IEEE 802.1ah on Provider Backbone Bridges

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The IEEE 802.1ah on Provider Backbone Bridges feature enables MAC-in-MAC tunneling 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 802.1ah on Provider Backbone Bridges" section on page 22.

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

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Prerequisites for IEEE 802.1ah on Provider Backbone Bridges

- The router configuration must include an ES40 line card, because the Institute of Electrical and Electronic Engineers (IEEE) 802.1ah standard is supported on ES40 line cards only.
- IEEE 802.1ah is supported on EVC architecture only.

Restrictions for IEEE 802.1ah on Provider Backbone Bridges

- The following features are not supported:
  - Connectivity Fault Management (CFM) over 802.1ah
  - Internet Group Multicast Protocol (IGMP) snooping or any mulitcast protocol on the customer-bridge (c-bridge) domain
  - Standalone customer-facing backbone edge bridge (I-BEB)
  - Standalone backbone core bridge-facing backbone edge bridge (B-BEB)
- The following limits apply to this feature:
  - Maximum number of MAC tunnels is 4094.
  - Maximum number of service instances under MAC tunnels is 16,384.
  - Maximum number of Ethernet Flow Points (EFP) is 32,768.
  - Maximum number of EFPs on a single interface is 8000.
  - 802.1ah on the port channel is supported for one member link per port channel only.

Information About IEEE 802.1ah on Provider Backbone Bridges

MAC-in-MAC

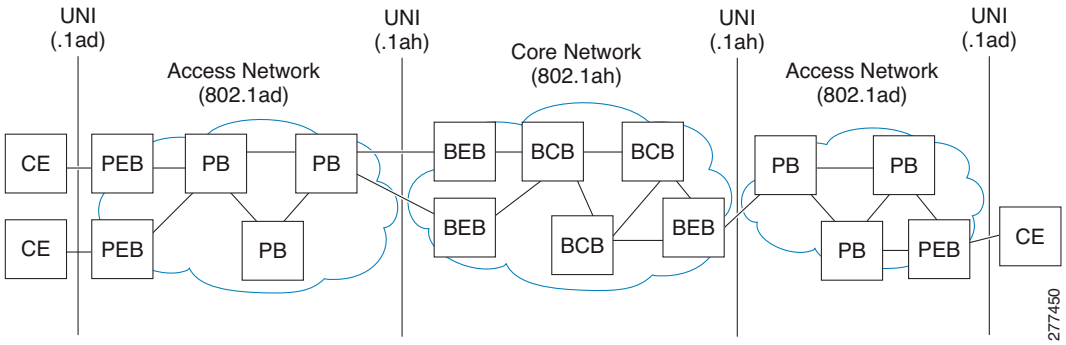
The IEEE 802.1ah on Provider Backbone Bridges feature encapsulates the end users traffic inside the service providers MAC header, enabling the backbone edge bridge (BEB) to support large numbers of service instances. This functionality is also known as MAC-in-MAC or MAC Tunneling Protocol (MTP). It also allows service providers to hide the identity of their equipment vendors by using user-specified MAC address as the tunnel source address. It also separates the user MAC address space from the provider MAC address space which means that only the edge bridges are aware of the customer MAC addresses, and that only the core bridges are aware of the provider addresses.

Figure 1 shows a typical 802.1ah PBB network and Table 1 describes the PBB network components.

Table 1 IEEE 802.1ah PBB Components

Component	Description
BCB	Backbone core bridge
BEB	Backbone edge bridge
CE	Customer equipment
PB	Provider bridge
PEB	Provider edge bridge

Figure 1 IEEE 802.1ah Provider Backbone Bridge



Backbone Edge Bridges

BEBs can contain either an I-Component or a B-Component. The I-Component maps Service VLAN identifiers (S-VIDs) to service instance identifiers (I-SIDs) and adds a PBB header without a B-Tag. The B-Component maps I-SIDs to backbone VIDs (B-VIDs) and adds a PBB header with a B-Tag. The IEEE 802.1ah standard specifies the following three types of BEBs:

- The B-Bridge (B-BEB) contains the B-Component of the MAC-in-MAC bridge. It validates the I-SIDs and maps the frames onto the backbone VLAN (B-VLAN). It also switches traffic based on the B-VLANS within the core bridge.
- The I-Bridge (I-BEB) contains the I-Component of the MAC-in-MAC bridge. It performs B-MAC encapsulation and inserts the I-SIDs based on the S-tags, C-tags, or S-tag/C-tag pairs.
- The IB-Bridge (IB-BEB) contains one or more I-Components and a single B-Component interconnected via a LAN segment.

