# show port-license
Available port activation licenses are 20
----------------------------------------------
  Interface   Cookie    Port Activation License
----------------------------------------------
  fc1/1       16777216        acquired
  fc1/2       16781312        acquired
  fc1/3       16785408        acquired
  fc1/4       16789504        acquired
  fc1/5       16793600        acquired
  fc1/6       16797696        acquired
```

```
fc1/7       16801792        acquired
fc1/8       16805888        acquired
fc1/9       16809984        acquired
fc1/10      16814080        acquired
fc1/11      16818176        acquired
fc1/12      16822272        acquired
fc1/13      16826368        acquired
fc1/14      16830464        acquired
fc1/15      16834560        acquired
fc1/16      16838656        acquired
fc1/17      16842752        acquired
fc1/18      16846848        acquired
fc1/19      16850944        acquired
fc1/20      16855040        acquired
fc1/21      16859136        eligible
fc1/22      16863232        eligible
fc1/23      16867328        eligible
fc1/24      16871424        eligible
fc1/25      16875520        eligible
fc1/26      16879616        eligible
fc1/27      16883712        eligible
fc1/28      16887808        eligible
fc1/29      16891904        eligible
fc1/30      16896000        eligible
fc1/31      16900096        eligible
fc1/32      16904192        eligible
fc1/33      16908288        eligible
fc1/34      16912384        eligible
fc1/35      16916480        eligible
fc1/36      16920576        eligible
fc1/37      16924672        eligible
fc1/38      16928768        eligible
fc1/39      16932864        eligible
fc1/40      16936960        eligible
```

Note   The cookie is used to acquire a license. Use the **show license usage PORT_ACTIV_20P** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIV_20P
Application
-----------------------------------------------------------------------
Port Manager (fc1/1)
Port Manager (fc1/2)
Port Manager (fc1/3)
Port Manager (fc1/4)
Port Manager (fc1/5)
Port Manager (fc1/6)
Port Manager (fc1/7)
Port Manager (fc1/8)
Port Manager (fc1/9)
Port Manager (fc1/10)
Port Manager (fc1/11)
Port Manager (fc1/12)
Port Manager (fc1/13)
Port Manager (fc1/14)
Port Manager (fc1/15)
Port Manager (fc1/16)
Port Manager (fc1/17)
Port Manager (fc1/18)
Port Manager (fc1/19)
Port Manager (fc1/20)
```
The following example shows the default port license configuration for the Cisco MDS 9396S Switch:

```
switch# show port-license
 Available port activation licenses are 0
------------------------------------------------
  Interface   Cookie    Port Activation License
```

```
------------------------------------------------
   fc1/1      16777216       acquired
   fc1/2      16781312       acquired
   fc1/3      16785408       acquired
   fc1/4      16789504       acquired
   fc1/5      16793600       acquired
   fc1/6      16797696       acquired
   fc1/7      16801792       acquired
   fc1/8      16805888       acquired
   fc1/9      16809984       acquired
   fc1/10     16814080       acquired
   fc1/11     16818176       acquired
   fc1/12     16822272       acquired
   fc1/13     16826368       acquired
   fc1/14     16830464       acquired
   fc1/15     16834560       acquired
   fc1/16     16838656       acquired
   fc1/17     16842752       acquired
   fc1/18     16846848       acquired
   fc1/19     16850944       acquired
   fc1/20     16855040       acquired
   fc1/21     16859136       acquired
   fc1/22     16863232       acquired
   fc1/23     16867328       acquired
   fc1/24     16871424       acquired
   fc1/25     16875520       acquired
   fc1/26     16879616       acquired
   fc1/27     16883712       acquired
   fc1/28     16887808       acquired
   fc1/29     16891904       acquired
   fc1/30     16896000       acquired
   fc1/31     16900096       acquired
   fc1/32     16904192       acquired
   fc1/33     16908288       acquired
   fc1/34     16912384       acquired
   fc1/35     16916480       acquired
   fc1/36     16920576       acquired
   fc1/37     16924672       acquired
   fc1/38     16928768       acquired
   fc1/39     16932864       acquired
   fc1/40     16936960       acquired
   fc1/41     16941056       acquired
   fc1/42     16945152       acquired
   fc1/43     16949248       acquired
   fc1/44     16953344       acquired
   fc1/45     16957440       acquired
   fc1/46     16961536       acquired
   fc1/47     16965632       acquired
   fc1/48     16969728       acquired
   fc1/49     16973824       eligible
   fc1/50     16977920       eligible
   fc1/51     16982016       eligible
   fc1/52     16986112       eligible
   fc1/53     16990208       eligible
   fc1/54     16994304       eligible
   fc1/55     16998400       eligible
   fc1/56     17002496       eligible
   fc1/57     17006592       eligible
   fc1/58     17010688       eligible
   fc1/59     17014784       eligible
   fc1/60     17018880       eligible
   fc1/61     17022976       eligible
   fc1/62     17027072       eligible
   fc1/63     17031168       eligible
   fc1/64     17035264       eligible
   fc1/65     17039360       eligible
   fc1/66     17043456       eligible
   fc1/67     17047552       eligible
   fc1/68     17051648       eligible
   fc1/69     17055744       eligible
   fc1/70     17059840       eligible
```

```
fc1/71      17063936      eligible
fc1/72      17068032      eligible
fc1/73      17072128      eligible
fc1/74      17076224      eligible
fc1/75      17080320      eligible
fc1/76      17084416      eligible
fc1/77      17088512      eligible
fc1/78      17092608      eligible
fc1/79      17096704      eligible
fc1/80      17100800      eligible
fc1/81      17104896      eligible
fc1/82      17108992      eligible
fc1/83      17113088      eligible
fc1/84      17117184      eligible
fc1/85      17121280      eligible
fc1/86      17125376      eligible
fc1/87      17129472      eligible
fc1/88      17133568      eligible
fc1/89      17137664      eligible
fc1/90      17141760      eligible
fc1/91      17145856      eligible
fc1/92      17149952      eligible
fc1/93      17154048      eligible
fc1/94      17158144      eligible
fc1/95      17162240      eligible
fc1/96      17166336      eligible
```

