IEEE 802.1s on Bridge Domains

First Published: October 20, 2008
Last Updated: February 8, 2011

The IEEE 802.1s on Bridge Domains feature enables Multiple Spanning Tree (MST) on Ethernet Virtual Circuits (EVCs).

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 IEEE 802.1s on Bridge Domains" section on page 9.

Use Cisco Feature Navigator to find information about platform support and Cisco 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 IEEE 802.1s on Bridge Domains, page 2
- Restrictions for IEEE 802.1s on Bridge Domains, page 2
- Information About IEEE 802.1s on Bridge Domains, page 2
- How to Configure IEEE 802.1s on Bridge Domains, page 3
- Configuration Examples for IEEE 802.1s on Bridge Domains, page 5
- Additional References, page 7
- Feature Information for IEEE 802.1s on Bridge Domains, page 9

Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Prerequisites for IEEE 802.1s on Bridge Domains

- MST must be configured.

Restrictions for IEEE 802.1s on Bridge Domains

- Service instances on a port-channel are not supported on Cisco 7600 series routers.
- Service instances with “encapsulation default” are not supported.
- Service instances with “encapsulation untagged” without the dot1q option are not supported.
- Service instances with “encapsulation priority-tagged” are not supported.

Information About IEEE 802.1s on Bridge Domains

- EVC, page 2
- MST and STP, page 2
- MST on Service Instances with Bridge Domains, page 3

EVC

An EVC as defined by the Metro Ethernet Forum is a port-level point-to-point or multipoint-to-multipoint Layer 2 circuit. It is an end-to-end representation of a single instance of a Layer 2 service being offered by a provider to a customer. An EVC embodies the different parameters on which the service is being offered. A service instance is the instantiation of an EVC on a specified port.

Service instances are configured under a port channel. The traffic, carried by the service instance is load balanced across member links. Service instances under a port channel are grouped and each group is associated with one member link. Ingress traffic for a single EVC can arrive on any member of the bundle. All egress traffic for a service instance uses only one of the member links. Load balancing is achieved by grouping service instances and assigning them to a member link.

Ethernet virtual connection services (EVCS) uses the concepts of EVCs and service instances to provide Layer 2 switched Ethernet services. EVC status can be used by a Customer Edge (CE) device either to find an alternative path in to the service provider network or in some cases, to fall back to a backup path over Ethernet or over another alternative service such as Frame Relay or ATM.

For information about the Metro Ethernet Forum standards, see the “Standards” section on page 7.

MST and STP

Spanning Tree Protocol (STP) is a Layer 2 link-management protocol that provides path redundancy while preventing undesirable loops in the network. For a Layer 2 Ethernet network to function properly, only one active path can exist between any two stations. STP operation is transparent to end stations, which cannot detect whether they are connected to a single VLAN segment or to a switched LAN of multiple segments.

Cisco 7600 series routers use STP (the IEEE 802.1D bridge protocol) on all VLANs. By default, a single instance of STP runs on each configured VLAN (provided you do not manually disable STP). You can enable and disable STP on a per-VLAN basis.

MST maps multiple VLANs into a spanning tree instance, with each instance having a spanning tree topology independent of other spanning tree instances. This architecture provides multiple forwarding paths for data traffic, enables load balancing, and reduces the number of spanning tree instances required to support many VLANs. MST improves the fault tolerance of the network because a failure in one instance (a forwarding path) does not affect other instances.

To participate in MST instances, routers must be consistently configured with the same MST configurations. A collection of interconnected routers that have the same MST configuration forms an MST region. For two or more routers to be in the same MST region, they must have the same VLAN-to-instance mapping, the same configuration revision number, and the same MST name.

The MST configuration controls the MST region to which each router belongs. The configuration includes the name of the region, the revision number, and the MST VLAN-to-instance assignment map.

A region can have one or multiple members with the same MST configuration; each member must be capable of processing Rapid Spanning Tree Protocol (RSTP) bridge protocol data units (BPDUs). There is no limit to the number of MST regions in a network, but each region can support up to 65 spanning tree instances. Instances can be identified by any number in the range from 0 to 4094. You can assign a VLAN to only one spanning tree instance at a time.