Note The Cisco 7600 series routers are designed to work as IB-Bridges.

IB-Bridges

The IB-Bridge contains both the I-Component and the B-Component. The bridge selects the B-MAC and inserts the I-SID based on the provider VLAN tag (S-tag), the customer VLAN tag (C-tag), or both the S-tag and the C-tag. It validates the I-SIDs and it transmits and receives frames on the B-VLAN.

The IB-Bridge has two types of interfaces:

- Port-based interface: On port-based interfaces all S-tagged frames received from a customer are mapped to an I-SID and the S-tags are preserved.
- S-tagged interface: S-tagged interfaces support one-to-one mapping of an S-VLAN to an I-SID to provide S-VLAN translation capabilities. They also support many-to-one mapping of S-VLANs to an I-SID to provide S-VLAN bundling capability.

The IEEE 802.1ah on Provider Backbone Bridges feature supports all services mandated by the IEEE 802.1ah standard and extends the services to provide additional functionality as follows:

- S-Tagged Service:
  - In multiplexed environments each S-tag maps to an I-SID and may be retained or removed.
  - In bundled environments multiple S-tags map to the same I-SID and the S-tags must be retained.
- C-Tagged Service:
  - In multiplexed environments each C-tag maps to an I-SID and may be retained or removed.
  - In bundled environments multiple C-tags map to the same I-SID and the C-tags must be retained.
- S/C-Tagged Service:
  - In multiplexed environments each S-tag/C-tag pair maps to an I-SID. The S-tag or the S-tag/C-tag pair may be retained or removed.
  - In bundled environments multiple S-tag/C-tags pairs map to the same I-SID and the S-tag/C-tag pair must be retained.
- Port-based Service
  - Any frame whether untagged or double tagged is mapped to the same I-SID and all tags are retained.

IEEE 802.1ah for L2 Bridging Networks

When IEEE 802.1ah is configured on PBBs in an L2 bridging network the packets on the ingress EFP are tunneled to the appropriate MAC tunnel using the bridging identifier in the I-Component (specified using the **bridge-domain c-mac** command). If multiple EFPs use the same I-SID then the C-MAC bridge domain also performs the switching between the EFPs.

Figure 2 shows a typical L2 bridging network configuration.

Figure 2 IEEE 802.1ah L2 Bridging Network

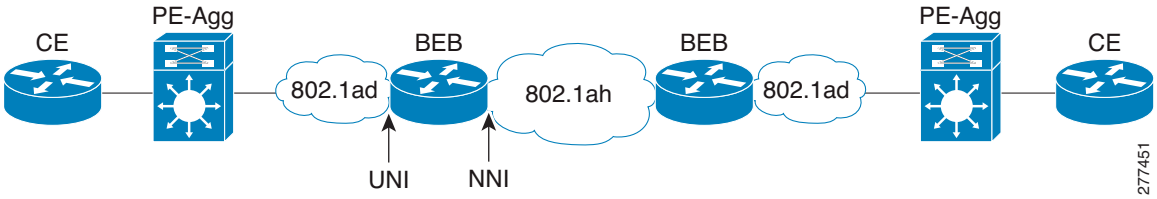


Table 2 describes the components of the L2 bridging network.

