Configuring IPv4

This chapter describes how to configure Internet Protocol version 4 (IPv4), which includes addressing, Address Resolution Protocol (ARP), and Internet Control Message Protocol (ICMP), on the Cisco NX-OS device.

This chapter includes the following sections:

About IPv4

You can configure IP on the device to assign IP addresses to network interfaces. When you assign IP addresses, you enable the interfaces and allow communication with the hosts on those interfaces.

You can configure an IP address as primary or secondary on a device. An interface can have one primary IP address and multiple secondary addresses. All networking devices on an interface should share the same primary IP address because the packets that are generated by the device always use the primary IPv4 address. Each IPv4 packet is based on the information from a source or destination IP address. For more information, see the Multiple IPv4 Addresses section.

You can use a subnet to mask the IP addresses. A mask is used to determine what subnet an IP address belongs to. An IP address contains the network address and the host address. A mask identifies the bits that denote the network number in an IP address. When you use the mask to subnet a network, the mask is then referred to as a subnet mask. Subnet masks are 32-bit values that allow the recipient of IP packets to distinguish the network ID portion of the IP address from the host ID portion of the IP address.

The IP feature is responsible for handling IPv4 packets that terminate in the supervisor module, as well as forwarding of IPv4 packets, which includes IPv4 unicast/multicast route lookup and software access control list (ACL) forwarding. The IP feature also manages the network interface IP address configuration, duplicate address checks, static routes, and packet send/receive interface for IP clients.

Note As Nexus behavior is to drop packets destined to null0 interface, if an IPv4 or IPv6 packet is sent to a null0 interface, Cisco Nexus 3000 switches will not respond with an ICMP or ICMPv6 packet.

Multiple IPv4 Addresses

Cisco NX-OS supports multiple IP addresses per interface. You can specify an unlimited number of secondary addresses for a variety of situations. The most common are as follows:

- When there are not enough host IP addresses for a particular network interface. For example, if your subnetting allows up to 254 hosts per logical subnet, but on one physical subnet you must have 300 host addresses, then you can use secondary IP addresses on the routers or access servers to allow you to have two logical subnets that use one physical subnet.
- Two subnets of a single network might otherwise be separated by another network. You can create a single network from subnets that are physically separated by another network by using a secondary address. In these instances, the first network is extended, or layered on top of the second network. A subnet cannot appear on more than one active interface of the router at a time.

Note If any device on a network segment uses a secondary IPv4 address, all other devices on that same network interface must also use a secondary address from the same network or subnet. The inconsistent use of secondary addresses on a network segment can quickly cause routing loops.

LPM Routing Modes

By default, Cisco NX-OS programs routes in a hierarchical fashion to allow for the longest prefix match (LPM) on the device. However, you can configure the device for different routing modes to support more LPM route entries.

The following tables list the LPM routing modes that are supported on Cisco Nexus 9000 Series switches.

Table 1: LPM Routing Modes for Cisco Nexus 9200 Platform Switches

LPM Routing Mode	CLI Command
Default system routing mode	
LPM dual-host routing mode	**system routing template-dual-stack-host-scale**
LPM heavy routing mode	**system routing template-lpm-heavy**

Note Cisco Nexus 9200 platform switches do not support the **system routing template-lpm-heavy** mode for IPv4 Multicast routes. Make sure to reset LPM's maximum limit to 0.

Table 2: LPM Routing Modes for Cisco Nexus 9300 Platform Switches

LPM Routing Mode	Broadcom T2 Mode	CLI Command
Default system routing mode	3	
ALPM routing mode	4	**system routing max-mode l3**

Table 3: LPM Routing Modes for Cisco Nexus 9300-EX/FX/FX2/FX3/GX Platform Switches

LPM Routing Mode	CLI Command
LPM dual-host routing mode	**system routing template-dual-stack-host-scale**
LPM heavy routing mode	**system routing template-lpm-heavy**
LPM Internet-peering mode	**system routing template-internet-peering**

Table 4: LPM Routing Modes for Cisco Nexus 9500 Platform Switches with 9700-EX and 9700-FX Line Cards

LPM Routing Mode	Broadcom T2 Mode	CLI Command
Default system routing mode	3 (for line cards); 4 (for fabric modules)	
Max-host routing mode	2 (for line cards); 3 (for fabric modules)	**system routing max-mode host**
Nonhierarchical routing mode	3 (for line cards); 4 with max-l3-mode option (for line cards)	**system routing non-hierarchical-routing [max-l3-mode]**
64-bit ALPM routing mode	Submode of mode 4 (for fabric modules)	**system routing mode hierarchical 64b-alpm**
LPM heavy routing mode		**system routing template-lpm-heavy** **Note** This mode is supported only for Cisco Nexus 9508 switches with the 9732C-EX line card.