Note   The cookie is used to acquire a license. Use the **show license usage PORT_ACTIV_9396S_PKG** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIV_9396S_PKG
Application
--------------------------------------------------------------------------
Port Manager (fc1/1)
Port Manager (fc1/2)
Port Manager (fc1/3)
Port Manager (fc1/4)
Port Manager (fc1/5)
Port Manager (fc1/6)
Port Manager (fc1/7)
Port Manager (fc1/8)
Port Manager (fc1/9)
Port Manager (fc1/10)
Port Manager (fc1/11)
Port Manager (fc1/12)
Port Manager (fc1/13)
Port Manager (fc1/14)
Port Manager (fc1/15)
Port Manager (fc1/16)
Port Manager (fc1/17)
Port Manager (fc1/18)
Port Manager (fc1/19)
Port Manager (fc1/20)
Port Manager (fc1/21)
Port Manager (fc1/22)
Port Manager (fc1/23)
Port Manager (fc1/24)
Port Manager (fc1/25)
Port Manager (fc1/26)
Port Manager (fc1/27)
Port Manager (fc1/28)
Port Manager (fc1/29)
Port Manager (fc1/30)
Port Manager (fc1/31)
Port Manager (fc1/32)
Port Manager (fc1/33)
Port Manager (fc1/34)
Port Manager (fc1/35)
Port Manager (fc1/36)
```

```
Port Manager (fc1/37)
Port Manager (fc1/38)
Port Manager (fc1/39)
Port Manager (fc1/40)
Port Manager (fc1/41)
Port Manager (fc1/42)
Port Manager (fc1/43)
Port Manager (fc1/44)
Port Manager (fc1/45)
Port Manager (fc1/46)
Port Manager (fc1/47)
Port Manager (fc1/48)
--------------------------------------------------------------------------
```

The following example shows the default port license configuration for the Cisco Fabric Switch for HP c-Class BladeSystem:

```
switch# show port-license
 Available ext port activation licenses are 0
 Available bay port activation licenses are 0
---------------------------------------------------
  Interface    Cookie      Port Activation License
---------------------------------------------------
  bay1         16838656         acquired
  bay2         16834560         eligible
  bay3         16818176         acquired
  bay4         16809984         eligible
  bay5         16789504         acquired
  bay6         16781312         eligible
  bay7         16805888         eligible
  bay8         16863232         acquired
  bay9         16850944         acquired
  bay10        16842752         acquired
  bay11        16822272         acquired
  bay12        16826368         eligible
  bay13        16785408         acquired
  bay14        16797696         eligible
  bay15        16801792         eligible
  bay16        16859136         eligible
  ext1         16814080         acquired
  ext2         16830464         acquired
  ext3         16846848         acquired
  ext4         16855040         acquired
  ext5         16871424         eligible
  ext6         16867328         eligible
  ext7         16793600         eligible
  ext8         16777216         eligible
```

Note The cookie is used to acquire a license. Use the **show license usage PORT_ACTIVATION_PKG** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIVATION_PKG
Application
-----------
16785408
16789504
16793600
16814080
16818176
16822272
16838656
16842752
16850944
16863232
16867328
16855040
-----------
```

