Configuring Overlay Transport Virtualization

Overlay Transport Virtualization (OTV) is a MAC-in-IP method that extends Layer 2 connectivity across a transport network infrastructure. OTV provides Layer 2 connectivity between remote network sites by using MAC-address-based routing and IP-encapsulated forwarding across a transport network to provide support for applications that require Layer 2 adjacency.

The OTV application (also known as OTV) is one of the modules of the OTV architecture in Cisco software. OTV interacts with the following other modules of the OTV architecture in Cisco IOS software:

- Layer 2 Intermediate System-to-Intermediate System (IS-IS)
- Ethernet infrastructure
- IP tunnel infrastructure
- Layer 2 Forwarding Information Base (L2FIB)
- Multilayer Routing Information Base (MLRIB)
- Ethernet Operation, Administration, and Maintenance (OAM)
- Internet Group Management Protocol (IGMP)
- Address Resolution Protocol (ARP)

You deploy OTV on edge devices in each site. OTV requires no other changes to the sites or to the transport network.

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.

Prerequisites for OTV

- Ensure that IGMP Version 3 (IGMPv3) is configured on the physical Layer 3 interface that you configure as the join interface.
- Ensure that there is connectivity for VLANs to be extended to the OTV edge device.

Restrictions for OTV

- An overlay interface will be in the up state only if the overlay interface configuration is complete and enabled (using the **no shutdown** command). The join interface must also be in the up state.
- Configure the join interface and all Layer 3 interfaces that face the IP core between the OTV edge devices with the highest maximum transmission unit (MTU) size supported by the IP core. OTV sets the Don't Fragment (DF) bit in the IP header for all OTV control and data packets so that the core cannot fragment these packets.
- Ensure that PIM is not enabled on the join interface; enable only passive PIM on the join interface. Configure SSM for the OTV data group multicast address range by using the **ip pim ssm** command.
- Ensure that a site identifier is configured and is the same for all edge devices in a site. OTV brings down all overlays and generates a system message when it detects a mismatched site identifier from a neighbor edge device.
- Only one join interface can be configured on a router for all overlays.
- OTV is compatible only with a transport network configured for IPv4. IPv6 is not supported.
- OTV cannot be configured on the same router on which Multiprotocol Label Switching (MPLS) is configured.
- The transport network must support the Protocol Independent Multicast (PIM) sparse mode (Any Source Multicast [ASM]) for the provider multicast group and Source Specific Multicast (SSM) for the delivery group.

Information About OTV

Functions of OTV

- Maintains a list of overlays

- Maintains a list of configured overlay parameters such as name, multicast address, encapsulation type, authentication, and OTV feature sets

- Maintains the state of the overlay interface

- Maintains the status of OTV VLAN membership from Ethernet infrastructure and the state of the authoritative edge device (AED) from IS-IS

- Maintains a database of overlay adjacencies as reported by IS-IS

- Maintains IP tunnel information and manages the encapsulation for data sent on the overlay network

- Manages delivery groups (DGs) for each overlay by snooping multicast traffic and monitoring traffic streams for active DGs

- Configures, starts, and stops the OTV IS-IS instance

- Interfaces with IP multicast to join provider multicast groups for each overlay

OTV Terms

Table 1: OTV Terms

Term	Description
Edge device	A device that performs typical Layer 2 learning and forwarding on site-facing interfaces (internal interfaces) and IP-based virtualization on transport-facing interfaces.
	OTV functionality occurs only in an edge device. A device that provides Layer 2 and Layer 3 connectivity can also serve as an edge device. You can configure multiple overlay interfaces on an edge device. You can also configure multiple edge devices in a site.
Authoritative edge device (AED)	An elected edge device that serves as the forwarder.
	OTV elects a forwarding device per site for each VLAN and designates the forwarding device as an AED. OTV provides loop-free multihoming by using this AED. The edge devices in a site communicate with each other through internal interfaces to elect an AED.

| Term	Description
Transport network	A network that connects OTV sites. A transport network can be managed by customers or provided by a service provider or be a mix of both.
Join interface	An uplink interface of an edge device. A join interface is a point-to-point routed interface. An edge device joins an overlay network through this interface. The IP address of this interface is used to advertise the reachability of a MAC address in a site. Both Ethernet and Packet over SONET (POS) interfaces are supported as join interfaces.
Internal interface	A Layer 2 interface on an edge device that connects to the VLANs that are to be extended. These VLANs typically form a Layer 2 domain known as a site and can contain site-based switches or site-based routers. An internal interface is a Layer 2 access interface or a trunk interface regardless of whether the internal interface connects to a switch or a router.
MAC routing	The type of routing that associates the destination MAC address of the Layer 2 traffic with the IP address of an edge device. The OTV control-plane protocol advertises the MAC-to-IP association to edge devices. In MAC routing, MAC addresses are reachable in an overlay network through the IP address of a remote edge device. Layer 2 traffic that is destined to a MAC address is encapsulated in an IP packet based on the MAC-to-IP mapping stored in the MAC table.
Overlay interface	A logical, multiaccess, multicast-capable interface. An overlay interface encapsulates Layer 2 frames in IP unicast or multicast headers.
Overlay network	A logical network that interconnects remote sites for MAC routing of Layer 2 traffic. An overlay network comprises multiple edge devices.

Term	Description
Site	A Layer 2 network that may be single-homed or multihomed to the transport network and the OTV overlay network.
	Edge devices that operate in an overlay network provide Layer 2 connectivity between sites. Layer 2 sites are physically separated from each other by the transport network.
Site VLAN	A dedicated VLAN on which an internal adjacency is established.
	OTV sends local hello messages on the site VLAN to detect other OTV edge devices in the site. OTV also uses the site VLAN to determine the AED for OTV-extended VLANs.
	We recommend that you use a dedicated VLAN as a site VLAN. You should also ensure the following: • Site VLAN is active on at least one of the edge device ports. • Site VLAN is not extended across the overlay.

OTV Overlay Network

An OTV overlay network provides Layer 2 connectivity between remote sites over a transport network. An overlay network consists of one or more edge devices in each site. The sites are interconnected using a control-plane protocol across the transport network.

The figure below shows two sites connected through edge devices to a transport network to create a virtual overlay network.

