Configuring IP Fabric for Media

This chapter describes how to configure the Cisco Nexus 9200 Series switches for Cisco's IP fabric for media solution.

Prerequisites

Cisco's IP fabric for media solution has the following prerequisites:

- The Cisco Nexus 9200 Series switches must be running Cisco NX-OS Release 7.0(3)I4(2) or a later release.

- TCAM carving must be configured on the spine switch and each leaf switch using the **hardware access-list tcam region ing-ifacl 2048** command. The following example shows how you might provision the TCAM. For more information on TCAM carving, see the Cisco Nexus 9000 Series NX-OS Security Configuration Guide.

```
hardware access-list tcam region ing-l2-qos 0
hardware access-list tcam region ing-l3-vlan-qos 256
hardware access-list tcam region ing-racl 256
hardware access-list tcam region ing-ifacl 2048
```

Guidelines and Limitations

Cisco's IP fabric for media solution has the following guidelines and limitations:

- Only the Cisco Nexus 9236C and 9272Q can be spine switches.

- Only the Cisco Nexus 9236C, 9272Q, and 92160YC-X can be leaf switches.

- The number of leaf switches depends on the number of uplinks used and the number of ports available on the spine switch.

- The uplink bandwidth from each leaf switch must be equal to the bandwidth provided to the endpoints.

- If possible, Cisco recommends overprovisioning uplinks to account for failures.

- As a best practice, use Layer 3 ports that go to the endpoints with a /30 mask. Assign one IP address to the endpoint and another to the switch interface.

- Cisco recommends that you choose the maximum bandwidth per flow. A constant or almost constant bandwidth rate is assumed. If you expect bursts of traffic in your IP fabric, consider reserving this value at a peak rate to prevent congestion.

- No two sources can transmit to the same multicast group at the same time. Also, when a given source stops transmitting traffic, the multicast group must time out before a new source can start transmitting to the same group.

Configuring NBM

Licensing Requirements

Product	License Requirement
Cisco NX-OS	The IP fabric for media solution requires an Enterprise Services license and a Network Services license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide*.

Configuring NBM

After you have set up the IP fabric, you must enable the NBM feature and set the flow bandwidth on the spine switch and each leaf switch. The NBM feature ensures that the bandwidth that is coming into the fabric is exactly the same as the bandwidth that is going out.

Before You Begin

Enable the SPT threshold infinity using the **ip pim spt-threshold infinity** command.

Procedure

	Command or Action	Purpose

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

	Command or Action	Purpose
Step 2	**[no] feature nbm** **Example:** `switch(config)# feature nbm`	Enables the NBM feature. The **no** form of this command disables this feature.
Step 3	**[no] ip multicast multipath nbm** **Example:** `switch(config)# ip multicast multipath nbm`	Configures multicast multipath for NBM. This command is required only if ECMP links are available for multicast traffic in the IP fabric. The **no** form of this command disables this feature.

Step 4	**[no] nbm flow bandwidth** *flow-bandwidth*
	
	Example:
	`switch(config)# nbm flow bandwidth 1500`
	`Setting NBM Per Flow Bandwidth as 1500.`
	`Existing NBM Per Flow Bandwidth Value (1000) will continue to be used.`
	`Changes shall take effect after reload`
		Configures the NBM flow size for this device. You should configure a flow size based on the type of video technology used in your broadcasting center. The range is from 1 to 100,000 Mbps.
		
		Table 1: Flow Sizes per Video Technology
		
		| Technology
			Flow Size

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HD video	1.5 Gbps (1500 Mbps)
3G HD video	3 Gbps (3000 Mbps)
4K ultra HD video	12 Gbps (12,000 Mbps)
8K ultra HD video	48 Gbps (48,000 Mbps)	 The **no** form of this command disables this feature. **Note** The NBM flow size should be configured when you are initially setting up the IP fabric. It should not be changed at random. Also, any change to the existing flow bandwidth value takes effect only after the device is rebooted.

Step 5	**show nbm flows bandwidth**
	
	Example:
	`switch(config)# show nbm flows bandwidth`
	`Applied NBM Per Flow Bandwidth Value: 1000 Mbps`
	`Configured NBM Per Flow Bandwidth Value: 1500 Mbps`
		(Optional)
		Displays the configured and applied NBM bandwidth per flow.

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

Verifying the NBM Configuration

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

Command	Purpose
show ip mroute	Displays the uplink interfaces for each NBM (S,G) or (*,G) flow.
show nbm flows bandwidth	Displays the configured and applied NBM bandwidth per flow.
**show running-config	grep nbm**	Displays the NBM running-configuration information.