The following example shows the default port license configuration for the Cisco Fabric Switch for IBM BladeCenter:

Note   The first seven internal ports that come up acquire a license.

```
switch# show port-license
Available ext port activation licenses are 0
Available bay port activation licenses are 0
---------------------------------------------------
  Interface    Cookie       Port Activation License
---------------------------------------------------
   bay1        16850944        eligible
   bay2        16838656        eligible
   bay3        16842752        acquired
   bay4        16834560        eligible
   bay5        16822272        acquired
   bay6        16818176        eligible
   bay7        16826368        acquired
   bay8        16809984        eligible
   bay9        16797696        acquired
   bay10       16781312        eligible
   bay11       16785408        acquired
   bay12       16789504        eligible
   bay13       16801792        acquired
   bay14       16805888        acquired
   ext0        16846848        acquired
   ext15       16855040        acquired
   ext16       16830464        acquired
   ext17       16814080        eligible
   ext18       16793600        eligible
   ext19       16777216        eligible
```

Note   The cookie is used to acquire a license. Use the **show license usage PORT_ACTIVATION_PKG** command to show the cookies for acquired licenses.

```
switch# show license usage PORT_ACTIVATION_PKG
Application
-----------
16830464
16826368
16818176
16822272
16834560
16838656
16846848
16850944
16855040
16842752
-----------
```

Note   Cisco MDS 9124 Multilayer Fabric Switch and Cisco MDS 9134 Multilayer Fabric Switch do not support Cisco MDS 9000 NX-OS 6.x release.

License Status Definitions

This table defines the port activation license status terms.

Table 3: Port Activation License Status Definitions

Port Activation License Status	Definition
acquired	The port is licensed and active.
eligible	The port is eligible to receive a license but does not yet have one.
ineligible	The port is not allowed to receive a license.

By default, when you install additional port license activation packages, the activation status of ports changes from "eligible" to "acquired." If you prefer to accept the default behavior, no further action is required.

Note You can uninstall licenses for ports not in use; however, you cannot uninstall default licenses.

This table describes the port license assignments for the Cisco MDS 9124 Switch.

Table 4: Default Port License Assignments for Cisco MDS 9124 Switch

License Package (PORT_ACTIVATION_PKG)	Assigned to Ports on the Cisco MDS 9124 Switch
Default	1–8
First PORT_ACTIVATION_PKG	9–16
Second PORT_ACTIVATION_PKG	17–24

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but features or ports have acquired the license, then the status displayed is Unused.

The default license package for the Cisco MDS 9124 Switch is as follows:

```
switch# show license usage

Feature                       Ins    Lic   Status     Expiry Date  Comments
                                     Count
--------------------------------------------------------------------------------
FM_SERVER_PKG                 Yes    -     Unused     never        -
ENTERPRISE_PKG                Yes    -     In use     never        -
PORT_ACTIVATION_PKG           No     8     In use     never        -
10G_PORT_ACTIVATION_PKG       No     0     Unused                  -
--------------------------------------------------------------------------------
```

Note The PORT_ACTIVATION_PKG does not appear as installed if you have only the default license installed.

This table describes the port license assignments for the Cisco MDS 9134 Switch.

Table 5: Default Port License Assignments for Cisco MDS 9134 Switch

License Package (PORT_ACTIVATION_PKG)	Assigned to Ports on the Cisco MDS 9134 Switch
Default	1–24
PORT_ACTIVATION_PKG	25–32
10G_PORT_ACTIVATION_PKG	33–34

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but features or ports have acquired the license, then the status displayed is Unused.

