



Layer 3 EVPN and Layer 3 VPN

This chapter describes tasks to configure the Layer 3 EVPN and stitching of L3 EVPN and L3VPN router. Perform the following tasks to complete the configuration:

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Configuring VRF and Route Targets for Import and Export Rules

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	vrf <i>vrf-name</i>	Defines a VPN routing and forwarding (VRF) instance and enters the VRF configuration mode.
Step 3	rd auto	Automatically assigns a unique route distinguisher (RD) to VRF.
Step 4	address-family { ipv4 ipv6 } unicast	Specifies either the IPv4 or IPv6 address family for the VRF instance and enters address family configuration submode.
Step 5	route-target import <i>route-target-id</i>	Configures importing of routes to the VRF from the L3VPN BGP NLRIIs that have the matching route-target value.

	Command or Action	Purpose
Step 6	route-target export route-target-id	Configures exporting of routes from the VRF to the L3VPN BGP NLRI and assigns the specified route-target identifiers to the L3VPN BGP NLRI.
Step 7	route-target import route-target-id evpn	Configures importing of routes from the L3 EVPN BGP NLRI that have the matching route-target value.
Step 8	route-target export route-target-id evpn	Configures exporting of routes from the VRF to the L3 EVPN BGP NLRI and assigns the specified route-target identifiers to the BGP EVPN NLRI.

Configuring BGP EVPN and Label Allocation Mode

You can use MPLS tunnel encapsulation using the **encapsulation mpls** command. You can configure the label allocation mode for the EVPN address family. The default tunnel encapsulation in EVPN for IP Route type in NX-OS is VXLAN.

Advertisement of (IP or Label) bindings from a Cisco Nexus 9000 Series switch via BGP EVPN enables a remote switch to send the routed traffic to that IP using the label for that IP to the switch that advertised the IP over MPLS.

The IP prefix route (Type-5) is:

- Type-5 route with MPLS encapsulation

```
RT-5 Route - IP Prefix

RD: L3 RD
IP Length: prefix length
IP address: IP (4 bytes)
Label1: BGP MPLS Label
Route Target
RT for IP-VRF
```

The default label allocation mode is per-VRF for Layer 3 EVPN over MPLS.

Complete the following steps to configure BGP EVPN and label allocation mode:

Before you begin

You must install and enable the MPLS feature set using the **install feature-set mpls** and **feature-set mpls** commands.

You must enable the MPLS segment routing feature.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	[no] router bgp autonomous-system-number Example: <pre>switch(config)# router bgp 64496 switch(config-router) #</pre>	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.
Step 3	Required: address-family l2vpn evpn Example: <pre>switch(config-router) # address-family l2vpn evpn switch(config-router-af) #</pre>	Enters global address family configuration mode for the Layer 2 VPN EVPN.
Step 4	Required: exit Example: <pre>switch(config-router-af) # exit switch(config-router) #</pre>	Exits global address family configuration mode.
Step 5	neighbor ipv4-address remote-as autonomous-system-number Example: <pre>switch(config-router) # neighbor 10.1.1.1 remote-as 64497 switch(config-router-neighbor) #</pre>	Configures the IPv4 address and AS number for a remote BGP peer.
Step 6	address-family l2vpn evpn Example: <pre>switch(config-router-neighbor) # address-family l2vpn evpn switch(config-router-neighbor-af) #</pre>	Advertises the labeled Layer 2 VPN EVPN.
Step 7	encapsulation mpls Example: <pre>router bgp 100 address-family l2vpn evpn neighbor NVE2 remote-as 100 address-family l2vpn evpn send-community extended encapsulation mpls vrf foo address-family ipv4 unicast advertise l2vpn evpn</pre>	Enables BGP EVPN address family and sends EVPN type-5 route update to the neighbors. Note The default tunnel encapsulation in EVPN for the IP route type in NX-OS is VXLAN. To override that, a new CLI is introduced to indicate MPLS tunnel encapsulation.

	Command or Action	Purpose
	BGP segment routing configuration: router bgp 100 address-family ipv4 unicast network 200.0.0.1/32 route-map label_index_pol_100 network 192.168.5.1/32 route-map label_index_pol_101 network 101.0.0.0/24 route-map label_index_pol_103 allocate-label all neighbor 192.168.5.6 remote-as 20 address-family ipv4 labeled-unicast send-community extended	
Step 8	vrf <customer_name>	Configures the VRF.
Step 9	address-family ipv4 unicast	Enters global address family configuration mode for the IPv4 address family.
Step 10	advertise l2vpn evpn	Advertises Layer 2 VPN EVPN.
Step 11	redistribute direct route-map DIRECT_TO_BGP	Redistributes the directly connected routes into BGP-EVPN.
Step 12	label-allocation-mode per-vrf	Sets the label allocation mode to per-VRF. If you want to configure the per-prefix label mode, use the no label-allocation-mode per-vrf CLI command. For the EVPN address family, the default label allocation is per-vrf, compared to per-prefix mode for the other address-families where the label allocation CLI is supported. No form of CLI is displayed in the running configuration.

