Configuring IP Unicast Routing

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Information About Configuring IP Unicast Routing

This module describes how to configure IP Version 4 (IPv4) unicast routing on the switch.

A switch stack operates and appears as a single router to the rest of the routers in the network. .

Note   In addition to IPv4 traffic, you can also enable IP Version 6 (IPv6) unicast routing and configure interfaces to forward IPv6 traffic.

Information About IP Routing

In some network environments, VLANs are associated with individual networks or subnetworks. In an IP network, each subnetwork is mapped to an individual VLAN. Configuring VLANs helps control the size of the broadcast domain and keeps local traffic local. However, network devices in different VLANs cannot communicate with one another without a Layer 3 device (router) to route traffic between the VLAN, referred to as inter-VLAN routing. You configure one or more routers to route traffic to the appropriate destination VLAN.

Figure 1: Routing Topology Example

This figure shows a basic routing topology. Switch A is in VLAN 10, and Switch B is in VLAN 20. The router
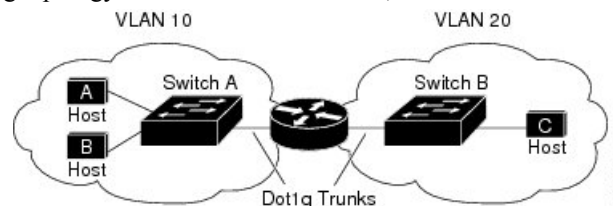
has an interface in each VLAN.

When Host A in VLAN 10 needs to communicate with Host B in VLAN 10, it sends a packet addressed to that host. Switch A forwards the packet directly to Host B, without sending it to the router.

When Host A sends a packet to Host C in VLAN 20, Switch A forwards the packet to the router, which receives the traffic on the VLAN 10 interface. The router checks the routing table, finds the correct outgoing interface, and forwards the packet on the VLAN 20 interface to Switch B. Switch B receives the packet and forwards it to Host C.

Types of Routing

Routers and Layer 3 switches can route packets in these ways:

- By using default routing

- By using preprogrammed static routes for the traffic

- By dynamically calculating routes by using a routing protocol

The switch supports static routes and default routes. It does not support routing protocols.

IP Routing and Switch Stacks

A switch stack appears to the network as a single switch, regardless of which switch in the stack is connected to a routing peer.

The active switch performs these functions:

- It initializes and configures the routing protocols.

- It sends routing protocol messages and updates to other routers.

- It processes routing protocol messages and updates received from peer routers.

- It generates, maintains, and distributes the distributed Cisco Express Forwarding (dCEF) database to all stack members. The routes are programmed on all switches in the stack bases on this database.

- The MAC address of the active switch is used as the router MAC address for the whole stack, and all outside devices use this address to send IP packets to the stack.

- All IP packets that require software forwarding or processing go through the CPU of the active switch.

Stack members perform these functions:

- They act as routing standby switches, ready to take over in case they are elected as the new active switch if the active switch fails.

- They program the routes into hardware.

If a active switch fails, the stack detects that the active switch is down and elects one of the stack members to be the new active switch. During this period, except for a momentary interruption, the hardware continues to forward packets with no active protocols.

However, even though the switch stack maintains the hardware identification after a failure, the routing protocols on the router neighbors might flap during the brief interruption before the active switch restarts. Routing protocols such as OSPF and EIGRP need to recognize neighbor transitions.

Upon election, the new active switch performs these functions:

- It starts generating, receiving, and processing routing updates.

- It builds routing tables, generates the CEF database, and distributes it to stack members.

- It uses its MAC address as the router MAC address. To notify its network peers of the new MAC address, it periodically (every few seconds for 5 minutes) sends a gratuitous ARP reply with the new router MAC address.

> **Note** If you configure the persistent MAC address feature on the stack and the active switch changes, the stack MAC address does not change for the configured time period. If the previous active switch rejoins the stack as a member switch during that time period, the stack MAC address remains the MAC address of the previous active switch.

- It attempts to determine the reachability of every proxy ARP entry by sending an ARP request to the proxy ARP IP address and receiving an ARP reply. For each reachable proxy ARP IP address, it generates a gratuitous ARP reply with the new router MAC address. This process is repeated for 5 minutes after a new active switch election.

> **Caution** Partitioning of the switch stack into two or more stacks might lead to undesirable behavior in the network.

If the switch is reloaded, then all the ports on that switch go down and there is a loss of traffic for the interfaces involved in routing.

Configuring IP Unicast Routing

By default, IP routing is disabled on the switch. For detailed IP routing configuration information, see the *Cisco IOS IP Configuration Guide, Release 12.2* from the *Cisco.com* page under **Documentation** > **Cisco IOS Software Releases** > **12.2 Mainline** > **Configuration Guides**.

In these procedures, the specified interface must be a switch virtual interface (SVI)-a VLAN interface created by using the **interface vlan** *vlan_id* global configuration command and by default a Layer 3 interface. All Layer 3 interfaces on which routing will occur must have IP addresses assigned to them. See the *Assigning IP Addresses to SVIs* section.

