Configuring Proportional Multipath for VNF

This chapter contains the following sections:

About Proportional Multipath for VNF

In Network Function Virtualization Infrastructures (NFVi), anycast services networks are advertised from multiple Virtual Network Functions (VNFs). The Proportional Multipath for VNF feature enables advertising of all the available next hops to a given destination network. This feature enables the switch to consider all paths to a given route as equal cost multipath (ECMP) allowing the traffic to be forwarded using all the available links stretched across multiple ToRs.

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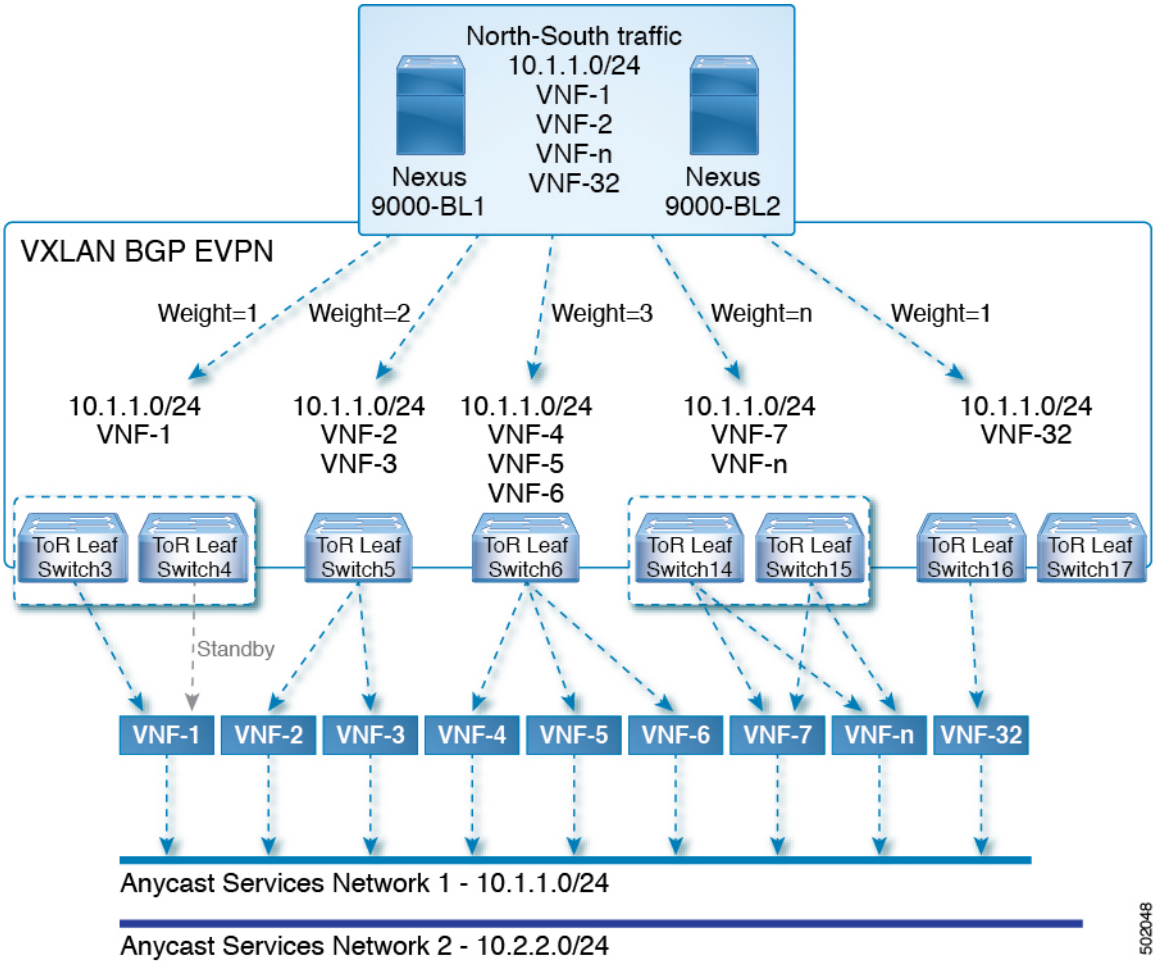
Figure 1: Sample Topology (North-South Traffic)



In the preceding diagram, North-South traffic that enters the VXLAN fabric at a border leaf is sent across all egress endpoints with the traffic forwarded proportional to the number of links from the egress top of rack (ToR) to the destination network.