Example

See the following example for configuring per-prefix label allocation:

```
router bgp 65000
  [address-family l2vpn evpn]
  neighbor 10.1.1.1
    remote-as 100
    address-family l2vpn evpn
    send-community extended
  neighbor 20.1.1.1
    remote-as 65000
    address-family l2vpn evpn
    encapsulation mpls
    send-community extended
vrf customer1
  address-family ipv4 unicast
  advertise l2vpn evpn
```

```
redistribute direct route-map DIRECT_TO_BGP
no label-allocation-mode per-vrf
```

Configuring BGP Layer 3 EVPN and Layer 3 VPN Stitching

In order to configure the stitching on the same router, configure the layer 3 VPN neighbor relationship and router advertisement.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	[no] router bgp autonomous-system-number Example: switch# configure terminal switch(config)# router bgp 64496 switch(config-router)#	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.
Step 3	address-family {vpnv4 vpnv6} unicast Example: switch(config-router)# address-family vpnv4 unicast switch(config-router-af)# address-family vpnv6 unicast switch(config-router-af)#	Enters global address family configuration mode for the Layer 3 VPNv4 or VPNv6.
Step 4	exit Example: switch(config-router-af)# exit switch(config-router)#	Exits global address family configuration mode.
Step 5	neighbor <i>ipv4-address</i> remote-as <i>autonomous-system-number</i> Example: switch(config-router)# neighbor 20.1.1.1 remote-as 64498	Configures the IPv4 address and AS number for a remote BGP L3VPN peer.
Step 6	address-family {vpnv4 vpnv6} unicast Example:	Configure the neighbor address-family for VPNv4 or VPNv6.

	Command or Action	Purpose
	switch(config-router)# address-family vpnv4 unicast switch(config-router-af)# address-family vpnv6 unicast switch(config-router-af)#[/td][td>	
Step 7	send-community extended	Enables BGP VPN address family
Step 8	import l2vpn evpn reoriginate	Configures import of routing information from the Layer 3 VPN 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.
Step 9	neighbor <i>ipv4-address</i> remote-as <i>autonomous-system-number</i> Example: switch(config-router)# neighbor 10.1.1.1 remote-as 64497 switch(config-router-neighbor)#[/td][td>	
Step 10	address-family {l2vpn evpn} Example: switch(config-router-neighbor)# address-family l2vpn evpn switch(config-router-neighbor-af)#[/td][td>	
Step 11	import vpn unicast 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 Layer 3 VPN BGP neighbor.
Step 12	vrf <customer_name>	Configures the VRF.
Step 13	address-family ipv4 unicast	Enters global address family configuration mode for the IPv4 address family.
Step 14	advertise l2vpn evpn	Advertises Layer 2 VPN EVPN.

Example

```
vrf context Customer1
  rd auto
  address-family ipv4 unicast
    route-target import 100:100
    route-target export 100:100
    route-target import 100:100 evpn
    route-target export 100:100 evpn
```

```
segment-routing
  mpls
    global-block 11000 20000
    connected-prefix-sid
      address-family ipv4 unicast
        200.0.0.1 index 101
    !
  int lo1
    ip address 200.0.0.1/32
  !
  interface e1/13
    description "MPLS interface towards Core"
    ip address 192.168.5.1/24
    mpls ip forwarding
    no shut

  router bgp 100
    address-family ipv4 unicast
    allocate-label all
    address-family ipv6 unicast
    address-family l2vpn evpn
    address-family vpnv4 unicast
    address-family vpnv6 unicast
    neighbor 10.0.0.1 remote-as 200
      update-source loopback1
      address-family vpnv4 unicast
        send-community extended
        import l2vpn evpn reoriginate
      address-family vpnv6 unicast
        import l2vpn evpn reoriginate
        send-community extended
    neighbor 20.0.0.1 remote-as 300
      address-family l2vpn evpn
      send-community extended
      import vpn unicast reoriginate
      encapsulation mpls
    neighbor 192.168.5.6 remote-as 300
      address-family ipv4 labeled-unicast
    vrf Customer1
      address-family ipv4 unicast
        advertise l2vpn evpn
      address-family ipv6 unicast
        advertise l2vpn evpn
```

Configuring the Features to Enable Layer3 EVPN and Layer3 VPN

Before you begin

Install the VPN Fabric license.

Make sure that the **feature interface-vlan** command is enabled.