Figure 1: OTV Overlay Network
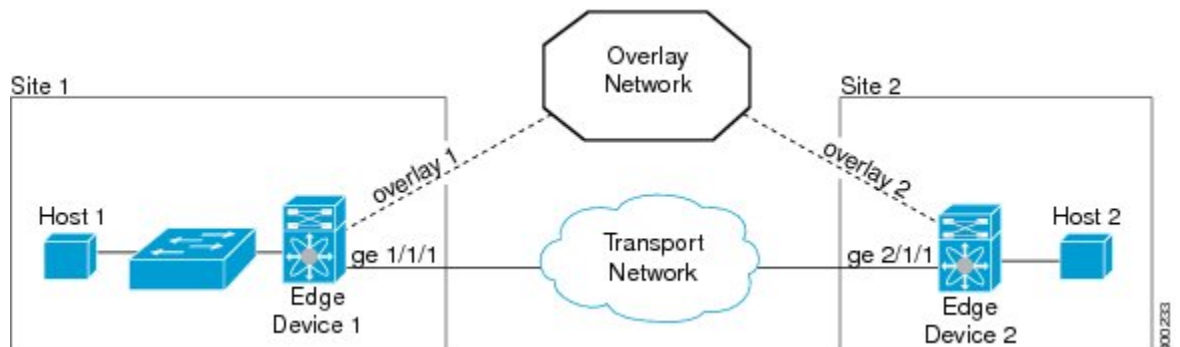
An overlay network maps MAC addresses of edge devices to their respective IP addresses. After OTV identifies the edge device to which a Layer 2 frame is to be sent, OTV encapsulates the frame and sends the resulting IP packet by using the transport network routing protocols.

OTV can support more than one overlay network running IPv4 unicast forwarding or multicast flooding. Each overlay network can support more than one VLAN.

Note OTV does not extend Spanning Tree Protocol (STP) across sites. Each site runs its own STP instead of all sites being included in a large STP domain. This per-site STP topology allows the use of different STP modes, such as Per-VLAN Rapid Spanning Tree Plus (PVRST+) or Multiple Spanning Tree (MST), in each site.

Edge Devices

Each site consists of one or more edge devices and other internal routers, switches, or servers. OTV is configured only on an edge device. The OTV configuration is completely transparent to the rest of the site. For example, information about MAC learning, STP root bridge placement, and STP mode is transparent. An edge device has internal interfaces that are part of the Layer 2 network in the site and external interfaces that are reachable through IP in the transport network.

An edge device performs typical Layer 2 learning and forwarding on its internal interfaces and transmits and receives encapsulated Layer 2 traffic on the physical interface through the transport network. An edge device sends and receives control-plane traffic through the join interface. The control-plane traffic exchanges reachability information between remote sites to build up a table that maps MAC addresses to the IP address of the edge device that is local to the MAC address.

Site-to-Site Connectivity

OTV builds Layer 2 reachability information by communicating between edge devices with the overlay protocol. The overlay protocol forms adjacencies with all edge devices. After each edge device is adjacent with all its peers in an overlay network, the edge devices share MAC address reachability information with other edge devices that participate in the same overlay network.

OTV discovers edge devices through dynamic neighbor detection, which leverages the multicast support of the core.

Overlay Networks Mapping to Multicast Groups

For transport networks that support IP multicast, one multicast address (the control-group address) is used to encapsulate and exchange OTV control-plane protocol updates. Each edge device that participates in a particular overlay network shares the same control-group address with all other edge devices of the same overlay network. As soon as a control-group address and a join interface are configured on an edge device, the edge device sends an IGMP report message to join the control group. Edge devices act as hosts in the multicast network and send multicast IGMP report messages to the assigned multicast group address.

As in traditional link-state routing protocols, edge devices exchange OTV control-plane hellos to build adjacencies with other edge devices in the overlay network. After adjacencies are established, OTV control-plane link-state packets (LSPs) communicate MAC-to-IP mappings to adjacent devices. These LSPs contain the IP address of the remote edge device, VLAN IDs, and the learned MAC addresses that are reachable through that edge device.

Edge devices participate in data-plane learning on internal interfaces to build up the list of MAC addresses that are reachable within a site. OTV sends these locally learned MAC addresses in the OTV control-plane updates to remote sites.

OTV Packet Flow

When an edge device receives a Layer 2 frame on an internal interface, OTV performs the MAC table lookup based on the destination address of the Layer 2 frame. If the frame is destined to a MAC address that is reachable through another internal interface, the frame is forwarded on that internal interface. OTV performs no other actions and the processing of the frame is complete.

If the frame is destined to a MAC address that was learned over an overlay interface, OTV performs the following tasks:

1 Strips the preamble and frame check sequence (FCS) from the Layer 2 frame.

2 Adds an OTV header to the Layer 2 frame and copies the 802.1Q information into the OTV header.

3 Adds the IP address to the packet based on the initial MAC address table lookup. This IP address is used as the destination address for the IP packet that is sent into the core switch.

OTV traffic appears as IP traffic to the network core.

At the destination site, the edge device performs the reverse operation and presents the original Layer 2 frame to the local site. The edge device determines the correct internal interface to forward the frame on, based on the local MAC address table.

The figure below shows the encapsulation and decapsulation of a MAC-routed packet across an overlay network.

Figure 2: MAC Routing
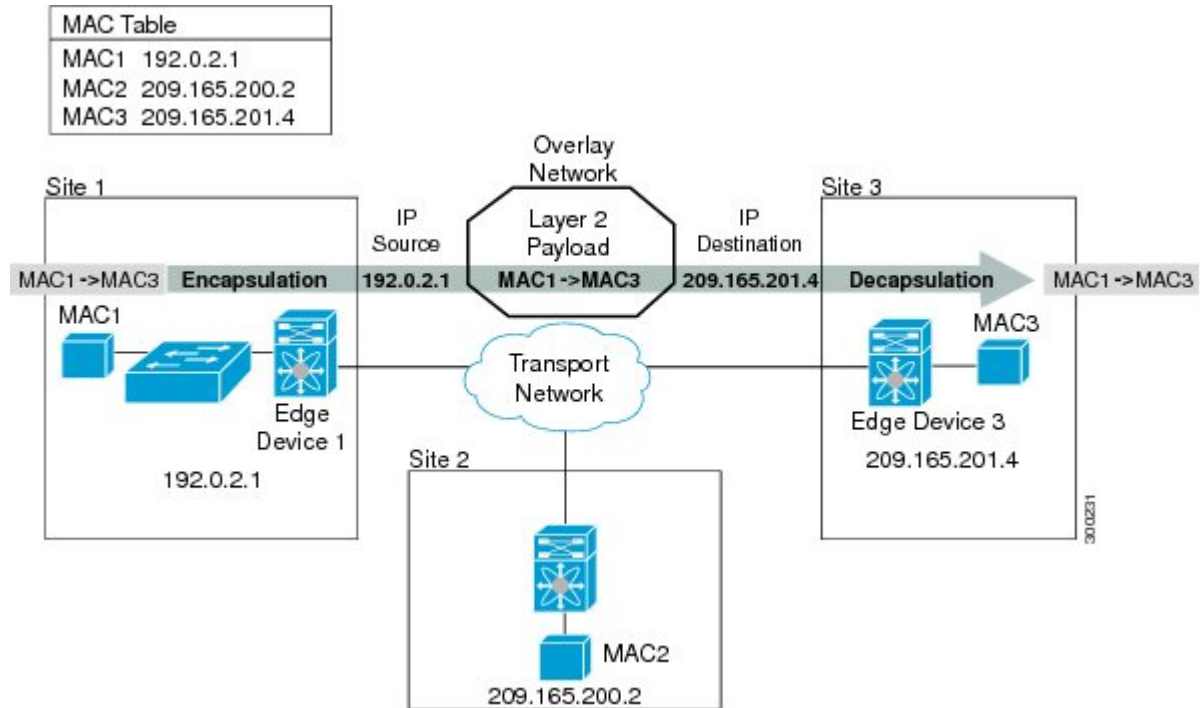
In the figure above, Site 1 communicates with Site 3 over the overlay network. Edge Device 1 receives the Layer 2 frame from MAC1 and looks up the destination MAC address, MAC3, in the MAC table. The edge device encapsulates the Layer 2 frame in an IP packet with the IP destination address set for Edge Device 3 (209.165.201.4). When Edge Device 3 receives the IP packet, the edge device strips off the IP header and sends the original Layer 2 frame to the VLAN and the port that MAC3 is connected to.

