



## Implementing DCI VXLAN Layer 3 Gateway

This chapter module provides conceptual and configuration information for Data Center Interconnect (DCI) VXLAN Layer 3 Gateway on Cisco ASR 9000 Series Router.

Release	Modification
Release 5.3.2	This feature was introduced.
Release 6.1.x	<ul style="list-style-type: none"><li>• OpFlex</li></ul>

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## Prerequisites for Implementing Data Center Interconnect Layer 3 Gateway

- You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.
- You need to have understanding of the following features:
  - VxLAN: For detailed conceptual and configuration information, see the chapters *Implementing Layer 2 VxLAN Gateway* and *Implementing Layer 3 VxLAN Gateway* in *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide* and *Cisco ASR 9000 Series Aggregation Services Router MPLS Layer 3 VPN Configuration Guide*.
  - MP-BGP: For detailed conceptual and configuration information, see the chapter *Implementing BGP* in the *Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide*.

- MPLS L3VPN: For detailed conceptual and configuration information, see the *Cisco ASR 9000 Series Aggregation Services Router MPLS Layer 3 VPN Configuration Guide*.

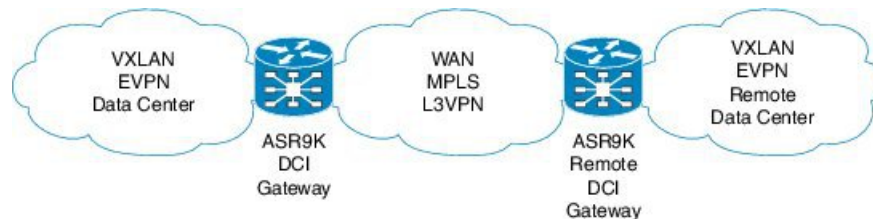
## Data Center Interconnect VXLAN Layer 3 Gateway

The Cisco ASR 9000 Series Router can serve as a Data Center Interconnect (DCI) L3 Gateway to provide IP connectivity between multi-tenant remote Data Center sites. Consider the following network topology, which has two Data Center sites connected through the intermediate Service Provider network. The multi-tenant Data Centers use VXLAN encapsulation to carry separate tenant IP traffic. The VXLAN-enabled Data Center sites use MP-BGP EVPN control plane for distributing both Layer-2 and Layer-3 forwarding information within the site. The RFC 5512 and *draft-ietf-bess-evpn-inter-subnet-forwarding-00* define how MP-BGP Network Layer Reachability Information (NLRI) carries VXLAN encapsulation as well as L2/L3 forwarding information details to provide an integrated routing and bridging solution within the Data Center site. The Cisco ASR 9000 Series Router uses MPLS L3VPN application service over the Service Provider network to provide L3 connectivity between the two Data Center sites.



**Note** DCI Gateway does not provide layer 2 inter-connectivity across Data Centers.

**Figure 1: Data Center Interconnect Layer 3 Gateway**



The Cisco ASR 9000 Series Router functions as a Data Center Interconnect (DCI) gateway by intermediating between the two MP-BGP control planes, one on the Data Center site and the other on the MPLS L3VPN network. To enable this exchange of forwarding information between the two MP-BGP control planes, the DCI router has a VRF instance configured with two sets of import and export route-targets. One set of import/export route targets is associated with the Data Center BGP neighbor router that uses MP-BGP EVPN with route type 5 NLRI to exchange VXLAN encapsulation and L3 routing information with the DCI router. The other set of import/export route-targets is associated with the L3VPN BGP neighbor in the service provider network that uses VPNv4 or VPNv6 address-family to exchange L3 and MPLS information. The DCI router exchanges the IP prefixes in VRF instance as L3VPN NLRIs with the L3VPN BGP neighbor and as EVPN NLRIs with the EVPN BGP neighbor and thus, effectively stitches these two sets of route targets. This enables the DCI router to convert the received Data Center EVPN forwarding information into VPNv4 or VPNv6 routes that, in turn, is to be forwarded to the remote DCI router and vice versa. The remote DCI router connected to the remote Data Center performs same functions. This enables L3 connectivity between two hosts located across remote Data Center sites. The DCI Gateway enables tenant Layer 3 data traffic movement across remote Data Centers by stitching the per-tenant VXLAN encapsulation in the DCI Gateway router to the per-tenant MPLS encapsulation in L3VPN service provider network.

The DCI L3 Gateway can be configured on the Provider Edge (PE) router or a Data Center router that connects to the WAN. The WAN network can be any VRF-deployed network configured with any control plane protocol. For example, a VRF-lite WAN network configured with an IGP.



**Note** In a DCI deployment, for route reoriginate with stitching-rt for a particular VRF, using the same Route Distinguisher (RD) between ASR9K DCI and MPLS-VPN PE or same RD between ASR9K DCI and VxLAN Top of Rack (ToR) is not supported.

## Route Targets

For each VRF on the DCI router, there are two sets of manually configured import and export route-targets. One set of import and export route-targets is associated with the Data Center BGP neighbor that uses EVPN address-family to exchange L3 information; the other set of import and export route-targets is associated with the L3VPN BGP neighbor that use VPNv4 or VPNv6 unicast address-family to exchange L3 information. This separation of route targets (RTs) enables the two sets of RTs to be independently configured. The DCI router effectively stitches the two set of RTs. The RTs associated with the EVPN BGP neighbor are labelled as stitching RTs. The RTs associated with the L3VPN BGP neighbor are normal RTs.

## Route Re-origination

Consider the case of control plane information propagation by the DCI from the L3VPN side to the Data Center side. Here, instead of advertising the remote Data Center's original BGP EVPN routes, you can configure the DCI router to advertise to its BGP EVPN neighbor the routes that are re-originated after importing them from the L3VPN BGP neighbor. For this case of VPNv4 or VPNv6 routes being propagated to the BGP EVPN neighbors (Data Center neighbors), re-originating the routes refers to replacing the normal route-targets with the local route-target values associated with the BGP EVPN neighbors. The converse holds true for the routing information traffic propagation from the BGP EVPN control plane to BGP L3VPN control plane. You can configure this re-origination by using the re-originate keyword in the **import re-originate** command. Configuring this command, by default, also enables advertisement of L2VPN EVPN prefixes to the EVPN BGP neighbors. You can suppress native L2VPN EVPN address-family NLRI advertisements towards the EVPN Neighbor using the **advertise l2vpn evpn disable** command under the EVPN BGP address-family configuration mode.

## Route Address-Family and Encoded Address-Family

When an address-family is configured for a BGP neighbor, it means that the specified address-family routes encoded with the NLRI for that address-family is advertised to the neighbor. This does not hold for data center BGP neighbors because they use only EVPN address-family. Here, BGP neighbors advertise VPNv4 or VPNv6 unicast routes using the EVPN NLRI encoding. Thus, here the encoded address-family and route address family can be possibly different. You can advertise the VPNv4 or VPNv6 address-family using the **advertise vpnv4 unicast** or **advertise vpnv6 unicast** command. For example, a EVPN address-family BGP neighbor configured with the **advertise vpnv4 unicast** command sends VPNv4 unicast routes in an EVPN encoded NLRI.

