IPv6 Multicast: Bootstrap Router

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 table at the end of this module.

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

Information About IPv6 Multicast: Bootstrap Router

IPv6 BSR

PIM devices in a domain must be able to map each multicast group to the correct RP address. The BSR protocol for PIM-SM provides a dynamic, adaptive mechanism to distribute group-to-RP mapping information rapidly throughout a domain. With the IPv6 BSR feature, if an RP becomes unreachable, it will be detected and the mapping tables will be modified so that the unreachable RP is no longer used, and the new tables will be rapidly distributed throughout the domain.

Every PIM-SM multicast group needs to be associated with the IP or IPv6 address of an RP. When a new multicast sender starts sending, its local DR will encapsulate these data packets in a PIM register message and send them to the RP for that multicast group. When a new multicast receiver joins, its local DR will send

a PIM join message to the RP for that multicast group. When any PIM device sends a (*, G) join message, the PIM device needs to know which is the next device toward the RP so that G (Group) can send a message to that device. Also, when a PIM device is forwarding data packets using (*, G) state, the PIM device needs to know which is the correct incoming interface for packets destined for G, because it needs to reject any packets that arrive on other interfaces.

A small set of devices from a domain are configured as candidate bootstrap routers (C-BSRs) and a single BSR is selected for that domain. A set of devices within a domain are also configured as candidate RPs (C-RPs); typically, these devices are the same devices that are configured as C-BSRs. Candidate RPs periodically unicast candidate-RP-advertisement (C-RP-Adv) messages to the BSR of that domain, advertising their willingness to be an RP. A C-RP-Adv message includes the address of the advertising C-RP, and an optional list of group addresses and mask length fields, indicating the group prefixes for which the candidacy is advertised. The BSR then includes a set of these C-RPs, along with their corresponding group prefixes, in bootstrap messages (BSMs) it periodically originates. BSMs are distributed hop-by-hop throughout the domain.

Bidirectional BSR support allows bidirectional RPs to be advertised in C-RP messages and bidirectional ranges in the BSM. All devices in a system must be able to use the bidirectional range in the BSM; otherwise, the bidirectional RP feature will not function.

IPv6 BSR: Configure RP Mapping

The IPv6 BSR ability to configure RP mapping allows IPv6 multicast devices to be statically configured to announce scope-to-RP mappings directly from the BSR instead of learning them from candidate-RP messages. Announcing RP mappings from the BSR is useful in several situations:

- When an RP address never changes because there is only a single RP or the group range uses an anycast RP, it may be less complex to configure the RP address announcement statically on the candidate BSRs.
- When an RP address is a virtual RP address (such as when using bidirectional PIM), it cannot be learned by the BSR from a candidate-RP. Instead, the virtual RP address must be configured as an announced RP on the candidate BSRs.

IPv6 BSR: Scoped Zone Support

BSR provides scoped zone support by distributing group-to-RP mappings in networks using administratively scoped multicast. The user can configure candidate BSRs and a set of candidate RPs for each administratively scoped region in the user's domain.

For BSR to function correctly with administrative scoping, a BSR and at least one C-RP must be within every administratively scoped region. Administratively scoped zone boundaries must be configured at the zone border devices, because they need to filter PIM join messages that might inadvertently cross the border due to error conditions. In addition, at least one C-BSR within the administratively scoped zone must be configured to be a C-BSR for the administratively scoped zone's address range.

A separate BSR election will then take place (using BSMs) for every administratively scoped range, plus one for the global range. Administratively scoped ranges are identified in the BSM because the group range is marked to indicate that this is an administrative scope range, not just a range that a particular set of RPs is configured to handle.

Unless the C-RP is configured with a scope, it discovers the existence of the administratively scoped zone and its group range through reception of a BSM from the scope zone's elected BSR containing the scope zone's group range. A C-RP stores each elected BSR's address and the administratively scoped range contained

in its BSM. It separately unicasts C-RP-Adv messages to the appropriate BSR for every administratively scoped range within which it is willing to serve as an RP.

All PIM devices within a PIM bootstrap domain where administratively scoped ranges are in use must be able to receive BSMs and store the winning BSR and RP set for all administratively scoped zones that apply.

IPv6 Multicast: RPF Flooding of BSR Packets

Cisco IPv6 devices provide support for the RPF flooding of BSR packets so that the device will not disrupt the flow of BSMs. The device will recognize and parse enough of the BSM to identify the BSR address. The device performs an RPF check for this BSR address and forwards the packet only if it is received on the RPF interface. The device also creates a BSR entry containing RPF information to use for future BSMs from the same BSR. When BSMs from a given BSR are no longer received, the BSR entry is timed out.