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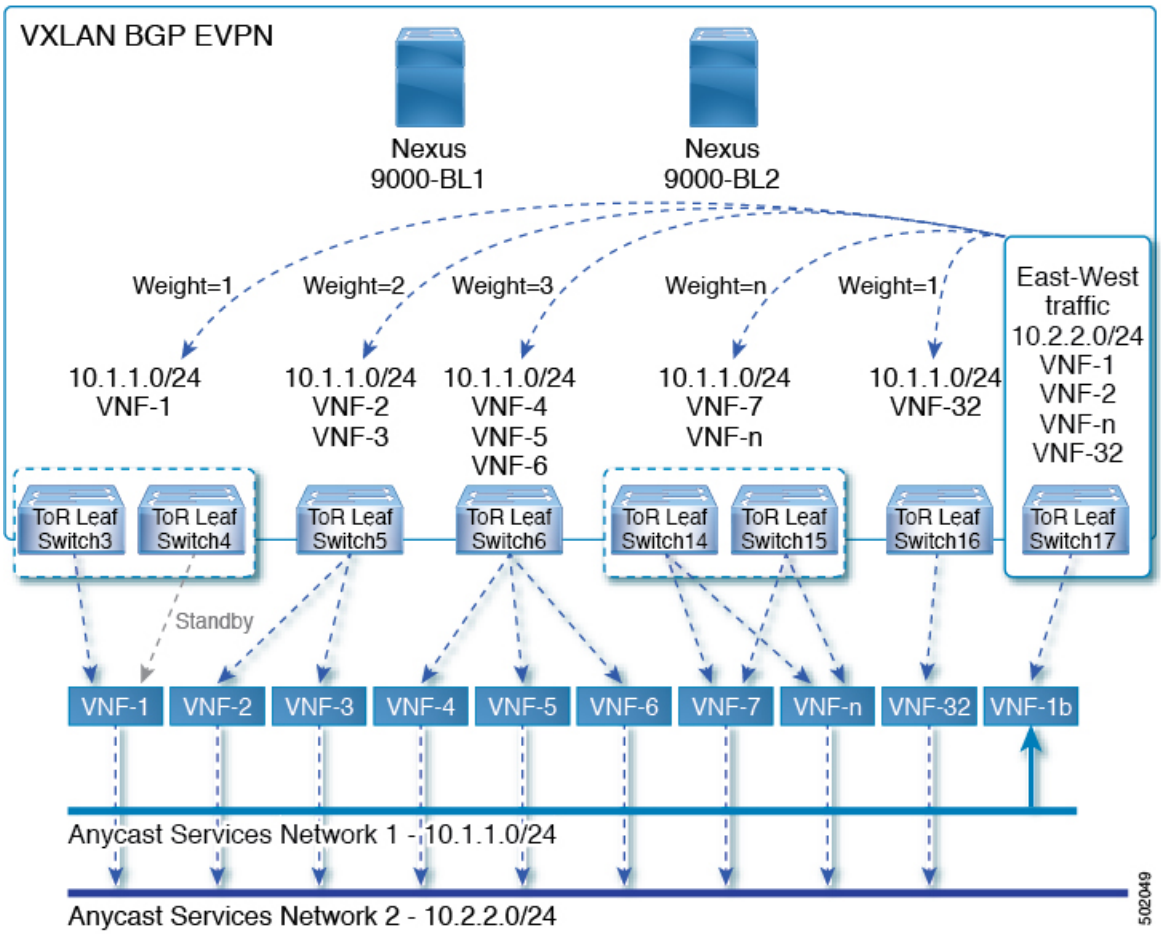
Figure 2: Sample Topology (East-West Traffic)



East-West traffic is forwarded between the VXLAN Tunnel Endpoints (VTEPs) proportional to the number of next hops advertised by each ToR switch to the destination network.