## Local VPNv4 or VPNv6 Routes Advertisement

On the DCI router, the locally sourced VPNv4 or VPNv6 routes can be advertised to the BGP EVPN neighbors with the normal route targets (RTs) configured for the VRF or the stitching RTs associated with the BGP EVPN neighbors. By default, these routes are advertised with the normal route targets. You can configure these local VPNv4 or VPNv6 route advertisements to be advertised with stitching RTs to the BGP EVPN

neighbors by using the **advertise vpnv4 unicast local stitching-rt** or **advertise vpnv6 unicast local stitching-rt** command as required.

## Data Center VXLAN with Support for MP-BGP

The Data Center VXLAN uses MP-BGP for control-plane learning of end-host Layer 2 and Layer 3 reachability information. The DCI router is configured with a VXLAN Tunnel EndPoint (VTEP). For VTEP configuration details, see the chapter *Implementing Layer 3 VXLAN Gateway*. You also need to run the **host-reachability protocol bgp** command to specify that control-plane learning within Data center site is through BGP routing protocol.

The DCI Gateway router and the EVPN BGP neighbor (Data Center BGP neighbor) exchange BGP EVPN NLRIs of route type 5 that carry L3 routing information and associated VXLAN encapsulation information. Some of the VXLAN information is carried in the EVPN NLRI and the rest is carried in RFC 5512 Tunnel Type Encapsulation EXTCOMM and Router MAC EXTCOMM defined in *draft-ietf-bess-evpn-inter-subnet-forwarding-00*. BGP downloads VXLAN encapsulation as *RIB remote next hop opaque* attribute to L3RIB.

## Default-Originate Forwarding to BGP EVPN Neighbor

Instead of advertising the specific networks available in the remote Data Center, you can configure the DCI gateway to advertise a default route to the directly connected Data Center neighbor. To send the default route for a VRF instance to the Data Center BGP EVPN neighbor, the VPN default-originate information that is typically forwarded to the L3VPN BGP neighbor, is also configured to be forwarded to the BGP EVPN neighbor in the Data Center. To do so, you need to configure **allow vpn default-originate** command in the BGP VRF configuration mode and also configure **default-originate** command under EVPN BGP neighbor in L2VPN EVPN address-family configuration mode. This configures BGP to forward only one default route information for a VRF instance from the DCI Gateway to the BGP neighbor that has L2VPN EVPN address-family. This default route information is encoded in the EVPN "IP Prefix Route" NLRI.

With the advertisement of a default route to the connected Data Center, the DCI Gateway should not advertise specific prefixes of the remote Data Center to the BGP EVPN neighbor. To prevent forwarding of VRF prefixes, you need to configure the DCI gateway with a EVPN BGP neighbor policy that drops forwarding of all prefixes.

## Configure Data Center Interconnect Router

This section describes tasks to configure the Data Center Interconnect (DCI) router. Perform the following tasks to complete the configuration:

### Configure VRF and route targets import/export rules

Perform the following steps to configure VRF and define route targets to be used for import and export of forwarding information.

#### SUMMARY STEPS

1. **configure**
2. **vrf** *vrf-name*

3. **address-family { ipv4 | ipv6 } unicast**
4. **import route-target route-target-id**
5. **export route-target route-target-id**
6. **import route-target route-target-id stitching**
7. **export route-target route-target-id stitching**
8. **commit**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>	
<b>Step 2</b>	<b>vrf vrf-name</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# vrf data-center-10	Defines a VPN routing and forwarding (VRF) instance and enters VRF configuration mode.
<b>Step 3</b>	<b>address-family { ipv4   ipv6 } unicast</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-vrf-af)# address-family ipv4 unicast	Specifies either the IPv4 or IPv6 address family for the VRF instance and enters address family configuration submode.
<b>Step 4</b>	<b>import route-target route-target-id</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-vrf-af)# import route-target 1:1	Configures importing of routes to the VRF from the L3VPN BGP NLRI that have the matching route-target value.
<b>Step 5</b>	<b>export route-target route-target-id</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-vrf-af)# export route-target 1:2	Configures exporting of routes from the VRF to the L3VPN BGP NLRI and assigns the specified route-target identifiers to the L3VPN BGP NLRI.
<b>Step 6</b>	<b>import route-target route-target-id stitching</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-vrf-af)# import route-target 10:1 stitching	Configures importing of routes from the EVPN BGP NLRI that have the matching route-target value.
<b>Step 7</b>	<b>export route-target route-target-id stitching</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-vrf-af)# export route-target 10:2 stitching	Configures exporting of routes from the VRF to the EVPN BGP NLRI and assigns the specified route-target identifiers to the BGP EVPN NLRI.
<b>Step 8</b>	<b>commit</b>	

## Configure Bridge Domain for DCI Gateway

Perform the following steps to configure the bridge domain on the DCI Gateway.

### SUMMARY STEPS

1. **configure**
2. **interface bvi** *bvi-id*
3. **vrf** *vrf-id*
4. **ipv4 address** *ip-address subnet-mask*
5. **exit**
6. **l2vpn**
7. **bridge group** *bridge-group-identifier*
8. **bridge-domain** *bridge-group-identifier*
9. **routed interface** *interface-identifier*
10. **member vni** *vni-id*
11. **commit**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>	
<b>Step 2</b>	<b>interface bvi</b> <i>bvi-id</i> <b>Example:</b>  RP/0/RSP0/CPU0:router(config)# interface bvi 1	Creates a BVI (Bridge Virtual Interface) with the user-defined identifier and enters the interface configuration mode.
<b>Step 3</b>	<b>vrf</b> <i>vrf-id</i> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-if)# vrf cust1	Associates a VRF (Virtual Routing and Forwarding) instance to the BVI.
<b>Step 4</b>	<b>ipv4 address</b> <i>ip-address subnet-mask</i> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-if)# ipv4 address 40.1.1.1 255.255.255.255	Creates an IPv4 address for the BVI.
<b>Step 5</b>	<b>exit</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config)# exit	Exits the interface configuration mode and returns to Global Configuration mode.
<b>Step 6</b>	<b>l2vpn</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config)# l2vpn	Enters the L2VPN configuration mode.

	Command or Action	Purpose
Step 7	<b>bridge group</b> <i>bridge-group-identifier</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-l2vpn)# bridge group bg1	Configures a bridge group and enters the Bridge Group configuration mode.
Step 8	<b>bridge-domain</b> <i>bridge-group-identifier</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-l2vpn-bg)# bridge-domain bd1	Configures a bridge domain and enters Bridge Domain configuration mode.
Step 9	<b>routed interface</b> <i>interface-identifier</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd)# routed interface BVI1	Configures a BVI interface as a routing interface for the bridge domain.
Step 10	<b>member vni</b> <i>vni-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd)# member vni 5001	Assigns the bridge domain to a VxLAN segment.
Step 11	<b>commit</b>	

## Configure VTEP

Perform the following steps to configure VTEP (VxLAN Terminal EndPoint) on the DCI Gateway.

