

# 1 IP Multicast Switching

## Introduction

This chapter describes how to install and use IP Multicast Switching (IPMS) on your switch. IPMS optimizes the delivery of IP multicast traffic by sending packets only to those stations that request it.

IP multicast is a one-to-many communication technique employed by emerging applications such as video distribution, news feeds, conferencing, netcasting, and resource discovery (OSPF, RIP2, BOOTP). Unlike unicast, which sends one packet per destination, multicast sends one packet to all devices in any subnetwork that has at least one device requesting the multicast traffic. The Multicast Backbone of the Internet (MBone) is one of the most familiar multicast networks.

### ◆ Note ◆

Multicast is not used for audio- or video-on-demand applications. Unicast streams are required for on-demand applications.

IPMS is typically used in conjunction with the switch's internal IP multicast router (see Chapter 2, "IP Multicast Routing"). In IP multicast routing, bandwidth is wasted because when one host joins a multicast group all IP hosts in the destination subnet receive multicast traffic, regardless of whether or not they have signaled that they want to receive the traffic. With IPMS, packets are sent only to those ports that request membership in the multicast group.

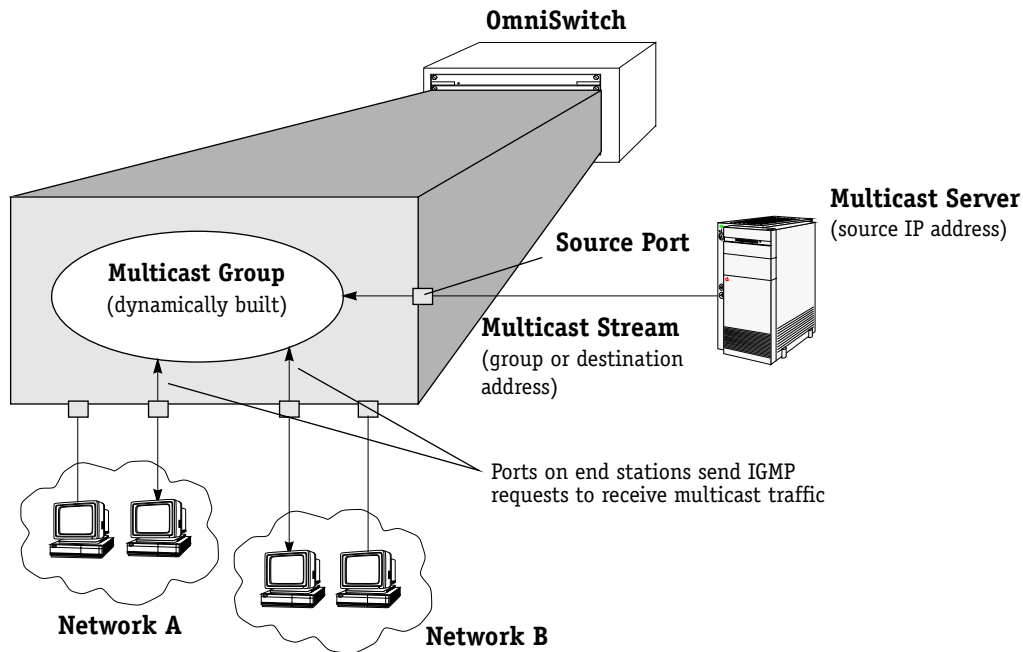
A multicast group is defined by a multicast group address, which is a Class D IP address in the range 224.0.0.0 to 239.255.255.255. (Addresses in the range 239.0.0.0 to 239.255.255.255 are reserved for boundaries. For more information about boundaries, see Chapter 2, "IP Multicast Routing.") The multicast group address is indicated in the Destination Address field of the IP header. Multicast groups are *not* a mobile or non-mobile group as defined in your switch user manual. In this chapter, mobile or non-mobile groups are referred to as *VLAN groups* to distinguish them from multicast groups.