The switch uses BGP to advertise reachability within the fabric using the Layer 2 VPN (L2VPN)/Ethernet VPN (EVPN) address family. If all ToR switches and border leafs are within the same Autonomous System (AS), a full internal BGP (iBGP) mesh is configured by using route reflectors or by having each BGP router peer with every other router.

Each ToR and border leaf constitutes a VTEP in the VXLAN fabric. You can use a BGP route reflector to reduce the full mesh BGP sessions across the VTEPs to a single BGP session between a VTEP and the route reflector. Virtual Network Identifiers (VNIs) are globally unique within the overlay. Each Virtual Routing and Forwarding (VRF) instance is mapped to a unique VNI. The inner destination MAC address in the VXLAN header belongs to the receiving VTEP that does the routing of the VXLAN payload. This MAC address is distributed as a BGP attribute along with the EVPN routes.

Advertisement of Customer Networks

Customer networks are configured statically or learned locally by using an interior gateway protocol, (IGP) or external BGP (eBGP), over a Provider Edge(PE)-Customer Edge(CE) link. These networks are redistributed into BGP and advertised to the VXLAN fabric.

The networks advertised to the ToRs by the virtual machines (VMs) attached to them are advertised to the VXLAN fabric as EVPN Type-5 routes with the following:

- The route distinguisher (RD) will be the Layer 3 VNI's configured RD.
- The gateway IP field will be populated with the next hop.
- The next hop of the EVPN route will continue to be the VTEP IP.
- The export route targets of the routes will be derived from the configured export route targets of the associated Layer 3 VNI.

Multiple VRF routes may generate the same Type-5 Network Layer Reachability Information (NLRI) differentiated only by the gateway IP field. The routes are advertised with the L3VNI's RD, and the gateway IP isn't part of the Type-5 NLRI's key. The NLRI is exchanged between BGP routers using update messages. These routes are advertised to the EVPN AF by extending the BGP export mechanism to include ECMPs and using the addpath BGP feature in the EVPN AF.

Each Type-5 route within the EVPN AF that is created by using the Proportional Multipath for VNF feature may have multiple paths that are imported into the corresponding VRF based on the matching of the received route targets and by having ECMP enabled within the VRF and in the EVPN AF. Within the VRF, the route is a single prefix with multiple paths. Each path represents a Type-5 EVPN path or those learned locally within the VRF. The EVPN Type-5 routes that are enabled for the Proportional Multipath for VNF feature will have their next hop in the VRF derived from their gateway IP field. Use the **export-gateway-ip** command to enable BGP to advertise the gateway IP in the EVPN Type-5 routes.

Use the **maximum-paths mixed** command to enable BGP and the Unicast Routing Information Base (URIB) to consider the following paths as ECMP:

- iBGP paths
- eBGP paths
- Paths from other protocols (such as static) that are redistributed or injected into BGP

The paths can be either local to the device (static, iBGP, or eBGP) or remote (eBGP or iBGP learned over BGP-EVPN). This overrides the default route selection behavior in which local routes are preferred over remote routes. URIB downloads all next hops of the route, including locally learned and user-configured routes, to the Unicast FIB Distribution Module (uFDM)/Forwarding Information Base (FIB).

When the **maximum-paths mixed** command is enabled, BGP ignores the AS-path length, and URIB ignores the administrative distance when choosing ECMPs.

Legacy Peer Support

Use the **advertise-gw-ip** command to advertise EVPN Type-5 routes with the gateway IP set. ToRs then advertise the gateway IP in the Type-5 NLRI. However, legacy peers running on NX-OS version older than Cisco NX-OS Release 9.2(1) can't process the gateway IP which might lead to unexpected behavior. To prevent this scenario from occurring, use the **no advertise-gw-ip** command to disable the Proportional Multipath for VNF feature for a legacy peer. BGP sets the gateway IP field of the Type-5 NLRI to zero even if the path being advertised has a valid gateway IP.