Mobility

OTV uses a metric value to support seamless MAC mobility.

When an AED learns a new MAC address, the AED advertises the new address in OTV control-plane updates with a metric value of one if no other edge device has advertised that MAC address before.

In the case of a mobile MAC address, an AED advertises the newly learned, local MAC address with a metric value of zero. This metric value signals the remote edge device to stop advertising that MAC address. After the remote edge device stops advertising the moved MAC address, the AED that contains the new MAC address changes the metric value to one.

Virtual machine (VM) mobility is one common example of MAC mobility. VM mobility occurs when the virtual machine moves from one site to another. OTV detects this change based on the changed advertisement of the mobile MAC address.

Sample OTV Topologies

You can use OTV to connect remote sites in multiple topologies.

Two-Site Network

Figure 3: Basic Two-Site OTV Topology
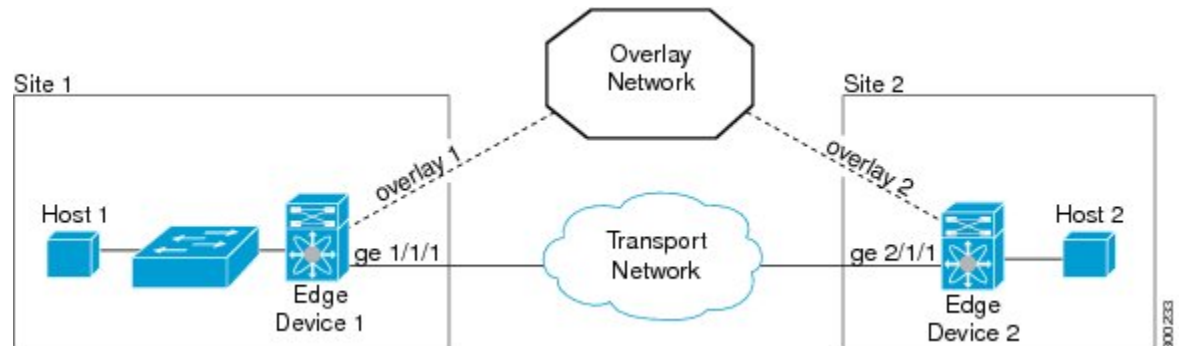
In this sample topology, both sites are connected over a common transport network. The edge devices in both the sites have an overlay interface configured (interface overlay 1 and interface overlay 2) with the same control-group address, which makes both the edge devices join a common overlay network. Although the control-group addresses of the two edge devices need to match, the figure shows that the external interface is unique for each edge device.

Multiple Overlay Networks

You can configure an edge device in more than one overlay network. Each overlay network uses a different multicast group address.

Figure 4: Two Overlay Networks
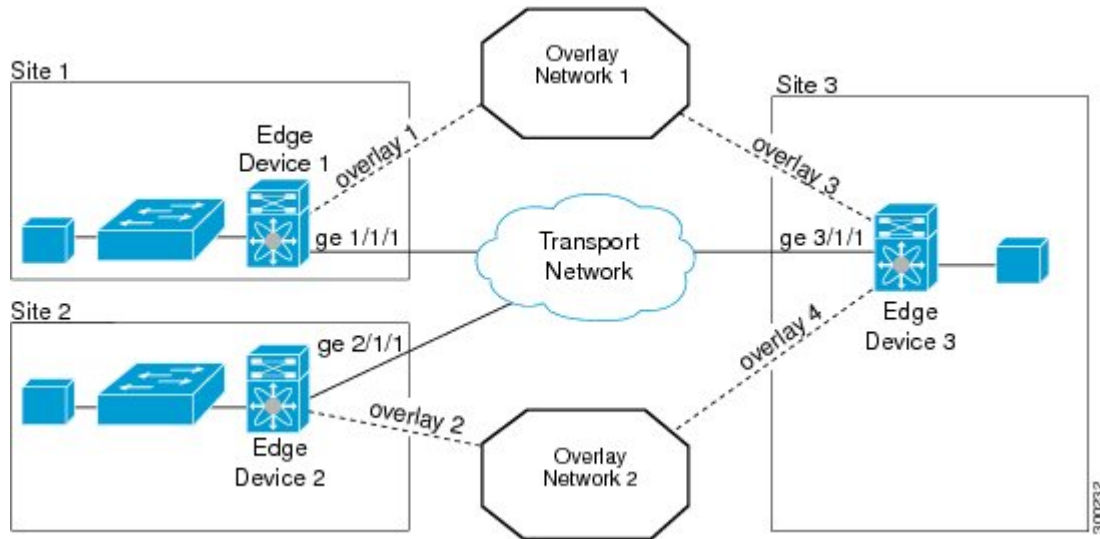
In the figure above, Site 3 connects to Site 1 over Overlay Network 1 through overlay interface 3 on Edge Device 3. Site 3 also connects to Site 2 over Overlay Network 2 through overlay interface 4 on Edge Device 3. Each overlay network has different control-group addresses.

Site 3 uses Edge Device 3 to connect to both the overlay networks—Overlay Network 1 and Overlay Network 2. Edge Device 3 associates the same physical interface for both the overlay networks.

Multihomed Sites and Load Balancing

For resiliency and load balancing, a site can have multiple edge devices.

When more than one edge device exists in a site and both participate in the same overlay network, the site is considered multihomed. For the VLANs that are extended using OTV, one edge device is elected as an AED on a per-VLAN basis. OTV leverages a local VLAN to establish an adjacency between edge devices on their internal interfaces. The local VLAN that is shared by the internal interfaces is the site VLAN. The adjacency establishment over the site VLAN determines whether the other edge device is still present and which edge device is authoritative for what VLANs.

Load balancing is achieved because each edge device is authoritative for a subset of all VLANs that are transported over the overlay. Link utilization to and from the transport is optimized.

The figure below shows the AED that is selected for a multihomed site in an overlay network.