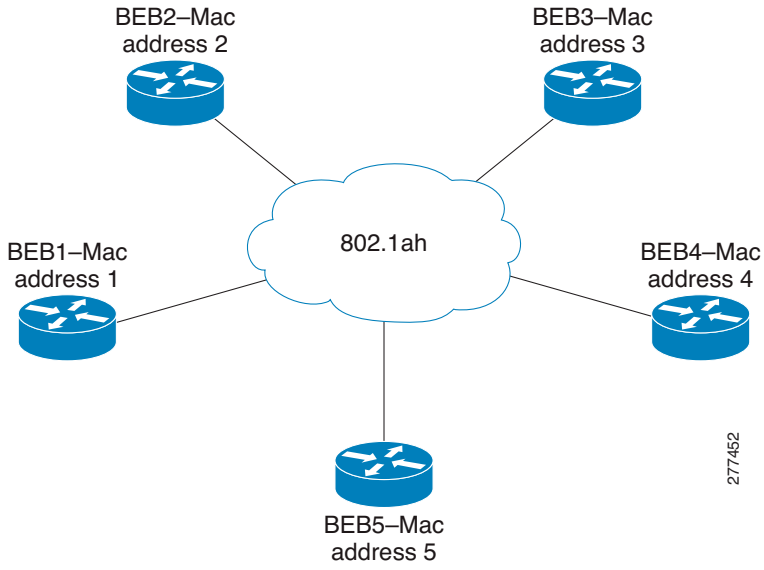
Table 2 L2 Bridging Network Components

Component Name	Description
802.1ad	IEEE 802.1ad (provider bridges) network
802.1ah	IEEE 802.1ah (provider backbone bridge) network
BEB	Backbone edge bridge
CE	Customer equipment
NNI	Network-to-network interface (egress EFP)
PE-Agg	Provider edge aggregation device
UNI	User-Network Interface (ingress EFP)

Unknown Unicast and Customer Multicast Traffic

Figure 3 shows an L2 network where all the BEBs are connected to each other through a single Backbone VLAN (B-VLAN). In this scenario any unknown unicast traffic from BEB1 is forwarded to BEB2 through to BEB5 because they all share the same B-VLAN.

Figure 3 BEB B-VLAN Network



In order to reduce network traffic you can configure a BEB to send traffic to specific BEBs on the B-VLAN. For example, if BEB1 needs to send traffic to BEB3 and BEB4 only, you can use the **mac tunnel address destination map** command to map the customer destination address (C-DA) to a multicast backbone destination address (B-DA). BEB3 and BEB4 are then registered to receive traffic for this B-DA.

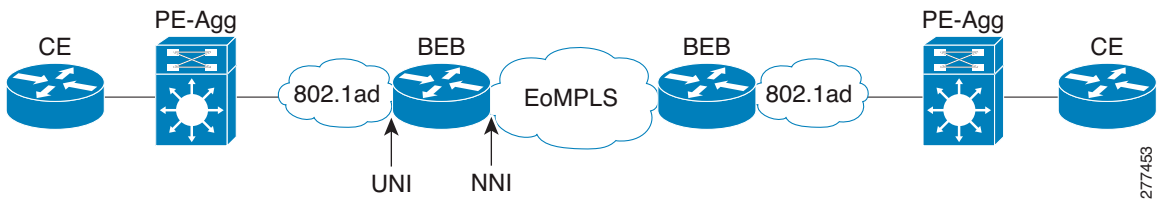
All packets within the 802.1ah network must be sent to a specified MAC address. The address is a static entry in the MAC address tables in the backbone core bridges. If a default MAC tunnel address is not specified in the table, then all unknown unicast packets and customer multicast traffic are sent with the default B-DA, which is a combination of IEEE-assigned Organizational Unique Identifier (OUI) and the I-SID values.

IEEE 802.1ah for Ethernet Over MPLS

When IEEE 802.1ah is configured on Ethernet over Multiprotocol Label Switching (EoMPLS) networks, the Ethernet links are transported as pseudowires using MPLS label switched paths (LSPs) inside an MPLS tunnel. To configure MAC-in-MAC on EoMPLS networks you must specify ingress EFP configuration settings at the UNI, specify MAC-in-MAC settings, and specify switch virtual interface (SVI) configuration settings at the egress NNI. The SVI represents a VLAN of switch ports connected to the bridge via a single interface.

Figure 4 shows a typical EoMPLS network configuration.

Figure 4 EEE 802.1ah EoMPLS Network



Note In EoMPLS networks Cisco 7600 series routers use the bridge domain identifier (set using the **bridge-domain** command) as the B-tag identifier. Therefore it is not necessary to specify B-VLAN configuration for the MAC-in-MAC tunnel.