LPM Routing Mode	Broadcom T2 Mode	CLI Command
LPM Internet-peering mode		**system routing template-internet-peering** **Note** This mode is supported only for the following Cisco Nexus 9500 Platform Switches: • Cisco Nexus 9500 platform switches with 9700-EX line cards. • Cisco Nexus 9500-FX platform switches (Cisco NX-OS release 7.0(3)I7(4) and later) • Cisco 9500-R platform switches (Cisco NX-OS release 9.3(1) and later)
LPM dual-host routing mode		

Table 5: LPM Routing Modes for Cisco Nexus 9500-R Platform Switches with 9600-R Line Cards

LPM Routing Mode	CLI Command
LPM Internet-peering mode	**system routing template-internet-peering** (Cisco NX-OS release 9.3(1) and later)

Host to LPM Spillover

Beginning with Cisco NX-OS Release 7.0(3)I5(1), host routes can be stored in the LPM table in order to achieve a larger host scale. In ALPM mode, the switch allows fewer host routes. If you add more host routes than the supported scale, the routes that are spilled over from the host table take the space of the LPM routes in the LPM table. The total number of LPM routes allowed in that mode is reduced by the number of host routes stored. This feature is supported on Cisco Nexus 9300 and 9500 platform switches.

In the default system routing mode, Cisco Nexus 9300 platform switches are configured for higher host scale and fewer LPM routes, and the LPM space can be used to store more host routes. For Cisco Nexus 9500 platform switches, only the default system routing and nonhierarchical routing modes support this feature on line cards. Fabric modules do not support this feature.

Address Resolution Protocol

Networking devices and Layer 3 switches use Address Resolution Protocol (ARP) to map IP (network layer) addresses to (Media Access Control [MAC]-layer) addresses to enable IP packets to be sent across networks. Before a device sends a packet to another device, it looks in its own ARP cache to see if there is a MAC address and corresponding IP address for the destination device. If there is no entry, the source device sends a broadcast message to every device on the network.

Each device compares the IP address to its own. Only the device with the matching IP address replies to the device that sends the data with a packet that contains the MAC address for the device. The source device adds the destination device MAC address to its ARP table for future reference, creates a data-link header and trailer that encapsulates the packet, and proceeds to transfer the data. The following figure shows the ARP broadcast and response process.

Figure 1: ARP Process

When the destination device lies on a remote network that is beyond another device, the process is the same except that the device that sends the data sends an ARP request for the MAC address of the default gateway. After the address is resolved and the default gateway receives the packet, the default gateway broadcasts the destination IP address over the networks connected to it. The device on the destination device network uses ARP to obtain the MAC address of the destination device and delivers the packet. ARP is enabled by default.

The default system-defined CoPP policy rate limits ARP broadcast packets bound for the supervisor module. The default system-defined CoPP policy prevents an ARP broadcast storm from affecting the control plane traffic but does not affect bridged packets.

ARP Caching

ARP caching minimizes broadcasts and limits wasteful use of network resources. The mapping of IP addresses to MAC addresses occurs at each hop (device) on the network for every packet sent over an internetwork, which may affect network performance.

ARP caching stores network addresses and the associated data-link addresses in the memory for a period of time, which minimizes the use of valuable network resources to broadcast for the same address each time that a packet is sent. You must maintain the cache entries that are set to expire periodically because the information might become outdated. Every device on a network updates its tables as addresses are broadcast.

Static and Dynamic Entries in the ARP Cache

Static routing requires that you manually configure the IP addresses, subnet masks, gateways, and corresponding MAC addresses for each interface of each device. Static routing requires more work to maintain the route table. You must update the table each time you add or change routes.

Dynamic routing uses protocols that enable the devices in a network to exchange routing table information with each other. Dynamic routing is more efficient than static routing because the route table is automatically updated unless you add a time limit to the cache. The default time limit is 25 minutes but you can modify the time limit if the network has many routes that are added and deleted from the cache.

Devices That Do Not Use ARP

When a network is divided into two segments, a bridge joins the segments and filters traffic to each segment based on MAC addresses. The bridge builds its own address table, which uses MAC addresses only. A device has an ARP cache that contains both IP addresses and the corresponding MAC addresses.

Passive hubs are central-connection devices that physically connect other devices in a network. They send messages out on all their ports to the devices and operate at Layer 1 but do not maintain an address table.