### SUMMARY STEPS

1. **configure**
2. **interface loopback** *loopback-id*
3. **ipv4 address** *ip-address subnet-mask*
4. **exit**
5. **interface nve** *nve-id*
6. **source interface loopback** *loopback-interface-identifier*
7. **member vni** *vni-id*
8. **vrf** *vrf-id*
9. **host reachability protocol bgp**
10. **commit**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b>	

	Command or Action	Purpose
<b>Step 2</b>	<b>interface loopback</b> <i>loopback-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config)# interface loopback 0</pre>	Creates a loopback interface with the user-defined loopback identifier and enters the interface configuration mode.
<b>Step 3</b>	<b>ipv4 address</b> <i>ip-address subnet-mask</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-if)# ipv4 address 40.1.1.1 255.255.255.255</pre>	Creates an IPv4 address for the loopback interface.
<b>Step 4</b>	<b>exit</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config)# exit</pre>	Exits the interface configuration mode and returns to Global Configuration mode.
<b>Step 5</b>	<b>interface nve</b> <i>nve-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config)# interface nve 1</pre>	Creates an NVE (Network Virtualization Endpoint) interface with the identifier and enters the interface configuration mode.
<b>Step 6</b>	<b>source interface loopback</b> <i>loopback-interface-identifier</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-if)# source interface loopback 0</pre>	Configures the loopback interface IP address as the source IP address for the NVE interface.
<b>Step 7</b>	<b>member vni</b> <i>vni-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-if)# member vni 5001</pre>	Configures the NVE interface under a VxLAN with VNI (VxLAN Network Identifier) 5001 and enters the NVE VNI configuration mode.
<b>Step 8</b>	<b>vrf</b> <i>vrf-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-nve-vni)# vrf cust1</pre>	Associates a VRF (Virtual Routing and Forwarding) instance to the VxLAN segment.
<b>Step 9</b>	<b>host reachability protocol bgp</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-nve-vni)# host reachability protocol bgp</pre>	Specifies BGP protocol as the control protocol for VxLAN VTEP end-host reachability.
<b>Step 10</b>	<b>commit</b>	



## Configure EVPN BGP neighbor and route advertisements

Perform this task on the DCI router to configure BGP neighbor relationship and route advertisements with the EVPN BGP neighbor.

### SUMMARY STEPS

1. **configure**
2. **router bgp** *asn-id*
3. **address-family** *l2vpn evpn*
4. **exit**
5. **neighbor** *neighbor-ip-address*
6. **remote-as** *remote-as-id*
7. **address-family** *l2vpn evpn*
8. *(Optional)* **default-originate**
9. **import** *stitching-rt reoriginate*
10. **advertise** { *vpn4 | vpn6* } **unicast re-originated**
11. **advertise** { *vpn4 | vpn6* } **unicast local stitching-rt**
12. *(Optional)* **advertise** *l2vpn evpn disable*
13. **commit**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b>	
Step 2	<b>router bgp</b> <i>asn-id</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router bgp 100	Specifies the BGP AS number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
Step 3	<b>address-family</b> <i>l2vpn evpn</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# address-family l2vpn evpn	Enables EVPN address family globally under BGP routing process and enters EVPN address family configuration submode.
Step 4	<b>exit</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-af)# exit	Exits the EVPN address family configuration and returns to the BGP router configuration mode.
Step 5	<b>neighbor</b> <i>neighbor-ip-address</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# neighbor 1.1.1.1	Configures the specified neighbor IP address as a BGP peer and enters neighbor configuration mode for BGP routing.

	Command or Action	Purpose
<b>Step 6</b>	<b>remote-as</b> <i>remote-as-id</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# remote-as 100	Specifies the autonomous system identifier of the BGP neighbor.
<b>Step 7</b>	<b>address-family l2vpn evpn</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# address-family l2vpn evpn	Enables EVPN address family under BGP routing process and enters EVPN address family configuration submode.
<b>Step 8</b>	<i>(Optional)</i> <b>default-originate</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# default-originate	<i>(Optional)</i> Configures advertisement of a default route instead of specific prefixes to the BGP EVPN neighbor.
<b>Step 9</b>	<b>import stitching-rt reoriginate</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# import stitching-rt reoriginate	Enables import of routing information from BGP EVPN NLRIs that has route target identifier matching the stitching route target identifier and exports this routing information after re-origination to the L3VPN BGP neighbor.
<b>Step 10</b>	<b>advertise { vpnv4   vpnv6 } unicast re-originated</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise vpnv4 unicast re-originated	Configures advertisement of VPNv4 or VPNv6 unicast routes that are redistributed from the L3VPN BGP neighbor, to the EVPN BGP neighbor. The route targets are changed to the stitching route targets before advertising onto the EVPN BGP neighbor.
<b>Step 11</b>	<b>advertise { vpnv4   vpnv6 } unicast local stitching-rt</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise vpnv4 unicast local stitching-rt	Configures the local VPNv4 or VPNv6 unicast routes to be advertised with stitching route target identifiers to the EVPN BGP neighbor.
<b>Step 12</b>	<i>(Optional)</i> <b>advertise l2vpn evpn disable</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise	Suppresses the advertisement of the L2VPN EVPN routes to the EVPN BGP neighbor. The step 7 <b>address-family l2vpn evpn</b> command, by default, causes the L2VPN EVPN routes to be advertised along with the VPNv4 or VPNv6 unicast routes received from the L3VPN BGP neighbor.
<b>Step 13</b>	<b>commit</b>	

## Configure L3VPN BGP neighbor relationship and route advertisements

Perform the following steps to configure BGP neighbor relationship and route advertisements with the L3VPN BGP neighbor.

### SUMMARY STEPS

1. **configure**
2. **router bgp *asn-id***
3. **address-family { *vpn4* | *vpn6* }**
4. **exit**
5. **neighbor *neighbor-ipv4/6-address***
6. **remote-as *remote-as-id***
7. **address-family { *vpn4* | *vpn6* }**
8. **import reoriginate stitching-rt**
9. **advertise { *vpn4* | *vpn6* } unicast re-originated**
10. **commit**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>	
<b>Step 2</b>	<b>router bgp <i>asn-id</i></b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router bgp 100	Specifies the BGP AS number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
<b>Step 3</b>	<b>address-family { <i>vpn4</i>   <i>vpn6</i> }</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# address-family vpn4	Configures VPNv4 or VPNv6 address family for the global BGP routing process and enters VPNv4 or VPNv6 address family configuration mode.
<b>Step 4</b>	<b>exit</b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-af)# exit	Exits the VPNv4 or VPNv6 address family configuration and returns to the BGP router configuration mode.
<b>Step 5</b>	<b>neighbor <i>neighbor-ipv4/6-address</i></b>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# neighbor 1.1.1.1	Configures the specified neighbor IP address as a BGP peer and enters neighbor configuration mode for BGP routing.
<b>Step 6</b>	<b>remote-as <i>remote-as-id</i></b>  <b>Example:</b>	Specifies the autonomous system identifier of the BGP neighbor.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-bgp-nbr)# remote-as 100	
<b>Step 7</b>	<b>address-family { vpnv4   vpnv6 }</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# address-family vpnv4	Configures VPNv4 or VPNv6 address family for the BGP neighbor and enters VPNv4 or VPNv6 address family configuration mode.
<b>Step 8</b>	<b>import reoriginate stitching-rt</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# import reoriginate stitching-rt	Configures import of routing information from the L3VPN BGP NLRIs that has route target identifier matching the normal route target identifier and exports this routing information after re-origination that assigns it with stitching route target identifier, to the BGP EVPN neighbor.
<b>Step 9</b>	<b>advertise { vpnv4   vpnv6 } unicast re-originated</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise vpnv4 unicast re-originated	Configures advertisement of VPNv4 or VPNv6 unicast routes that are redistributed from the EVPN BGP neighbor, to the L3VPN BGP neighbor. The route targets are changed to the normal route targets before advertising onto the L3VPN BGP neighbor.
<b>Step 10</b>	<b>commit</b>	

## Verification of Data Center Gateway Configuration

These show commands can be used to verify the DCI Gateway configurations:

### SUMMARY STEPS

1. **show bgp l2vpn evpn**
2. **show bgp l2vpn evpn rd rd-id l2vpn-evpn-prefix detail**
3. **show bgp l2vpn evpn neighbors neighbor-ip-address detail**
4. **show bgp sessions**
5. **show bgp vpnv4 unicast**
6. **show bgp vpnv4 unicast rd-id vpnv4-prefix detail**
7. **show bgp vrf foo**
8. **show bgp vrf foo ipv4 unicast 100.1.1.1/32 detail**
9. **show bgp vpnv4 unicast update-group**
10. **show bgp l2vpn evpn update-group**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>show bgp l2vpn evpn</b> <b>Example:</b>	Displays a summary of the BGP information advertised from the EVPN BGP neighbor.