Displaying NBM Flows and Flow Statistics

To display the NBM flows and flow statistics, perform one of the following tasks:

Command	Purpose
show nbm flows [all]	Displays the current NBM flows in the IP fabric. The flows are ordered by their startup time, with the most recent first. The **all** option shows the following information for expired flows: end time, total number of packets or bytes, and average flow rate.
show nbm flows statistics	Displays the NBM flow statistics.

The following example shows sample output for the **show nbm flows** command:

```
switch# show nbm flows

NBM Active flow(s)
Start-Time          Src-Port   Mcast-Group    Src-IP         L4-S  L4-D
06/17 01:27:11. 53 Eth1/2      225.0.0.9      192.168.102.2  1024  1024
06/17 01:27:11. 52 Eth1/2      225.0.0.8      192.168.102.2  1024  1024
06/17 01:27:11. 51 Eth1/2      225.0.0.7      192.168.102.2  1024  1024
06/17 01:27:11. 50 Eth1/2      225.0.0.6      192.168.102.2  1024  1024
06/17 01:27:11. 50 Eth1/2      225.0.0.4      192.168.102.2  1024  1024
06/17 01:27:11. 50 Eth1/2      225.0.0.3      192.168.102.2  1024  1024
06/17 01:27:11. 49 Eth1/2      225.0.0.2      192.168.102.2  1024  1024
06/17 01:27:11. 49 Eth1/2      225.0.0.1      192.168.102.2  1024  1024
06/17 01:27:11. 49 Eth1/2      225.0.0.0      192.168.102.2  1024  1024
```

The following example shows sample output for the **show nbm flows statistics** command:

```
switch# show nbm flows statistics

NBM Flow Statistics
```

```
Start-Time          Src-Port  Mcast-Group     Packets       Bytes
06/17 01:27:11. 53 Eth1/2    225.0.0.9       65163         268992864
06/17 01:27:11. 52 Eth1/2    225.0.0.8       65163         268992864
06/17 01:27:11. 51 Eth1/2    225.0.0.7       65196         269129088
06/17 01:27:11. 50 Eth1/2    225.0.0.6       65196         269129088
06/17 01:27:11. 50 Eth1/2    225.0.0.4       65198         269137344
06/17 01:27:11. 50 Eth1/2    225.0.0.3       65201         269149728
06/17 01:27:11. 49 Eth1/2    225.0.0.2       65207         269174496
06/17 01:27:11. 49 Eth1/2    225.0.0.1       65208         269178624
06/17 01:27:11. 49 Eth1/2    225.0.0.0       65207         269174496
```

Configuring PTP for Media

Cisco's IP fabric for media solution supports the following IEEE 1588 PTP profiles:

- Audio Engineering Society 67 profile (AES67) - For high-performance streaming audio over IP

- Professional Broadcast Environment profile (SMPTE-2059-2) - For high-performance streaming video over IP

The solution also introduces mixed mode PTP support with multicast sync and announce messages as well as unicast delay request and response messages.

To configure PTP for media, you should use one of these profiles.

Note The PTP configuration for media is different than the PTP configuration for a non-media network. However, you can refer to the *Cisco Nexus 9000 Series NX-OS System Management Configuration Guide* for more information on PTP.

Procedure

	Command or Action	**Purpose**

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

Step 2	[**no**] **feature ptp** **Example:** `switch(config)# feature ptp`	Enables or disables PTP on the device. **Note** Enabling PTP on the switch does not enable PTP on each interface.

Step 3	[**no**] **ptp source** *ip-address* [**vrf** *vrf*]
	
	Example:
	`switch(config)# ptp source`
	`10.10.10.1`
		Configures the source IPv4 address for all PTP packets.

	Command or Action	Purpose

Step 4	**interface ethernet** *slot/port*
	
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Specifies the interface on which you are enabling PTP and enters the interface configuration mode.