The default license package for the Cisco MDS 9134 Switch is as follows:

```
switch# show license usage

Feature                     Ins    Lic   Status     Expiry Date  Comments
                                   Count
--------------------------------------------------------------------------
FM_SERVER_PKG               Yes     -    Unused        never       -
ENTERPRISE_PKG              Yes     -    In use        never       -
PORT_ACTIVATION_PKG         No     24    In use        never       -
10G_PORT_ACTIVATION_PKG     yes     2    Unused        never       -
--------------------------------------------------------------------------
```

This table describes the port license assignments for the Cisco MDS 9148 Switch.

Table 6: Default Port License Assignments for Cisco MDS 9148 Switch

License Package (PORT_ACTIVATION_PKG)	Assigned to Ports on the Cisco MDS 9148 Switch
Default	1–16
First PORT_ACTIVATION_PKG	17–24
Second PORT_ACTIVATION_PKG	25-32
Third PORT_ACTIVATION_PKG	33-40
Fourth PORT_ACTIVATION_PKG	41-48

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but features or ports have acquired the license, then the status displayed is Unused.

The default license package for the Cisco MDS 9148 Switch is as follows:

```
switch# show license usage

Feature                     Ins  Lic   Status Expiry Date Comments
                                 Count
--------------------------------------------------------------------------
```

```
FM_SERVER_PKG                      No   -   Unused          -
ENTERPRISE_PKG                     Yes  -   Unused never     -
PORT_ACTIVATION_PKG                No   16  In use never     -
-------------------------------------------------------------------------------
```

This table describes the port license assignments for the Cisco MDS 9148S Switch.

Table 7: Default Port License Assignments for Cisco MDS 9148S Switch

License Package (PORT_ACTIV_9148S_PKG)	Assigned to Ports on the Cisco MDS 9148S Switch
Default	1–12
First PORT_ACTIV_9148S_PKG	13–24
Second PORT_ACTIV_9148S_PKG	25-36
Third PORT_ACTIV_9148S_PKG	37-48

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but features or ports have acquired the license, then the status displayed is Unused.

The default license package for the Cisco MDS 9148S Switch is as follows:

```
switch# show license usage

Feature                      Ins  Lic    Status Expiry Date Comments
                                  Count
-------------------------------------------------------------------------------
FM_SERVER_PKG                Yes  -    Unused never      -
ENTERPRISE_PKG               No   -    Unused            Grace expired
PORT_ACTIV_9148S_PKG         No   12   In use never      -
-------------------------------------------------------------------------------
```

This table describes the port license assignments for the Cisco MDS 9250i Switch.

Table 8: Default Port License Assignments for Cisco MDS 9250i Switch

License Package (PORT_ACTIV_20P)	Assigned to Ports on the Cisco MDS 9250i Switch
Default	1–20
First PORT_ACTIV_20P	21–40

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but no ports have acquired a license, then the status displayed is Unused.

The default license package for the Cisco MDS 9250i Switch is as follows:

```
switch# show license usage
Feature                      Ins  Lic    Status Expiry Date Comments
                                  Count
-------------------------------------------------------------------------------
DMM_9250                     No   0    Unused            -
IOA_9250                     No   0    Unused            -
XRC_ACCL                     No   -    Unused            -
```

```
FM_SERVER_PKG                   Yes   -   Unused never      -
MAINFRAME_PKG                   No    -   Unused            -
ENTERPRISE_PKG                  No    -   Unused            -
PORT_ACTIV_20P                  No    20  In use never      -
--------------------------------------------------------------------------
```

This table describes the port license assignments for the Cisco MDS 9396S Switch.

Table 9: Default Port License Assignments for Cisco MDS 9396S Switch

License Package (PORT_ACTIV_9396S_PKG)	Assigned to Ports on the Cisco MDS 9396S Switch
Default	1–48
First PORT_ACTIV_9396S_PKG	49-60
Second PORT_ACTIV_9396S_PKG	61-72
Third PORT_ACTIV_9396S_PKG	73-84
Fourth PORT_ACTIV_9396S_PKG	85-96

You can use the **show license usage** command to view any licenses assigned to a switch. If a license is in use, the status displayed is In use. If a license is installed but features or ports have acquired the license, then the status displayed is Unused.

The default license package for the Cisco MDS 9396S Switch is as follows:

```
switch# show license usage

Feature                   Ins  Lic   Status Expiry Date Comments
                               Count
--------------------------------------------------------------------------
FM_SERVER_PKG             No    -   Unused            -
ENTERPRISE_PKG           No    -   In use            Grace 24D 0H
PORT_ACTIV_9396S_PKG     No    48  In use never      -
--------------------------------------------------------------------------
```

This table describes the port license assignments for the Cisco Fabric Switch for HP c-Class BladeSystem.