> **Note**
> The switch supports 16 static routes (including user-configured routes and the default route) and any directly connected routes and default routes for the management interface. You can use the "lanbase-default" SDM template to configure the static routes. The switch can have an IP address assigned to each SVI. Before enabling routing, enter the **sdm prefer lanbase-routing** global configuration command and reload the switch.

Procedures for configuring routing:

- To support VLAN interfaces, create and configure VLANs on the switch or switch stack, and assign VLAN membership to Layer 2 interfaces. For more information, see chapter: *Configuring VLANs*.

- Configure Layer 3 interfaces (SVIs).

- Enable IP routing on the switch.

- Assign IP addresses to the Layer 3 interfaces.

- Configure static routes.

Enabling IP Unicast Routing

By default, the Switch is in Layer 2 switching mode and IP routing is disabled. To use the Layer 3 capabilities of the Switch, you must enable IP routing.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** Switch> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	**Purpose**
	Switch# **configure terminal**	
Step 3	**ip routing** **Example:** Switch(config)# ip routing	Enables IP routing.
Step 4	**end** **Example:** Switch(config)# **end**	Returns to privileged EXEC mode.
Step 5	**show running-config** **Example:** Switch# **show running-config**	Verifies your entries.
Step 6	**copy running-config startup-config** **Example:** Switch# **copy running-config startup-config**	(Optional) Saves your entries in the configuration file.

Assigning IP Addresses to SVIs

To configure IP routing, you need to assign IP addresses to Layer 3 network interfaces. This enables communication with the hosts of those interfaces that use IP. IP routing is disabled by default, and no IP addresses are assigned to SVIs.

An IP address identifies a location to which IP packets can be sent. Some IP addresses are reserved for special uses and cannot be used for host, subnet, or network addresses. RFC 1166, "Internet Numbers," contains the official description of IP addresses.

An interface can have one primary IP 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 referred to as a subnet mask. To receive an assigned network number, contact your Internet service provider.

Follow these steps to assign an IP address and a network mask to an SVI:

Procedure

	Command or Action	**Purpose**
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: Switch> **enable**	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** Switch# **configure terminal**	Enters global configuration mode.
Step 3	**interface vlan** *vlan-id*	Enters interface configuration mode, and specifies the Layer 3 VLAN to configure. **Note** If the interface is still in Layer 2 mode (the default), you must enter a **no switchport** interface configuration command before entering the **ip address** interface configuration command.
Step 4	**ip address** *ip-address subnet-mask* **Example:** Switch(config-if)# **ip address 10.1.5.1 255.255.255.0**	Configures the IP address and IP subnet mask.
Step 5	**end** **Example:** Switch(config)# **end**	Returns to privileged EXEC mode.
Step 6	**show interfaces** [*interface-id*] **Example:** Switch# **show interfaces gigabitethernet 1/0/1**	Verifies your entries.
Step 7	**show interfaces vlan** [*vlan-id*] **Example:** Switch# **show interfaces vlan 4**	Verifies your entries.
Step 8	**show running-config** **Example:** Switch# **show running-config**	Verifies your entries.

	Command or Action	Purpose
Step 9	**copy running-config startup-config** **Example:** Switch# **copy running-config startup-config**	(Optional) Saves your entries in the configuration file.

Configuring Static Unicast Routes

Static unicast routes are user-defined routes that cause packets moving between a source and a destination to take a specified path. Static routes can be important if the router cannot build a route to a particular destination and are useful for specifying a gateway of last resort to which all unroutable packets are sent.

Follow these steps to configure a static route:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** Device> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Device# **configure terminal**	Enters global configuration mode.
Step 3	**ip route prefix mask** {*address* | *interface*} [*distance*] **vlan** *vlan-id* **Example:** Device(config)# **ip route prefix mask gigabitethernet 1/0/4vlan 4**	Establish a static route.
Step 4	**end** **Example:** Switch(config)# **end**	Returns to privileged EXEC mode.
Step 5	**show ip route** **Example:**	Displays the current state of the routing table to verify the configuration.

Command or Action	Purpose
Switch# **show ip route**	
Step 6 **copy running-config startup-config** **Example:** Device# **copy running-config startup-config**	(Optional) Saves your entries in the configuration file.

What to do next

Use the **no ip route** *prefix mask* {*address*| *interface*} global configuration command to remove a static route. The switch retains static routes until you remove them.

Monitoring and Maintaining the IP Network

You can remove all contents of a particular cache, table, or database. You can also display specific statistics.

Table 1: Commands to Clear IP Routes or Display Route Status

Command	Purpose
show ip route [*address* [*mask*] [**longer-prefixes**]]	Displays the current state of the routing table.
show ip route summary	Displays the current state of the routing table in summary form.
show platform ip unicast	Displays platform-dependent IP unicast information.