The **no advertise-gw-ip** command flaps the specified peer session as gracefully as possible. The remote peer triggers a graceful restart if the peer supports this capability. When the session is re-established, the local peer advertises EVPN Type-5 routes with the gateway IP set or with the gateway IP as zero depending on whether

the **advertise-gw-ip** command has been used. By default, this knob is enabled and the gateway IP field is populated with the appropriate next hop value.

Guidelines and Limitations for Proportional Multipath for VNF

Proportional Multipath for VNF has the following guidelines and limitations:

- If the Proportional Multipath for VNF feature is enabled, maintenance mode isolation doesn't work because BGP installs all the paths in mixed multipath mode. Alternatively, a route-map is used to deny outbound BPG updates when a switch goes into maintenance mode by using user-defined profiles.
- This feature is supported for Cisco Nexus 9364C, 9300-EX, and 9300-FX/FX2 platform switches.
- Static and direct routes have to be redistributed into the BGP when the Proportional Multipath for VNF feature is enabled.
- If OSPF or EIGRP is being used as an IGP, routes can't be redistributed into BGP.
- If Proportional Multipath for VNF is enabled and routes aren't redistributed into BGP, asymmetric load balancing of traffic may occur as the local routes from URIB may not show up in BGP and on remote TORs as EVPN paths.
- Devices on which mixed-multipath is enabled must support the same load-balancing algorithm.
- If a VNF instance is multi-homed to multiple TORs, policies have to be configured or BGP routes have to be originated using a network command. As a result, each TOR connection to the VNF is displayed in the BGP routing table. Each TOR can now see the VNF's direct routes to the other TORs in which the VNF is multi-homed. Consequently, each TOR can advertise paths to the Gateway IPs through other TORs leading to a next hop resolution loop.

  Consider a scenario in which a VNF is multi-homed to two TORs, TOR1 and TOR2. Individual links to the TORs are addressed as 1.1.1.1 and 2.2.2.2. If the VNF advertises a service 192.168.1.0/24 through the TORs, the TORs advertise EVPN routes to 192.168.1.0/24 with Gateway IPs of 1.1.1.1 and 2.2.2.2 respectively.

  As a result, an issue occurs with the Recursive Next Hop (RNH) resolution on a remote TOR (for example, TOR3). The gateway IP is resolved to a /24 route pointing to another gateway IP. That second gateway IP is resolved by a route pointing to the first gateway IP. So, in our scenario, the gateway IP 1.1.1.1 is resolved by 1.1.1.0/24 which points to 2.2.2.2. And 2.2.2.2 is resolved by 2.2.2.0/24 which points to 1.1.1.1.

  This condition occurs as both TORs connected to the VNF are advertising the VNF’s connected routes. TOR1 is advertising 1.1.1.0/24 and 2.2.2.0/24. However, 1.1.1.0 is advertised without a gateway IP as it's a connected subnet on TOR1. Also, 2.2.2.0 is an OSPF route pointing to 1.1.1.1 which is the VNF’s address connected to TOR1.

  Similarly, TOR2 advertises both subnets and 2.2.2.0/24 is sent without a gateway IP as it is directly connected to TOR2. 1.1.1.0 is learned via OSPF and is sent with a gateway IP of 2.2.2.2 which is the VNF’s address connected to TOR2. 1.1.1.1/32 and 2.2.2.2/32 won't be advertised as they are Adjacency Manager (AM) routes on each TOR.

  This issue doesn't have a resolution when Type-5 routes are involved. However, this scenario can be avoided if the TORs advertise the gateway IP’s /32 address using a network command. And if the gateway IPs are being resolved by Type-2 EVPN MAC/IP routes, this scenario can be avoided as the gateway IP will be resolved by the /32 IP route.

- Following guidelines and limitations are applied when a multisite Border Gateway is put into Maintenance Mode:
  - BUM Traffic from remote Fabrics will still be attracted to the Border gateway that is in maintenance mode
  - Border Gateway in maintenance mode still participates in Designated Forwarder Election
  - Default Maintenance mode profile applies the command "ip pim isolate" and so the Border gateway is isolated from S,G tree towards the fabric direction. This leads to BUM traffic loss and hence an appropriate maintenance mode profile should be used for Border Gateways than the default.

