Configuring IP Multicast Multilayer Switching

This module describes how to configure IP multicast Multilayer Switching (MLS).

Note
This module is a brief summary of the information contained in the Catalyst 5000 Series Multilayer Switching User Guide. The commands and configurations described in this guide apply only to the devices that provide routing services. Commands and configurations for Catalyst 5000 series switches are documented in the Catalyst 5000 Series Multilayer Switching User Guide and the Catalyst 5000 Series Software Configuration Guide. For configuration information for the Catalyst 6000 series switch, see the Configuring and Troubleshooting IP MLS on Catalyst 6500/6000 Switches with an MSFC document or see the “Configuring IP Multilayer Layer 3 Switching” chapter in the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the “Feature Information for Configuring IP Multicast Multilayer Switching” section on page 17.

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Contents

- Prerequisites for Configuring IP Multicast Multilayer Switching, page 2
- Restrictions for Configuring IP Multicast Multilayer Switching, page 2
- Information About IP Multicast Multilayer Switching, page 4
- How to Configure and Monitor IP Multicast Multilayer Switching, page 4
Prerequisites for Configuring IP Multicast Multilayer Switching

The following prerequisites are necessary before IP multicast MLS can function:

- A VLAN interface must be configured on both the switch and the router. For information on configuring inter-VLAN routing on the Route Switch Module (RSM) or an external router, see the Catalyst 5000 Series Software Configuration Guide or the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide.

- IP multicast routing and Protocol Independent Multicast (PIM) must be enabled on the router. The minimal steps to configure them are described in the “How to Configure and Monitor IP Multicast Multilayer Switching” section of this module. For detailed information on configuring IP multicast routing and PIM, see the “Configuring Basic IP Multicast” in the Cisco IOS IP Multicast Configuration Guide.

- You must also configure the Catalyst 5000 or 6500/6000 series switch in order for IP multicast MLS to function on the router. For more information, see the Catalyst 5000 Series Software Configuration Guide or the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide.

Restrictions for Configuring IP Multicast Multilayer Switching

The restrictions in the following sections apply to IP multicast MLS on the router:

- Router Configuration Restrictions for IP Multicast Multilayer Switching, page 2
- External Router Guidelines for IP Multicast Multilayer Switching, page 3
- Access List Restrictions and Guidelines for IP Multicast Multilayer Switching, page 3

Router Configuration Restrictions for IP Multicast Multilayer Switching

IP multicast MLS does not work on internal or external routers in the following situations:

- If IP multicast MLS is disabled on the RPF interface for the flow (using the no mls rp ip multicast command).
- For IP multicast groups that fall into these ranges (where * is in the range from 0 to 255):
  - 224.0.0.* through 239.0.0.*
  - 224.128.0.* through 239.128.0.*

  Note  
  Groups in the 224.0.0.* range are reserved for routing control packets and must be flooded to all forwarding ports of the VLAN. These addresses map to the multicast MAC address range 01-00-5E-00-00-xx, where xx is in the range from 0 to 0xFF.

- For PIM auto-RP multicast groups (IP multicast group addresses 224.0.1.39 and 224.0.1.40).
Restrictions for Configuring IP Multicast Multilayer Switching

- For flows that are forwarded on the multicast shared tree (that is, \( \{*, G, *\} \) forwarding) when the interface or group is running PIM sparse mode.
- If the shortest path tree (SPT) bit for the flow is cleared when running PIM sparse mode for the interface or group.
- When an input rate limit is applied on an RPF interface.
- For any RPF interface with access lists applied. For detailed information, see the “Access List Restrictions and Guidelines for IP Multicast Multilayer Switching” section in this module.
- For any RPF interface with multicast boundary configured.
- For packets that require fragmentation and packets with IP options. However, packets in the flow that are not fragmented or that do not specify IP options are multilayer switched.
- On external routers, for source traffic received at the router on non-ISL or non-802.1Q interfaces.
- For source traffic received on tunnel interfaces (such as MBONE traffic).
- For any RPF interface with multicast tag switching enabled.