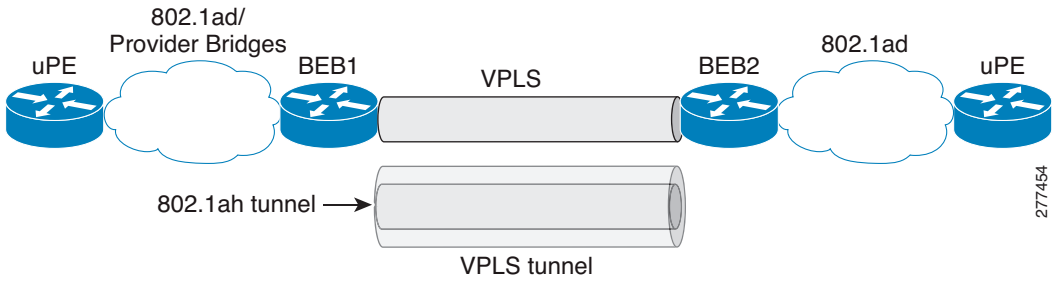
IEEE 802.1ah for Virtual Private LAN Services

When IEEE 802.1ah is configured on virtual private LAN service (VPLS) networks the 802.1ah packets are encapsulated in the VPLS pseudowire.

To configure MAC-in-MAC on VPLS networks you must specify the ingress EFP configuration settings at the UNI, specify the MAC-in-MAC settings, specify the virtual forwarding interface (VFI) settings, and specify the SVI configuration settings at the egress NNI. The SVI represents a VLAN of switch ports connected to the bridge via a single interface.

Figure 5 shows two 802.1ah networks connected by VPLS.

Figure 5 IEEE 802.1ah VPLS Network



How to Configure MAC-in-MAC on Provider Backbone Bridges

- Configuring MAC-in-MAC in an L2 Bridging Network, page 7 (optional)
- Configuring MAC-in-MAC in an Ethernet over MPLS Network, page 11 (optional)
- Configuring MAC-in-MAC in a VPLS Network, page 13 (optional)

Configuring MAC-in-MAC in an L2 Bridging Network

Perform this task to configure MAC-in-MAC in an L2 bridging network where the NNI has a switchport-based configuration.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot/port*
4. **service instance** *id* **ethernet**
5. **encapsulation dot1q** *vlan-id*
6. **bridge-domain** *bridge-id* **c-mac**
7. **exit**
8. **exit**
9. **ethernet mac-tunnel virtual** *tunnel-id*
10. **description** *description*
11. **bridge-domain** *bridge-id*
12. **mac tunnel address destination default** *mac-addr*
13. **service instance** *id* **ethernet**
14. **encapsulation dot1ah isid** *isid*
15. **mac tunnel address destination map** *c-mac-addr b-mac-addr*
16. **bridge-domain** *bridge-id* **c-mac**
17. **exit**

18. **exit**
19. **interface gigabitethernet** *slot/port*
20. **switchport**
21. **switchport mode trunk**
22. **switchport trunk allowed vlan** *vlan-id*
23. **end**
24. **show bridge-domain**
25. **show ethernet mac-tunnel engine slot**
26. **show ethernet service instance**
27. **show ethernet service mac-tunnel**

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/port* **Example:** `Router(config)# interface gigabitethernet 6/1`	Specifies the Gigabit Ethernet interface to configure as the customer instance port and enters interface configuration mode.
Step 4	**service instance** *id* **ethernet** **Example:** `Router(config-if)# service instance 101 ethernet`	Creates an L2 service instance on an interface and enters service instance configuration mode.
Step 5	**encapsulation dot1q** *vlan-id* **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* **c-mac** **Example:** `Router(config-if-srv)# bridge-domain 12 c-mac`	Specifies the bridging identifier in the I-Component.
Step 7	**exit** **Example:** `Router(config-if-srv)# exit`	Exits service instance configuration mode.