Configuring the Route Reflector

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**router bgp** *number* **Example:** `switch(config)# router bgp 2`	Configure BGP.
Step 3	**address-family l2vpn evpn** **Example:** `switch(config-router)# address-family l2vpn evpn`	Configure address family Layer 2 VPN EVPN under **router bgp** context.
Step 4	**additional-paths send** **Example:** `switch(config-router-af)# additional-paths send`	The additional-paths configuration for sending..
Step 5	**additional-paths receive** **Example:** `switch(config-router-af)# additional-paths receive`	The additional-paths configuration for receiving.
Step 6	**additional-paths selection route-map passall** **Example:** `switch(config-router-af)# additional-paths selection route-map passall`	The additional-paths configuration applied the route map.

	Command or Action	Purpose
Step 7	**route-map passall permit** *seq-num* **Example:** `switch(config)# route-map passall permit 10`	Configure the route map.
Step 8	**set path-selection all advertise** **Example:** `switch(config-route-map)# set path-selection all advertise`	Sets the route-map related to the additional-paths feature.

Configuring the ToR

This procedure describes how to configure the ToR.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**router bgp** *number* **Example:** `switch(config)# router bgp 2`	Configure BGP.
Step 3	**address-family l2vpn evpn** **Example:** `switch(config-router)# address-family l2vpn evpn`	Configure address family Layer 2 VPN EVPN under **router bgp** context.

Step 4	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count*
	Example:
	`switch(config-router-af)# maximum-paths ?`
	`<1-64> Number of parallel paths`
	`*Default value is 1`
	`eibgp Configure multipath for both EBGP and IBGP paths`
	`ibgp Configure multipath for IBGP paths`
	`local Configure multipath for local paths`
	`mixed Configure multipath for local and remote paths`
		• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		  • eBGP paths
		  • eiBGP paths
		  • iBGP paths

	Command or Action	Purpose
	`switch(config-router-af)# maximum-paths mixed 32`	• Paths from other protocols (such as static) that are redistributed or injected into BGP • • **local**–Enables the multipath for local paths. •
Step 5	**additional-paths send** **Example:** `switch(config-router-af)# additional-paths send`	The additional-paths configuration for sending.
Step 6	**additional-paths receive** **Example:** `switch(config-router-af)# additional-paths receive`	The additional-paths configuration for receiving.
Step 7	**additional-paths selection route-map passall** **Example:** `switch(config-router-af)# additional-paths selection route-map passall`	The additional-paths configuration applied the route map.
Step 8	**exit** **Example:** `switch(config-router-af)# exit`	Exits command mode.
Step 9	**vrf evpn-tenant-1001** **Example:** `switch(config-router)# vrf evpn-tenant-1001`	Switch to the VRF configuration mode.
Step 10	**address-family ipv4 unicast** **Example:** `switch(config-router)# address-family ipv4 unicast`	Configure address family for IPv4.
Step 11	**export-gateway-ip** **Example:** `switch(config-router-vrf-af)# export-gateway-ip`	Enables BGP to advertise the gateway IP in the EVPN Type-5 routes.
Step 12	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count* **Example:**	• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.

	Command or Action	Purpose

	switch(config-router-vrf-af)# maximum-paths ?
	  <1-64> Number of parallel paths
	
	  *Default value is 1
	  eibgp Configure multipath for both EBGP and IBGP paths
	  ibgp Configure multipath for IBGP paths
	  local Configure multipath for local paths
	  mixed Configure multipath for local and remote paths
	switch(config-router-vrf-af)# **maximum-paths mixed 32**
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		• eBGP paths
		• eiBGP paths
		• iBGP paths
		• Paths from other protocols (such as static) that are redistributed or injected into BGP
		•
		• **local**–Enables the multipath for local paths.
		•

Step 13	**redistribute static route-map redist-rtmap** **Example:** switch(config-router-vrf-af)# **redistribute static route-map redist-rtmap**	Preserves the next-hop of the redistributed paths.
Step 14	**exit** **Example:** switch(config-router-vrf-af)# **exit**	Exits command mode.
Step 15	**address-family ipv6 unicast** **Example:** switch(config-router-vrf)# **address-family ipv6 unicast**	Configure address family for IPv6.
Step 16	**export-gateway-ip** **Example:** switch(config-router-vrf-af)# **export-gateway-ip**	Enables BGP to advertise the gateway IP in the EVPN Type-5 routes.