Figure 5: Multihomed Site
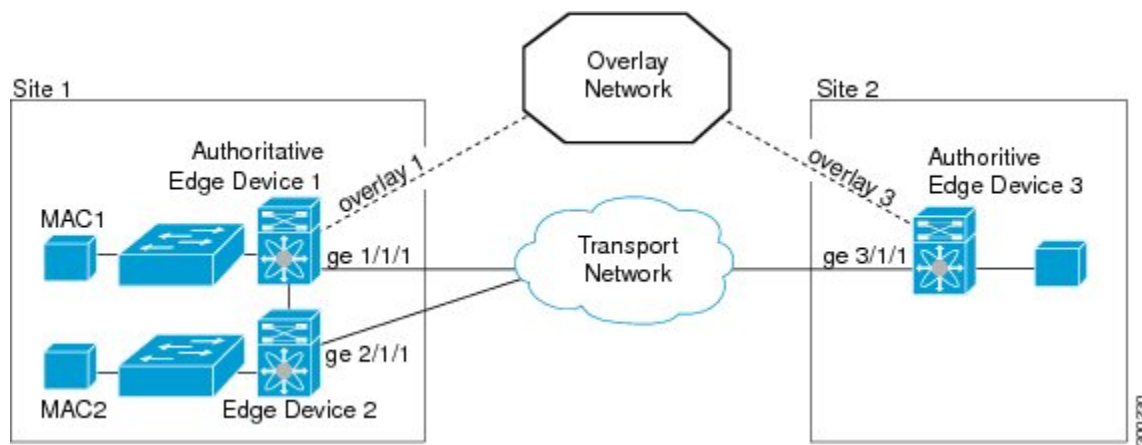
In the figure above, Site 1 is a multihomed site with two physical interfaces connected to the transport network.

An edge device can be authoritative for one set of VLANs but not authoritative for another set of VLANs.

Dual Site Adjacency

Dual site adjacency includes adjacency discovery over the overlay network and in the existing site VLAN. Dual site adjacency introduces additional resiliency and loop prevention. Loops may be caused by site VLAN partition or misconfiguration. Dual site adjacency also uses forwarding readiness notifications to detect when neighbor edge devices in the same site experience a change such as local failures (for example, the site VLAN or extended VLANs going down or the join interface going down). These forwarding readiness notifications trigger an immediate AED election for the site.

OTV sends forwarding readiness notifications to all neighbors of an edge device in the following isolation states:

   • Site isolation: All extended VLANs on an edge device go down.

   • Core isolation: All overlay adjacencies go down.

The dual site adjacency state results from the most recent adjacency state for either the overlay or the site VLAN adjacency. OTV determines AED election based on active dual site adjacencies only. An inactive dual site adjacency is ignored for AED election.

You must configure the same site identifier for all edge devices in a site. OTV advertises this site identifier in the IS-IS hello packets sent over the overlay network and on the local site VLAN. The combination of the IS-IS system ID and site identifier uniquely identifies the edge devices in a site.

OTV Features

The OTV control-plane creates adjacencies between remote sites to provide Layer 2 connectivity over a transport network. An OTV network performs the following functions:

   • Discovers remote sites and builds a control-protocol adjacency

• Shares MAC routing information across an overlay network

An overlay network consists of one or more logical overlay interfaces that are configured on an edge device in each remote site that connects to the physical transport network. You associate the logical overlay interface with a physical interface that connects to the transport network. The OTV control plane is responsible for discovering edge devices in remote sites, creating control-protocol adjacencies to these sites, and establishing protocol adjacencies among the sites. The OTV control-plane protocol uses the IS-IS protocol to establish adjacencies and exchange MAC reachability across an overlay network.

Note   You do not need to configure IS-IS to use OTV. IS-IS runs in the background after OTV is enabled.

The OTV control-plane protocol also sends and receives MAC routing updates between remote sites and updates the Routing Information Base (RIB) with these MAC-to-IP address pairs.

Overlay Interface

An overlay interface is a logical interface that connects to remote edge devices in an overlay network through an associated physical interface on the transport network. From the perspective of MAC-based forwarding in a site, an overlay interface is simply another bridged interface. As a bridged interface, unicast MAC addresses are associated with an overlay interface. An overlay interface is eligible for inclusion in the Outbound Interface List (OIL) for different multicast groups. However, no STP packets are forwarded over an overlay interface. Unknown unicast packets are also not flooded on an overlay interface. From the perspective of IP transport, an overlay interface is not visible.

OTV encapsulates Layer 2 frames in IP packets and transmits them to an overlay interface.

The following commands must be configured for an overlay interface to be in the up state:

- **no shutdown**
- **otv control-group**
- **otv data-group**
- **otv join-interface**
- **otv site bridge-domain**

Note   An overlay interface does not come up until you configure a multicast group address or a site VLAN has at least one active port on an edge device.

MAC Address Learning

OTV learns MAC-to-IP address pairs from the following:

- MAC address learning on internal interfaces
- OTV control-plane updates over an overlay network
- Multicast IGMP snooping

OTV edge devices snoop IGMP traffic and issue a Group Membership-link-state packet (GM-LSP) to advertise the presence of receivers to remote edge devices. The remote edge devices include the overlay interface in the Outbound Interface List (OIL) for the corresponding multicast group. OTV does not program multicast MAC addresses in the forwarding tables but rather updates the OIL state as necessary.

All learned MAC addresses are stored in the RIB with the associated remote IP addresses.

MAC Address Reachability Updates

The OTV control plane uses IS-IS link-state packets (LSPs) to propagate MAC address to IP address mappings to all edge devices in an overlay network. These address mappings contain the MAC address, VLAN ID, and the associated IP address of the edge device that the MAC address is reachable from.

An AED uses IGMP snooping to learn all multicast IP addresses in the local site. OTV includes these IP addresses in a special GM-LSP that is sent to remote edge devices in an overlay network.

Multicast Group Addresses and IGMP Snooping

OTV uses a multicast group address that is assigned from the transport network to create a unique multicast group between remote sites on an overlay network. Each edge device in an overlay network acts as a multicast host and sends an IGMP report message to join the multicast group. OTV sends encapsulated OTV control-plane hello messages and MAC routing updates across this multicast group.

OTV uses IGMP snooping and group membership advertisements (GM-LSPs) to learn all multicast group members from remote sites. OTV also uses IGMP snooping to detect all multicast groups in a local site.

ARP Cache

OTV can suppress unnecessary ARP messages from being sent over an overlay network. OTV builds a local Layer 3-to-Layer 2 mapping for remote hosts. Any ARP requests from local hosts are served by this ARP cache.

High Availability

OTV supports stateful switchovers. A stateful switchover occurs when the active supervisor switches to the standby supervisor. There may be a few seconds of traffic loss while the OTV tunnel is recreated following a switchover.

OTV IS-IS

OTV uses the IS-IS protocol for control-plane learning of MAC entries. The OTV IS-IS component is responsible for transporting MAC information across all VPN sites. It carries unicast and multicast MAC information encoded in type, length, values (TLVs).

On the site-facing interface, OTV IS-IS is responsible for sending IS-IS hello (IIH) packets on the site VLAN by using a multicast MAC destination address. Using a multicast MAC address ensures that all Layer 2 switches in a site forward the packet and that the packet reaches all other OTV edge devices. Each site has a configured site ID. The site ID is advertised by each edge device through the overlay interface. The site ID is used to identify all edge devices belonging to the same site. IS-IS assigns an AED for each VLAN. The AED for a VLAN is the edge device responsible for announcing local MACs for a given VLAN to remote sites and accepting packets destined for a given VLAN.