	Command or Action	Purpose
Step 8	**exit** **Example:** `Router(config-if)# exit`	Exits service interface configuration mode.
Step 9	**ethernet mac-tunnel virtual** *tunnel-id* **Example:** `Router(config)# ethernet mac-tunnel virtual 1`	Configures a virtual MAC-in-MAC tunnel and enters MAC-in-MAC tunnel configuration mode.
Step 10	**description** *description* **Example:** `Router(config-tunnel-minm)# description MAC-Tunnel-1`	(Optional) Describes the name and purpose of the MAC tunnel.
Step 11	**bridge-domain** *bridge-id* **Example:** `Router(config-tunnel-minm)# bridge-domain 100`	Binds the MAC tunnel to the bridge domain instance.
Step 12	**mac tunnel address destination default** *mac-addr* **Example:** `Router(config-tunnel-minm)# mac tunnel address destination default 4444.1111.1111`	Specifies a B-DA for a group of service instance IDs (I-SIDs).
Step 13	**service instance** *id* **ethernet** **Example:** `Router(config-tunnel-minm)# service instance 10 ethernet`	Defines an EFP that corresponds to a specific I-SID encapsulation and enters tunnel service configuration mode.
Step 14	**encapsulation dot1ah isid** *isid* **Example:** `Router(config-tunnel-srv)# encapsulation dot1ah isid 10000`	Configures dot1ah encapsulation for the specified I-SID.
Step 15	**mac tunnel address destination map** *c-mac-addr b-mac-addr* **Example:** `Router(config-tunnel-srv)# mac tunnel address destination map 3333.1111.1111 5555.2222.2222`	Maps the service provider backbone bridge MAC address to a customer MAC address.
Step 16	**bridge-domain** *bridge-id* **c-mac** **Example:** `Router(config-tunnel-srv)# bridge-domain 30 c-mac`	Configures the bridge domain as a customer domain.

	Command or Action	Purpose
Step 17	**exit** **Example:** `Router(config-tunnel-srv)# exit`	Exits tunnel service configuration mode.
Step 18	**exit** **Example:** `Router(config-tunnel-minm)# exit`	Exits MAC-in-MAC tunnel configuration mode.
Step 19	**interface gigabitethernet** *slot/port* **Example:** `Router(config)# interface gigabitethernet 6/2`	Specifies the Gigabit Ethernet interface to configure as the bridge instance port and enters interface configuration mode.
Step 20	**switchport** **Example:** `Router(config-if)# switchport`	Modifies the switching characteristics of the L2 switched interface.
Step 21	**switchport mode trunk** **Example:** `Router(config-if)# switchport mode trunk`	Specifies a trunking VLAN L2 interface.
Step 22	**switchport trunk allowed vlan** *vlan-id* **Example:** `Router(config-if)# switchport trunk allowed vlan 100`	Sets the list of allowed VLANs that transmit traffic from this interface in tagged format when in trunking mode.
Step 23	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and enables user EXEC mode.
Step 24	**show bridge-domain** **Example:** `Router> show bridge-domain`	(Optional) Displays bridge-domain information.
Step 25	**show ethernet mac-tunnel engine slot** *slot-number* **Example:** `Router> show ethernet mac-tunnel engine slot 2`	(Optional) Displays Ethernet MAC-in-MAC information.

	Command or Action	Purpose
Step 26	**show ethernet service instance** **Example:** `Router> show ethernet service instance`	(Optional) Displays Ethernet service instance information.
Step 27	**show ethernet service mac-tunnel** **Example:** `Router> show ethernet service mac-tunnel`	(Optional) Displays Ethernet service MAC-in-MAC information.

Configuring MAC-in-MAC in an Ethernet over MPLS Network

Perform this task to configure MAC-in-MAC in an EoMPLS network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot/port*
4. **service instance** *id* **ethernet**
5. **encapsulation dot1q** *vlan-id*
6. **bridge-domain** *bridge-id* **c-mac**
7. **exit**
8. **exit**
9. **ethernet mac-tunnel virtual** *tunnel-id*
10. **bridge-domain** *bridge-id*
11. **service instance** *id* **ethernet**
12. **encapsulation dot1ah isid** *isid*
13. **bridge-domain** *bridge-id* **c-mac**
14. **exit**
15. **exit**
16. **interface vlan** *vlanid*
17. **xconnect** *ipaddress vc-id* **encapsulation mpls**
18. **exit**

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/port* **Example:** `Router(config)# interface gigabitethernet 6/1`	Specifies the Gigabit Ethernet interface to configure as the customer instance port and enters interface configuration mode.
Step 4	**service instance** *id* **ethernet** **Example:** `Router(config-if)# service instance 101 ethernet`	Creates an L2 service instance on an interface and enters service instance configuration mode.
Step 5	**encapsulation dot1q** *vlan-id* **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* **c-mac** **Example:** `Router(config-if-srv)# bridge-domain 12 c-mac`	Specifies the bridging identifier in the I-Component.
Step 7	**exit** **Example:** `Router(config-if-srv)# exit`	Exits service instance configuration mode.
Step 8	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode.
Step 9	**ethernet mac-tunnel virtual** *tunnel-id* **Example:** `Router(config)# ethernet mac-tunnel virtual 1`	Configures a virtual MAC-in-MAC tunnel and enters MAC-in-MAC tunnel configuration mode.
Step 10	**bridge-domain** *bridge-id* **Example:** `Router(config-tunnel-minm)# bridge-domain 100`	Binds the MAC tunnel to the bridge domain instance.