Step 17	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count*
	Example:
	switch(config-router-vrf-af)# maximum-paths ?
	  <1-64> Number of parallel paths
	
	  *Default value is 1
	  eibgp Configure multipath for both EBGP and IBGP paths
		• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		• eBGP paths

	Command or Action	Purpose
	ibgp Configure multipath for IBGP paths local Configure multipath for local paths mixed Configure multipath for local and remote paths switch(config-router-vrf-af)# **maximum-paths mixed 32**	• eiBGP paths • iBGP paths • Paths from other protocols (such as static) that are redistributed or injected into BGP • • **local**–Enables the multipath for local paths. •
Step 18	**redistribute static route-map redist-rtmap** **Example:** switch(config-router-vrf-af)# **redistribute static route-map redist-rtmap**	Preserves the next-hop of the redistributed paths.
Step 19	**exit** **Example:** switch(config-router-vrf-af)# **exit**	Exits command mode.
Step 20	**route-map passall permit** *seq-num* **Example:** switch(config)# **route-map passall permit 10**	Configure the route map.
Step 21	**set path-selection all advertise** **Example:** switch(config-route-map)# **set path-selection all advertise**	Sets the route-map related to the additional-paths feature.

Configuring the Border Leaf

This procedure describes how to configure the border leaf.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** switch# **configure terminal**	Enter global configuration mode.

	Command or Action	Purpose
Step 2	**router bgp** *number* **Example:** `switch(config)# router bgp 2`	Configure BGP.
Step 3	**address-family l2vpn evpn** **Example:** `switch(config-router)# address-family l2vpn evpn`	Configure address family Layer 2 VPN EVPN under **router bgp** context.

Step 4	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count*
	Example:
	`switch(config-router-af)# maximum-paths ?`
	`<1-64> Number of parallel paths`
	`*Default value is 1`
	`eibgp Configure multipath for both EBGP and IBGP paths`
	`ibgp Configure multipath for IBGP paths`
	`local Configure multipath for local paths`
	`mixed Configure multipath for local and remote paths`
	`switch(config-router-af)# maximum-paths mixed 32`
		• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		  • eBGP paths
		  • eiBGP paths
		  • iBGP paths
		  • Paths from other protocols (such as static) that are redistributed or injected into BGP
		•
		• **local**–Enables the multipath for local paths.
		•

Step 5	**additional-paths send** **Example:** `switch(config-router-af)# additional-paths send`	The additional-paths configuration for sending.
Step 6	**additional-paths receive** **Example:** `switch(config-router-af)# additional-paths receive`	The additional-paths configuration for receiving.
Step 7	**additional-paths selection route-map passall** **Example:** `switch(config-router-af)# additional-paths selection route-map passall`	The additional-paths configuration enables the additional-paths feature.

	Command or Action	Purpose
Step 8	**exit** **Example:** `switch(config-router-af)# exit`	Exits command mode.
Step 9	**vrf evpn-tenant-1001** **Example:** `switch(config-router)# vrf evpn-tenant-1001`	Switch to the VRF configuration mode.
Step 10	**address-family ipv4 unicast** **Example:** `switch(config-router)# address-family ipv4 unicast`	Configure address family for IPv4.
Step 11	**export-gateway-ip** **Example:** `switch(config-router-vrf-af)# export-gateway-ip`	Enables BGP to advertise the gateway IP in the EVPN Type-5 routes.