On the overlay interface, OTV IS-IS is responsible for sending out IIH packets with site ID TLV on the specific multicast group. Using a multicast group ensures that all remote sites participating in the VPN are automatically discovered and an adjacency is formed among all edge devices belonging to the same VPN. OTV IS-IS also informs OTV whenever a new neighbor is discovered.

OTV IS-IS also handles fast MAC moves between remote sites and the local site and guards against fast oscillations in the event of misconfigurations where the same MAC address is used in multiple sites.

OTV IS-IS Instances

The creation of an overlay interface triggers the creation of an OTV IS-IS instance. OTV IS-IS supports multiple overlays. There is a one-to-one relationship between an OTV IS-IS instance and an overlay interface. OTV IS-IS discovers neighbors, forms adjacencies, and exchanges unicast MAC and multicast group information per overlay. All IS-IS databases, such as the adjacency database and the LSP database, are maintained per overlay.

OTV IS-IS forms only level-1 adjacencies. It advertises the primary IP/IPv6 address of the primary external interface in its hellos and protocol data units (PDUs). This address along with the system ID of the neighbor is added to OTV, which stores this information in its overlay adjacency database.

OTV IS-IS MLRIB Interactions

OTV IS-IS is a client of Multilayer Routing Information Base (MLRIB) for Layer 2. OTV IS-IS registers with MLRIB to get notifications for all local Layer 2 unicast and multicast address additions or deletions. Unicast MAC address information is put in OTV IS-IS LSPs, while multicast address information is put in OTV IS-IS multicast group PDUs for flooding to all remote sites.

Based on neighbor LSP advertisements, OTV IS-IS adds MAC reachability information for remote unicast and multicast group addresses to MLRIB. When OTV is disabled on a VLAN (the VLAN is removed from the list of OTV-advertised VLANs), OTV IS-IS withdraws the remote reachability information from MLRIB.

How to Configure OTV

Creating an Overlay Interface

An overlay interface is a logical interface that connects to remote edge devices in an overlay network through an associated physical interface on the transport network. After creating an overlay interface, you must associate the overlay interface with a physical interface and configure a multicast group address. For more information, see the "Associating an Overlay Interface with a Physical Interface" and "Configuring a Multicast Group Address" sections.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **otv vpn-name** *name*
5. **description** *string*
6. **end**
7. **show otv overlay** *overlay-interface*

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	**interface overlay** *interface* **Example:** `Device(config)# interface overlay 1`	Creates an OTV overlay interface and enters interface configuration mode. • The range is from 0 to 512.
Step 4	**otv vpn-name** *name* **Example:** `Device(config-if)# otv vpn-name overlay1`	(Optional) Creates an alias for the OTV overlay interface name. • The alias name is case-sensitive and must be no more than 20 alphanumeric characters in length.
Step 5	**description** *string* **Example:** `Device(config-if)# description site4`	(Optional) Adds a description for the overlay network. • The description string can be up to 200 characters in length.
Step 6	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.
Step 7	**show otv overlay** *overlay-interface* **Example:** `Device# show otv overlay 1`	(Optional) Displays the OTV overlay interface configuration.

Example

The following sample output shows the configuration of overlay interface 1:

```
Device# show otv overlay 1

Overlay Interface Overlay1
 VPN name                 : None
 VPN ID                   : 1
 State                    : UP
 AED Capable              : Yes
 IPv4 control group       : 224.0.0.1
 Mcast data group range(s): 239.0.0.1/8
 Join interface(s)        : GigabitEthernet 0/0/0
 Join IPv4 address        : 209.165.201.1
 Tunnel interface(s)      : Tunnel0
 Encapsulation format     : GRE/IPv4
 Site Bridge-Domain       : 100
 Capability               : Multicast-reachable
 Is Adjacency Server      : No
 Adj Server Configured    : No
 Prim/Sec Adj Svr(s)      : None
```

Associating an Overlay Interface with a Physical Interface

After creating an overlay interface, perform this task to associate the overlay interface with a physical interface. Define a physical Layer 3 interface as the join interface for the overlay, and associate the join interface with the overlay interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **otv join-interface** *type number*
5. **end**
6. **show otv overlay** *overlay-interface*

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	**interface overlay** *interface* **Example:** Device(config)# interface overlay 1	Creates an OTV overlay interface and enters interface configuration mode. • The range is from 0 to 512.
Step 4	**otv join-interface** *type number* **Example:** Device(config-if)# otv join-interface gigabitethernet 0/0/2	Joins the OTV overlay interface with a physical Layer 3 interface. • You must configure an IP address on the physical interface. • You can specify only one join interface per overlay. • A single join interface on a device is shared across all overlays.
Step 5	**end** **Example:** Device(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.
Step 6	**show otv overlay** *overlay-interface* **Example:** Device# show otv overlay 1	(Optional) Displays the OTV overlay interface configuration.

What to Do Next

To enable unicast and multicast IP forwarding on a join interface, perform the following tasks after creating the join interface:

• Configure the IP address and mask for the join interface by using the **ip address** command.

• Configure the join interface to operate in Protocol Independent Multicast (PIM) passive mode by using the **ip pim passive** command.

• Enable IP multicast routing by using the **ip multicast-routing distributed** command.

• Configure IGMPv3 on the join interface by using the **ip igmp version 3** command.

Configuring a Multicast Group Address

Perform this task to configure a unique multicast group address for each overlay network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **otv control-group** *multicast-address*
5. **otv data-group** *multicast-address/mask*
6. **end**
7. **show otv data-group** [**local** | **remote**] [**detail**]

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	**interface overlay** *interface* **Example:** `Device(config)# interface overlay 1`	Creates an OTV overlay interface and enters interface configuration mode. • The range is from 0 to 512.
Step 4	**otv control-group** *multicast-address* **Example:** `Device(config-if)# otv control-group 239.1.1.1`	Configures a multicast group address used by the OTV control plane for this OTV overlay network. • The multicast group address is an IPv4 address in dotted decimal notation.
Step 5	**otv data-group** *multicast-address/mask* **Example:** `Device(config-if)# otv data-group 232.1.1.0/28`	Configures one or more ranges of local IPv4 multicast group prefixes used for multicast data traffic. • Use SSM multicast groups 232.0.0.0/8. • Enable SSM for the groups by using the **ip pim ssm** command in global configuration mode. • The multicast group address is an IPv4 address in dotted decimal notation. • A subnet mask is used to indicate ranges of addresses. • You can define up to 8 data-group ranges.

	Command or Action	Purpose
Step 6	**end** **Example:** Device(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.
Step 7	**show otv data-group** [**local**	**remote**] [**detail**] **Example:** Device# show otv data-group	(Optional) Displays the advertised multicast groups.