Table 10: Default Port License Assignments for Cisco Fabric Switch for HP c-Class BladeSystem

License Package (PORT_ACTIVATION_PKG)	Assigned to Ports on the Cisco Fabric Switch for HP c-Class BladeSystem
Default	Any eight internal ports and the four external ports ext1 through ext4.
PORT_ACTIVATION_PKG	A single license required for the remaining eight internal and four external ports.

You can use the **show license usage** command to view any licenses assigned to a switch. The default license package for the Cisco Fabric Switch for HP c-Class BladeSystem is as follows:

```
switch# show license usage

Feature                   Ins    Lic   Status   Expiry Date  Comments
                                 Count
```

```
--------------------------------------------------------------------------------
FM_SERVER_PKG                    No      -    Unused                    -
ENTERPRISE_PKG                   No      -    Unused                    -
PORT_ACTIVATION_PKG              No      12   In use         never      -
10G_PORT_ACTIVATION_PKG          No      0    Unused                    -
--------------------------------------------------------------------------------
```

✎

Note   The PORT_ACTIVATION_PKG does not appear as installed if you have only the default license installed.

This table describes the port license assignments for the Cisco Fabric Switch for IBM BladeCenter.

Table 11: Default Port License Assignments for Cisco Fabric Switch for IBM BladeCenter

License Package (PORT_ACTIVATION_PKG)	Assigned to Ports on the Cisco Fabric Switch for IBM BladeCenter
Default	Any seven internal ports and the three external ports ext0, ext15 and ext16.
PORT_ACTIVATION_PKG	A single license required for the remaining seven internal and three external ports.

You can use the **show license usage** command to view any licenses assigned to a switch. The default license package for the Cisco Fabric Switch for IBM BladeCenter is as follows:

```
switch# show license usage

Feature                        Ins    Lic  Status      Expiry Date  Comments
                                      Count
--------------------------------------------------------------------------------
FM_SERVER_PKG                    No     -    Unused                   -
ENTERPRISE_PKG                   No     -    Unused                   -
PORT_ACTIVATION_PKG              No     10   In use        never      -
10G_PORT_ACTIVATION_PKG          No     0    Unused                   -
--------------------------------------------------------------------------------
```

✎

Note   The PORT_ACTIVATION_PKG does not appear as installed if you have only the default license installed.

Configuring Port Activation Licenses

This section describes how to configure port activation licenses.

Making a Port Eligible for a License

By default, all ports are eligible to receive a license. However, if a port has already been made ineligible and you prefer to activate it, then you must make that port eligible by using the **port-license** command.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface fc** *slot*/*port*
	
	Example:
	`switch(config)# interface fc1/1`
	`switch(config-if)#`
		Specifies the port interface that you want to make eligible for a license.
		
		Note The name of the port depends on the switch you are using.

Step 3	[**no**] **port-license** **Example:** `switch(config-if)# port-license`	Makes the port eligible to acquire a license. Use the **no** form of the command to remove a license from a port if it already has been assigned, and also make the port ineligible to acquire a license. **Note** You can remove licenses only from ports that are not in an administrative shutdown state.

Step 4	**exit**
	
	Example:
	`switch(config-if)# exit`
	`switch(config)#`
		Exits interface configuration mode.

Step 5	**show port-license** **Example:** `switch(config)# show port-license`	(Optional) Displays the port license configuration.

Step 6	**copy running-config startup-config**
	
	Example:
	`switch(config)# copy running-config`
	`startup-config`
		(Optional)
		Copies the running configuration to the startup configuration.

Acquiring a License for a Port

If you do not prefer to accept the default on-demand port license assignments, you will need to first acquire licenses for ports to which you want to move the license.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface fc** *slot/port*
	
	Example:
	`switch(config)# interface fc1/1`
	`switch(config-if)#`
		Specifies the port interface for which you want to acquire a license.
		
		Note The name of the port depends on the switch you are using.

Step 3	[**no**] **port-license acquire** **Example:** `switch(config-if)# port-license acquire`	Grants a license to a port or range of ports. Use the **no** form of the command to remove a license from a port or range of ports.