IPMS intercepts Internet Group Management Protocol (IGMP) packets to track multicast group membership by logical port; this tracking is called IGMP gleaning (snooping). IPMS dynamically stores and updates information as stations join and leave multicast groups. The multicast router (described in Chapter 2, "IP Multicast Routing") tracks the membership of networks and constructs a routing table using the Distance Vector Multicast Routing Protocol (DVMRP). This combined information is used by network interface modules to make forwarding decisions. The result is improved IP multicast forwarding performance.

### ◆ Important Note ◆

IPMS uses multicast router frames (DVMRP) to determine the relative locations of external routers. IPMS forwards IGMP membership reports and all local multicast traffic to ports on which these routers or layer 3 switches have been detected. At least one router must be configured as a multicast router, even if IPMS is running in a single subnet environment. To control multicast traffic, it is recommended that the multicast router be configured near the highest volume multicast source.

The illustration here shows stations from two different attached networks sending IGMP reports to the switch.



### Ports Joining a Multicast Group

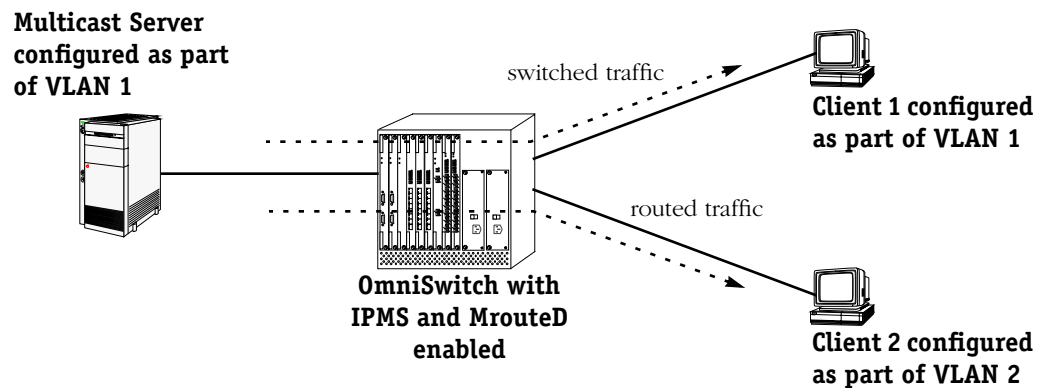
IPMS tracks the source VLAN on which the IGMP requests are received. The IPMS network interface forwarding tables track the IP source address of the device generating the multicast stream (in this case, the server), IP multicast address of the multicast stream, source VLAN, source port, and a list of ports that want to receive multicast traffic. The network interfaces verify that a multicast packet is received by the switch on the source (or expected) port. The packet is then switched or routed to all ports in the list.

The switching/routing decision is determined dynamically by the IPMS software in the switch. If both ports are contained in the same VLAN, the packet is switched. If the ports are in different VLANs, the packet is routed if a multicast routing protocol is installed and running on the switch and a valid route is available.

Routing between VLANs on the switch will not be possible if the multicast protocol is disabled on the switch or if it is not loaded. (This may be desirable if you don't want to configure IP addresses for many router ports on the switch.) In this scenario, if both the source and destination ports are in the same VLAN, the packet is switched.