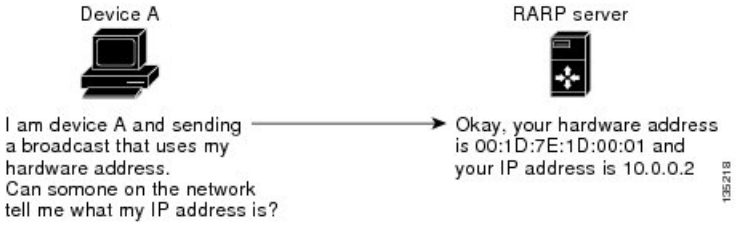
Layer 2 switches determine which port of a device receives a message that is sent only to that port. However, Layer 3 switches are devices that build an ARP cache (table).

Reverse ARP

Reverse ARP (RARP) as defined by RFC 903 works the same way as ARP, except that the RARP request packet requests an IP address instead of a MAC address. RARP often is used by diskless workstations because this type of device has no way to store IP addresses to use when they boot. The only address that is known is the MAC address because it is burned into the hardware.

Use of RARP requires an RARP server on the same network segment as the router interface. The following figure shows how RARP works.

Figure 2: Reverse ARP



RARP has several limitations. Because of these limitations, most businesses use Dynamic Host Control Protocol (DHCP) to assign IP addresses dynamically. DHCP is cost effective and requires less maintenance than RARP. The following are the most important limitations:

- Because RARP uses hardware addresses, if the internetwork is large with many physical networks, a RARP server must be on every segment with an additional server for redundancy. maintaining two servers for every segment is costly.
- Each server must be configured with a table of static mappings between the hardware addresses and IP addresses. Maintenance of the IP addresses is difficult.
- RARP only provides IP addresses of the hosts and not subnet masks or default gateways.

Proxy ARP

Proxy ARP enables a device that is physically located on one network appear to be logically part of a different physical network connected to the same device or firewall. Proxy ARP allows you to hide a device with a public IP address on a private network behind a router and still have the device appear to be on the public network in front of the router. By hiding its identity, the router accepts responsibility for routing packets to the real destination. Proxy ARP can help devices on a subnet reach remote subnets without configuring routing or a default gateway.

When devices are not in the same data link layer network but in the same IP network, they try to transmit data to each other as if they are on the local network. However, the router that separates the devices does not send a broadcast message because routers do not pass hardware-layer broadcasts and the addresses cannot be resolved.

When you enable proxy ARP on the device and it receives an ARP request, it identifies the request as a request for a system that is not on the local LAN. The device responds as if it is the remote destination for which the broadcast is addressed, with an ARP response that associates the device’s MAC address with the remote destination's IP address. The local device believes that it is directly connected to the destination, while in reality its packets are being forwarded from the local subnetwork toward the destination subnetwork by their local device. By default, proxy ARP is disabled.

Local Proxy ARP

You can use local proxy ARP to enable a device to respond to ARP requests for IP addresses within a subnet where normally no routing is required. When you enable local proxy ARP, ARP responds to all ARP requests for IP addresses within the subnet and forwards all traffic between hosts in the subnet. Use this feature only on subnets where hosts are intentionally prevented from communicating directly by the configuration on the device to which they are connected.

Gratuitous ARP

Gratuitous ARP sends a request with an identical source IP address and a destination IP address to detect duplicate IP addresses. Cisco NX-OS supports enabling or disabling gratuitous ARP requests or ARP cache updates.

Periodic ARP Refresh on MAC Delete

The ARP process tracks the MAC deletes and sends the periodic ARP Refresh on the L3 VLAN interface in a configured interval of time for the configured count. If the MAC is learned, ARP process stops sending the periodic ARP Refreshes.

For more information, see Configuring Periodic ARP Refresh on MAC Delete for SVIs, on page 23.

Glean Throttling

If the Address Resolution Protocol (ARP) request for the next hop is not resolved when incoming IP packets are forwarded in a line card, the line card forwards the packets to the supervisor (glean throttling). The supervisor resolves the MAC address for the next hop and programs the hardware.

When an ARP request is sent, the software adds a /32 drop adjacency in the hardware to prevent the packets to the same next-hop IP address to be forwarded to the supervisor. When the ARP is resolved, the hardware entry is updated with the correct MAC address. If the ARP entry is not resolved before a timeout period, the entry is removed from the hardware.

Note Glean throttling is supported for IPv4 and IPv6, but IPv6 link-local addresses are not supported.

Path MTU Discovery

Path maximum transmission unit (MTU) discovery is a method for maximizing the use of available bandwidth in the network between the endpoints of a TCP connection. It is described in RFC 1191. Existing connections are not affected when this feature is turned on or off.

