



# Configuring IP Multicast over ATM Point-to-Multipoint VCs

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This module describes how to configure IP multicast over ATM point-to-multipoint virtual circuits (VCs). This feature dynamically creates ATM point-to-multipoint switched virtual circuits (SVCs) to handle IP multicast traffic more efficiently. It can enhance router performance and link utilization because packets are not replicated and sent multiple times over the ATM interface.

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## Prerequisites for IP Multicast over ATM Point-to-Multipoint VCs

- You must have IP multicast routing and PIM sparse mode configured. This feature does not work with PIM dense mode.
- You must have ATM configured for multipoint signaling.
- You should understand the concepts in the “[IP Multicast Technology Overview](#)” module.

## Information About IP Multicast over ATM Point-to-Multipoint VCs

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## PIM Nonbroadcast Multiaccess

Protocol Independent Multicast (PIM) nonbroadcast multiaccess (NBMA) mode allows the software to replicate packets for each neighbor on the NBMA network. Traditionally, the software replicates multicast and broadcast packets to all broadcast configured neighbors. This action might be inefficient when not all neighbors want packets for certain multicast groups. NBMA mode enables you to reduce bandwidth on links leading into the NBMA network, and to reduce the number of CPU cycles in switches and attached neighbors.

It is appropriate to configure PIM NBMA mode on ATM, Frame Relay, Switched Multimegabit Data Service (SMDS), PRI ISDN, or X.25 networks only, especially when these media do not have native multicast available. Do not use PIM NBMA mode on multicast-capable LANs (such as Ethernet or FDDI).

You should use PIM sparse mode with this feature. Therefore, when each Join message is received from NBMA neighbors, PIM stores each neighbor IP address and interface in the outgoing interface list for the group. When a packet is destined for the group, the software replicates the packet and unicasts (data-link unicasts) it to each neighbor that has joined the group.

Consider the following two factors before enabling PIM NBMA mode:

- If the number of neighbors grows, the outgoing interface list gets large, which costs memory and replication time.
- If the network (Frame Relay, SMDS, or ATM) supports multicast natively, you should use it so that replication is performed at optimal points in the network.

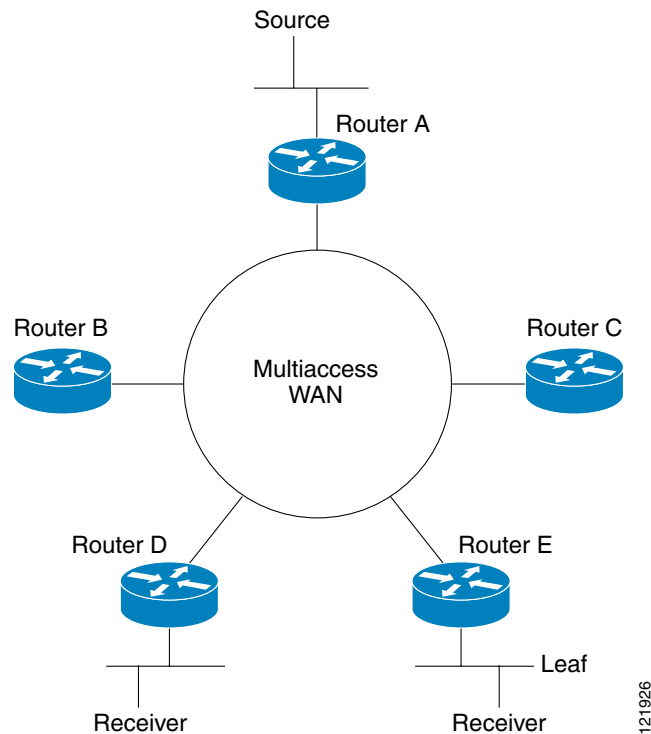
## IP Multicast over ATM Point-to-Multipoint VCs

IP Multicast over ATM Point-to-Multipoint VCs is a feature that dynamically creates ATM point-to-multipoint switched virtual circuits (SVCs) to handle IP multicast traffic more efficiently.

This feature can enhance router performance and link utilization because packets are not replicated and sent multiple times over the ATM interface.

Traditionally, over NBMA networks, Cisco routers would perform a pseudobroadcast to get broadcast or multicast packets to all neighbors on a multiaccess network. For example, assume in [Figure 1](#) that Routers A, B, C, D, and E were running the Open Shortest Path First (OSPF) protocol. Router A must deliver to Routers D and E. When Router A sends an OSPF Hello packet, the data link layer replicates the Hello packet and sends one to each neighbor (this procedure is known as pseudobroadcast), which results in four copies being sent over the link from Router A to the multiaccess WAN.