	Command or Action	Purpose
	<pre>RP/0/RSP0/CPU0:router# show bgp l2vpn evpn  Fri Aug 21 00:24:10.773 PDT BGP router identifier 30.30.30.30, local AS number 100 BGP generic scan interval 60 secs Non-stop routing is enabled BGP table state: Active Table ID: 0x0 RD version: 0 BGP main routing table version 16 BGP NSR Initial initsync version 1 (Reached) BGP NSR/ISSU Sync-Group versions 16/0 BGP scan interval 60 secs  Status codes: s suppressed, d damped, h history, * valid, &gt; best                 i - internal, r RIB-failure, S stale, N Nexthop-discard Origin codes: i - IGP, e - EGP, ? - incomplete       Network      Next Hop          Metric       LocPrf Weight Path Route Distinguisher: 100:1 *&gt;i[2][10000][48][0226.51bd.c81c][32][200::1001]/232                 11.0.0.1       100      0 i *&gt;i[2][10000][48][0226.51bd.c81c][32][200:1::1001]/232                 11.0.0.1       100      0 i *&gt;i[2][10000][48][0226.51bd.c81c][32][200.1.1.1]/136                 11.0.0.1       100      0 i *&gt;i[2][10000][48][0226.51bd.c81c][32][200.1.1.2]/136                 11.0.0.1       100      0 i *&gt;i[5][4231][32][100.1.1.1]/80                 11.0.0.1       100      0 i *&gt;i[5][4231][32][100.1.1.2]/80                 11.0.0.1       100      0 i *&gt;i[5][4231][112][fec0::1001]/176                 11.0.0.1       100      0 i *&gt;i[5][4232][112][fec0::1:1001]/176                 11.0.0.1       100      0 i  Processed 8 prefixes, 8 paths</pre>	
<p><b>Step 2</b></p>	<pre>show bgp l2vpn evpn rd rd-id l2vpn-evpn-prefix detail  Example:  RP/0/RSP0/CPU0:router# show bgp l2vpn evpn rd 100:1 [5][4231][112][fec0::1001]/176 detail</pre>	<p>Displays detailed information for a specific prefix advertised from an EVPN BGP neighbor.</p>

	Command or Action	Purpose
	<pre> Fri Aug 21 00:34:43.747 PDT BGP routing table entry for [5][4231][112][fec0::1001]/176, Route Distinguisher: 100:1 Versions:   Process          bRIB/RIB  SendTblVer   Speaker           5         5   Flags: 0x04040001+0x00000000; Last Modified: Aug 21 00:16:58.000 for 00:17:46 Paths: (1 available, best #1)   Not advertised to any peer   Path #1: Received by speaker 0   Flags: 0x4000600025060005, import: 0x3f   Not advertised to any peer   Local     11.0.0.1 (metric 2) from 20.0.0.1 (11.0.0.1)     Received Label 16001     Origin IGP, localpref 100, valid, internal, best, group-best, import-candidate, reoriginate, not-in-vrf     Received Path ID 0, Local Path ID 1, version 5     Extended community: Flags 0x2: Encapsulation Type:8 Router MAC:aabb.ccdd.eeff RT:65540:1 RT:40.40.40.40:1 RT:100:1     Originator: 11.0.0.1, Cluster list: 20.20.20.20     EVPN ESI: ffff.ffff.ffff.ffff.ff01, Gateway Address : fec0::254 </pre>	
<b>Step 3</b>	<p><b>show bgp l2vpn evpn neighbors <i>neighbor-ip-address</i> detail</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp l2vpn evpn neighbors 20.0.0.1 detail  Fri Aug 21 00:25:37.383 PDT  BGP neighbor is 20.0.0.1   Remote AS 100, local AS 100, internal link   Remote router ID 20.20.20.20   BGP state = Established, up for 00:08:58   NSR State: NSR Ready   Last read 00:00:34, Last read before reset 00:00:00   Hold time is 180, keepalive interval is 60 seconds   Configured hold time: 180, keepalive: 60, min acceptable hold time: 3   Last write 00:00:36, attempted 19, written 19   Second last write 00:01:36, attempted 143, written 143   Last write before reset 00:00:00, attempted 0, written 0   Second last write before reset 00:00:00, attempted 0, written 0   Last write pulse rcvd Aug 21 00:25:03.667 last full not set pulse count 33 </pre>	<p>Displays a detailed information of the specified L2VPN EVPN BGP neighbor.</p>

	Command or Action	Purpose
	<pre> Last write pulse rcvd before reset 00:00:00 Socket not armed for io, armed for read, armed for write Last write thread event before reset 00:00:00, second last 00:00:00 Last KA expiry before reset 00:00:00, second last 00:00:00 Last KA error before reset 00:00:00, KA not sent 00:00:00 Last KA start before reset 00:00:00, second last 00:00:00 Precedence: internet Non-stop routing is enabled Entered Neighbor NSR TCP mode: TCP Initial Sync : Aug 21 00:18:07.291 TCP Initial Sync Phase Two : Aug 21 00:18:07.319 TCP Initial Sync Done : Aug 21 00:18:08.334 Multi-protocol capability received Neighbor capabilities: Adv Rcvd Route refresh: Yes Yes 4-byte AS: Yes Yes Address family VPNv4 Unicast: Yes No Address family VPNv6 Unicast: Yes No Address family L2VPN EVPN: Yes Yes Message stats: InQ depth: 0, OutQ depth: 0 Last_Sent Sent Last_Rcvd Rcvd Open: Aug 21 00:16:38.087 1 Aug 21 00:16:40.123 1 Notification: --- 0 --- 0 Update: Aug 21 00:24:01.421 9 Aug 21 00:24:03.652 13 Keepalive: Aug 21 00:25:01.434 8 Aug 21 00:25:03.667 9 Route_Refresh: Aug 21 00:24:01.377 3 --- 0 Total: 21 23 Minimum time between advertisement runs is 0 secs Inbound message logging enabled, 3 messages buffered Outbound message logging enabled, 3 messages buffered  For Address Family: VPNv4 Unicast BGP neighbor version 35 Update group: 0.3 Filter-group: 0.1 No Refresh request being processed Advertise Reorigination Enabled Advertise AFI EoR can be sent                     </pre>	