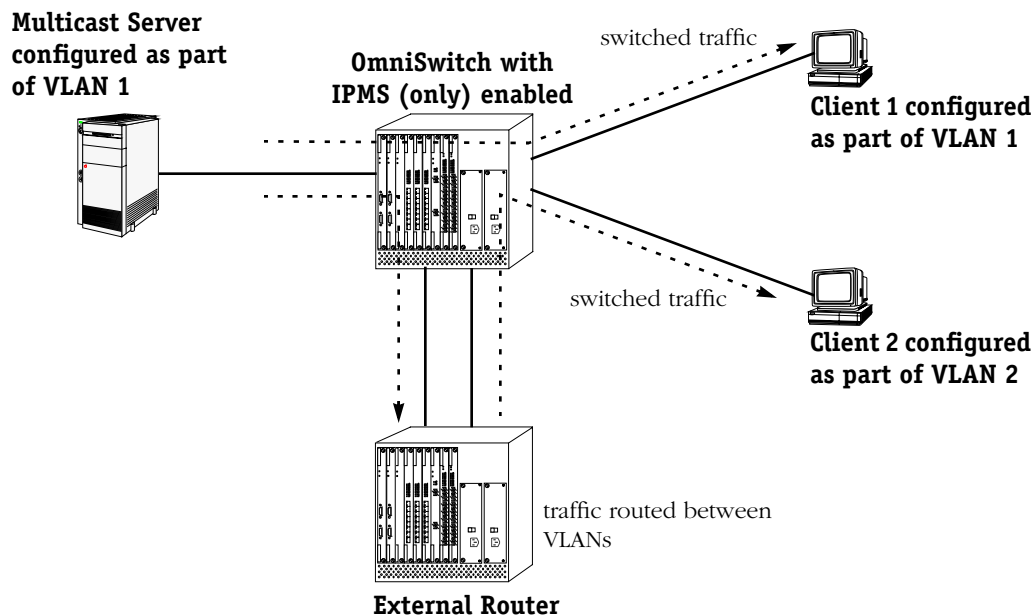
In the following illustrations, client 1 and client 2 request to join the multicast group. The multicast server and client 1 belong to the same VLAN. Client 2 belongs to a different VLAN.

In the first illustration, the switch will switch multicast traffic to VLAN 1 and route multicast traffic to VLAN 2.



**IPMS Example 1**

In this illustration, multicast traffic to be delivered to client 2 must be forwarded from the local switch to an external router that routes the traffic between VLAN 1 and VLAN 2.



**IPMS Example 2**

### Hardware/Software Support

IPMS is supported on OmniSwitches and OmniSwitch/Routers with at least 16 MB of memory. It is also supported on the following OmniStacks with at least 16 MB of memory: models 2032, 3032, 4024, and 5024. In addition, IPMS has the following hardware/software support:

- High-density later-generation (Mammoth) switch modules must be installed.

#### ◆ Important Note ◆

You should not have any early generation Ethernet modules installed in the switch when IPMS is running. Such a configuration will produce unexpected results. See your switch user manual for more information about managing Ethernet modules.

- ATM—supported on later-generation (SAHI) modules only (FCSM2, ASM2, and ASX). PTOP (1483 and private) is supported. In LANE networks, all LECs receive multicast traffic; IPMS cannot send multicast to individual stations. *CIP is not supported.*
- MPM/MPX redundant configuration is not supported.
- For WSXs and WSMs or Token Ring or FDDI: multicast routing is not supported between VLAN groups. For these interfaces, if the destination address is in the same VLAN group that the traffic came in on, IPMS floods to all ports in the VLAN. If the destination address is in a different VLAN, traffic is not forwarded.
- IPMS does not support AutoTracker VLANs.
- IP multicast routing (MrouteD) must be enabled on the switch to run IPMS with routing capability.
- IPMS does not support IP multicast tunnels. If multicast tunnels are configured on the switch, they should be disabled. For more information about multicast tunnels, see Chapter 2, “IP Multicast Routing.”

## IPMS and Multicast VLANs

When the switch is running IPMS, multicast VLANs for IP networks should *not* be configured. (IP multicast MAC addresses contain 01:00:5E in the first three octets.) IPMS dynamically creates the equivalent of user-configured multicast VLANs.

Multicast VLANs may be configured for other types of networks, such as AppleTalk or Decnet.

See your switch user manual for information about multicast VLANs.

## IPMS and MAC Addresses

Each multicast group address has a corresponding MAC address that is derived by combining the least significant 23 bits of the multicast group address with 01:00:5E. For example, multicast address 224.1.2.3 has a MAC address of 01:00:5E:01:02:03. Overlapping MAC addresses are possible with this scheme. A multicast address of 225.1.2.3 has the same MAC address as multicast address 224.1.2.3.

## IPMS and Flood Limits

To make sure multicast throughput is optimized, you should set the flood limit to zero for a particular port or group. (There may be flooding problems with other types of traffic on these ports or groups.) Use the **modvp** command to set flood limits for a particular port or the **flc** command to set flood limits for a particular group. Use the **fls** command to view the status of flood limits. See your switch user manual for more information about these commands.