Configuring a VLAN over an Overlay Interface

Ethernet service instances are configured with VLAN encapsulation on an overlay interface to define the VLANs that are part of an overlay network. MAC addresses learned on the service instances' bridge domains are advertised to other edge devices on the overlay along with the service instances' VLAN.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **service instance** *interface* **ethernet**
5. **encapsulation dot1q** *vlan-ID*
6. **bridge-domain** *bridge-domain-ID*
7. **end**
8. **show otv vlan**

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	**interface overlay** *interface* **Example:** Device(config)# interface overlay 1	Creates an OTV overlay interface and enters interface configuration mode. • The range is from 0 to 512.
Step 4	**service instance** *interface* **ethernet** **Example:** Device(config-if)# service instance 20 ethernet	Configures an Ethernet service instance on the overlay interface being configured and enters service instance configuration mode. • The service instance identifier range is from 1 to 8000.
Step 5	**encapsulation dot1q** *vlan-ID* **Example:** Device(config-if-srv)# encapsulation dot1q 10	Defines the VLAN encapsulation format as IEEE 802.1Q and specifies the VLAN identifier.
Step 6	**bridge-domain** *bridge-domain-ID* **Example:** Device(config-if-srv)# bridge-domain 100	Binds the specified bridge domain to a service instance.
Step 7	**end** **Example:** Device(config-if-srv)# end	Exits service instance configuration mode and returns to privileged EXEC mode.
Step 8	**show otv vlan** **Example:** Device# show otv vlan	(Optional) Displays VLAN information for the overlay interface.

Configuring the Site Bridge Domain and the Site Identifier

A site bridge domain is used by OTV to identify the service instance where local hello messages should be sent. There should be an Ethernet service instance configured with the site bridge domain on the internal interface. OTV uses the configured VLAN encapsulation (if any) from this service instance to encapsulate local hello messages before sending out a message from the local interface.

A site identifier is advertised by each edge device in an overlay network and is used to identify all edge devices belonging to the same site. All edge devices in the same site should be configured with the same site identifier.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **otv site bridge-domain** *bridge-domain-ID*
4. **exit**
5. **otv site-identifier** *site-ID*
6. **end**

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	**otv site bridge-domain** *bridge-domain-ID* **Example:** `Device(config)# otv site bridge-domain 1`	Configures the site bridge domain for sending IS-IS hellos over site interfaces and enters OTV site configuration mode. • The *bridge-domain-ID* range is from 1 to 4096. • One or more Ethernet service instances should be configured on the internal interface with the same bridge domain ID.
Step 4	**exit** **Example:** `Device(config-otv-site)# exit`	Exits OTV site configuration mode and returns to global configuration mode.
Step 5	**otv site-identifier** *site-ID* **Example:** `Device(config)# otv site-identifier 0000.0010.0020`	Configures the site identifier. • You should configure the same site identifier on all OTV edge devices in the same site. • The site identifier should be unique across different sites. • The range is from 0x1 to 0xffffffff. The default is 0x0. The format is either hexadecimal or MAC address format.
Step 6	**end** **Example:** `Device(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

Configuring Authentication for OTV IS-IS Hellos

You can configure authentication for OTV IS-IS hello messages. OTV uses hello authentication to authenticate a remote site before OTV creates an adjacency to that remote site. Each overlay network uses a unique authentication key. An edge device creates an adjacency only with a remote site that shares the same authentication key and authentication method.

OTV supports the following authentication methods:

- Clear text
- Message digest algorithm 5 (MD5)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **otv isis authentication mode** {**md5** | **text**}
5. **otv isis authentication key-chain** *key-chain-name*
6. **end**
7. **show otv** [**overlay** *overlay-interface*] **adjacency**

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	**interface overlay** *interface* **Example:** `Device(config)# interface overlay 1`	Creates an OTV overlay interface and enters interface configuration mode. - The range is from 0 to 512.

	Command or Action	**Purpose**
Step 4	**otv isis authentication mode** {**md5**	**text**} **Example:** `Device(config-if)# otv isis authentication mode md5`	Configures the authentication method.
Step 5	**otv isis authentication key-chain** *key-chain-name* **Example:** `Device(config-if)# otv isis authentication key-chain OTVkey`	Configures an authentication key chain for edge device authentication. • The key-chain name is case-sensitive and can be up to 16 alphanumeric characters in length.
Step 6	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.
Step 7	**show otv** [**overlay** *overlay-interface*] **adjacency** **Example:** `Device# show otv overlay 1 adjacency`	(Optional) Displays the OTV adjacency information.

Configuring Authentication for OTV IS-IS PDUs

Configure OTV to authenticate all incoming OTV IS-IS PDUs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **otv isis overlay** *overlay-interface*
4. **authentication mode** {**md5** | **text**}
5. **authentication key-chain** *key-chain-name*
6. **end**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	**Purpose**
Step 2	**configure terminal** **Example:** Device# configure terminal	Enters global configuration mode.
Step 3	**otv isis overlay** *overlay-interface* **Example:** Device(config)# otv isis overlay 1	Creates an OTV IS-IS instance and enters OTV IS-IS configuration mode. • The range is from 0 to 512.
Step 4	**authentication mode** {**md5**	**text**} **Example:** Device(config-otv-isis)# authentication mode md5	Configures the authentication method.
Step 5	**authentication key-chain** *key-chain-name* **Example:** Device(config-otv-isis)# authentication key-chain OTVkey	Configures the authentication key chain for PDU authentication. • The key-chain name is case-sensitive and can be up to 16 alphanumeric characters in length.
Step 6	**end** **Example:** Device(config-otv-isis)# end	Exits OTV IS-IS configuration mode and returns to privileged EXEC mode.

Disabling ARP Caching

An ARP cache is maintained by every OTV edge device and is populated by snooping ARP replies. Initial ARP requests are broadcast to all sites, but subsequent ARP requests are suppressed at the edge device and answered locally. OTV edge devices respond to ARP requests on behalf of remote hosts. Perform this task to allow ARP requests over an overlay network and to disable ARP caching on OTV edge devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **no otv suppress arp-nd**
5. **end**
6. **show otv** [**overlay** *overlay-interface*] **arp-nd-cache**

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	**interface overlay** *interface* **Example:** Device(config)# interface overlay 1	Creates an OTV overlay interface and enters interface configuration mode. • The range is from 0 to 512.
Step 4	**no otv suppress arp-nd** **Example:** Device(config-if)# no otv suppress arp-nd	Allows ARP requests over an overlay network and disables ARP caching on edge devices. • This command does not support IPv6.
Step 5	**end** **Example:** Device(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.
Step 6	**show otv** [**overlay** *overlay-interface*] **arp-nd-cache** **Example:** Device# show otv arp-nd-cache	(Optional) Displays the OTV Layer 2 to Layer 3 address mapping cache used for ARP suppression.

Tuning OTV Parameters

You can tune parameters for the overlay routing protocol.