Step 4	**exit**
	
	Example:
	`switch(config-if)# exit`
	`switch(config)#`
		Exits interface configuration mode.

Step 5	**show port-license** **Example:** `switch(config)# show port-license`	(Optional) Displays the port license configuration.

Step 6	**copy running-config startup-config**
	
	Example:
	`switch(config)# copy running-config`
	`startup-config`
		(Optional)
		Copies the running configuration to the startup configuration.

Moving Licenses Among Ports

Note   On the Cisco Fabric Switch for HP c-Class BladeSystem and the Cisco Fabric Switch for IBM BladeCenter, you can only move the license for internal ports among internal ports. Licenses from an internal port cannot be moved to an external port and vice versa. Licenses for external ports can only be moved among external ports.

You can move a license from a port (or range of ports) at any time. If you attempt to move a license to a port and no license is available, then the switch returns the message "port activation license not available."

> **✎**
>
> **Note** Once internal ports are licensed on the Cisco Fabric Switch for HP c-Class BladeSystem or the Cisco Fabric Switch for IBM BladeCenter, if you enter the **copy running-config startup-config** command, then on the next reload, these ports will retain the licenses.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface fc** *slot/port*
	
	Example:
	`switch(config)# interface fc1/1`
	`switch(config-if)#`
		Specifies the port interface from which you want to move a license.

Step 3	**shutdown** **Example:** `switch(config-if)# shutdown`	Disables the interface.
Step 4	**no port-license** **Example:** `switch(config-if)# no port-license`	Removes the license from port fc1/1 and makes the port ineligible to acquire a license.

Step 5	**exit**
	
	Example:
	`switch(config-if)# exit`
	`switch(config)#`
		Exits interface configuration mode.

Step 6	**interface fc** *slot/port*
	
	Example:
	`switch(config)# interface fc1/24`
	`switch(config-if)#`
		Specifies the port interface to which you want to move the license.
		
		Note The name of the port depends on the switch you are using.

Step 7	**shutdown** **Example:** `switch(config-if)# shutdown`	Disables the interface.
Step 8	**port-license acquire** **Example:** `switch(config-if)# port-license acquire`	Grants a license to port fc1/24.

	Command or Action	Purpose
Step 9	**no shutdown** **Example:** `switch(config-if)# shutdown`	Enables the interface.

Step 10	**exit**
	
	Example:
	`switch(config-if)# exit`
	`switch(config)#`
		Exits interface configuration mode.

Step 11	**show port-license** **Example:** `switch(config)# show port-license`	(Optional) Displays the port license configuration.

Step 12	**copy running-config startup-config**
	
	Example:
	`switch(config)# copy running-config`
	`startup-config`
		(Optional)
		Copies the running configuration to the startup configuration.

On-Demand Port License Activation Example

The following example shows how to do the following tasks:

- Make a port ineligible

- Install port activation licenses

- Move licenses from one port to another

If you do not want to accept the default behavior, or you need flexibility in terms of which ports acquire a license, you may want to make a port ineligible. For example, if the first eight ports have a license, but you want to move a license from port 7 to port 9, then you would need to make a port ineligible. Or, if you have a port that should never acquire a license, you can make it ineligible and it will not be a candidate for a license when additional licenses are installed.

Procedure

Step 1   Display the default port license configuration.

```
switch# show port-license
Available port activation licenses are 0
----------------------------------------------------
  Interface    Cookie       Port Activation License
----------------------------------------------------
    fc1/1      16777216             acquired
    fc1/2      16781312             acquired
    fc1/3      16785408             acquired
    fc1/4      16789504             acquired
```

```
        fc1/5       16793600              acquired
        fc1/6       16797696              acquired
        fc1/7       16801792              acquired
        fc1/8       16805888              acquired
        fc1/9       16809984              eligible
        fc1/10      16814080              eligible
        fc1/11      16818176              eligible
        fc1/12      16822272              eligible
        fc1/13      16826368              eligible
        fc1/14      16830464              eligible
        fc1/15      16834560              eligible
        fc1/16      16838656              eligible
        fc1/17      16842752              eligible
        fc1/18      16846848              eligible
        fc1/19      16850944              eligible
        fc1/20      16855040              eligible
        fc1/21      16859136              eligible
        fc1/22      16863232              eligible
        fc1/23      16867328              eligible
        fc1/24      16871424              eligible
```

Step 2 Install an additional license package.

```
switch# install license bootflash:license_file.lic
Installing license ..done
```

> **Note** If you provide a target name for the license key file, the file is installed with the specified name. Otherwise, the filename specified in the license key file is used to install the license.