MST on Service Instances with Bridge Domains

The IEEE 802.1s on Bridge Domains feature uses VLAN IDs for service-instance-to-MST-instance mapping. EVC service instances with the same VLAN ID (the outer VLAN IDs in the QinQ case) as the one in a particular MST instance will be mapped to that MST instance.

EVC service instances can have encapsulations with a single tag as well as double tags. In the case of double tag encapsulations, the outer VLAN ID is used for the MST instance mapping, and the inner VLAN ID is ignored.

Because MST requires bridge ports, you must configure a bridge domain for service instances to participate in the MST instances. Additionally, because MST runs by sending untagged BPDUs on the wire, independently of any VLAN, a native VLAN is required on the interface with EVC service instances. By default, switch ports have a native VLAN. However, if the port is not a switch port, you must specify a native VLAN using an EVC service instance.

Because a VLAN ID is required for EVC service-instance-to-MST-instance mapping, the following EVC service instances without any VLAN IDs in the encapsulation are not supported:

- Untagged (encapsulation untagged)
- Priority-tagged (encapsulation priority-tagged)
- Default (encapsulation default)

How to Configure IEEE 802.1s on Bridge Domains

- Configuring MST on EVC Bridge Domains, page 4

Configuring MST on EVC Bridge Domains

Perform this task to configure MST on EVC bridge domains:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]
   or
   interface tengigabitethernet *slot*/*subslot*/*port* [**.***subinterface-number*]
4. **service instance** *id* **ethernet** [*evc-id*]
5. **encapsulation dot1q** *vlan-id* [**native**]
6. **bridge-domain** *bridge-id* [**split-horizon** [**group** *group-id*]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*] or **interface tengigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*] **Example:** `Router(config)# interface gigabitethernet 4/0/0` or `Router(config)# interface tengigabitethernet 4/0/0`	Specifies the Gigabit Ethernet or the Ten Gigabit Ethernet interface to configure,
Step 4	**service instance** *id* **ethernet** [*evc-id*] **Example:** `Router(config-if)# service instance 101 ethernet`	Creates a service instance (an instance of an EVC) on an interface and enters service instance configuration mode.

	Command or Action	Purpose
Step 5	**encapsulation dot1q** *vlan-id* [**native**] **Example:** `Router(config-if-srv)# encapsulation dot1q 13`	Defines the matching criteria to be used in order to map ingress dot1q frames on an interface to the appropriate service instance.
Step 6	**bridge-domain** *bridge-id* [**split-horizon** [**group** *group-id*]] **Example:** `Router(config-if-srv)# bridge-domain 12`	Binds the service instance to a bridge domain instance.

Troubleshooting Tips

The following commands can be used to troubleshoot MST configurations on EVC bridge domains.

- **debug ethernet l2ctrl**
- **debug l2ctrl**

Configuration Examples for IEEE 802.1s on Bridge Domains

- Example: Configuring MST on EVC Bridge Domains, page 5

Example: Configuring MST on EVC Bridge Domains

In the following example, the two interfaces participate in MST instance 0, the default instance to which all VLANs are mapped:

```
Router# enable
Router# configure terminal
Router(config)# interface gigabitethernet 4/0/0
Router(config-if)# service instance 1 ethernet
Router(config-if-srv)# encapsulation dot1q 2
Router(config-if-srv)# bridge-domain 100
Router(config-if-srv)# interface gigabitethernet 4/0/3
Router(config-if)# service instance 1 ethernet
Router(config-if-srv)# encapsulation dot1q 2
Router(config-if-srv)# bridge-domain 100
Router(config-if-srv)# end
```

Issue the following command to verify:

```
Router# show spanning-tree vlan 2

MST0
    Spanning tree enabled protocol mstp
    Root ID Priority 32768
                Address 0009.e91a.bc40
                This bridge is the root
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

    Bridge ID Priority 32768 (priority 32768 sys-id-ext 0)
                Address 0009.e91a.bc40
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Interface              Role Sts Cost         Prio.Nbr Type
-------------------    ---- --- ---------    -------- --------------------------------
Gi4/0/0                Desg FWD 20000        128.1537 P2p
Gi4/0/3                Back BLK 20000        128.1540 P2p
```