Note   We recommend that only experienced users of OTV perform these configurations.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface overlay** *interface*
4. **otv isis csnp-interval** *seconds*
5. **otv isis hello-interval** [*seconds* | **minimal**]
6. **otv isis hello-multiplier** *multiplier*
7. **otv isis hello padding**
8. **otv isis lsp-interval** *milliseconds*
9. **otv isis metric** {*metric* | **maximum**} [*delay-metric* | *expense-metric* | *error-metric*]
10. **otv isis priority** *value*
11. **end**

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	**interface overlay** *interface* **Example:** Device(config)# interface overlay 1	Creates an OTV overlay interface and enters interface configuration mode.
Step 4	**otv isis csnp-interval** *seconds* **Example:** Device(config-if)# otv isis csnp-interval 100	(Optional) Specifies the interval between complete sequence number PDUs (CSNPs) sent on an interface.
Step 5	**otv isis hello-interval** [*seconds*	**minimal**] **Example:** Device(config-if)# otv isis hello-interval 30	(Optional) Specifies the interval between hello PDUs on an interface.
Step 6	**otv isis hello-multiplier** *multiplier* **Example:** Device(config-if)# otv isis hello-multiplier 30	(Optional) Specifies the multiplier that is used to calculate the interval within which hello PDUs must be received to keep the OTV adjacency up.

	Command or Action	Purpose
Step 7	**otv isis hello padding** **Example:** Device(config-if)# otv isis hello padding	(Optional) Pads OTV hello PDUs to the full MTU length.
Step 8	**otv isis lsp-interval** *milliseconds* **Example:** Device(config-if)# otv isis lsp-interval 30	(Optional) Specifies the interval between LSP PDUs on an interface during flooding.
Step 9	**otv isis metric** {*metric* | **maximum**} [*delay-metric* | *expense-metric* | *error-metric*] **Example:** Device(config-if)# otv isis metric 25	(Optional) Configures the OTV metric on an interface.
Step 10	**otv isis priority** *value* **Example:** Device(config-if)# otv isis priority 6	(Optional) Configures the OTV priority for the designated router election on an IS-IS interface.
Step 11	**end** **Example:** Device(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Verifying the OTV Configuration

Use the following commands to display the required OTV configuration information. You can use one or more commands, as required, in any order.

SUMMARY STEPS

1. **show otv** [**overlay** *overlay-interface*]
2. **show otv** [**overlay** *overlay-interface*] **arp-nd-cache**
3. **show otv data-group** [**local** \| **remote**] [**detail**]
4. **show otv log** {**event** \| **error**}
5. **show otv** [**overlay** *overlay-interface*] **adjacency**
6. **show otv** [**overlay** *overlay-interface*] **vlan** [**authoritative**]
7. **show otv** [**overlay** *overlay-interface*] **site**
8. **show otv route**
9. **show otv mroute**

DETAILED STEPS

Step 1   **show otv** [**overlay** *overlay-interface*]
Use this command to display the overlay status and parameters.

Example:
```
Device# show otv
```

Step 2   **show otv** [**overlay** *overlay-interface*] **arp-nd-cache**
Use this command to display the Layer 3 to Layer 2 address mapping cache that is used for ARP suppression.

Example:
```
Device# show otv arp-nd-cache
```

Step 3   **show otv data-group** [**local** | **remote**] [**detail**]
Use this command to display the advertised multicast groups.

Example:
```
Device# show otv data-group
```

Step 4   **show otv log** {**event** | **error**}
Use this command to display the OTV debug log of events or errors.

Example:
```
Device# show otv log event
```

Step 5   **show otv** [**overlay** *overlay-interface*] **adjacency**
Use this command to display information about neighbors in an overlay network.

Example:
```
Device# show otv adjacency
```

Step 6   **show otv** [**overlay** *overlay-interface*] **vlan** [**authoritative**]
Use this command to display information about the enabled OTV VLANs.

Example:
```
Device# show otv vlan
```

Step 7   **show otv** [**overlay** *overlay-interface*] **site**
Use this command to display OTV site information such as the site VLAN and neighbors within the site.

Example:
```
Device# show otv site
```

Step 8   **show otv route**
Use this command to display unicast OTV MAC routes from the MLRIB route database.

Example:
```
Device# show otv route
```

Step 9   **show otv mroute**
Use this command to display OTV multicast routes from the MLRIB route database.

Example:
```
Device# show otv mroute
```

Configuration Examples for OTV Features

Example: Configuring Overlay Interface and VLANs

The following example shows how to create and configure an overlay interface and how to configure VLANs on this overlay interface:

```
ip multicast-routing distributed
!
otv site bridge-domain 1
otv site-identifier 0000.0000.0050
!
interface overlay 2
 otv control-group 225.0.0.1
 otv data-group 232.10.10.0/8
 otv join-interface GigabitEthernet 0/0/0
 no shutdown
!
service instance 10 ethernet
 encapsulation dot1q 100
 bridge-domain 200
service instance 11 ethernet
 encapsulation dot1q 101
 bridge-domain 201
!
interface GigabitEthernet 0/0/0
 ip address 209.165.200.1 255.255.255.224
 ip pim passive
 ip igmp version 3
!
interface GigabitEthernet 0/0/1
 service instance 1 ethernet
  encapsulation untagged
  bridge-domain 1
 service instance 50 ethernet
  encapsulation dot1q 100
  bridge-domain 200
 service instance 51 ethernet
  encapsulation dot1q 101
  bridge-domain 201
!
ip pim ssm default
```
The following is sample output from the **show otv** command:

```
Device# show otv

Overlay Interface Overlay1
```

```
VPN name                 : None
VPN ID                   : 1
State                    : UP
AED Capable              : Yes
IPv4 control group       : 225.0.0.1
Mcast data group range(s): 232.10.10.0/8
Join interface(s)        : GigabitEthernet0/0/0
Join IPv4 address        : 209.165.200.1
Tunnel interface(s)      : Tunnel0
Encapsulation format     : GRE/IPv4
Site Bridge-Domain       : 4
Capability               : Multicast-reachable
Is Adjacency Server      : No
Adj Server Configured    : No
Prim/Sec Adj Svr(s)      : None
```

The following sample output from the **show otv adjacency** command shows the OTV overlay adjacency status:

```
Device# show otv adjacency

Overlay 1 Adjacency Database
Hostname  System-ID       Dest Addr          Up Time   State
ED2       0023.33cc.ea00  209.165.200.225    1w3d      UP
ED4       000e.0cbc.5d6e  209.165.201.1      1w3d      UP
ED5       68ef.bdca.8d00  209.165.202.129    4d03h     UP
```

The following sample output from the **show otv vlan** command shows the OTV VLAN AED status:

```
Device# show otv vlan

Key:  SI - Service Instance

Overlay 1 VLAN Configuration Information
 Inst VLAN  Bridge-Domain Auth  Site Interface(s)
 0    2     2             yes   Gi0/0/0:SI2
 0    3     3             yes   Gi0/0/1:SI3
 0    4     4             yes   Gi0/0/1:SI4
 0    5     5             yes   Gi0/0/1:SI5
 0    10    10            yes   Gi0/0/1:SI10
 0    11    11            yes   Gi0/0/1:SI11
 0    12    12            yes   Gi0/0/1:SI12
 0    13    13            yes   Gi0/0/1:SI13
 0    17    17            yes   Gi0/0/1:SI17
 0    18    18            yes   Gi0/0/1:SI18
Total VLAN(s): 10
 Total Authoritative VLAN(s): 10
```