	Command or Action	Purpose
	<pre> Route refresh request: received 0, sent 0 0 accepted prefixes, 0 are bestpaths Cumulative no. of prefixes denied: 0. Prefix advertised 4, suppressed 0, withdrawn 0 Maximum prefixes allowed 2097152 Threshold for warning message 75%, restart interval 0 min AIGP is enabled An EoR was not received during read-only mode Last ack version 35, Last synced ack version 35  Outstanding version objects: current 0, max 1 Additional-paths operation: None Send Multicast Attributes  For Address Family: VPNv6 Unicast BGP neighbor version 29 Update group: 0.3 Filter-group: 0.1 No Refresh request being processed Advertise Reorigination Enabled Advertise AFI EoR can be sent Route refresh request: received 0, sent 0 0 accepted prefixes, 0 are bestpaths Cumulative no. of prefixes denied: 0. Prefix advertised 0, suppressed 0, withdrawn 0 Maximum prefixes allowed 1048576 Threshold for warning message 75%, restart interval 0 min AIGP is enabled An EoR was not received during read-only mode Last ack version 29, Last synced ack version 29  Outstanding version objects: current 0, max 0 Additional-paths operation: None Send Multicast Attributes Advertise VPNv4 routes enabled with Reoriginate,Local with stitching-RT option  For Address Family: L2VPN EVPN BGP neighbor version 18 Update group: 0.2 Filter-group: 0.1 No Refresh request being processed Route refresh request: received 0, sent 3 8 accepted prefixes, 8 are bestpaths Cumulative no. of prefixes denied: 0. Prefix advertised 4, suppressed 0, withdrawn 6 Maximum prefixes allowed 2097152 Threshold for warning message 75%, restart interval 0 min AIGP is enabled An EoR was received during read-only mode Last ack version 18, Last synced ack version 18  Outstanding version objects: current 0, max 2 Additional-paths operation: None Send Multicast Attributes Advertise VPNv4 routes enabled with Reoriginate, option Advertise VPNv6 routes is enabled with Reoriginate, option Import Stitching is enabled for this neighbor address-family </pre>	



	Command or Action	Purpose
	<pre> Import Reoriginate is enabled for this neighbor address-family  Connections established 1; dropped 0 Local host: 30.0.0.1, Local port: 59405, IF Handle: 0x00000000 Foreign host: 20.0.0.1, Foreign port: 179 Last reset 00:00:00                     </pre>	
<p><b>Step 4</b></p>	<p><b>show bgp sessions</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp sessions  Fri Aug 21 00:25:57.216 PDT  Neighbor          VRF                Spk    AS   InQ  OutQ  NBRState    NSRState 20.0.0.1          default              0    100    0    0  Established  NSR Ready[PP] 32.0.0.2          default              0    200    0    0  Established  NSR Ready                     </pre>	<p>Displays current BGP sessions.</p>
<p><b>Step 5</b></p>	<p><b>show bgp vpnv4 unicast</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp vpnv4 unicast  Fri Aug 21 00:28:41.253 PDT BGP router identifier 30.30.30.30, local AS number  100 BGP generic scan interval 60 secs Non-stop routing is enabled BGP table state: Active Table ID: 0x0  RD version: 0 BGP main routing table version 39 BGP NSR Initial initsync version 4 (Reached) BGP NSR/ISSU Sync-Group versions 39/0 BGP scan interval 60 secs  Status codes: s suppressed, d damped, h history, * valid, &gt; best                 i - internal, r RIB-failure, S stale, N Nexthop-discard Origin codes: i - IGP, e - EGP, ? - incomplete Network          Next Hop          Metric LocPrf Weight Path Route Distinguisher: 1:1 *&gt; 1.1.1.0/24          32.0.0.2                 0 200 300 i *&gt; 1.1.2.0/24          32.0.0.2                 0 200 300 i Route Distinguisher: 30.30.30.30:0 (default for vrf foo) *&gt; 1.1.1.0/24          32.0.0.2                 0 200 300 i *&gt; 1.1.2.0/24          32.0.0.2                     </pre>	<p>Displays summary information of unicast BGP prefixes. The <b>show bgp vpnv6 unicast</b> provides similar output information for IPv6 prefixes.</p>

	Command or Action	Purpose
	<pre> 0 200 300 i *&gt;i100.1.1.1/32      11.0.0.1   100      0 i *&gt;i100.1.1.2/32      11.0.0.1   100      0 i *&gt;i200.1.1.1/32      11.0.0.1   100      0 i *&gt;i200.1.1.2/32      11.0.0.1   100      0 i </pre>	
<b>Step 6</b>	<p><b>show bgp vpnv4 unicast rd-id vpnv4-prefix detail</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp vpnv4 unicast rd 30.30.30.30:0 1.1.1.0/24 detail  Fri Aug 21 00:28:57.824 PDT BGP routing table entry for 1.1.1.0/24, Route Distinguisher: 30.30.30.30:0 Versions:   Process          bRIB/RIB  SendTblVer   Speaker           26        26   Flags: 0x04103001+0x00000000; Last Modified: Aug 21 00:24:01.000 for 00:04:58 Paths: (1 available, best #1)   Advertised to peers (in unique update groups):     20.0.0.1   Path #1: Received by speaker 0   Flags: 0x4000c00005060001, import: 0x80   Advertised to peers (in unique update groups):     20.0.0.1     200 300     32.0.0.2 from 32.0.0.2 (40.40.40.40)       Received Label 24001       Origin IGP, localpref 100, valid, external,       best, group-best, import-candidate, imported,       reoriginated with stitching-rt       Received Path ID 0, Local Path ID 1, version       26       Extended community: RT:100:2       Source AFI: VPNv4 Unicast, Source VRF:       default, Source Route Distinguisher: 1:1 </pre>	<p>Displays detailed information of specified VPNv4 prefixes. The <b>show bgp vpnv6 unicast</b> provides similar output information for VPNv6 prefixes.</p>
<b>Step 7</b>	<p><b>show bgp vrf foo</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp vrf foo  Fri Aug 21 00:24:36.523 PDT BGP VRF foo, state: Active BGP Route Distinguisher: 30.30.30.30:0 VRF ID: 0x60000002 BGP router identifier 30.30.30.30, local AS number   100 Non-stop routing is enabled BGP table state: Active Table ID: 0xe0000011  RD version: 35 </pre>	<p>Displays summary information of prefixes in the specified VRF instance BGP table.</p>

	Command or Action	Purpose
	<pre> BGP main routing table version 35 BGP NSR Initial initsync version 4 (Reached) BGP NSR/ISSU Sync-Group versions 31/0  Status codes: s suppressed, d damped, h history, * valid, &gt; best               i - internal, r RIB-failure, S stale, N Nexthop-discard Origin codes: i - IGP, e - EGP, ? - incomplete Network      Next Hop      Metric LocPrf Weight Path Route Distinguisher: 30.30.30.30:0 (default for vrf foo) *&gt; 1.1.1.0/24      32.0.0.2               0 200 300 i *&gt; 1.1.2.0/24      32.0.0.2               0 200 300 i *&gt;i100.1.1.1/32    11.0.0.1               100   0 i *&gt;i100.1.1.2/32    11.0.0.1               100   0 i *&gt;i200.1.1.1/32    11.0.0.1               100   0 i *&gt;i200.1.1.2/32    11.0.0.1               100   0 i  Processed 6 prefixes, 6 paths                     </pre>	
<p><b>Step 8</b></p>	<p><b>show bgp vrf foo ipv4 unicast 100.1.1.1/32 detail</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp vrf foo ipv4 unicast 100.1.1.1/32 detail  Mon Dec  8 23:24:50.243 PST BGP routing table entry for 100.1.1.1/32, Route Distinguisher: 30.30.30.30:0 Versions:   Process          bRIB/RIB  SendTblVer   Speaker          43        43   Local Label: 24001 (with rewrite);   Flags: 0x05081001+0x00000200; Last Modified: Dec  8 18:04:21.000 for 05:20:30 Paths: (1 available, best #1)   Advertised to PE peers (in unique update groups):     32.0.0.2   Path #1: Received by speaker 0   Flags: 0x400061000d060005, import: 0x80   Advertised to PE peers (in unique update groups):     32.0.0.2   Local     11.0.0.1 (metric 2) from 20.0.0.1 (11.0.0.1)     Received Label 1234     Origin IGP, localpref 100, valid, internal, best, group-best, import-candidate, imported, reoriginated     Received Path ID 0, Local Path ID 1, version                     </pre>	<p>Displays detailed information for a specified prefix in the specified VRF instance BGP table.</p>