Step 5	[**no**] **ptp** **Example:** `switch(config-if)# ptp`	Enables or disables PTP on an interface.
Step 6	[**no**] **ptp announce interval** [**aes67** | **smpte-2059**] *log-seconds* **Example:** `switch(config-if)# ptp announce interval aes67 3`	(Optional) Configures the interval between PTP announce messages on an interface. *Table 2: PTP Announcement Interval Range and Default Values*
Step 7	[**no**] **ptp announce timeout** [**aes67** | **smpte-2059**] *count* **Example:** `switch(config-if)# ptp announce timeout aes67 2`	(Optional) Configures the number of PTP intervals before a timeout occurs on an interface. *Table 3: PTP Announcement Timeout Range and Default Values*

Table 2: PTP Announcement Interval Range and Default Values

Option	Range	Default Value
aes67	0 to 4 log seconds	1 log second
smpte-2059	−3 to 1 log seconds	1 log second
Without the **aes67** or **smpte-2059** option	0 to 4 log seconds	1 log second

Table 3: PTP Announcement Timeout Range and Default Values

Option	Range	Default Value
aes67	2 to 10 intervals	3 intervals
smpte-2059	2 to 10 intervals	3 intervals
Without the **aes67** or **smpte-2059** option	2 to 4 intervals	3 intervals

	Command or Action	Purpose
Step 8	[**no**] **ptp delay-request minimum interval** [**aes67** | **smpte-2059**] *log-seconds* **Example:** `switch(config-if)# ptp delay-request minimum interval aes67 -1`	(Optional) Configures the minimum interval allowed between PTP delay messages when the port is in the master state. ***Table 4: PTP Delay-Request Minimum Interval Range and Default Values*** <table><tr><th>Option</th><th>Range</th><th>Default Value</th></tr><tr><td>aes67</td><td>−4 to 5 log seconds</td><td>0 log seconds</td></tr><tr><td>smpte-2059</td><td>−4 to 5 log seconds</td><td>0 log seconds</td></tr><tr><td>Without the aes67 or smpte-2059 option</td><td>−1 to 6 log seconds (where −1 = 1 frame per second)</td><td>0 log seconds</td></tr></table>
Step 9	[**no**] **ptp sync interval** [**aes67** | **smpte-2059**] *log-seconds* **Example:** `switch(config-if)# ptp sync interval aes67 1`	(Optional) Configures the interval between PTP synchronization messages on an interface. ***Table 5: PTP Synchronization Interval Range and Default Values*** <table><tr><th>Option</th><th>Range</th><th>Default Value</th></tr><tr><td>aes67</td><td>−4 to 1 log seconds</td><td>−2 log seconds</td></tr><tr><td>smpte-2059</td><td>−4 to −1 log seconds</td><td>−2 log seconds</td></tr><tr><td>Without the aes67 or smpte-2059 option</td><td>−3 to 1 log seconds</td><td>−2 log seconds</td></tr></table>

	Command or Action	Purpose
Step 10	[**no**] **ptp vlan** *vlan-id* **Example:** switch(config-if)# ptp vlan 1	(Optional) Specifies the VLAN for the interface where PTP is being enabled. You can enable PTP only on one VLAN on an interface. The range is from 1 to 4094.
Step 11	**show ptp brief** **Example:** switch(config-if)# show ptp brief	(Optional) Displays the PTP status.
Step 12	**show ptp port interface** *interface slot/port* **Example:** switch(config-if)# show ptp port interface ethernet 2/1	(Optional) Displays the status of the PTP port.
Step 13	**copy running-config startup-config** **Example:** switch(config-if)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuration Example

The following example shows how to configure an IP network that supports 3G HD video broadcast traffic:

```
switch# configure terminal
switch(config)# hardware access-list tcam region ing-ifacl 2048
switch(config)# feature nbm
switch(config)# ip multicast multipath nbm
switch(config)# nbm flow bandwidth 3000
Setting NBM Per Flow Bandwidth as 3000.
Existing NBM Per Flow Bandwidth Value (1000) will continue to be used.
Changes shall take effect after reload
switch(config)# feature ptp
switch(config)# ptp source 10.10.10.1
switch(config)# interface ethernet 1/1
switch(config-if)# ptp
switch(config-if)# ptp announce interval smpte-2059 1
switch(config-if)# ptp announce timeout smpte-2059 5
switch(config-if)# ptp delay-request minimum interval smpte-2059 -1
switch(config-if)# ptp sync interval smpte-2059 -1
switch(config-if)# ptp vlan 1
```

Related Documentation

Related Topic	Document Title
IP fabric for media	Cisco IP Fabric for Media Solution video

Related Topic	Document Title
Cisco NX-OS release information	Cisco Nexus 9000 Series NX-OS IP Fabric for Media Release Notes
Cisco NX-OS software upgrades	Cisco Nexus 9000 Series NX-OS Software Upgrade and Downgrade Guide
PTP	Cisco Nexus 9000 Series NX-OS System Management Configuration Guide
TCAM carving	Cisco Nexus 9000 Series NX-OS Security Configuration Guide