Procedure

	Command or Action	Purpose
Step 1	feature bgp	Enables BGP feature and configurations.
Step 2	install feature-set mpls	Enables MPLS configuration commands.
Step 3	feature-set mpls	Enables MPLS configuration commands.
Step 4	feature mpls segment-routing	Enables segment routing configuration commands.
Step 5	feature mpls evpn	Enables EVPN over MPLS configuration commands. This command is mutually exclusive with the feature-nv CLI command.
Step 6	feature mpls l3vpn	Enables EVPN over MPLS configuration commands. This command is mutually exclusive with the feature-nv CLI command.

Configuring BGP L3 VPN over Segment Routing

Before you begin

You must install and enable the MPLS feature set using the **install feature-set mpls** and **feature-set mpls** commands.

You must enable the MPLS segment routing feature.

You must enable the MPLS L3 VPN feature using the **feature mpls l3vpn** command.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config) #	Enters global configuration mode.
Step 2	[no] router bgp autonomous-system-number Example: switch(config)# router bgp 64496 switch(config-router) #	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.

	Command or Action	Purpose
Step 3	address-family {vpnv4 vpng6} unicast Example: <pre>switch(config-router)# address-family vpng4 unicast switch(config-router-af)# address-family vpng6 unicast switch(config-router-af)#+</pre>	Enters global address family configuration mode for the Layer 3 Vpnv4 or Vpnv6.
Step 4	[no] allocate-label option-b	Disables the inter-AS option-b
Step 5	Required: exit Example: <pre>switch(config-router-af)# exit switch(config-router)#+</pre>	Exits global address family configuration mode.
Step 6	neighbor ip4-address remote-as autonomous-system-number Example: <pre>switch(config-router)# neighbor 20.1.1.1 remote-as 64498 switch(config-router-neighbor)#+</pre>	Configures the IPv4 address and AS number for a remote BGP L3VPN peer.
Step 7	address-family {vpnv4 vpng6 } unicast Example: <pre>switch(config-router-neighbor)# address-family vpng4 unicast switch(config-router-neighbor-af)#+</pre>	Configure the neighbor address-family for Vpnv4 or Vpnv6.
Step 8	send-community extended	Enables BGP VPN address family.
Step 9	vrf <customer_name>	Configures the VRF.
Step 10	allocate-index x	Configure the allocate-index.
Step 11	address-family ip4 unicast	Enters global address family configuration mode for the IPv4 address family.
Step 12	redistribute direct route-map DIRECT_TO_BGP	Redistributes the directly connected routes into BGP-L3VPN.

BGP Layer3 VPN Over SRTE

This feature enables the traffic engineering capabilities towards the Segment Routing core for Data-Center Interconnect (DCI)/WAN Edge deployments. It enables DCI hand off (VxLAN to L3VPN based on SR and vice-versa) and can use SRTE capabilities in SR Core so that SLA's can be achieved by different traffic classes. SRTE capabilities can be applied on DCI or edge routers by applying SR-Policy for L3VPN prefixes. L3VPN prefixes can be advertised(by DCI or Edge nodes) after setting extended community color and BGP L3VPN neighbor can apply SR-policy based on that color to create SRTE. Listed below are the configurations for configuring extended community color on L3VPN prefixes.

Guidelines and Limitations for Configuring Layer 3 VPN Over SRTE

Beginning with Cisco NX-OS Release 10.1(2), segment routing traffic engineering is supported over Layer 3 VPN on Cisco Nexus 9300-FX3, N9K-C9316D-GX , N9K-C93180YC-FX, N9K-C93240YC-FX2, and N9K-C9364C platform switches.

The limitations for this feature are as follows:

- UnderLay IPv6 is not supported. SRv6 is the alternate.
- PCE using BGP underlay is not supported, due to PCE's shortcoming on BGP only fabric.
- OSPF-SRTE with PCE is not supported, due NXOS's inability to advertise LSA in BGP-LS.
- Supports total SRTE policy scale of 1000, BGP VPKN4 32K routes, BGP VPKN6 32k routes, and underlay SR prefixes of 1000.

Beginning with Cisco NX-OS Release 10.2(3)F, the option of color-only (CO) bits is added in route map. If the value of the CO bits change for a given prefix that is using an SRTE policy, BGP will delete the old policy and add a new policy.

Configuring Extended Community Color

This section includes the following topics:

Configuring Extended Community Color at the Ingress Node

To configure extended community color at the ingress node when the prefix is announced by the ingress node, where the SRTE policy is instantiated, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	route-map <i>map-name</i> Example: switch(config)# route-map ABC switch(config-route-map)	Creates a route map or enters route-map configuration mode for an existing route map.
Step 3	set extcommunity color <i>color-num</i> Example:	Sets BGP extcommunity attribute for color extended community.