How to Configure IPv6 Multicast: Bootstrap Router

Configuring a BSR and Verifying BSR Information

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 pim** [**vrf** *vrf-name*] **bsr candidate bsr** *ipv6-address*[*hash-mask-length*] [**priority** *priority-value*]
4. **interface** *type number*
5. **ipv6 pim bsr border**
6. **end**
7. **show ipv6 pim** [**vrf** *vrf-name*] **bsr** {**election** | **rp-cache** | **candidate-rp**}

DETAILED STEPS

	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.

	Command or Action	Purpose
Step 3	**ipv6 pim** [**vrf** *vrf-name*] **bsr candidate bsr** *ipv6-address*[*hash-mask-length*] [**priority** *priority-value*] **Example:** `Device(config)# ipv6 pim bsr candidate bsr 2001:DB8:3000:3000::42 124 priority 10`	Configures a device to be a candidate BSR.
Step 4	**interface** *type number* **Example:** `Device(config)# interface FastEthernet 1/0`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 5	**ipv6 pim bsr border** **Example:** `Device(config-if)# ipv6 pim bsr border`	Configures a border for all BSMs of any scope on a specified interface.
Step 6	**end** **Example:** `Device(config-if)# end`	Exits to privileged EXEC mode.
Step 7	**show ipv6 pim** [**vrf** *vrf-name*] **bsr** {**election** | **rp-cache** | **candidate-rp**} **Example:** `Device# show ipv6 pim bsr election`	Displays information related to PIM BSR protocol processing.

Sending PIM RP Advertisements to the BSR

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 pim** [**vrf** *vrf-name*] **bsr candidate rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**interval** *seconds*] [**scope** *scope-value*] [**bidir**]
4. **interface** *type number*
5. **ipv6 pim bsr border**

DETAILED STEPS

	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	**ipv6 pim** [**vrf** *vrf-name*] **bsr candidate rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**interval** *seconds*] [**scope** *scope-value*] [**bidir**] **Example:** `Device(config)# ipv6 pim bsr candidate rp 2001:DB8:3000:3000::42 priority 0`	Sends PIM RP advertisements to the BSR.
Step 4	**interface** *type number* **Example:** `Device(config)# interface FastEthernet 1/0`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 5	**ipv6 pim bsr border** **Example:** `Device(config-if)# ipv6 pim bsr border`	Configures a border for all BSMs of any scope on a specified interface.

Configuring BSR for Use Within Scoped Zones

A user can configure candidate BSRs and a set of candidate RPs for each administratively scoped region in the domain.

If scope is specified on the candidate RP, then this device will advertise itself as C-RP only to the BSR for the specified scope. If the group list is specified along with the scope, then only prefixes in the access list with the same scope as that configured will be advertised.

If a scope is specified on the bootstrap device, the BSR will originate BSMs including the group range associated with the scope and accept C-RP announcements for groups that belong to the given scope.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 pim** [**vrf** *vrf-name*] **bsr candidate bsr** *ipv6-address* [*hash-mask-length*] [**priority** *priority-value*]
4. **ipv6 pim** [**vrf** *vrf-name*] **bsr candidate rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**interval** *seconds*] [**scope** *scope-value*] [**bidir**]
5. **interface** *type number*
6. **ipv6 multicast boundary scope** *scope-value*

DETAILED STEPS

	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	**ipv6 pim** [**vrf** *vrf-name*] **bsr candidate bsr** *ipv6-address* [*hash-mask-length*] [**priority** *priority-value*] **Example:** `Device(config)# ipv6 pim bsr candidate bsr 2001:DB8:1:1:4`	Configures a device to be a candidate BSR.
Step 4	**ipv6 pim** [**vrf** *vrf-name*] **bsr candidate rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**interval** *seconds*] [**scope** *scope-value*] [**bidir**] **Example:** `Device(config)# ipv6 pim bsr candidate rp 2001:DB8:1:1:1 group-list list scope 6`	Configures the candidate RP to send PIM RP advertisements to the BSR.
Step 5	**interface** *type number* **Example:** `Device(config)# interface FastEthernet 1/0`	Specifies an interface type and number, and places the device in interface configuration mode.

	Command or Action	Purpose
Step 6	**ipv6 multicast boundary scope** *scope-value* **Example:** `Device(config-if)# ipv6 multicast boundary scope 6`	Configures a multicast boundary on the interface for a specified scope.