	Command or Action	Purpose
	<pre> 43   Extended community: Encapsulation Type:8 Router MAC:aabb.ccdd.eeff RT:1:2   Originator: 11.0.0.1, Cluster list: 20.20.20.20   RIB RNH: table_id 0xe0000011, Encap 8, VNI 1234, MAC Address: aabb.ccdd.eeff, IP Address: 11.0.0.1, IP table_id 0xe0000000   Source AFI: L2VPN EVPN, Source VRF: default,   Source Route Distinguisher: 100:1 </pre>	
<b>Step 9</b>	<p><b>show bgp vpnv4 unicast update-group</b></p> <p><b>Example:</b></p> <pre> RP/0/RSP0/CPU0:router# show bgp vpnv4 unicast update-group  Fri Aug 21 00:27:57.910 PDT  Update group for VPNv4 Unicast, index 0.1:   Attributes:     Outbound policy: pass     First neighbor AS: 200     Send communities     Send GSHUT community if originated     Send extended communities     4-byte AS capable     Send Re-originated VPN routes     Send multicast attributes     Minimum advertisement interval: 30 secs     Update group desynchronized: 0     Sub-groups merged: 0     Number of refresh subgroups: 0     Messages formatted: 8, replicated: 8     All neighbors are assigned to sub-group(s)     Neighbors in sub-group: 0.2, Filter-Groups num:1       Neighbors in filter-group: 0.2(RT num: 0)       32.0.0.2  Update group for VPNv4 Unicast, index 0.3:   Attributes:     Neighbor sessions are IPv4     Internal     Common admin     First neighbor AS: 100     Send communities     Send GSHUT community if originated     Send extended communities     4-byte AS capable     Send AIGP     Send Re-originated VPN routes     Send multicast attributes     Minimum advertisement interval: 0 secs     Update group desynchronized: 0     Sub-groups merged: 0     Number of refresh subgroups: 0     Messages formatted: 2, replicated: 2     All neighbors are assigned to sub-group(s) </pre>	Displays update-group details for BGP VPNv4 unicast address-family.

	Command or Action	Purpose
	<pre>Neighbors in sub-group: 0.1, Filter-Groups num:1 Neighbors in filter-group: 0.1(RT num: 0) 20.0.0.1</pre>	
<b>Step 10</b>	<p><b>show bgp l2vpn evpn update-group</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# show bgp l2vpn evpn update-group  Fri Aug 21 00:27:42.786 PDT  Update group for L2VPN EVPN, index 0.2:   Attributes:     Neighbor sessions are IPv4     Internal     Common admin     First neighbor AS: 100     Send communities     Send GSHUT community if originated     Send extended communities     4-byte AS capable     Send AIGP     Send multicast attributes     Minimum advertisement interval: 0 secs     Update group desynchronized: 0     Sub-groups merged: 0     Number of refresh subgroups: 0     Messages formatted: 4, replicated: 4     All neighbors are assigned to sub-group(s)     Neighbors in sub-group: 0.1, Filter-Groups num:1     Neighbors in filter-group: 0.1(RT num: 0)     20.0.0.1</pre>	Displays update-group details for BGP L2VPN EVPN address-family.

## Example: Data Center Interconnection Layer 3 Gateway Configuration

The following configurations provide an example Data Center Interconnection (DCI) Layer 3 Gateway configuration.

### VTEP-related configuration

```
interface Loopback1
  ipv4 address 40.1.1.1 255.255.255.255
!

interface nve1
  source-interface Loopback1
  member vni 1
  vrf cust1
  host-reachabilty protocol bgp
!
```

```

interface BVI1
 vrf cust1
 ipv4 address 10.99.1.30 255.255.255.0
 ipv6 address 10:99:1::30/64
!

l2vpn
 bridge group bg1
  bridge-domain bd1
  routed interface BVI1
  member vni 1
!
!

```

### VRF-related configuration

```

vrf data-center-10
 import route-target 1:1
 export route-target 1:2
 import route-target 10:10 stitching
 export route-target 10:20 stitching

```

### Data Center EVPN BGP neighbor-related configuration

```

router bgp 1
 neighbor 1.1.1.1
  address-family l2vpn evpn
  import stitching-rt reoriginate
  advertise vpv4 unicast reoriginated
  advertise vpv6 unicast reoriginated
  advertise vpv4 unicast local stitching-rt
  advertise vpv6 unicast local stitching-rt
  advertise l2vpn evpn disable

```

### L3VPN BGP neighbor-related configuration

```

router bgp 2
 neighbor 10.10.10.10
  address-family vpv4
  import reoriginate stitching-rt
  advertise vpv4 unicast reoriginated

```

The following example configuration shows how to configure the DCI router to forward default route to its Data Center neighbor.

```

router bgp 1
 address-family vpv4 unicast
 address-family vpv6 unicast
 address-family l2vpn evpn
 exit
 neighbor 1.1.1.1
  address-family l2vpn evpn
  default-originate
  exit
 vrf foo
  rd 2:1
  address-family ipv4 unicast
  allow vpn default-originate
  exit
  address-family ipv6 unicast
  allow vpn default-originate
  exit

```

```
exit
!
```

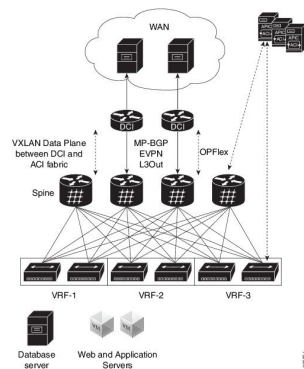
## OpFlex

OpFlex is an open and extensible policy protocol used for transferring the policy information between a network policy controller such as the Cisco Application Policy Infrastructure Controller (APIC) and network elements such as routers that are configured as Data Center Interconnect (DCI) gateway. The policies are distributed using the Cisco® Application Centric Infrastructure (ACI) infrastructure within the fabric to the spine nodes. The spine nodes send policies to the DCI gateway through the OpFlex framework. An OpFlex framework resides between the spines and the DCIs. It enables the distribution of the DCI policy model from the fabric to the DCI gateways. DCI gateway acts as an OpFlex agent and the spine acts a policy repository. Fabric tenant interconnect (FTI) is the OpFlex agent application that runs on the DCI to generate and apply the tenant device configuration on the DCI. Policies configure the DCI service for a given tenant on the DCI gateway.