	Command or Action	Purpose
	switch(config-route-map) # set extcommunity color 20 switch(config-route-map) #	
Step 4	exit Example: switch(config-route-map) # exit switch(config) #	Exits route-map configuration mode.
Step 5	[no] router bgp autonomous-system-number Example: switch(config) # router bgp1 switch(config-router) #	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.
Step 6	neighbor ip-address Example: switch(config-router) # neighbor 209.165.201.1 switch(config-router-neighbor) #	Adds an entry to the BGP or multiprotocol BGP neighbor table. The ip-address argument specifies the IP address of the neighbor in dotted decimal notation.
Step 7	address-family vpng4/vpng6 unicast Example: switch(config-router-neighbor) # address-family vpng4/vpng6 unicast switch(config-router-neighbor-af) #	Enters router address-family configuration mode for the vpng4/vpng6 address family type.
Step 8	route-map map-name in Example: switch(config-router-neighbor-af) # route-map ABC in switch(config-router-neighbor-af) #	Applies the configured BGP policy to incoming routes. The map-name can be any case-sensitive, alphanumeric string up to 63 characters.

Configuring Extended Community Color at the Egress Node

To configure extended community color at the egress node when the prefix is announced by the egress node, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example:	Enters global configuration mode.

Configuring Extended Community Color at the Egress Node

	Command or Action	Purpose
	switch# configure terminal switch(config) #	
Step 2	route-map <i>map-name</i> Example: switch(config) # route-map ABC switch(config-route-map)	Creates a route map or enters route-map configuration mode for an existing route map.
Step 3	set extcommunity color <i>color-num</i> Example: switch(config-route-map) # set extcommunity color 20 switch(config-route-map) #	Sets BGP extcommunity attribute for color extended community.
Step 4	exit Example: switch(config-route-map) # exit switch(config) #	Exits route-map configuration mode.
Step 5	[no] router bgp <i>autonomous-system-number</i> Example: switch(config) # router bgp1 switch(config-router) #	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.
Step 6	neighbor <i>ip-address</i> Example: switch(config-router) # neighbor 209.165.201.1 switch(config-router-neighbor) #	Adds an entry to the BGP or multiprotocol BGP neighbor table. The ip-address argument specifies the IP address of the neighbor in dotted decimal notation.
Step 7	address-family vpnv4/vpnv6 unicast Example: switch(config-router-neighbor) # address-family vpnv4/vpnv6 unicast switch(config-router-neighbor-af) #	Enters router address-family configuration mode for the vpnv4/vpnv6 address family type.
Step 8	route-map <i>map-name</i> out Example: switch(config-router-neighbor-af) # route-map ABC out switch(config-router-neighbor-af) #	Applies the configured BGP policy to outgoing routes. The map-name can be any case-sensitive, alphanumeric string up to 63 characters.

Configuring Extended Community Color for Network/Redistribute Command at the Egress Node

To configure extended community color for the network/redistribute command at the egress node when the prefix is announced by the egress node, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	route-map map-name Example: switch(config)# route-map ABC switch(config-route-map)	Creates a route map or enters route-map configuration mode for an existing route map.
Step 3	set extcommunity color color-num Example: switch(config-route-map)# set extcommunity color 20 switch(config-route-map) #	Sets BGP extcommunity attribute for color extended community.
Step 4	exit Example: switch(config-route-map)# exit switch(config) #	Exits route-map configuration mode.
Step 5	[no] router bgp autonomous-system-number Example: switch(config)# router bgp1; switch(config-router) #	Enables BGP and assigns the AS number to the local BGP speaker. The AS number can be a 16-bit integer or a 32-bit integer in the form of a higher 16-bit decimal number and a lower 16-bit decimal number in xx.xx format. Use the no option with this command to remove the BGP process and the associated configuration.
Step 6	vrf <customer_name>	Configures the VRF.
Step 7	address-family ipv4 unicast Example: switch(config-router-vrf)# address-family ipv4 unicast switch(config-router-af) #	Specifies the IPv4 address family for the VRF instance and enters the address family configuration mode.

	Command or Action	Purpose
Step 8	redistribute static route-map map-name out Example: <pre>switch(config-router-vrf-af)# redistribute static route-map ABC switch(config-router-af) #</pre>	Redistributes static routes into BGP. The map-name can be any case-sensitive, alphanumeric string up to 63 characters.
Step 9	network ip-prefix [route-map map-name] Example: <pre>switch(config-router-vrf-af)# network 1.1.1.1/32 route-map ABC switch(config-router-af-network) #</pre>	Specifies a network as local to this autonomous system and adds it to the BGP routing table.