ICMP

You can use the Internet Control Message Protocol (ICMP) to provide message packets that report errors and other information that is relevant to IP processing. ICMP generates error messages, such as ICMP destination unreachable messages, ICMP Echo Requests (which send a packet on a round trip between two hosts) and

Echo Reply messages. ICMP also provides many diagnostic functions and can send and redirect error packets to the host. By default, ICMP is enabled.

Some of the ICMP message types are as follows:

- Network error messages
- Network congestion messages
- Troubleshooting information
- Timeout announcements

Note

- ICMP redirects are disabled on interfaces where the local proxy ARP feature is enabled.
- The ICMP redirect feature is not supported on the Cisco N93-C64E-SG2-Q switch platform. If ICMP redirect is currently enabled on the Cisco N93-C64E-SG2-Q switch, it must be disabled.

Virtualization Support for IPv4

IPv4 supports virtual routing and forwarding (VRF) instances.

Prerequisites for IPv4

IPv4 has the following prerequisites:

- IPv4 can only be configured on Layer 3 interfaces.

Guidelines and Limitations for IPv4

IPv4 has the following configuration guidelines and limitations:

- Cisco Nexus 9300-EX and Cisco Nexus 9300-FX2 platform switches configured for internet-peering mode might not have sufficient hardware capacity to install full IPv4 and IPv6 Internet routes simultaneously.
- You can configure a secondary IP address only after you configure the primary IP address.
- Local proxy ARP is not supported for an interface with more than one HSRP group that belongs to multiple subnets.
- The **ip proxy-arp** command is not supported in a VXLAN EVPN Fabric specifically on an SVI which is enabled with **fabric forwarding mode anycast-gateway**.
- For Cisco Nexus 9500 platform switches with -R line cards, internet-peering mode is only intended to be used with the prefix pattern as distributed in the global internet routing table. In this mode, other prefix distributions/patterns can operate, but not predictably. As a result, maximum achievable LPM/LEM scale is reliable only when the prefix patterns are actual internet prefix patterns. In Internet-peering mode, if

route prefix patterns other than those in the global internet routing table are used, the switch might not successfully achieve documented scalability numbers.

- LPM heavy routing mode is supported on Cisco Nexus **9500** series switches with **9700**-EX, -FX, and -GX series modules.
- Beginning with Cisco NX-OS Release 10.2(3)F, syslog will be printed when IPv4 redirect message is triggered based on the configured interval.
- Beginning with Cisco NX-OS Release 10.2(4)M, periodic ARP Refresh on MAC delete support is provided on Cisco Nexus 9000 Series platform switches with the following limitations:
  - During configuration of the **ip arp refresh-adj-on-mac-delete retry** command, ARP process does not trigger Refresh although ARP is learned and MAC is not learned. It tries to send periodic ARP Refreshes on MAC delete/flush.
  - The periodic ARP Refresh behavior is triggered for the MAC's deletion after configuring the **ip arp refresh-adj-on-mac-delete retry** command.
  - The trigger for this periodic ARP Refresh is MAC delete. This feature does not address the MAC learn miss on receiving burst packets.
  - During configuring, you must choose the right count and interval based on the scale/network requirements.

Default Settings

The table below lists the default settings for IP parameters.

Parameters	Default
ARP timeout	1500 seconds
Proxy ARP	Disabled

Configuring IPv4

Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Configuring IPv4 Addressing

You can assign a primary IP address for a network interface.

SUMMARY STEPS

1. **configure terminal**

2. **interface ethernet** *number*
3. **ip address** *ip-address/length* [*secondary*]
4. (Optional) **show ip interface**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**ip address** *ip-address/length* [*secondary*] **Example:** `switch(config-if)# ip address 192.2.1.1 255.0.0.0`	Specifies a primary or secondary IPv4 address for an interface. • The network mask can be a four-part dotted decimal address. For example, 255.0.0.0 indicates that each bit equal to 1 means the corresponding address bit belongs to the network address. • The network mask can be indicated as a slash (/) and a number, which is the prefix length. The prefix length is a decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash must precede the decimal value and there must be no space between the IP address and the slash.
Step 4	(Optional) **show ip interface** **Example:** `switch(config-if)# show ip interface`	Displays interfaces configured for IPv4.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring Multiple IP Addresses

You can only add secondary IP addresses after you configure primary IP addresses.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *number*
3. **ip address** *ip-address/length* [*secondary*]
4. (Optional) **show ip interface**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**ip address** *ip-address/length* [*secondary*]
	Example:
	`switch(config-if)# ip address`
	`192.168.1.1 255.0.0.0 secondary`
		Specifies a the configured address as a secondary IPv4 address.