## OpFlex Topology

Consider the topology where OpFlex framework is used between the DCI gateway and the Cisco ACI spine switches to automate fabric-facing tenant provisioning on the DCI gateway. When you configure a new external Layer 3 outside (L3Out) policy for a tenant on the Cisco Application Policy Infrastructure Controller (APIC), the controller programs all related information associated with that tenant, such as VRF instance name and BGP extended community route-target attributes for the Cisco ACI spine switches. The OpFlex framework running on the spine switches reads the L3Out managed object and converts it to the OpFlex model. This information is then pushed to the DCI gateway, which acts as a policy element for the OpFlex framework. On the DCI, the fabric facing configuration for the tenant VFR is auto-generated.

**Figure 2: OpFlex Topology**



## Restrictions

The OpFlex feature is supported with the following restrictions:

- OpFlex feature is not supported on ASR9K with power PC based route-processor.

- FTI cannot generate configuration for multiple RTs of one address family in a tenant VRF provisioned in one fabric.
- On exhaustion of FTI configuration pools, the OpFlex notifications to add tenants are ignored. If existing tenants are deleted, the new tenants must be added again to enable OpFlex notifications to be re-sent to the DCI.
- FTI supports only Type 0 RT format: 2 byte ASN + 4 byte value. Type 1 and Type 2 RT formats are not supported.
- XML configuration and oper schema are not supported for FTI configuration and show commands.

## Configure OpFlex

Perform the following tasks to configure the OpFlex session to automate fabric-facing tenant provisioning on the DCI gateway. This includes the one-time configuration that must be done on the DCI to enable DCI hand-off from an ACI fabric.

## Configure BGP

Perform this task to enable address-family under BGP routing process for fabric and WAN peering.

### SUMMARY STEPS

1. **configure**
2. **router bgp** *as-number*
3. **bgp router-id** *ip-address*
4. **address-family** {*vpn4* | *vpn6*} **unicast**
5. **address-family l2vpn evpn**
6. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>  <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>router bgp</b> <i>as-number</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router bgp 1234	Specifies the autonomous system number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
<b>Step 3</b>	<b>bgp router-id</b> <i>ip-address</i>  <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# bgp router-id 198.51.100.1	Configures the router with a specified router ID.



	Command or Action	Purpose
<b>Step 4</b>	<b>address-family {vpnv4   vpnv6} unicast</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# address-family vpnv4 unicast	Specifies either the vpnv4 or vpnv6 address family.
<b>Step 5</b>	<b>address-family l2vpn evpn</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-af)# address-family l2vpn evpn	Configures EVPN address family.
<b>Step 6</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure BGP Session on the Fabric Side

Perform this task to configure BGP session on the fabric side.

### SUMMARY STEPS

1. **configure**
2. **router bgp *asn\_id***
3. **neighbor *ip-address***
4. **remote-as *autonomous-system-number***
5. **update-source *loopback***
6. **address-family l2vpn evpn**
7. **import stitching-rt reoriginate**
8. **advertise {vpnv4 | vpnv6} unicast re-originated**
9. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>router bgp <i>asn_id</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router bgp 200	Specifies the BGP AS number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
<b>Step 3</b>	<b>neighbor <i>ip-address</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# neighbor 209.165.201.1	Places the router in neighbor configuration mode for BGP routing and configures the neighbor IP address 209.165.201.1 as a BGP peer.
<b>Step 4</b>	<b>remote-as <i>autonomous-system-number</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# remote-as 100	Creates a neighbor and assigns it a remote autonomous system number.
<b>Step 5</b>	<b>update-source <i>loopback</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# update-source loopback2	Allows BGP sessions to use the primary IP address from a particular interface as the local address.
<b>Step 6</b>	<b>address-family <i>l2vpn evpn</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# address-family l2vpn evpn	Configures EVPN address family.
<b>Step 7</b>	<b>import stitching-rt reoriginate</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# import stitching-rt reoriginate	Enables import of routing information from BGP EVPN NLRI that has route target identifier matching the stitching route target identifier and exports this routing information after re-origination to the L2VPN BGP neighbor.
<b>Step 8</b>	<b>advertise {<i>vpn4</i>   <i>vpn6</i>} unicast re-originated</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise vpn4 unicast re-originated	Configures advertisement of VPNv4 or VPNv6 unicast routes that are redistributed from the L2VPN BGP neighbor, to the EVPN BGP neighbor. The route targets are changed to the stitching route targets before advertising onto the EVPN BGP neighbor.
<b>Step 9</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure BGP Session on the WAN Side

Perform this task to configure BGP session on the WAN side.

### SUMMARY STEPS

1. **configure**
2. **router bgp *asn\_id***
3. **neighbor *ip-address***
4. **remote-as *autonomous-system-number***
5. **update-source *loopback***
6. **address-family vpv4 unicast**
7. **import re-originate stitching-rt**
8. **advertise {vpnv4 | vpv6} unicast re-originated**
9. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 2	<b>router bgp <i>asn_id</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router bgp 200	Specifies the BGP AS number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
Step 3	<b>neighbor <i>ip-address</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp)# neighbor 209.165.200.226	Places the router in neighbor configuration mode for BGP routing and configures the neighbor IP address 209.165.200.226 as a BGP peer.
Step 4	<b>remote-as <i>autonomous-system-number</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# remote-as 100	Creates a neighbor and assigns it a remote autonomous system number.
Step 5	<b>update-source <i>loopback</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# update-source loopback2	Allows BGP sessions to use the primary IP address from a particular interface as the local address.
Step 6	<b>address-family vpv4 unicast</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr)# address-family vpv4 unicast	Enters VPNv4 address family configuration mode for the VPNv4 address family.

	Command or Action	Purpose
<b>Step 7</b>	<b>import re-originate stitching-rt</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# import re-originate stitching-rt	Enables import of routing information from BGP EVPN NLRIs that has route target identifier matching the stitching route target identifier and exports this routing information after re-origination to the L2VPN BGP neighbor.
<b>Step 8</b>	<b>advertise {vpngv4   vpngv6} unicast re-originated</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-bgp-nbr-af)# advertise vpngv4 unicast re-originated	Configures advertisement of VPNv4 or VPNv6 unicast routes that are redistributed from the L2VPN BGP neighbor, to the EVPN BGP neighbor. The route targets are changed to the stitching route targets before advertising onto the EVPN BGP neighbor.
<b>Step 9</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure DCI Underlay for Fabric and WAN Interfaces

Perform this task to configure DCI underlay for fabric facing interface and WAN facing interface. Perform this task on both the interfaces.

### SUMMARY STEPS

1. **configure**
2. **interface type interface-path-id**
3. **ipv4 address ipv4-address mask**
4. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>interface type interface-path-id</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# interface GigabitEthernet 0/0/0/0	Configures Gigabit Ethernet interface.

	Command or Action	Purpose
<b>Step 3</b>	<b>ipv4 address</b> <i>ipv4-address mask</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-if)# ipv4 address 209.165.200.226 255.255.255.224	Specifies the IPv4 address and subnet mask for the interface.
<b>Step 4</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure IGP for ACI and WAN Reachability

Perform this task to configure IGP for ACI and WAN reachability.