**Figure 1** Environment for IP Multicast over ATM Point-to-Multipoint VCs



With the advent of IP multicast, where high-rate multicast traffic can occur, the pseudobroadcast approach does not scale. Furthermore, in the preceding example, Routers B and C would get data traffic they do not need. To handle this problem, PIM can be configured in NBMA mode using the **ip pim nbma-mode** command. PIM in NBMA mode works only for sparse mode groups. Configuring PIM in NBMA mode would allow only Routers D and E to get the traffic without distributing to Routers B and C. However, two copies are still delivered over the link from Router A to the multiaccess WAN.

If the underlying network supported multicast capability, the routers could handle this situation more efficiently. If the multiaccess WAN were an ATM network, IP multicast could use multipoint VCs.

To configure IP multicast using multipoint VCs, Routers A, B, C, D, and E in [Figure 1](#) must run PIM sparse mode. If the Receiver directly connected to Router D joins a group and Router A is the PIM RP, the following sequence of events occurs:

1. Router D sends a PIM Join message to Router A.
2. When Router A receives the PIM join, it sets up a multipoint VC for the multicast group.
3. Later, when the Receiver directly connected to Router E joins the same group, Router E sends a PIM Join message to Router A.
4. Router A will see there is a multipoint VC already associated with the group, and will add Router E to the existing multipoint VC.
5. When the Source sends a data packet, Router A can send a single packet over its link that gets to both Router D and Router E. The replication occurs in the ATM switches at the topological diverging point from Router A to Router D and Router E.

If a host sends an IGMP report over an ATM interface to a router, the router adds the host to the multipoint VC for the group.

This feature can also be used over ATM subinterfaces.

## Idling Policy for ATM VCs Created by PIM

An idling policy uses the **ip pim vc-count** command to limit the number of VCs created by PIM. When the router stays at or below the number configured, no idling policy is in effect. When the next VC to be opened will exceed the value, an idling policy is exercised. An idled VC does not mean that the multicast traffic is not forwarded; the traffic is switched to VC 0. VC 0 is the broadcast VC that is open to all neighbors listed in the map list. The name VC 0 is unique to PIM and the mroute table.

### How the Idling Policy Works

The idling policy works as follows:

- The only VCs eligible for idling are those with a current 1-second activity rate less than or equal to the value configured by the **ip pim minimum-vc-rate** interface configuration command on the ATM interface. Activity level is measured in packets per second (pps).
- The VC with the least amount of activity below the configured **ip pim minimum-vc-rate** pps rate is idled.
- If the **ip pim minimum-vc-rate** command is not configured, all VCs are eligible for idling.
- If other VCs are at the same activity level, the VC with the highest fanout (number of leaf routers on the multipoint VC) is idled.
- The activity level is rounded to three orders of magnitude (less than 10 pps, 10 to 100 pps, and 100 to 1000 pps). Therefore, a VC that has 40 pps activity and another that has 60 pps activity are considered to have the same rate, and the fanout count determines which one is idled. If the first VC has a fanout of 5 and the second has a fanout of 3, the first one is idled.
- Idling a VC means releasing the multipoint VC that is dedicated for the multicast group. The traffic of the group continues to be sent; it is moved to the static map VC. Packets will flow over a shared multipoint VC that delivers packets to all PIM neighbors.
- If all VCs have a 1-minute rate greater than the pps value, the new group (that exceeded the **ip pim vc-count number**) will use the shared multipoint VC.

### Keeping VCs from Idling

By default, all VCs are eligible for idling. You can configure a minimum rate required to keep VCs from being idled.

## How to Configure IP Multicast over ATM Point-to-Multipoint VCs

- [Configuring IP Multicast over ATM Point-to-Multipoint VCs, page 5](#)

## Configuring IP Multicast over ATM Point-to-Multipoint VCs

Perform this task to configure IP multicast over ATM point-to-multipoint VCs. All of the steps in the task can be used in an ATM network. This feature can also be used over ATM subinterfaces. PIM NBMA mode could be used in an ATM, Frame Relay, SMDS, PRI ISDN, or X.25 network.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *number*
4. **ip pim nbma-mode**
5. **ip pim multipoint-signalling**
6. **atm multipoint-signalling**
7. **ip pim vc-count** *number*
8. **ip pim minimum-vc-rate** *pps*
9. **show ip pim vc**