Step 4	(Optional) **show ip interface** **Example:** `switch(config-if)# show ip interface`	Displays interfaces configured for IPv4.

Step 5	(Optional) **copy running-config startup-config**
	Example:
	`switch(config-if)# copy running-config`
	`startup-config`
		Saves this configuration change.

Configuring Max-Host Routing Mode

By default, Cisco NX-OS programs routes in a hierarchical fashion (with fabric modules that are configured to be in mode 4 and line card modules that are configured to be in mode 3), which allows for longest prefix match (LPM) and host scale on the device.

You can modify the default LPM and host scale to program more hosts in the system, as might be required when the node is positioned as a Layer-2 to Layer-3 boundary node.

Note If you want to further scale the entries in the LPM table, see the Configuring Nonhierarchical Routing Mode (Cisco Nexus 9500 Platform Switches Only) section to configure the device to program all the Layer 3 IPv4 and IPv6 routes on the line cards and none of the routes on the fabric modules.

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For the max-host routing mode scale numbers, refer to the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing max-mode host**
3. (Optional) **show forwarding route summary**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing max-mode host** **Example:** `switch(config)# system routing max-mode host`	Puts the line cards in Broadcom T2 mode 2 and the fabric modules in Broadcom T2 mode 3 to increase the number of supported hosts.
Step 3	(Optional) **show forwarding route summary** **Example:** `switch(config)# show forwarding route summary`	Displays the LPM routing mode.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

	Command or Action	Purpose
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring Nonhierarchical Routing Mode (Cisco Nexus 9500 Platform Switches Only)

If the host scale is small (as in a pure Layer 3 deployment), we recommend programming the longest prefix match (LPM) routes in the line cards to improve convergence performance. Doing so programs routes and hosts in the line cards and does not program any routes in the fabric modules.

Note This configuration impacts both the IPv4 and IPv6 address families.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing non-hierarchical-routing** [**max-l3-mode**]
3. (Optional) **show forwarding route summary**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing non-hierarchical-routing** [**max-l3-mode**] **Example:** `switch(config)# system routing non-hierarchical-routing max-l3-mode`	Puts the line cards in Broadcom T2 mode 3 (or Broadcom T2 mode 4 if you use the **max-l3-mode** option) to support a larger LPM scale. As a result, all of the IPv4 and IPv6 routes will be programmed on the line cards rather than on the fabric modules.

Step 3	(Optional) **show forwarding route summary**
	Example:
	`switch(config)# show forwarding route summary`
	`Mode 3:`
		Displays the LPM mode.

	Command or Action	Purpose
	120K IPv4 Host table 16k LPM table (> 65 < 127 1k entry reserved) Mode 4: 16k V4 host/4k V6 host 128k v4 LPM/20K V6 LPM	
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring 64-Bit ALPM Routing Mode (Cisco Nexus 9500 Platform Switches Only)

You can use the 64-bit algorithmic longest prefix match (ALPM) feature to manage IPv4 and IPv6 route table entries. In 64-bit ALPM routing mode, the device can store more route entries. In this mode, you can program one of the following:

- 80,000 IPv6 entries and no IPv4 entries
- No IPv6 entries and 128,000 IPv4 entries
- *x* IPv6 entries and y IPv4 entries, where $2x + y <= 128,000$

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For the 64-bit ALPM routing mode scale numbers, see the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing mode hierarchical 64b-alpm**
3. (Optional) **show forwarding route summary**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing mode hierarchical 64b-alpm** **Example:** `switch(config)# system routing mode hierarchical 64b-alpm`	Causes all IPv4 and IPv6 LPM routes with a mask length that is less than or equal to 64 to be programmed in the fabric module. All host routes for IPv4 and IPv6 and all LPM routes with a mask length of 65–127 are programmed in the line card.
Step 3	(Optional) **show forwarding route summary** **Example:** `switch(config)# show forwarding route summary`	Displays the LPM mode.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring ALPM Routing Mode (Cisco Nexus 9300 Platform Switches Only)

You can configure Cisco Nexus 9300 platform switches to support more LPM route entries.

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For ALPM routing mode scale numbers, see the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing max-mode l3**
3. (Optional) **show forwarding route summary**

4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing max-mode l3** **Example:** `switch(config)# system routing max-mode l3`	Puts the device in Broadcom T2 mode 4 to support a larger LPM scale.
Step 3	(Optional) **show forwarding route summary** **Example:** `switch(config)# show forwarding route summary`	Displays the LPM mode.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring LPM Heavy Routing Mode (Cisco Nexus 9200 and 9300-EX Platform Switches and 9732C-EX Line Card Only)

Beginning with Cisco NX-OS Release 7.0(3)I4(4), you can configure LPM heavy routing mode in order to support more LPM route entries. Only the Cisco Nexus 9200 and 9300-EX platform switches and the Cisco Nexus 9508 switch with an 9732C-EX line card support this routing mode.