	Command or Action	Purpose
Step 11	**service instance** *id* **ethernet** **Example:** `Router(config-tunnel-minm)# service instance 10 ethernet`	Defines an EFP that corresponds to a specific I-SID encapsulation and enters tunnel service configuration mode.
Step 12	**encapsulation dot1ah isid** *isid* **Example:** `Router(config-tunnel-srv)# encapsulation dot1ah isid 10000`	Configures dot1ah encapsulation for the specified I-SID.
Step 13	**bridge-domain** *bridge-id* **c-mac** **Example:** `Router(config-tunnel-srv)# bridge-domain 30 c-mac`	Configures the bridge domain as a customer domain.
Step 14	**exit** **Example:** `Router(config-tunnel-srv)# exit`	Exits tunnel service configuration mode.
Step 15	**exit** **Example:** `Router(config-tunnel-minm)# exit`	Exits MAC-in-MAC tunnel configuration mode.
Step 16	**interface vlan** *vlanid* **Example:** `Router(config)# interface vlan 1000`	Creates a dynamic SVI, and enters interface configuration mode.
Step 17	**xconnect** *ipaddress vc-id* **encapsulation mpls** **Example:** `Router(config-if)# xconnect 10.243.245.11 100 encapsulation mpls`	Binds the attachment circuit to the pseudowire, and configures an Any Transport over MPLS (AToM) static pseudowire. • Specifies MPLS as the tunneling method to encapsulate the data in the pseudowire.
Step 18	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.

Configuring MAC-in-MAC in a VPLS Network

Perform this task to configure MAC-in-MAC in a VPLS network. The following configuration enables the router to work as an IB-Bridge.

Note On Cisco 7600 series routers the bridge-domain identifier must be the same as the SVI identifier.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot/port*
4. **service instance** *id* **ethernet**
5. **encapsulation dot1q** *vlan-id*
6. **bridge-domain** *bridge-id* **c-mac**
7. **exit**
8. **exit**
9. **ethernet mac-tunnel virtual** *tunnel-id*
10. **bridge-domain** *bridge-id*
11. **service instance** *id* **ethernet**
12. **encapsulation dot1ah isid** *isid*
13. **bridge-domain** *bridge-id* **c-mac**
14. **exit**
15. **service instance** *id* **ethernet**
16. **encapsulation dot1ah isid** *isid*
17. **bridge-domain** *bridge-id* **c-mac**
18. **exit**
19. **exit**
20. **l2 vfi** *vfi-name* **manual**
21. **vpn id** *vpn-id*
22. **neighbor** *ipaddress vcid* **encapsulation mpls**
23. **neighbor** *ipaddress vcid* **encapsulation mpls**
24. **exit**
25. **interface vlan** *vlan-id*
26. **xconnect** *ipaddress vc-id* **encapsulation mpls**
27. **exit**

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.

	Command or Action	Purpose
Step 3	**interface gigabitethernet** *slot/port* **Example:** `Router(config)# interface gigabitethernet 6/1`	Specifies the Gigabit Ethernet interface to configure as the customer instance port and enters interface configuration mode.
Step 4	**service instance** *id* **ethernet** **Example:** `Router(config-if)# service instance 101 ethernet`	Creates an L2 service instance on an interface and enters service instance configuration mode.
Step 5	**encapsulation dot1q** *vlan-id* **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* **c-mac** **Example:** `Router(config-if-srv)# bridge-domain 12`	Specifies the bridging identifier in the I-Component.
Step 7	**exit** **Example:** `Router(config-if-srv)# exit`	Exits service instance configuration mode.
Step 8	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode.
Step 9	**ethernet mac-tunnel virtual** *tunnel-id* **Example:** `Router(config)# ethernet mac-tunnel virtual 1`	Configures a virtual MAC-in-MAC tunnel and enters MAC-in-MAC tunnel configuration mode.
Step 10	**bridge-domain** *bridge-id* **Example:** `Router(config-tunnel-minm)# bridge-domain 100`	Binds the MAC tunnel to the bridge domain instance.
Step 11	**service instance** *id* **ethernet** **Example:** `Router(config-tunnel-minm)# service instance 31 ethernet`	Defines an EFP that corresponds to a specific I-SID encapsulation and enters tunnel service configuration mode.
Step 12	**encapsulation dot1ah isid** *isid* **Example:** `Router(config-tunnel-srv)# encapsulation dot1ah isid 10000`	Configures dot1ah encapsulation for the specified I-SID.