### DETAILED STEPS

|        | Command or Action   | Purpose   |
|--------|---|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                | Enters global configuration mode.   |
| Step 3 | <b>interface atm</b> <i>number</i><br><br><b>Example:</b><br>Router(config)# interface atm 0                  | Configures an ATM interface.  |
| Step 4 | <b>ip pim nbma-mode</b><br><br><b>Example:</b><br>Router(config-if)# ip pim nbma-mode                         | (Optional) Enables NBMA mode on a serial link.  |
| Step 5 | <b>ip pim multipoint-signalling</b><br><br><b>Example:</b><br>Router(config-if)# ip pim multipoint-signalling | Enables IP multicast over ATM point-to-multipoint VCs. <ul style="list-style-type: none"> <li>• This command enables PIM to open ATM point-to-multipoint VCs for each multicast group that a receiver joins.</li> </ul> |

|        | Command or Action   | Purpose   |
|--------|---|---|
| Step 6 | <b>atm multipoint-signalling</b><br><br><b>Example:</b><br>Router(config-if)# atm multipoint-signalling           | Enables point-to-multipoint signaling to the ATM switch. <ul style="list-style-type: none"> <li>This command is required so that static map multipoint VCs can be opened. The router uses existing static map entries that include the <b>broadcast</b> keyword to establish multipoint calls. The map list is needed because it acts like a static ARP table.</li> </ul> |
| Step 7 | <b>ip pim vc-count</b> <i>number</i><br><br><b>Example:</b><br>Router(config-if)# ip pim vc-count 300             | (Optional) Changes the maximum number of VCs that PIM can open. <ul style="list-style-type: none"> <li>By default, PIM can open a maximum of 200 VCs. When the router reaches this number, it deletes inactive VCs so it can open VCs for new groups that might have activity.</li> </ul>   |
| Step 8 | <b>ip pim minimum-vc-rate</b> <i>pps</i><br><br><b>Example:</b><br>Router(config-if)# ip pim minimum-vc-rate 1500 | (Optional) Sets the minimum activity rate required to keep VCs from being idled. <ul style="list-style-type: none"> <li>By default, all VCs are eligible for idling.</li> </ul>   |
| Step 9 | <b>show ip pim vc</b><br><br><b>Example:</b><br>Router# show ip pim vc  | (Optional) Displays ATM VC status information for multipoint VCs opened by PIM.   |

## Configuration Examples for IP Multicast over ATM Point-to-Multipoint VCs

- [IP Multicast over ATM Point-to-Multipoint VCs: Example, page 6](#)

### IP Multicast over ATM Point-to-Multipoint VCs: Example

The following example shows how to enable IP multicast over ATM point-to-multipoint VCs:

```
interface ATM2/0
ip address 171.69.214.43 255.255.255.248
 ip pim sparse-mode
 ip pim multipoint-signalling
 ip ospf network broadcast
 atm nsap-address 47.00918100000000410B0A1981.333333333333.00
 atm pvc 1 0 5 qsaal
 atm pvc 2 0 16 ilmi
 atm multipoint-signalling
 map-group mpvc
router ospf 9
 network 171.69.214.0 0.0.0.255 area 0
!
ip classless
 ip pim rp-address 171.69.10.13 98
!
map-list mpvc
 ip 171.69.214.41 atm-nsap 47.00918100000000410B0A1981.111111111111.00 broadcast
 ip 171.69.214.42 atm-nsap 47.00918100000000410B0A1981.222222222222.00 broadcast
```

```
ip 171.69.214.43 atm-nsap 47.0091810000000410B0A1981.333333333333.00 broadcast
```

## Additional References

### Related Documents

| Related Topic                                     | Document Title   |
|---|--|
| IP multicast commands                             | <a href="#">Cisco IOS IP Multicast Command Reference</a> |
| Configuring ATM for point-to-multipoint signaling | “Configuring ATM”  |

### MIBs

| MIBs | MIBs Link  |
|------|--|
| None | To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

### Technical Assistance

| Description  | Link  |
|--|---|
| Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content. | <a href="http://www.cisco.com/public/support/tac/home.shtml">http://www.cisco.com/public/support/tac/home.shtml</a> |

## Feature Information for Configuring IP Multicast over ATM Point-to-Multipoint VCs

[Table 1](#) lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Releases 12.2(1) or 12.0(3)S or later appear in the table.

Not all commands may be available in your Cisco IOS software release. For details on when support for specific commands was introduced, see the command reference documents.

If you are looking for information on a feature in this technology that is not documented here, see the “IP Multicast Features Roadmap”.

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**Note**

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

**Table 1** Feature Information for IP Multicast over ATM Point-to-Multipoint VCs

| Feature Name   | Releases | Feature Configuration Information |
|--|----------|-----------------------------------|
| 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. | —        | —                                 |

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