External Router Guidelines for IP Multicast Multilayer Switching

Follow these guidelines when using an external router:

- The connection to the external router must be over a single ISL or 802.1Q trunk link with subinterfaces (using appropriate encapsulation type) configured.
- A single external router can serve as the MMLS-RP for multiple switches, provided each switch connects to the router through a separate ISL or 802.1Q trunk link.
- If the switch connects to a single router through multiple trunk links, IP multicast MLS is supported on one of the links only. You must disable IP multicast MLS on the redundant links using the `no mls rp ip multicast` interface configuration command.
- You can connect end hosts (source or multicast destination devices) through any media (Ethernet, Fast Ethernet, ATM, and FDDI), but the connection between external routers and the switch must be through Fast Ethernet or Gigabit Ethernet interfaces.

Access List Restrictions and Guidelines for IP Multicast Multilayer Switching

The following restrictions apply when using access lists on interfaces participating in IP multicast MLS:

- All standard access lists are supported on any interface. The flow is multilayer switched on all interfaces on which the traffic for the flow is allowed by the access list.
- Layer 4 port-based extended IP input access lists are not supported. For interfaces with these access lists applied, no flows are multilayer switched.
- Extended access lists on the RPF interface that specify conditions other than Layer 3 source, Layer 3 destination, and `ip` protocol are not multilayer switched.

For example, if the following input access list is applied to the RPF interface for a group of flows, no flows will be multilayer switched even though the second entry permits all IP traffic (because the protocol specified in the first entry is not `ip`):

```bash
Router(config)# access-list 101 permit udp any any
Router(config)# access-list 101 permit ip any any
```
If the following input access list is applied to the RPF interface for a group of flows, all flows except the \( \{ s1, g1 \} \) flow are multilayer switched (because the protocol specified in the entry for \( \{ s1, g1 \} \) is not ip):

```
Router(config)# access-list 101 permit udp s1 g1
Router(config)# access-list 101 permit ip any any
```

### Information About IP Multicast Multilayer Switching

The IP multicast MLS feature provides high-performance, hardware-based, Layer 3 switching of IP multicast traffic for routers connected to LAN switches.

An IP multicast flow is a unidirectional sequence of packets between a multicast source and the members of a destination multicast group. Flows are based on the IP address of the source device and the destination IP multicast group address.

IP multicast MLS switches IP multicast data packet flows between IP subnets using advanced, ASIC switching hardware, thereby off loading processor-intensive, multicast packet routing from network routers.

The packet forwarding function is moved onto the connected Layer 3 switch whenever a supported path exists between a source and members of a multicast group. Packets that do not have a supported path to reach their destinations are still forwarded in software by routers. Protocol Independent Multicast (PIM) is used for route determination.

For conceptual information about IP Multicast Multilayer Switching, see the “Multilayer Switching Overview” module.

### How to Configure and Monitor IP Multicast Multilayer Switching

To configure your Cisco router for IP multicast MLS, perform the tasks described in the following sections. The first two sections contain required tasks; the remaining tasks are optional.

- **Enabling IP Multicast Routing**, page 4 (Required)
- **Enabling IP PIM**, page 5 (Required)
- **Reenabling IP Multicast MLS**, page 6 (Optional, required task only if you disabled it)
- **Specifying an IP Multicast MLS Management Interface**, page 7 (Optional)

### Enabling IP Multicast Routing

You must enable IP multicast routing globally on the MMLS-RPs before you can enable IP multicast MLS on router interfaces. To enable IP multicast routing on the router, complete the following steps.

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `ip multicast-routing`
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 ip multicast-routing</td>
<td>Enables IP multicast routing globally.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# ip multicast-routing</td>
<td></td>
</tr>
<tr>
<td>Step 4 end</td>
<td>Exits global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# end</td>
<td></td>
</tr>
</tbody>
</table>

Note: This section describes only how to enable IP multicast routing on the router. For detailed IP multicast configuration information, see the “Configuring Basic IP Multicast” module in the Cisco IOS IP Multicast Configuration Guide.

Enabling IP PIM

You must enable IP PIM on the router interfaces connected to the switch before IP multicast MLS will function on those router interfaces.

To enable IP PIM, complete the following steps.

SUMMARY STEPS

1. enable
2. configure terminal
3. interface type number
4. ip pim {dense-mode | sparse-mode | sparse-dense-mode}
5. end
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> interface type number</td>
<td>Configures an interface and enters interface configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config)# interface</td>
<td></td>
</tr>
<tr>
<td>fastethernet 2/0.1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> ip pim {dense-mode</td>
<td>sparse-mode</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# ip pim dense-mode</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits interface configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# end</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

This section describes only how to enable PIM on router interfaces. For detailed PIM configuration information, see the “Configuring Basic IP Multicast” module in the Cisco IOS IP Multicast Configuration Guide.