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For LPM heavy routing mode scale numbers, see the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing template-lpm-heavy**
3. (Optional) **show system routing mode**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing template-lpm-heavy** **Example:** `switch(config)# system routing template-lpm-heavy`	Puts the device in LPM heavy routing mode to support a larger LPM scale.

Step 3	(Optional) **show system routing mode**
	Example:
	`switch(config)# show system routing mode`
	`Configured System Routing Mode: LPM Heavy`
	`Applied System Routing Mode: LPM Heavy`
		Displays the LPM routing mode.

Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring LPM Internet-Peering Routing Mode

Beginning with Cisco NX-OS Release 7.0(3)I6(1), you can configure LPM Internet-peering routing mode in order to support IPv4 and IPv6 LPM Internet route entries. This mode supports dynamic Trie (tree bit lookup) for IPv4 prefixes (with a prefix length up to /32) and IPv6 prefixes (with a prefix length up to /83).

Beginning with Cisco NX-OS Release 9.3(1), Cisco Nexus 9500-R platform switches support this routing mode.

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For LPM Internet-peering routing mode scale numbers, see the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide. Cisco Nexus 9500-R platform switches in LPM Internet-peering mode scale out predictably only if they use internet-peering prefixes. If Cisco Nexus 9500-R platform switches use other prefix patterns, it might not achieve documented scalability numbers.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing template-internet-peering**
3. (Optional) **show system routing mode**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing template-internet-peering** **Example:** `switch(config)# system routing template-internet-peering`	Puts the device in LPM Internet-peering routing mode to support IPv4 and IPv6 LPM Internet route entries.

Step 3	(Optional) **show system routing mode**
	Example:
	`switch(config)# show system routing mode`
	`Configured System Routing Mode: Internet Peering`
	`Applied System Routing Mode: Internet Peering`
		Displays the LPM routing mode.

Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

	Command or Action	Purpose
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring LPM Dual-Host Routing Mode (Cisco Nexus 9200 and 9300-EX Platform Switches)

Beginning with Cisco NX-OS Release 7.0(3)I5(1), you can configure LPM dual-host routing mode in order to increase the ARP/ND scale to double the default mode value. Only the Cisco Nexus 9200 and 9300-EX platform switches support this routing mode.

Note Ensure that the **system routing template-dual-stack-host-scale** profile is not used with BGW.

Note This configuration impacts both the IPv4 and IPv6 address families.

Note For LPM dual-host routing mode scale numbers, see the .

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **system routing template-dual-stack-host-scale**
3. (Optional) **show system routing mode**
4. **copy running-config startup-config**
5. **reload**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **system routing template-dual-stack-host-scale** **Example:**	Puts the device in LPM dual-host routing mode to support a larger ARP/ND scale.

	Command or Action	Purpose

	`switch(config)# system routing template-dual-stack-host-scale`
	`Warning: The command will take effect after next reload. Multicast is not supported in this profile`
	
	`Note: This requires copy running-config to startup-config before switch reload`	

Step 3	(Optional) **show system routing mode** **Example:** `switch(config)# show system routing mode`	Displays the LPM routing mode.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.
Step 5	**reload** **Example:** `switch(config)# reload`	Reboots the entire device.

Configuring a Static ARP Entry

You can configure a static ARP entry on the device to map IP addresses to MAC hardware addresses, including static multicast MAC addresses.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *number*
3. **ip arp address** *ip-address mac-address*
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

	Command or Action	Purpose
Step 3	**ip arp address** *ip-address mac-address* **Example:** `switch(config-if)# ip arp 192.168.1.1 0019.076c.1a78`	Associates an IP address with a MAC address as a static entry.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves this configuration change.

Configuring Proxy ARP

Configure proxy ARP on the device to determine the media addresses of hosts on other networks or subnets.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *number*
3. **ip proxy arp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**ip proxy arp** **Example:** `switch(config-if)# ip proxy arp`	Enables proxy ARP on the interface.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves this configuration change.

Configuring Local Proxy ARP on Ethernet Interfaces

You can configure local proxy ARP on Ethernet interfaces.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *number*
3. [**no**]**ip local-proxy-arp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	[**no**]**ip local-proxy-arp** **Example:** `switch(config-if)# ip local-proxy-arp`	Enables Local Proxy ARP on the interface.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves this configuration change.