Step 3 Make port fc1/8 ineligible to receive a license.

> **Note** When you make a port ineligible, the license does not automatically transfer to another port.

```
switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# interface fc1/8
switch(config-if)# shutdown
switch(config-if)# no port-license
switch(config-if)# exit
switch(config)# show port-license
Available port activation licenses are 1
---------------------------------------------------
  Interface    Cookie      Port Activation License
---------------------------------------------------
   fc1/1       16777216          acquired
   fc1/2       16781312          acquired
   fc1/3       16785408          acquired
   fc1/4       16789504          acquired
   fc1/5       16793600          acquired
   fc1/6       16797696          acquired
   fc1/7       16801792          acquired
   fc1/8       16805888          ineligible
```

```
   fc1/9      16809984          eligible
   fc1/10     16814080          eligible
```

Step 4   Display the licensed features to confirm that you have successfully installed PORT_ACTIVATION_PKG.

```
switch(config)# show license default
Feature                           Default License Count
-----------------------------------------------------------------------
FM_SERVER_PKG                                 -
ENTERPRISE_PKG                                -
PORT_ACTIVATION_PKG                           8
10G_PORT_ACTIVATION_PKG                       0
switch# -----------------------------------------------------------------------
```

Step 5   Display the port license configuration to confirm that additional ports have acquired a license.
    Note   Port fc1/8 remains ineligible and one license remains available. Ports fc1/9 through fc1//16 have acquired an additional license.

```
switch(config)# show port-license
Available port activation licenses are 1
----------------------------------------------------
  Interface    Cookie      Port Activation License
----------------------------------------------------
   fc1/1      16777216          acquired
   fc1/2      16781312          acquired
   fc1/3      16785408          acquired
   fc1/4      16789504          acquired
   fc1/5      16793600          acquired
   fc1/6      16797696          acquired
   fc1/7      16801792          acquired
   fc1/8      16805888          ineligible
   fc1/9      16809984          acquired
   fc1/10     16814080          acquired
   fc1/11     16818176          acquired
   fc1/12     16822272          acquired
   fc1/13     16826368          acquired
   fc1/14     16830464          acquired
   fc1/15     16834560          acquired
   fc1/16     16838656          acquired
   fc1/17     16842752          eligible
   fc1/18     16846848          eligible
   fc1/19     16850944          eligible
   fc1/20     16855040          eligible
   fc1/21     16859136          eligible
   fc1/22     16863232          eligible
   fc1/23     16867328          eligible
   fc1/24     16871424          eligible
```

Step 6   Move the remaining license to port fc1/17.

```
switch(config)# interface fc1/17
switch(config-if)# shutdown
```

```
switch(config-if)# port-license acquire
switch(config-if)# no shutdown
switch(config-if)# exit
switch(config)#
```

Step 7   Display the port license configuration to confirm that port fc1/17 has acquired a license.

```
switch(config)# show port-license
Available port activation licenses are 0
-----------------------------------------------------
  Interface   Cookie       Port Activation License
-----------------------------------------------------
    fc1/1     16777216        acquired
    fc1/2     16781312        acquired
    fc1/3     16785408        acquired
    fc1/4     16789504        acquired
    fc1/5     16793600        acquired
    fc1/6     16797696        acquired
    fc1/7     16801792        acquired
    fc1/8     16805888        ineligible
    fc1/9     16809984        acquired
    fc1/10    16814080        acquired
    fc1/11    16818176        acquired
    fc1/12    16822272        acquired
    fc1/13    16826368        acquired
    fc1/14    16830464        acquired
    fc1/15    16834560        acquired
    fc1/16    16838656        acquired
    fc1/17    16842752        acquired
    fc1/18    16846848        eligible
    fc1/19    16850944        eligible
    fc1/20    16855040        eligible
    fc1/21    16859136        eligible
    fc1/22    16863232        eligible
    fc1/23    16867328        eligible
    fc1/24    16871424        eligible
```

Step 8   Make this configuration your startup configuration by saving the new port license configuration into nonvolatile storage. Once you complete this step, the running and the startup copies of the configuration are identical.

```
switch(config)# copy running-config startup-config
```