	Command or Action	Purpose
Step 13	**bridge-domain** *bridge-id* **c-mac** **Example:** `Router(config-tunnel-srv)# bridge-domain 10 c-mac`	Configures the bridge domain as a customer domain.
Step 14	**exit** **Example:** `Router(config-tunnel-srv)# exit`	Exits tunnel service configuration mode.
Step 15	**service instance** *id* **ethernet** **Example:** `Router(config-tunnel-minm)# service instance 41 ethernet`	Defines an EFP that corresponds to a specific I-SID encapsulation and enters tunnel service configuration mode.
Step 16	**encapsulation dot1ah isid** *isid* **Example:** `Router(config-tunnel-srv)# encapsulation dot1ah isid 20000`	Configures dot1ah encapsulation for the specified I-SID.
Step 17	**bridge-domain** *bridge-id* **c-mac** **Example:** `Router(config-tunnel-srv)# bridge-domain 20 c-mac`	Configures the bridge domain as a customer domain.
Step 18	**exit** **Example:** `Router(config-tunnel-srv)# exit`	Exits tunnel service configuration mode.
Step 19	**exit** **Example:** `Router(config-tunnel-minm)# exit`	Exits MAC-in-MAC tunnel configuration mode.
Step 20	**l2 vfi** *vfi-name* **manual** **Example:** `Router(config)# l2 vfi myvfi manual`	Configures a virtual forwarding instance and enters L2 VFI point-to-point configuration mode.
Step 21	**vpn id** *vpn-id* **Example:** `Router(config-vfi)# vpn id 20`	Sets a VPN ID on a VPN routing and forwarding (VRF) instance.
Step 22	**neighbor** *ipaddress vcid* **encapsulation mpls** **Example:** `Router(config-vfi)# neighbor 172.16.10.12 2000 encapsulation mpls`	Specifies the first router that forms a point-to-point Layer 2 VFI connection.

	Command or Action	Purpose
Step 23	**neighbor** *ipaddress vcid* **encapsulation mpls** **Example:** `Router(config-vfi)# neighbor 172.16.200.120 2000 encapsulation mpls`	Specifies the second router that forms a point-to-point Layer 2 VFI connection.
Step 24	**exit** **Example:** `Router(config-vfi)# exit`	Exits L2 VFI point-to-point configuration mode.
Step 25	**interface vlan** *vlanid* **Example:** `Router(config)# interface vlan 1000`	Creates a dynamic SVI, and enters interface configuration mode.
Step 26	**xconnect** *ipaddress vc-id* **encapsulation mpls** **Example:** `Router(config-if)# xconnect 10.243.245.11 100 encapsulation mpls`	Binds the attachment circuit to the pseudowire, and configures an AToM static pseudowire. • Specifies MPLS as the tunneling method to encapsulate the data in the pseudowire.
Step 27	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.

Configuration Examples for MAC-in-MAC on Provider Backbone Bridges

Example: MAC-in-MAC Configuration for L2 Bridging Networks

In the following example, the UNI configuration is performed on the GigabitEthernet 1/0, GigabitEthernet 2/0, and GigabitEthernet 3/0 interfaces. The MAC-in-MAC tunnel configuration includes commands to configure the default MAC tunnel destination address and the destination map. The NNI configuration is performed on the GigabitEthernet 1/2 interface, and shows the options for a switchport or External Interface (EI)-based NNI.

Note For switchport NNI configurations the VLAN ID is the same as the bridge domain ID configured under the MAC tunnel. For EI NNI configurations a service instance is configured under the NNI interface and the binding of the MAC tunnel to the service instance is done using the bridge domain.