### SUMMARY STEPS

1. **configure**
2. **router ospf** *process-name*
3. **area** *area-id*
4. **interface** *type interface-path-id*
5. **exit**
6. **exit**
7. **area** *area-id*
8. **nssa**
9. **interface loopback** *loopback-id*
10. **exit**
11. **interface** *type interface-path-id*
12. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>router ospf</b> <i>process-name</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# router ospf 100	Enables OSPF routing for the specified routing process and places the router in router configuration mode.
<b>Step 3</b>	<b>area</b> <i>area-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf)# area 0	Enters area configuration mode and configures an area for the OSPF process.
<b>Step 4</b>	<b>interface</b> <i>type interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar)# interface GigabitEthernet 0/0/0/1	Configures Gigabit Ethernet interface. Enables reachability to WAN.
<b>Step 5</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar-if)# exit	Exits the interface submode and returns to area submode.
<b>Step 6</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar)# exit	Exits the area submode and returns to router configuration mode.
<b>Step 7</b>	<b>area</b> <i>area-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf)# area 100	Enters area configuration mode and configures an area for the OSPF process.
<b>Step 8</b>	<b>nssa</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar)# nssa	Specifies area as a NSSA area
<b>Step 9</b>	<b>interface loopback</b> <i>loopback-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar)# interface loopback0	Creates a loopback interface with the user-defined loopback identifier and enters the interface configuration mode.
<b>Step 10</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar-if)# exit	Exits the interface submode and returns to area submode.
<b>Step 11</b>	<b>interface</b> <i>type interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ospf-ar)# interface GigabitEthernet 0/0/0/0	Configures Gigabit Ethernet interface. Enables reachability to ACI.
<b>Step 12</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session.

	Command or Action	Purpose
		<b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure MPLS towards WAN

Perform this task to configure MPLS on the DCI.

### SUMMARY STEPS

1. **configure**
2. **mpls ldp**
3. **interface** *type interface-path-id*
4. **exit**
5. **exit**
6. **interface loopback** *instance*
7. **ipv4 address** *ipv4-address mask*
8. **exit**
9. **interface nve** *nve-identifier*
10. **source-interface loopback** *loopback-interface-identifier*
11. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# <code>configure</code>	Enters global configuration mode.
<b>Step 2</b>	<b>mpls ldp</b> <b>Example:</b> RP/0/RSP0/CPU0:router# <code>mpls ldp</code>	Enables MPLS LDP configuration mode.
<b>Step 3</b>	<b>interface</b> <i>type interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ldp)# <code>interface GigabitEthernet 0/0/0/1</code>	Configures Gigabit Ethernet interface.

	Command or Action	Purpose
<b>Step 4</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ldp-if)# exit	Exits the interface submode and returns to MPLS LDP submode.
<b>Step 5</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-ldp)# exit	Exits the MPLS LDP submode and returns to global configuration mode.
<b>Step 6</b>	<b>interface loopback <i>instance</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# interface Loopback0	Enters interface configuration mode and names the new loopback interface.
<b>Step 7</b>	<b>ipv4 address <i>ipv4-address mask</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-if)# ipv4 address 209.165.200.227 255.255.255.224	Specifies the IPv4 address and subnet mask for the interface.
<b>Step 8</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-if)# exit	Exits the interface submode and returns to global configuration mode.
<b>Step 9</b>	<b>interface nve <i>nve-identifier</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# interface nve 1	Creates the NVE interface and enters the NVE interface configuration sub-mode.
<b>Step 10</b>	<b>source-interface loopback <i>loopback-interface-identifier</i></b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-if)# source-interface loopback 0	Sets a loopback interface as the source interface for the VTEP.
<b>Step 11</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure FTI Auto-Configuration Parameters

Perform this task to configure FTI auto-configuration parameters.



## SUMMARY STEPS

1. **configure**
2. **dci-fabric-interconnect**
3. **auto-configuration-pool**
4. **bgp-as** *AS number*
5. **bridge group** *bridge-group-name*
6. **vrf vrf name ipv4-address** *ipv4 address*
7. **bd-pool** *bd range minimum bd range maximum*
8. **bvi-pool** *bvi range minimum bvi range maximum*
9. **vni-pool** *vni minimum range vni maximum range*
10. **local-vtep nve index**
11. Use the **commit** or **end** command.

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 2	<b>dci-fabric-interconnect</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# dci-fabric-interconnect	Enters the fabric tenant interconnect submode.
Step 3	<b>auto-configuration-pool</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti)# auto-configuration-pool	Enters the auto configuration pool submode and enables to set the auto configuration pool parameters.
Step 4	<b>bgp-as</b> <i>AS number</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-acp)# bgp-as 1234	Specifies the BGP AS number that is used when the configuration is generated. The BGP AS must be configured separately.
Step 5	<b>bridge group</b> <i>bridge-group-name</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-acp)# bridge group bg1	Specifies the L2VPN bridge group to be used for generation of configuration.
Step 6	<b>vrf vrf name ipv4-address</b> <i>ipv4 address</i> <b>Example:</b> vrf vrf1 ipv4-address 198.51.100.1	Configures per-VRF BVI interface IP address. If the default IPv4 address from link-local range is not acceptable for tenant addressing, this IP address must be configured. If configured, this must match the WAN-side tenant VRF configuration.
Step 7	<b>bd-pool</b> <i>bd range minimum bd range maximum</i> <b>Example:</b>	Specifies the bridge domain range. The range is from 1 through 4000.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-fti-acp)# bd-pool 1 1 1000	
<b>Step 8</b>	<b>bvi-pool</b> <i>bvi range minimum bvi range maximum</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-acp)# bvi-pool 1 1000	Specifies the bridge-group virtual interface (BVI) range. The range is from 1 through 4000.
<b>Step 9</b>	<b>vni-pool</b> <i>vni minimum range vni maximum range</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-acp)# vni-pool 1 1000	Specifies the VNI range. The range is from 1 through 4000.
<b>Step 10</b>	<b>local-vtep nve index</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-acp)# local-vtep nve 1	Specifies an NVE interface and configures it as VXLAN Tunnel EndPoint (VTEP) for the VXLAN.
<b>Step 11</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> - Saves the configuration changes and remains within the configuration session. <b>end</b> - Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

## Configure OpFlex Session

This task enables the fabric tenant interconnect to setup an OpFlex session with the spine.

### SUMMARY STEPS

1. **configure**
2. **dci-fabric-interconnect**
3. **fabric fabric identifier**
4. **opflex-peer spine IP address**
5. **exit**
6. **identity loopback IP address**
7. Use the **commit** or **end** command.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>dci-fabric-interconnect</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# dci-fabric-interconnect	Enters the fabric tenant interconnect submenu.
<b>Step 3</b>	<b>fabric fabric identifier</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti)# fabric 1001	Enters the fabric submenu and you can configure the fabric parameters. The fabric identifier range is from 1000 through 9999.
<b>Step 4</b>	<b>opflex-peer spine IP address</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-fabric)# opflex-peer 192.0.2.1	FTI sets up an OpFlex session with the spine.
<b>Step 5</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti-fabric)# exit	Exits the current configuration mode and returns to fti submenu.
<b>Step 6</b>	<b>identity loopback IP address</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-fti)# identity 203.0.113.1	Specifies the DCI's BGP loopback IP address.
<b>Step 7</b>	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> - Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> - Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> - Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> - Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> - Remains in the configuration mode, without committing the configuration changes.</li> </ul>

