



## IEEE 802.1s on Bridge Domains

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

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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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

### 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

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 table in the Additional References section.

### 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

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type 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
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode.  <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>interface</b> <i>type slot / subslot / port</i> [ <i>.subinterface-number</i> ]  <b>Example:</b> Device(config)# interface gigabitethernet 4/0/0	Specifies the interface to configure and enters interface configuration mode.
<b>Step 4</b>	<b>service instance</b> <i>id ethernet</i> [ <i>evc-id</i> ]  <b>Example:</b> Device(config-if)# service instance 101 ethernet	Creates a service instance (an instance of an Ethernet virtual circuit [ EVC]) on an interface and enters service instance configuration mode.
<b>Step 5</b>	<b>encapsulation dot1q</b> <i>vlan-id</i> [ <b>native</b> ]  <b>Example:</b> Device(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.

	Command or Action	Purpose
Step 6	<b>bridge-domain</b> <i>bridge-id</i> [ <b>split-horizon</b> [ <b>group</b> <i>group-id</i> ]]  <b>Example:</b> Device(config-if-srv)# bridge-domain 12	Binds the service instance to a bridge domain instance.

## Troubleshooting Tips

To verify and isolate a fault, start at the highest level maintenance domain and do the following:

- Check the device error status.
- When an error exists, perform a loopback test to confirm the error.
- Run a traceroute to the destination to isolate the fault.
- If the fault is identified, correct the fault.
- If the fault is not identified, go to the next lower maintenance domain and repeat these four steps at that maintenance domain level.
- Repeat the first four steps, as needed, to identify and correct the fault.

# Configuration Examples for IEEE 802.1s on Bridge Domains

## 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:

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

Issue the following command to verify the configuration:

```
Device# 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, Gigabit Ethernet interface 4/0/0 and Gigabit Ethernet interface 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 Multiservice Transport Platform (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:

```

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

```

Use the **show spanning-tree vlan** command to verify the configuration, as shown in the following two examples.

```
Device# 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

```

```
Device# 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, Gigabit Ethernet interface 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:

```

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

```

Now two service instances are configured on Gigabit Ethernet interface 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 Gigabit Ethernet interface 4/0/3 in the MST instance to which it belongs.

Use the **show spanning-tree mst** command to display the information about the Multiple Spanning Tree (MST) protocol, as shown below.

```
Device# 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
Configuration guide	<i>Cisco IOS Carrier Ethernet Configuration Guide, Release 12.2SR</i>
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Carrier Ethernet Command Reference</i>
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<a href="#">Cisco IOS Master Command List, All Releases</a>

### Standards

Standard	Title
None	--

**MIBs**

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software 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>

**RFCs**

RFC	Title
None	--

**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.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

## Feature Information for IEEE 802.1s on Bridge Domains

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.

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**Table 1: Feature Information for IEEE 802.1s on Bridge Domains**

Feature Name	Releases	Feature Information
IEEE 802.1s on Bridge Domains	12.2(50)SY	<p>The IEEE 802.1s on Bridge Domains feature enables MST on EVC interfaces.</p> <p>The following commands were introduced or modified: <b>bridge-domain</b> (service instance), <b>debug ethernet l2ctrl</b>, <b>debug l2ctrl</b>.</p>