### ◆ Important Note ◆

It is strongly recommended that you set the flood limit to zero when running IPMS on the switch.

# Installing IPMS

IPMS is a separately loaded module contained in the **ipms.img** image file. For IPMS to have routing capability, the multicast routing feature (MrouteD) must also be loaded on the switch. For information about multicast routing, see Chapter 2, “IP Multicast Routing.”

To upload the file, use standard FTP or ZMODEM procedures. Refer to your switch user manual for information about uploading software.

IPMS is initially disabled and must be enabled using the **imcfg** command described in *Enabling or Disabling IPMS* on page 1-7.

## IPMS User Interface Commands

IPMS is disabled by default. When enabled, it does not require any additional configuration in the User Interface (UI). Optional configuration may include enabling/disabling IPMS and resetting IPMS counters.

When IPMS is loaded in the switch, an IPMS menu option is added to the Networking menu. Commands in the UI are executed by typing the relevant command and pressing **<Enter>**.

### ◆ Note ◆

For general information about the UI, see your switch user manual.

## IP Multicast Switching Menu

To display the IP Multicast Switching Menu, enter the following command:

**ipms**

If the UI is configured for terse mode, you must then enter a **?** to display the submenu. In verbose mode, the UI automatically displays the submenu as shown here.

Command	IP Multicast Switching Menu
<b>imcfg</b>	<b>Configure IPMS (enable/disable)</b>
<b>imfwd</b>	<b>Display the Entries in the IPMS Forwarding Table</b>
<b>imgrp</b>	<b>Display the Group Table Showing Member Ports</b>
<b>imnbr</b>	<b>Display the IPMS Neighbor Table</b>
<b>imsum</b>	<b>Display IPMS Summary Information</b>
<b>imsts</b>	<b>Display the Statistics Data</b>
<b>imzst</b>	<b>Zero IPMS Statistics Counters</b>
<b>Main</b>	<b>File</b>
<b>Interface</b>	<b>Security</b>
	<b>Summary</b>
	<b>System</b>
	<b>VLAN</b>
	<b>Services</b>
	<b>Networking</b>
	<b>Help</b>

The IPMS commands are only available if IPMS is loaded and enabled in the switch. If IPMS is not loaded, and you enter any of the IPMS commands, the following message displays:

**unknown command**

If IPMS is initializing (such as at startup) or if IPMS is disabled, the following message displays:

**IPMS not currently enabled. Command ignored.**

## Enabling or Disabling IPMS

IPMS is disabled by default. When IPMS is disabled, any IPMS command you enter (except for **imcfg** or **imsum**) is ignored.

To enable/disable IPMS:

1. At the system prompt, enter the following command:

**imcfg**

A screen similar to the following displays:

**Current IPMS Configuration Status:**

**IPMS status (e=enable, d=disable): Disabled**

**(save/quit/cancel)**

**:**

- 2.** At the prompt enter **e** for enable or **d** for disable.
- 3.** Enter **save** to save the change, or enter **q** to quit the screen without saving the change or **c** to cancel the change.



## Viewing the IPMS Forwarding Table

To display a list of ports associated with source address and IP multicast group address, use the **imfwd** command. (The IP multicast group address is sometimes referred to as the destination address.) You can limit the display by specifying multicast group address, destination slot/port, or destination slot. If you do not specify a particular IP multicast group address, slot number, or slot/port number combination, information displays for all group addresses.