### Reenabling IP Multicast MLS

IP multicast MLS is enabled by default when you enable IP PIM on the interface. Perform this task only if you disabled IP multicast MLS and you want to reenable it.

To reenable IP multicast MLS on an interface, complete the following steps.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. interface type number
4. mls rp ip multicast
5. end
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Step 3 interface type number</td>
<td>Configures an interface and enters interface</td>
</tr>
<tr>
<td>Example:</td>
<td>configuration mode.</td>
</tr>
<tr>
<td>Step 4 mls rp ip multicast</td>
<td>Enables IP multicast MLS on an interface.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enables IP multicast MLS on an interface.</td>
</tr>
<tr>
<td>Step 5 end</td>
<td>Exits interface configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Exits interface configuration mode.</td>
</tr>
</tbody>
</table>

Specifying an IP Multicast MLS Management Interface

To specify the IP multicast MLS management interface, complete the following steps.

IP Multicast MLS and Management Interfaces

When you enable IP multicast MLS, the subinterface (or VLAN interface) that has the lowest VLAN ID and is active (in the “up” state) is automatically selected as the management interface. The one-hop protocol Multilayer Switching Protocol (MLSP) is used between a router and a switch to pass messages about hardware-switched flows. MLSP packets are sent and received on the management interface. Typically, the interface in VLAN 1 is chosen (if that interface exists). Only one management interface is allowed on a single trunk link.

In most cases, we recommend that the management interface be determined by default. However, you can optionally specify a different router interface or subinterface as the management interface. We recommend using a subinterface with minimal data traffic so that multicast MLSP packets can be sent and received more quickly.

If the user-configured management interface goes down, the router uses the default interface (the active interface with the lowest VLAN ID) until the user-configured interface comes up again.

SUMMARY STEPS

1. enable
2. configure terminal
3. interface type number
4. mls rp ip multicast management-interface
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> interface type number</td>
<td>Configures an interface and enters interface configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config)# interface fastethernet 2/0.1</td>
<td>- Enter the interface type and interface number.</td>
</tr>
<tr>
<td><strong>Step 4</strong> mls rp ip multicast management-interface</td>
<td>Configures an interface as the IP multicast MLS management interface.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config-if)# mls rp ip multicast management-interface</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits interface configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config-if)# end</td>
<td></td>
</tr>
</tbody>
</table>

**Monitoring and Maintaining an IP Multicast MLS Network**

To monitor and maintain an IP multicast MLS network, use one or more of the `show` commands listed below.

**SUMMARY STEPS**

1. enable
2. show ip mroute
3. show ip pim interface
4. show mls rp ip multicast
5. end
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> show ip mroute</td>
<td>Displays the contents of the multicast routing (mroute) table.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# show ip mroute</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> show ip pim interface</td>
<td>Displays information about interfaces configured for PIM.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# show ip pim interface</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> show mls rp ip multicast</td>
<td>Displays hardware-switched multicast flow information about IP multicast MLS.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# show mls rp ip multicast</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# end</td>
<td></td>
</tr>
</tbody>
</table>

**IP Multicast MLS Configuration: Examples**

This section contains the following examples:

- Basic IP Multicast MLS Network: Examples, page 9
- Complex IP Multicast MLS Network: Examples, page 12

*Note* These examples include the switch configurations, although switch commands are not documented in this module. For switch command information, see the *Catalyst 5000 Family Command Reference* or the *Catalyst 6500 Series Command Reference*.

**Basic IP Multicast MLS Network: Examples**

This section contains the following examples.

- Network Topology: Example, page 10
- Operation Before IP Multicast MLS: Example, page 10
- Operation After IP Multicast MLS: Example, page 11
- Router Configuration: Example, page 11
- Switch Configuration: Example, page 11
Network Topology: Example

Figure 1 shows a basic IP multicast MLS example network topology.