Configuring Local Proxy ARP on SVIs

You can configure local proxy ARP on SVIs, and beginning with Cisco NX-OS Release 7.0(3)I7(1), you can suppress ARP broadcasts on corresponding VLANs.

Before you begin

If you are planning to suppress ARP broadcasts, configure the double-wide ACL TCAM region size for ARP/Layer 2 Ethertype using the hardware access-list tcam region arp-ether 256 double-wide command, save the configuration, and reload the switch. (For more information, see the Configuring ACL TCAM Region Sizes section in the Cisco Nexus 9000 Series NX-OS Security Configuration Guide.)

SUMMARY STEPS

1. **configure terminal**
2. **interface vlan vlan-id**
3. [**no**] **ip local-proxy-arp** [**no-hw-flooding**]
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface vlan vlan-id**
	Example:
	`switch(config)# interface vlan 5`
	`switch(config-if)#`
		Creates a VLAN interface and enters the configuration mode for the SVI.

Step 3	[**no**] **ip local-proxy-arp** [**no-hw-flooding**] **Example:** `switch(config-if)# ip local-proxy-arp no-hw-flooding`	Enables local proxy ARP on SVIs. The no-hw-flooding option suppresses ARP broadcasts on corresponding VLANs. **Note** If you configure the no-hw-flooding option and then want to change the configuration to allow ARP broadcasts on SVIs, you must first disable this feature using the no ip local-proxy-arp no-hw-flooding command and then enter the ip local-proxy-arp command.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring Periodic ARP Refresh on MAC Delete for SVIs

Beginning with Cisco NX-OS Release 10.2(4)M, you can configure periodic ARP Refresh on MAC delete for SVIs.

By default this command is disabled. This command must be configured under the SVI for the periodic ARP Refreshes to learn the MACs from the ARP response packet for the silent hosts on MAC delete/flush.

SUMMARY STEPS

1. **configure terminal**

2. **interface vlan vlan-id**
3. [**no**] **ip arp refresh-adj-on-mac-delete retry** [**count** <*frequency count*>] [**interval** <*interval in sec*>]
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface vlan vlan-id**
	Example:
	`switch(config)# interface vlan 5`
	`switch(config-if)#`
		Creates a VLAN interface and enters the configuration mode for the SVI.

Step 3	[**no**] **ip arp refresh-adj-on-mac-delete retry** [**count** <*frequency count*>] [**interval** <*interval in sec*>]
	Example:
	`switch(config-if)# ip arp refresh-adj-on-mac-delete retry count 3 interval 15`
	`switch(config-if)#`
		Configures the ARP Refreshes to learn the MACs from the ARP response packet for the silent hosts on MAC delete/flush.
		• <*frequency count*>: The range is 1–3. The default is 3.
		• <*interval in sec*>: The range is 1–60 seconds. The default is 15 seconds.
		Note
		If the interval is greater than 3/4th of ARP Refresh time, this command is rejected with the below message:
		`ARP refresh will be sent earlier to the interval due to ARP timeout configuration. This configuration is not useful.`

Step 4	(Optional) **copy running-config startup-config**
	Example:
	`switch(config-if)# copy running-config startup-config`
	`switch(config-if)#`
		Copies the running configuration to the startup configuration.

Configuring Gratuitous ARP

You can configure gratuitous ARP on an interface.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *number*
3. **ip arp gratuitous** {**request** | **update**]
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**interface ethernet** *number*
	Example:
	`switch(config)# interface ethernet 2/3`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**ip arp gratuitous** {**request**	**update**] **Example:** `switch(config-if)# ip arp gratuitous request`	Enables gratuitous ARP on the interface. Gratuitous ARP is enabled by default.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves this configuration change.

Configuring Path MTU Discovery

You can configure path MTU discovery.

SUMMARY STEPS

1. **configure terminal**
2. **ip tcp path-mtu-discovery**
3. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**ip tcp path-mtu-discovery** **Example:** `switch(config)# ip tcp path-mtu-discovery`	Enables path MTU discovery.
Step 3	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Configuring IP Directed Broadcasts

An IP directed broadcast is an IP packet whose destination address is a valid broadcast address for some IP subnet, but which originates from a node that is not itself part of that destination subnet.

A devices that is not directly connected to its destination subnet forwards an IP directed broadcast in the same way it forwards unicast IP packets destined to a host on that subnet. When a directed broadcast packet reaches a device that is directly connected to its destination subnet, that packet is broadcast on the destination subnet. The destination address in the IP header of the packet is rewritten to the configured IP broadcast address for the subnet, and the packet is sent as a link-layer broadcast.