To display all entries in the forwarding table, enter the command without any parameters as follows:

```
imfwd
```

To display the forwarding table for a particular destination slot, enter the command with the slot number. For example:

```
imfwd 2
```

To display the forwarding table for a particular destination slot/port, enter the command with the slot/port number. For example:

```
imfwd 2/3
```

To display the forwarding table for a particular multicast group address, enter the command with the group address. For example:

```
imfwd 224.1.1.1
```

The screen display is similar to the following:

### IMFWD List of Forwarding Table Entries:

Number of Entries Displayed: 4

IP Multicast Group Address	Source IP Addr.	Source Port S/P/Type/I/S	Src Grp		
=====	=====	=====	=====		
224.1.1.1	1.1.2.3	2/1/Brg/1/1	2	Possible Configuration Error	
Dest. Ports	Grp	Type	Nbr	Mbr	
-----	-----	-----	-----	-----	
2/3/Brg/1/na	2	Swtd	Yes	No	
2/6/Brg/1/na	2	Swtd	No	Yes	
4/3/Brg/1/na	3	Rtd	No	No	
4/6/Brg/1/na	3	Rtd	Yes	Yes	

Fields in the table are defined as follows:

**IP Multicast Group Address.** The IP address of a multicast group, which is associated with a multicast stream. This address is used by host applications in the IGMP control packet when requesting membership in the multicast group. There may be multiple addresses per port. This group address is sometimes called the destination address.

**Source IP Addr.** The source address of the device that is generating the multicast stream. This address corresponds to the group address. The group address and source IP address are called the source/destination pair.

**Source Port S/P/Type/I/S.** Ports on which the switch expects to receive data for the source/destination pair. Information displayed for the port includes:

- **S**—Slot number
- **P**—Port number

- **Type**—Type of interface, such as **Brg** for bridging or **Lne** for LANE (Classical IP is currently not supported)
- **I**—Port instance
- **S**—Service (for WAN ports, which will be supported in future releases)

**Src Group.** The group on which the traffic originates.

**Possible Configuration Error.** This message displays if there is an incompatibility between the configuration of the switch and the client station; for example, if the user configures a device with an IP address of a VLAN group that is known to the switch but connects the device to a switch port that is configured for a different VLAN group. In this scenario, IPMS will switch the traffic within the VLAN group; the traffic will not be routed if MrouteD is loaded in the switch.

**Dest. Ports.** Indicates which ports have requested membership in the specified group. The port is indicated by slot number, port number, type, port instance, and service.

**Grp.** The group to which the destination port belongs.

**Type.** Whether the destination port is switched or routed.

**Nbr.** Whether or not the port is receiving traffic as a neighbor.

**Mbr.** Whether or not this port is receiving traffic as a group member.

## Viewing Multicast Groups

To display a list of multicast groups and member ports, use the **imgrp** command. The display may be limited by multicast group address, destination slot/port, or destination slot.

To display a list of members of a particular multicast group address, enter the command with the multicast group address. For example:

```
imgrp 225.1.2.3
```

To display a list of members associated with a particular destination slot, enter the command with the slot number. For example:

```
imgrp 4
```

To display a list of members by slot/port number, enter the command with the slot/port. For example:

```
imgrp 4/1
```

To display information for all multicast groups, enter the command without any parameters as follows:

```
imgrp
```

The screen displays similar to the following:

### IMGRP Group Membership Port List:

Number of Member Ports Displayed: 5

IP Multicast Group Address	Member Ports S/P/Type/I/S	Source IP Address	Group	Timeout
225.1.2.3	3/2/Brg/1/na	172.26.5.66	8	250
	3/7/Brg/1/na	172.26.5.63	7	124
	6/1/Brg/1/na	13.1.103.112	8	87
225.2.2.2	4/1/Brg/1/na	172.26.5.65	8	145
	4/2/Brg/1/na	172.27.4.67	7	250

Fields are defined as follows:

**IP Multicast Group Address.** The IP address of a multicast group, which is associated with a multicast stream. This address is used by host applications in the IGMP control packet when requesting membership in the multicast group. There may be multiple addresses per port. The group address is also called the destination address.

**Member Ports.** Indicates which ports have requested membership in the group. Ports may request membership in multiple groups.

- **S**—Slot number
- **P**—Port number
- **Type**—Type of interface, such as **Brg** for bridging or **Lne** for LANE (Classical IP is currently not supported)
- **I**—Port instance
- **S**—Service (for WAN ports, which will be supported in future releases)

**Source IP Address.** The source address of the device that is generating the multicast stream. The source address and the IP multicast group address are called the source/destination pair.