In the following example, interface gigabitethernet 4/0/0 and interface gigabitethernet 4/0/3 are connected back to back. Each has a service instance attached to it. The service instance on both interfaces has an encapsulation VLAN ID of 2. Changing the VLAN ID from 2 to 8 in the encapsulation directive for the service instance on interface gi4/0/0 stops the MSTP from running in the MST instance to which the old VLAN is mapped and starts the MSTP in the MST instance to which the new VLAN is mapped:

```
Router(config-if)# interface gigabitethernet 4/0/0
Router(config-if)# service instance 1 ethernet
Router(config-if-srv)# encapsulation dot1q 8
Router(config-if-srv)# end
```

Issue the following command to verify:

```
Router# show spanning-tree vlan 2

MST1
    Spanning tree enabled protocol mstp
    Root ID     Priority   32769
                Address    0009.e91a.bc40
                This bridge is the root
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

    Bridge ID   Priority   32769 (priority 32768 sys-id-ext 1)
                Address    0009.e91a.bc40
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Interface           Role Sts Cost         Prio.Nbr Type
------------------- ---- --- ---------    -------- --------------------------------
Gi4/0/3             Desg FWD 20000        128.1540 P2p

Router# show spanning-tree vlan 8

MST2
    Spanning tree enabled protocol mstp
    Root ID     Priority   32770
                Address    0009.e91a.bc40
                This bridge is the root
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

    Bridge ID   Priority   32770 (priority 32768 sys-id-ext 2)
                Address    0009.e91a.bc40
                Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Interface          Role Sts Cost       Prio.Nbr Type
------------------- ---- --- ---------    -------- --------------------------------
Gi4/0/0            Desg FWD 20000 128.1537 P2p
```

In the following example, interface gigabitethernet 4/0/3 with a service instance that has an outer encapsulation VLAN ID of 2 and a bridge domain of 100 receives a new service:

```
Router# enable
Router# configure terminal
Router(config)# interface gigabitethernet 4/0/3
Router((config-if)# service instance 2 ethernet
Router((config-if-srv)# encap dot1q 2 second-dot1q 100
Router((config-if-srv)# bridge-domain 200
```

Now there are two service instances configured on interface gigabitethernet 4/0/3 and both of them have the same outer VLAN 2.

```
interface GigabitEthernet4/0/3
        no ip address
    service instance 1 ethernet
    encapsulation dot1q 2
    bridge-domain 100
!
service instance 2 ethernet
    encapsulation dot1q 2 second-dot1q 100
        bridge-domain 200
```

The preceding configuration does not affect the MSTP operation on the interface; there is no state change for interface gi4/0/3 in the MST instance it belongs to.

```
Router# show spanning-tree mst 1

##### MST1 vlans mapped: 2
Bridge      address 0009.e91a.bc40 priority   32769 (32768 sysid 1)
Root        this switch for MST1

Interface          Role Sts Cost      Prio.Nbr Type
-----------------  ---- --- --------- -------- --------------------------------
Gi4/0/3            Desg FWD 20000     128.1540 P2p
```

Additional References

Related Documents

Related Topic	Document Title
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Master Commands List, All Releases*

Standards

Standard	Title
MEF 6.1	Metro Ethernet Services Definitions Phase 2 (PDF 6/08)
MEF 10.1	Ethernet Services Attributes Phase 2 (PDF 10/06)

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

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 IEEE 802.1s on Bridge Domains

Table 1 lists the release history for this feature.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which 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 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.

Table 1 Feature Information for IEEE 802.1s on Bridge Domains

Feature Name	Releases	Feature Information
IEEE 802.1s on Bridge Domains	12.2(33)SRD	The IEEE 802.1s on Bridge Domains feature enables MST on EVC interfaces. The following commands were introduced or modified: **bridge-domain** (service instance)**, debug ethernet l2ctrl, debug l2ctrl**.