The following sample output from the **show otv route** command shows the OTV unicast routing table:

```
Device# show otv route

Codes: BD - Bridge-Domain, AD - Admin-Distance,
       SI - Service Instance, * - Backup Route

OTV Unicast MAC Routing Table for Overlay1

 Inst VLAN BD     MAC Address     AD    Owner  Next Hops(s)
 0    5    5      0030.96e6.fc38 40    BD Eng Gi0/0/1:SI5
 0    5    5      0030.96e6.fc37 50    ISIS   ED3
 0    10   10     0030.96e6.fc39 50    ISIS   ED3
 0    12   12     0030.96e6.fc33 50    ISIS   ED3

4 unicast routes displayed in Overlay1

-----------------------------------------------------------
4 Total Unicast Routes Displayed
```

The following sample output from the **show otv mroute** command shows the OTV multicast routing table:

```
Device# show otv mroute

OTV Multicast Routing Table for Overlay1

Bridge-Domain = 2, s = *, g = *
 Outgoing interface list:
```

```
  Default, NoRedist
 Incoming interface count = 0, Outgoing interface count = 1

Bridge-Domain = 3, s = *, g = *
 Outgoing interface list:
  Default, NoRedist
 Incoming interface count = 0, Outgoing interface count = 1

Bridge-Domain = 4, s = *, g = *
 Outgoing interface list:
  Default, NoRedist
 Incoming interface count = 0, Outgoing interface count = 1

Bridge-Domain = 10, s = *, g = 224.0.1.40
 Outgoing interface list:
  Overlay1, ED3
 Incoming interface count = 0, Outgoing interface count = 1

Bridge-Domain = 11, s = *, g = *
 Outgoing interface list:
  Default, NoRedist
 Incoming interface count = 0, Outgoing interface count = 1
5 multicast routes displayed in Overlay1


-----------------------------------------------------------
5 Total Multicast Routes Displayed
```

The following sample output from the **show otv data-group** command shows the OTV data group multicast address mappings:

```
Device# show otv data-group

Flags:  D - Local active source dynamically detected
        S - Local active source statically configured
        J - Data group has been joined in the core
        U - Data group has not been joined in the core

Remote Active Sources for Overlay1
 BD    Active-Source    Active-Group    Delivery-Source    Delivery-Group    Flags
 1     10.0.1.1         232.0.0.1       209.165.201.10     232.5.0.0         U
 2     10.0.2.1         232.0.0.1       209.165.201.10     232.5.0.1         U
 3     10.0.3.1         232.0.0.1       209.165.201.10     232.5.0.2         U
 4     10.0.4.1         232.0.0.1       209.165.201.10     232.5.0.3         U
 5     10.0.5.1         232.0.0.1       209.165.201.10     232.5.0.4         J
 6     10.0.6.1         232.0.0.1       209.165.201.10     232.5.0.5         J
Displayed 6 remote data-group mappings

Local Active Sources for Overlay1
 BD    Active-Source    Active-Group    Delivery-Source    Delivery-Group    Flags
 1     10.0.1.1         232.0.0.1       209.165.201.10     232.5.0.0         D
 2     10.0.2.1         232.0.0.1       209.165.201.10     232.5.0.1         D
 3     10.0.3.1         232.0.0.1       209.165.201.10     232.5.0.2         D
 4     10.0.4.1         232.0.0.1       209.165.201.10     232.5.0.3         D
 5     10.0.5.1         232.0.0.1       209.165.201.10     232.5.0.4         D
 6     10.0.6.1         232.0.0.1       209.165.201.10     232.5.0.5         D
 7     10.0.7.1         232.0.0.1       209.165.201.10     232.5.0.6         D
 8     10.0.8.1         232.0.0.1       209.165.201.10     232.5.0.7         D
 9     10.0.9.1         232.0.0.1       209.165.201.10     232.5.0.8         D
Displayed 9 local data-group mappings
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Wide-area networking commands: complete command syntax, command mode, defaults, usage guidelines, and examples	Cisco IOS Wide-Area Networking Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 2461	*Neighbor Discovery for IPv6*

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 OTV

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 2: Feature Information for OTV

Feature Name	Releases	Feature Information
OTV—Overlay Transport Virtualization	Cisco IOS XE Release 3.5S	

Feature Name	Releases	Feature Information
		OTV provides Layer 2 connectivity between remote network sites by using MAC-address-based routing and IP-encapsulated forwarding across a transport network to provide support for applications that require Layer 2 adjacency. The following commands were introduced or modified: **authentication key-chain (OTV)**, **authentication mode (OTV)**, **authentication send-only (OTV)**, **clear otv arp-nd**, **clear otv isis**, **clear otv isis lspfull**, **clear otv isis neighbors**, **clear otv isis rib**, **debug l2fib**, **debug mlrib common**, **debug mlrib layer2**, **debug otv**, **debug otv isis**, **debug platform software l2fib**, **debug platform software otv**, **debug platform hardware qfp feature otv client**, **debug platform hardware qfp feature otv datapath**, **hostname dynamic (OTV)**, **interface overlay**, **log-adjacency-changes (OTV)**, **lsp-gen-intervaL (OTV)**, **lsp-mtu (OTV)**, **lsp-refresh-interval (OTV)**, **max-lsp-lifetime (OTV)**, **nsf (OTV)**, **otv active-source**, **otv control-group**, **otv data-group**, **otv filter-fhrp**, **otv fragmentation**, **otv isis authentication**, **otv isis csnp-interval**, **otv isis hello-interval**, **otv isis hello-multiplier**, **otv isis hello padding**, **otv isis lsp-interval**, **otv isis metric**, **otv isis overlay**, **otv isis priority**, **otv isis retransmit-interval**, **otv isis retransmit-throttle-interval**, **otv isis site otv join-interface**, **otv mac flood**, **otv site bridge-domain**, **otv site-identifier**, **otv suppress arp-nd**, **otv vpn-name**, **prc-interval (OTV)**, **show l2fib**, **show mlrib common log**, **show**

Feature Name	Releases	Feature Information
		mlrib layer2 log, **show otv**, **show otv adjacency**, **show otv arp-nd-cache**, **show otv data-group**, **show otv isis database**, **show otv isis hostname**, **show otv isis lsp-log**, **show otv isis neighbors**, **show otv isis nsf**, **show otv isis protocol**, **show otv isis rib**, **show otv isis spf-log**, **show otv isis vlan-database**, **show otv log**, **show otv mroute**, **show otv route**, **show otv site**, **show otv statistics**, **show otv summary**, **show otv vlan**, **show platform hardware qfp feature otv client interface**, **show platform software l2fib fp**, **show platform software l2fib rp**, **show platform software otv fp**, **skeptical interval (OTV)**, **spf-interval (OTV)**.