**Group.** The VLAN group associated with the member port.

**Timeout.** The number of seconds remaining before this membership times out. The timer is reset to 260 seconds every time a membership report is received.

### Viewing the IPMS Neighbor Table

To view the IPMS Neighbor Table, enter the following command:

```
imnbr
```

The screen displays similar to the following:

#### IMNBR Neighbor Table

Number of Neighbors Displayed: 1

Group	Neighbor Port S/P/Type/I/S	IP Address	Timeout
=====	=====	=====	=====
2	6/1/Brg/1/na	172.202.184.199	26

Fields are defined as follows:

**Group.** The group associated with the upstream neighbor.

**Neighbor Port S/P/Type/I/S.** Ports on which the switch expects to receive data from the upstream neighbor. Information displayed for the port includes:

- **S**—Slot number
- **P**—Port number
- **Type**—Type of interface, for example, **Brg** for bridging or **Lne** for LANE (Classical IP is currently not supported)
- **I**—Port instance
- **S**—Service (for WAN ports, which will be supported in future releases)

**IP Address.** The unicast IP address of the upstream neighbor.

**Timeout.** The timeout for receiving neighbor probes. When neighbor probes are received before this timer expires, the timer is reset to 90 seconds. If neighbor probes are not received before this timer expires, the switch stops forwarding packets to those neighbors.

## Displaying IPMS Summary Status

To display a summary status of IPMS, enter the following command:

**imsum**

The screen displays similar to the following:

**IPMS Current status for Version 4.1.2. 0 Release Build Jan 28 2000 at 15:45:44**

**IPMS State: Enabled**

Fields are defined as follows:

**Version.** The current version of the IPMS software.

**IPMS State.** The current state of IPMS, enabled or disabled. IPMS may be enabled/disabled through the **imcfg** command.

## Viewing IPMS Statistics

To display a list of system statistics for packets that have been forwarded by IPMS, use the **imsts** command. The display may be limited by multicast group address.

### ◆ Important Note ◆

If the packet rate is especially high, statistics on this screen may be reported with inaccurate values.

To display a list of statistics for a particular multicast group address, enter the command with the relevant IP address. For example:

**imsts 225.1.2.3**

To display a list of statistics for all multicast groups, enter the command without a multicast group address as follows:

**imsts**

The screen display is similar to the following:

#### IMSTS Display Multicast Statistics by Multicast Group and Source IP

Number of Multicast Entries Displayed: 5  
Time since Statistics Last Zeroed: 00:00:20

IP Multicast Group Address	Source IP Addr.	Group	Packets Out	Average Packets/Second
=====	=====	=====	=====	=====
225.1.2.3	195.123.222.3	2	65668	3283
225.1.2.3	5.213.45.110	4	845	42
225.1.2.3	183.12.34.7	7	293	14
225.4.5.6	192.34.33.8	7	10234	511
225.4.5.6	13.1.103.27	7	50345	2517
Total:			127385	6369

Fields are defined as follows:

**Time since Statistics Last Zeroed.** The time since the **imzst** command was last entered, in *hours:minutes:seconds*.

**IP Multicast Group Address.** The IP address of a multicast group, which is associated with a multicast stream. This address is used by host applications in the IGMP control packet when requesting membership in the multicast group. There may be multiple addresses, or groups, per port. The group address is also called the destination address.

**Source IP Addr.** The IP address of the user or server that generated the IP multicast packet. The group address and source IP address are called the source/destination pair.

**Group.** The group associated with the source IP address.

**Packets Out.** Number of packets sent to the destination address since the last time the counters were reset.

**Average Packets/Second.** Number of packets sent, divided by the number of seconds since the statistics were reset. This parameter shows the current data rate for the video stream.

**Total.** The total number of packets out and average packets/second for the destination (group) address.

## Resetting Statistics to Zero

The counters on the IPMS statistics screen (displayed using the **imsts** command) may be reset to zero. To reset the statistics counters for all multicast group addresses, enter the following command:

**imzst**

A message similar to the following displays:

**IPMS Statistics Counters Reset.**