If directed broadcast is enabled for an interface, incoming IP packets whose addresses identify them as directed broadcasts intended for the subnet to which that interface is attached are broadcasted on that subnet. You can optionally filter those broadcasts through an IP access list such that only those packets that pass through the access list are broadcasted on the subnet.

To enable IP directed broadcasts, use the following command in the interface configuration mode:

SUMMARY STEPS

1. **ip directed-broadcast** [*acl*]

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**ip directed-broadcast** [*acl*] **Example:** `switch(config-if) # ip directed-broadcast`	Enables the translation of a directed broadcast to physical broadcasts. You can optionally filter those broadcasts through an IP access list.

Configuring IP Glean Throttling

We recommend that you configure IP glean throttling to filter the unnecessary glean packets that are sent to the supervisor for ARP resolution for the next hops that are not reachable or do not exist. IP glean throttling boosts software performance and helps to manage traffic more efficiently.

Note Glean throttling is supported for IPv4 and IPv6, but IPv6 link-local addresses are not supported.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **hardware ip glean throttle**
3. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **hardware ip glean throttle** **Example:** `switch(config) # hardware ip glean throttle`	Enables IP glean throttling.
Step 3	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Configuring the Hardware IP Glean Throttle Maximum

You can limit the maximum number of drop adjacencies that are installed in the Forwarding Information Base (FIB).

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **hardware ip glean throttle maximum** *count*
3. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **hardware ip glean throttle maximum** *count* **Example:** `switch(config) # hardware ip glean throttle maximum 2134`	Configures the number of drop adjacencies that are installed in the FIB.
Step 3	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Configuring the Hardware IP Glean Throttle Timeout

You can configure a timeout for the installed drop adjacencies to remain in the FIB.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **hardware ip glean throttle maximum timeout** *timeout-in-seconds*
3. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	[**no**] **hardware ip glean throttle maximum timeout** *timeout-in-seconds* **Example:** `switch(config)# hardware ip glean throttle maximum timeout 300`	Configures the timeout for the installed drop adjacencies to remain in the FIB. The range is from 300 seconds (5 minutes) to 1800 seconds (30 minutes). **Note** After the timeout period is exceeded, the drop adjacencies are removed from the FIB.
Step 3	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Configuring the Interface IP Address for the ICMP Source IP Field

You can configure an interface IP address for the ICMP source IP field to handle ICMP error messages.

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **ip source** {**ethernet** *slot/port* | **loopback** *number* | **port-channel** *number*} **icmp-errors**
3. (Optional) **copy running-config startup-config**

DETAILED STEPS

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**] **ip source** {**ethernet** *slot/port* | **loopback** *number* | **port-channel** *number*} **icmp-errors** **Example:** `switch(config)# ip source loopback 0 icmp-errors`	Configures an interface IP address for the ICMP source IP field to route ICMP error messages.
Step 3	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Configuring IPv4 Redirect Syslog

To enable/disable the IPv4 redirect syslog or change the logging interval, use the below CLIs:

Note By default, redirecting syslog will be enabled.

SUMMARY STEPS

1. **configure terminal**
2. **ip redirect syslog** [<*value*>]
3. (Optional) **no ip redirect syslog**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal switch(config)#`	Enters global configuration mode.
Step 2	**ip redirect syslog** [<*value*>] **Example:** `switch(config)# ip redirect syslog 60 switch(config)#`	Configures the syslog for excessive IP redirect messages. • **ip redirect syslog**: Enables the syslog for IPv4 redirect messages. • *value*: Configures the logging interval. The range is minimum 30 seconds to maximum 1800 seconds. The default interval is 60 seconds.
Step 3	(Optional) **no ip redirect syslog** **Example:**	Disables the syslog for excessive IPv4 redirect messages.

	Command or Action	Purpose
	`switch(config)# no ip redirect syslog`	

Verifying the IPv4 Configuration

To display the IPv4 configuration information, perform one of the following tasks:

Command	Purpose
show ip adjacency	Displays the adjacency table.
show ip adjacency summary	Displays the summary of number of throttle adjacencies.
show ip arp	Displays the ARP table.
show ip arp summary	Displays the summary of the number of throttle adjacencies.
show ip interface	Displays IP-related interface information.
show ip arp statistics [**vrf** *vrf-name*]	Displays the ARP statistics.
show ip arp internal info interface <*interface-name*>	Displays the configured count and interval

Additional References

Related Documents for IPv4

Related Topic	Document Title
TCAM regions	See the Configuring ACL TCAM Region Sizes section in the Cisco Nexus 9000 Series NX-OS Security Configuration Guide.