The network is configured as follows:

- There are three VLANs (IP subnetworks): VLANs 10, 20, and 30.
- The multicast source for group G1 belongs to VLAN 10.
- Hosts A, C, and D have joined IP multicast group G1.
- Port 1/2 on the MMLS-SE is connected to interface fastethernet 2/0 on the MMLS-RP.
- The link between the MMLS-SE and the MMLS-RP is configured as an ISL trunk.
- The subinterfaces on the router interface have these IP addresses:
  - fastethernet2/0.10: 10.1.10.1 255.255.255.0 (VLAN 10)
  - fastethernet2/0.20: 10.1.20.1 255.255.255.0 (VLAN 20)
  - fastethernet2/0.30: 10.1.30.1 255.255.255.0 (VLAN 30)

Operation Before IP Multicast MLS: Example

Without IP multicast MLS, when the G1 source (on VLAN 10) sends traffic destined for IP multicast group G1, the switch forwards the traffic (based on the Layer 2 multicast forwarding table entry generated by the IGMP snooping, CGMP, or GMRP multicast service) to Host A on VLAN 10 and to the router subinterface in VLAN 10.

The router receives the multicast traffic on its incoming subinterface for VLAN 10, checks the multicast routing table, and replicates the traffic to the outgoing subinterfaces for VLANs 20 and 30. The switch receives the traffic on VLANs 20 and 30 and forwards the traffic received on these VLANs to the appropriate switch ports, again based on the contents of the Layer 2 multicast forwarding table.
Operation After IP Multicast MLS: Example

After IP multicast MLS is implemented, when the G1 source sends traffic destined for multicast group G1, the MMLS-SE checks its Layer 3 multicast MLS cache and recognizes that the traffic belongs to a multicast MLS flow. The MMLS-SE forwards the traffic to Host A on VLAN 10 based on the multicast forwarding table, but does not forward the traffic to the router subinterface in VLAN 10 (assuming a completely switched flow).

For each multicast MLS cache entry, the switch maintains a list of outgoing interfaces for the destination IP multicast group. The switch replicates the traffic on the appropriate outgoing interfaces (VLANs 20 and 30) and then forwards the traffic on each VLAN to the destination hosts (using the Layer 2 multicast forwarding table). The switch performs a packet rewrite for the replicated traffic so that the packets appear to have been routed by the appropriate router subinterface.

If not all the router subinterfaces are eligible to participate in IP multicast MLS, the switch must forward the multicast traffic to the router subinterface in the source VLAN (in this case, VLAN 10). In this situation, on those subinterfaces that are ineligible, the router performs multicast forwarding and replication in software, in the usual manner. On those subinterfaces that are eligible, the switch performs multilayer switching.

Note

On the MMLS-RP, the IP multicast MLS management interface is user-configured to the VLAN 30 subinterface. If this interface goes down, the system will revert to the default management interface (in this case, the VLAN 10 subinterface).

Router Configuration: Example

The following is an example configuration of IP multicast MLS on the router:

```
ip multicast-routing
interface fastethernet2/0.10
  encapsulation isl 10
  ip address 10.1.10.1 255.255.255.0
  ip pim dense-mode
interface fastethernet2/0.20
  encapsulation isl 20
  ip address 10.1.20.1 255.255.255.0
  ip pim dense-mode
interface fastethernet2/0.30
  encapsulation isl 30
  ip address 10.1.30.1 255.255.255.0
  ip pim dense-mode
mls rp ip multicast management-interface
```

You will receive the following message informing you that you changed the management interface:

```
Warning: MLS Multicast management interface is now Fa2/0.30
```

Switch Configuration: Example

The following example shows how to configure the switch (MMLS-SE):

```
Console> (enable) set trunk 1/2 on isl
Port(s) 1/2 trunk mode set to on.
Port(s) 1/2 trunk type set to isl.
Console> (enable) set igmp enable
IGMP feature for IP multicast enabled
Console> (enable) set mls multicast enable
```
Multilayer Switching for Multicast is enabled for this device.
Console> (enable) set mls multicast include 10.1.10.1
Multilayer switching for multicast is enabled for router 10.1.10.1.

Complex IP Multicast MLS Network: Examples

This section contains the following examples:
- Network Topology: Example, page 12
- Operation Before IP Multicast MLS: Example, page 13
- Operation After IP Multicast MLS: Example, page 13

Network Topology: Example

Figure 2 shows a more complex IP multicast MLS example network topology.