Step 9   Display and confirm the licenses in the running configuration by entering the **show running-config** command.

```
switch# show running-config
...
interface fc1/1
  switchport trunk mode auto
  port-license acquire
  channel-group 122 force
  no shutdown
```

```
interface fc1/2
  switchport trunk mode auto
  port-license acquire
  channel-group 122 force
  no shutdown

interface fc1/3
  switchport trunk mode auto
  port-license acquire
  no shutdown

interface fc1/4
  port-license acquire
  no shutdown

interface fc1/5
  switchport trunk mode auto
  port-license acquire
  port-track interface fc1/13
  port-track interface fc1/21
  port-track interface fc1/24
  port-track interface port-channel 122
  no shutdown

interface fc1/6
  switchport trunk mode off
  port-license acquire
  fcsp auto-active
  no shutdown
```

Related Documentation

The documentation set for the Cisco MDS 9000 Family includes the following documents. To find a document online, use the Cisco MDS NX-OS Documentation Locator at:

http://www.cisco.com/en/US/docs/storage/san_switches/mds9000/roadmaps/doclocater.htm

Release Notes

- *Cisco MDS 9000 Family Release Notes for Cisco MDS NX-OS Releases*

- *Cisco MDS 9000 Family Release Notes for MDS SAN-OS Releases*

- *Cisco MDS 9000 Family Release Notes for Storage Services Interface Images*

- *Cisco MDS 9000 Family Release Notes for Cisco MDS 9000 EPLD Images*

- *Release Notes for Cisco MDS 9000 Family Fabric Manager*

Regulatory Compliance and Safety Information

- *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*

Compatibility Information

- *Cisco Data Center Interoperability Support Matrix*
- *Cisco MDS 9000 NX-OS Hardware and Software Compatibility Information and Feature Lists*
- *Cisco MDS NX-OS Release Compatibility Matrix for Storage Service Interface Images*
- *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*
- *Cisco MDS NX-OS Release Compatibility Matrix for IBM SAN Volume Controller Software for Cisco MDS 9000*
- *Cisco MDS SAN-OS Release Compatibility Matrix for VERITAS Storage Foundation for Networks Software*

Hardware Installation

- *Cisco MDS 9710 Director Hardware Installation Guide*
- *Cisco MDS 9500 Series Hardware Installation Guide*
- *Cisco MDS 9250i Multiservice Switch Hardware Installation Guide*
- *Cisco MDS 9200 Series Hardware Installation Guide*
- *Cisco MDS 9100 Series Hardware Installation Guide*
- *Cisco MDS 9124 and Cisco MDS 9134 Multilayer Fabric Switch Quick Start Guide*

Software Installation and Upgrade

- *Cisco MDS 9000 Family Storage Services Interface Image Install and Upgrade Guide*
- *Cisco MDS 9000 Family Storage Services Module Software Installation and Upgrade Guide*
- *Cisco MDS 9000 NX-OS Release 4.1(x) and SAN-OS 3(x) Software Upgrade and Downgrade Guide*

Cisco NX-OS

- *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Licensing Guide*
- *Cisco MDS 9000 Family NX-OS System Management Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Fabric Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Quality of Service Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Security Configuration Guide*
- *Cisco MDS 9000 Family NX-OS IP Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Intelligent Storage Services Configuration Guide*

- *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Inter-VSAN Routing Configuration Guide*

Command-Line Interface

- *Cisco MDS 9000 Family Command Reference*

Intelligent Storage Networking Services Configuration Guides

- *Cisco MDS 9000 I/O Acceleration Configuration Guide*
- *Cisco MDS 9000 Family SANTap Deployment Guide*
- *Cisco MDS 9000 Family Data Mobility Manager Configuration Guide*
- *Cisco MDS 9000 Family Storage Media Encryption Configuration Guide*
- *Cisco MDS 9000 Family Secure Erase Configuration Guide*
- *Cisco MDS 9000 Family Cookbook for Cisco MDS SAN-OS*

Troubleshooting and Reference

- *Cisco NX-OS System Messages Reference*
- *Cisco MDS 9000 Family NX-OS Troubleshooting Guide*
- *Cisco MDS 9000 Family NX-OS MIB Quick Reference*
- *Cisco MDS 9000 Family NX-OS SMI-S Programming Reference*
- *Cisco MDS 9000 Family Fabric Manager Server Database Schema*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What's New in Cisco Product Documentation*, at: http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html.

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