UNI (Ingress) Configuration

```
interface gigabitethernet  1/0
 service instance 10 ethernet
  encapsulation dot1q 10
  bridge-domain 20 c-mac
 service instance 20 ethernet
  encapsulation dot1q  20
  bridge-domain 30 c-mac

interface gigabitethernet 2/0
 service instance 10 ethernet
  encapsulation dot1q 10
  bridge-domain 20 c-mac
 service instance 30 ethernet
  encapsulation dot1q 20
  bridge-domain 30 c-mac

interface gigabitethernet 3/0
 service instance 10 ethernet
  encapsulation dot1q 10
  bridge-domain 20 c-mac
```

MAC-in-MAC Tunnel Configuration

```
ethernet mac-tunnel virtual 1
 bridge-domain 100
 mac tunnel address destination default 4444.1111.1111
 service instance 10 ethernet
  encapsulation  dot1ah isid 10000
  bridge-domain 20 c-mac
 service instance 20 ethernet
  encapsulation  dot1ah isid 20000
  bridge-domain 30 c-mac
  mac tunnel address destination map 3333.1111.1111 5555.2222.2222
```

Switchport NNI (Egress) Configuration

```
interface gigabitethernet 1/2
 switchport
 switchport mode trunk
 switchport trunk allowed vlan 100
```

EI NNI (Egress) Configuration

```
interface gigabitethernet 1/2
 service instance 20 ethernet
  encapsulation dot1q
  bridge-domain 100
```

Example: MAC-in-MAC Configuration for Ethernet over MPLS Networks

The following example shows how to configure a BEB where two 802.1ah networks are connected using MPLS:

UNI (Ingress) Configuration

```
interface gigabitethernet 1/1
 service instance 15 ethernet
  encapsulation dot1q 20
  bridge-domain 10 c-mac
```

MAC-in-MAC Tunnel Configuration

```
ethernet mac-tunnel virtual 1
 bridge-domain 1000
 service instance 500 ethernet
  encapsulation dot1ah isid 10000
  bridge-domain 10 c-mac
```

SVI Configuration

```
interface vlan 1000
 xconnect 10.243.245.11 100 encapsulation mpls
```

Example: MAC-in-MAC Configuration for VPLS Networks

The following example shows how to configure a BEB where two 802.1ah networks are connected using VPLS. The 802.1ah packets are encapsulated in the VPLS pseudowire.

UNI (Ingress) Configuration

```
interface gigabitethernet 1/1
 service instance 21 ethernet
  encapsulation dot1q 20
  bridge-domain 10 c-mac
```

MAC-in-MAC Tunnel Configuration

```
ethernet mac-tunnel virtual 1
 bridge-domain 100
 service instance 31 ethernet
  encapsulation dot1ah isid 10000
  bridge-domain 10 c-mac
 service instance 41 ethernet
  encapsulation dot1ah isid 30000
  bridge-domain 20 c-mac
```

VFI Configuration

```
l2 vfi myvfi manual
vpn id 20
 neighbor 172.16.10.12 2000 encapsulation mpls
 neighbor 172.16.200.120 2000 encapsulation mpls
vpn id vpn-id
```

SVI Configuration

```
interface vlan 100
 xconnect vfi vfi100
```

Additional References

Related Documents

Related Topic	Document Title
MAC-in-MAC 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
IEEE 802.1ah	*IEEE 802.1ah - Provider Backbone Bridges*

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: 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 802.1ah on Provider Backbone Bridges

Table 3 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 3 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 3 Feature Information for IEEE 802.1ah on Provider Backbone Bridges feature.

Feature Name	Releases	Feature Information
802.1ah/EVC2.0 for 7600 (Infrastructure)	12.2(33)SRE	The IEEE 802.1ah on Provider Backbone Bridges feature enables MAC-in-MAC on EVCs. In Cisco IOS Release 12.2(33)SRE, this feature was introduced on the Cisco 7600 series routers. The following sections provide information about this feature: • Information About IEEE 802.1ah on Provider Backbone Bridges, page 2 • How to Configure MAC-in-MAC on Provider Backbone Bridges, page 7 The following commands were introduced or modified: **bridge-domain**, **clear bridge-domain mac table**, **description**, **encapsulation dot1ah isid**, **ethernet mac-tunnel virtual**, **mac tunnel address destination default**, **mac tunnel address destination map**, **service instance ethernet** (mac-tunnel), **show bridge-domain**, **show ethernet mac-tunnel engine slot**, **show ethernet service instance**, **show ethernet service mac-tunnel**.