Figure 2 Complex IP Multicast MLS Example Network

The network is configured as follows:
- There are four VLANs (IP subnetworks): VLANs 1, 10, 20, and 30 (VLAN 1 is used only for management traffic, not multicast data traffic).
- The G1 multicast source belongs to VLAN 10.
- Hosts A, C, D, and E have joined IP multicast group G1.
- Switch A is the MMLS-SE.
- Router A and Router B are both operating as MMLS-RPs.
- Port 1/1 on the MMLS-SE is connected to interface fastethernet1/0 on Router A.
- Port 1/2 on the MMLS-SE is connected to interface fastethernet2/0 on Router B.
- The MMLS-SE is connected to the MMLS-RPs through ISL trunk links.
- The trunk link to Router A carries VLANs 1, 10, and 20.
• The trunk link to Router B carries VLANs 1, 10, and 30.
• The subinterfaces on the Router A interface have these IP addresses:
  – fastethernet1/0.1: 172.20.1.1 255.255.255.0 (VLAN 1)
  – fastethernet1/0.10: 172.20.10.1 255.255.255.0 (VLAN 10)
  – fastethernet1/0.20: 172.20.20.1 255.255.255.0 (VLAN 20)
• The subinterfaces on the Router B interface have these IP addresses:
  – fastethernet1/0.1: 172.20.1.2 255.255.255.0 (VLAN 1)
  – fastethernet2/0.10: 172.20.10.100 255.255.255.0 (VLAN 10)
  – fastethernet2/0.30: 172.20.30.100 255.255.255.0 (VLAN 30)
• The default IP multicast MLS management interface is used on both MMLS-RPs (VLAN 1).
• Port 1/3 on the MMLS-SE is connected to Switch B through an ISL trunk link carrying all VLANs.
• Port 1/4 on the MMLS-SE is connected to Switch C through an ISL trunk link carrying all VLANs.
• Switch B and Switch C perform Layer 2 switching functions only.

**Operation Before IP Multicast MLS: Example**

Without IP multicast MLS, when Server A (on VLAN 10) sends traffic destined for IP multicast group G1, Switch B forwards the traffic (based on the Layer 2 multicast forwarding table entry) to Host A on VLAN 10 and to Switch A. Switch A forwards the traffic to the Router A and Router B subinterfaces in VLAN 10.

Router A receives the multicast traffic on its incoming subinterface for VLAN 10, checks the multicast routing table, and replicates the traffic to the outgoing subinterface for VLAN 20. Router B receives the multicast traffic on its incoming interface for VLAN 10, checks the multicast routing table, and replicates the traffic to the outgoing subinterface for VLAN 30.

Switch A receives the traffic on VLANs 20 and 30. Switch A forwards VLAN 20 traffic to the appropriate switch ports (in this case, to Host C), based on the contents of the Layer 2 multicast forwarding table. Switch A forwards the VLAN 30 traffic to Switch C.

Switch C receives the VLAN 30 traffic and forwards it to the appropriate switch ports (in this case, Hosts D and E) using the multicast forwarding table.

**Operation After IP Multicast MLS: Example**

After IP multicast MLS is implemented, when Server A sends traffic destined for multicast group G1, Switch B forwards the traffic (based on the Layer 2 multicast forwarding table entry) to Host A on VLAN 10 and to Switch A.

Switch A checks its Layer 3 multicast MLS cache and recognizes that the traffic belongs to a multicast MLS flow. Switch A does not forward the traffic to the router subinterfaces in VLAN 10 (assuming a completely switched flow). Instead, Switch A replicates the traffic on the appropriate outgoing interfaces (VLANs 20 and 30).

VLAN 20 traffic is forwarded to Host C and VLAN 30 traffic is forwarded to Switch C (based on the contents of the Layer 2 multicast forwarding table). The switch performs a packet rewrite for the replicated traffic so that the packets appear to have been routed by the appropriate router subinterface.

Switch C receives the VLAN 30 traffic and forwards it to the appropriate switch ports (in this case, Hosts D and E) using the multicast forwarding table.
If not all the router subinterfaces are eligible to participate in IP multicast MLS, the switch must forward the multicast traffic to the router subinterfaces in the source VLAN (in this case, VLAN 10). In this situation, on those subinterfaces that are ineligible, the routers perform multicast forwarding and replication in software in the usual manner. On those subinterfaces that are eligible, the switch performs multilayer switching.

**Note**
On both MMLS-RPs, no user-configured IP multicast MLS management interface is specified. Therefore, the VLAN 1 subinterface is used by default.