Configuring BSR Devices to Announce Scope-to-RP Mappings

IPv6 BSR devices can be statically configured to announce scope-to-RP mappings directly instead of learning them from candidate-RP messages. A user might want to configure a BSR device to announce scope-to-RP mappings so that an RP that does not support BSR is imported into the BSR. Enabling this feature also allows an RP positioned outside the enterprise's BSR domain to be learned by the known remote RP on the local candidate BSR devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 pim** [**vrf** *vrf-name*] **bsr announced rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**bidir**] [**scope** *scope-value*]

DETAILED STEPS

	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	**ipv6 pim** [**vrf** *vrf-name*] **bsr announced rp** *ipv6-address* [**group-list** *access-list-name*] [**priority** *priority-value*] [**bidir**] [**scope** *scope-value*] **Example:** `Device(config)# ipv6 pim bsr announced rp 2001:DB8:3000:3000::42 priority 0`	Announces scope-to-RP mappings directly from the BSR for the specified candidate RP.

Configuration Examples for IPv6 Multicast: Bootstrap Router

Example: Configuring a BSR

```
Device# show ipv6 pim bsr election

PIMv2 BSR information
BSR Election Information
Scope Range List: ff00::/8
This system is the Bootstrap Router (BSR)
BSR Address: 60::1:1:4
Uptime: 00:11:55, BSR Priority: 0, Hash mask length: 126
RPF: FE80::A8BB:CCFF:FE03:C400,Ethernet0/0
BS Timer: 00:00:07
This system is candidate BSR
Candidate BSR address: 60::1:1:4, priority: 0, hash mask length: 126
```

Additional References

Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IPv6 commands	Cisco IOS IPv6 Command Reference
Cisco IOS IPv6 features	Cisco IOS IPv6 Feature Mapping

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

MIBs

MIB	MIBs Link
	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IPv6 Multicast: Bootstrap Router

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 1: Feature Information for IPv6 Multicast: Bootstrap Router

Feature Name	Releases	Feature Information
IPv6 Multicast: Bootstrap Router	12.0(28)S 12.2(25)S 12.2(25)SG 12.2(33)SRA 12.2(33)SXH 12.3(11)T 12.4 12.4(2)T Cisco IOS XE Release 2.4 15.0(1)S	If an RP becomes unreachable, this feature allows the RP to be detected and the mapping tables modified so that the unreachable RP is no longer used, and the new tables will be rapidly distributed throughout the domain. The following commands were introduced or modified: **debug ipv6 pim bsr**, **ipv6 pim bsr border**, **ipv6 pim bsr candidate bsr**, **ipv6 pim bsr candidate rp**, **show ipv6 pim bsr**, **show ipv6 pim group-map**.
IPv6 BSR Bi-Dir Support	12.2(33)SRE 12.3(14)T 15.0(1)S Cisco IOS XE Release 3.8S Cisco IOS XE Release 3.9S	Bidirectional BSR support allows bidirectional RPs to be advertised in C-RP messages and bidirectional ranges in the BSM. In Cisco IOS XE Release 3.8S, support was added for the Cisco ISR 4400 Series router. In Cisco IOS XE Release 3.9S, support was added for the Cisco CSR 1000V.
IPv6 BSR: Configure RP Mapping	12.2(33)SRE 12.2(50)SY 12.4(2)T Cisco IOS XE Release 2.4 15.0(1)S 15.1(1)SY	This feature allows IPv6 multicast devices to be statically configured to announce scope-to-RP mappings directly from the BSR instead of learning them from candidate-RP messages. The following commands were introduced or modified: **ipv6 multicast-routing**, **ipv6 pim bsr announced rp**, **ipv6 pim bsr candidate bsr**.

Feature Name	Releases	Feature Information
IPv6 Multicast: RPF Flooding of BSR Packets	12.0(26)S 12.3(4)T 12.2(25)S 12.2(25)SG 12.2(33)SRA 12.2(33)SXH 12.4 12.4(2)T 15.0(1)S	The RPF flooding of BSR packets feature enables a Cisco IPv6 device to not disrupt the flow of BSMs. The following command was introduced: **show ipv6 pim bsr**.
IPv6 BSR Scoped Zone Support	12.2(18)SXE Cisco IOS XE Release 3.8S Cisco IOS XE Release 3.9S	BSR provides scoped zone support by distributing group-to-RP mappings in networks using administratively scoped multicast. The user can configure candidate BSRs and a set of candidate RPs for each administratively scoped region in the user's domain. In Cisco IOS XE Release 3.8S, support was added for the Cisco ISR 4400 Series router. In Cisco IOS XE Release 3.9S, support was added for the Cisco CSR 1000V. The following commands were introduced or modified: **ipv6 multicast boundary scope**, **ipv6 pim bsr candidate bsr**, **ipv6 pim bsr candidate rp**.