**Router A (MMLS-RP) Configuration**

```conf
ip multicast-routing
interface fastethernet1/0.1
  encapsulation isl 1
  ip address 172.20.1.1 255.255.255.0
interface fastethernet1/0.10
  encapsulation isl 10
  ip address 172.20.10.1 255.255.255.0
  ip pim dense-mode
interface fastethernet1/0.20
  encapsulation isl 20
  ip address 172.20.20.1 255.255.255.0
  ip pim dense-mode
```

**Router B (MMLS-RP) Configuration**

```conf
ip multicast-routing
interface fastethernet1/0.1
  encapsulation isl 1
  ip address 172.20.1.2 255.255.255.0
interface fastethernet2/0.10
  encapsulation isl 10
  ip address 172.20.10.100 255.255.255.0
  ip pim dense-mode
interface fastethernet2/0.30
  encapsulation isl 30
  ip address 172.20.30.100 255.255.255.0
  ip pim dense-mode
```

**Switch A (MMLS-SE) Configuration**

```conf
Console> (enable) set vlan 10
Vlan 10 configuration successful
Console> (enable) set vlan 20
Vlan 20 configuration successful
Console> (enable) set vlan 30
Vlan 30 configuration successful
Console> (enable) set trunk 1/1 on isl
  Port(s) 1/1 trunk mode set to on.
  Port(s) 1/1 trunk type set to isl.
Console> (enable) set trunk 1/2 on isl
  Port(s) 1/2 trunk mode set to on.
  Port(s) 1/2 trunk type set to isl.
Console> (enable) set trunk 1/3 desirable isl
  Port(s) 1/3 trunk mode set to desirable.
  Port(s) 1/3 trunk type set to isl.
Console> (enable) set trunk 1/4 desirable isl
  Port(s) 1/4 trunk mode set to desirable.
  Port(s) 1/4 trunk type set to isl.
Console> (enable) set igmp enable
IGMP feature for IP multicast enabled
```
Console> (enable) set mls multicast enable
Multilayer Switching for Multicast is enabled for this device.
Console> (enable) set mls multicast include 172.20.10.1
Multilayer switching for multicast is enabled for router 172.20.10.1.
Console> (enable) set mls multicast include 172.20.10.100
Multilayer switching for multicast is enabled for router 172.20.10.100.

Switch B Configuration
The following example shows how to configure Switch B assuming VLAN Trunking Protocol (VTP) is used for VLAN management:

Console> (enable) set igmp enable
IGMP feature for IP multicast enabled
Console> (enable)

Switch C Configuration
The following example shows how to configure Switch C assuming VTP is used for VLAN management:

Console> (enable) set igmp enable
IGMP feature for IP multicast enabled
Console> (enable)

Additional References
The following sections provide references related to configuring IP multicast multilayer switching.

Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP LAN switching commands: complete command syntax, command mode, defaults, usage guidelines, and examples</td>
<td>Cisco IOS LAN Switching Services Command Reference</td>
</tr>
<tr>
<td>MLS overview</td>
<td>“Multilayer Switching Overview” module</td>
</tr>
<tr>
<td>MLS on a Catalyst 5000 series switch</td>
<td>Catalyst 5000 Series Multilayer Switching User Guide</td>
</tr>
<tr>
<td></td>
<td>Catalyst 5000 Series Software Configuration Guide</td>
</tr>
<tr>
<td>MLS on a Catalyst 6500/6000 series switch</td>
<td>Configuring and Troubleshooting IP MLS on Catalyst 6500/6000 Switches with an MSFC</td>
</tr>
<tr>
<td></td>
<td>“Configuring IP Multilayer Layer 3 Switching” chapter in the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide</td>
</tr>
<tr>
<td>Catalyst switch commands</td>
<td>Catalyst 5000 Family Command Reference</td>
</tr>
<tr>
<td></td>
<td>Catalyst 6500 Series Command Reference</td>
</tr>
<tr>
<td>IP multicast routing and PIM</td>
<td>“Configuring Basic IP Multicast” in the Cisco IOS IP Multicast Configuration Guide</td>
</tr>
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### Standards

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<th>Title</th>
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### MIBs

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<th>MIB</th>
<th>MIBs Link</th>
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<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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### RFCs

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### Technical Assistance

<table>
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<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>
Feature Information for Configuring IP Multicast Multilayer Switching

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release. Unless noted otherwise, subsequent releases of that Cisco IOS software also support that feature.

Table 1  Feature Information for Configuring IP Multicast Multilayer Switching

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
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<td>This table is intentionally left blank because no features were introduced or modified in Cisco IOS Release 12.2(1) or later. This table will be updated when feature information is added to this module.</td>
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