Step 12	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count*
	Example:
	`switch(config-router-af)# maximum-paths ?`
	`<1-64> Number of parallel paths`
	`*Default value is 1`
	`eibgp Configure multipath for both EBGP and IBGP paths`
	`ibgp Configure multipath for IBGP paths`
	`local Configure multipath for local paths`
	`mixed Configure multipath for local and remote paths`
	`switch(config-router-vrf-af)# maximum-paths mixed 32`
		• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		  • eBGP paths
		  • eiBGP paths
		  • iBGP paths
		  • Paths from other protocols (such as static) that are redistributed or injected into BGP
		•
		• **local**–Enables the multipath for local paths.
		•

Step 13	**redistribute static route-map redist-rtmap** **Example:** `switch(config-router-vrf-af)# redistribute static route-map redist-rtmap`	Preserves the next-hop of the redistributed paths.

	Command or Action	Purpose
Step 14	**address-family ipv6 unicast** **Example:** `switch(config-router-vrf)# address-family ipv6 unicast`	Configure address family for IPv6.
Step 15	**export-gateway-ip** **Example:** `switch(config-router-vrf-af)# export-gateway-ip`	Enables BGP to advertise the gateway IP in the EVPN Type-5 routes.

Step 16	**maximum-paths** *eBGP max-paths* |**mixed** *mpath-count*
	Example:
	`switch(config-router-vrf-af)# maximum-paths ?`
	`<1-64> Number of parallel paths`
	`*Default value is 1`
	`eibgp Configure multipath for both EBGP and IBGP paths`
	`ibgp Configure multipath for IBGP paths`
	`local Configure multipath for local paths`
	`mixed Configure multipath for local and remote paths`
	`switch(config-router-vrf-af)# maximum-paths mixed 32`
		• *eBGP max-path*–Enables the eBGP maximum paths. The range is from 1 to 64 parallel paths. The default value is 1.
		• Enables BGP and the Unicast Routing Information Base (URIB) to consider the following paths as Equal Cost Multi Path (ECMP):
		  • eBGP paths
		  • eiBGP paths
		  • iBGP paths
		  • Paths from other protocols (such as static) that are redistributed or injected into BGP
		•
		• **local**–Enables the multipath for local paths.
		•

Step 17	**redistribute static route-map redist-rtmap** **Example:** `switch(config-router-vrf-af)# redistribute static route-map redist-rtmap`	Preserves the next-hop of the redistributed paths.
Step 18	**exit** **Example:** `switch(config-router-vrf-af)# exit`	Exits command mode.
Step 19	**route-map passall permit** *seq-num* **Example:** `switch(config)# route-map passall permit 10`	Configure the route map.

	Command or Action	Purpose
Step 20	**set path-selection all advertise** **Example:** `switch(config-route-map)# set path-selection all advertise`	Sets the route-map related to the additional-paths feature.
Step 21	**ip load-sharing address source-destination rotate** *rotate* **universal-id** *seed* **Example:** `ip load-sharing address source-destination rotate 32 universal-id 1`	Configures the unicast FIB load-sharing algorithm for data traffic. • The **universal-id** option sets the random seed for the hash algorithm and shifts the flow from one link to another. You do not need to configure the universal ID. Cisco NX-OS chooses the Universal ID if you do not configure it. The *seed* range is from 1 to 4294967295. • The **rotate** option causes the hash algorithm to rotate the link picking selection so that it does not continually choose the same link across all nodes in the network. It does so by influencing the bit pattern for the hash algorithm. This option shifts the flow from one link to another and load balances the already load-balanced (polarized) traffic from the first ECMP level across multiple links. If you specify a **rotate** value, the 64-bit stream is interpreted starting from that bit position in a cyclic rotation. The **rotate** range is from 1 to 63, and the default is 32. **Note** With multi-tier Layer 3 topology, polarization is possible. To avoid polarization, use a different rotate bit at each tier of the topology. **Note** To configure a rotation value for port channels, use the **port-channel load-balance src-dst ip-l4port rotate** *rotate* command. For more information on this command, see the *Cisco Nexus 9000 Series NX-OS Interfaces Configuration Guide, Release 9.x*.

Configuring the BGP Legacy Peer

If you are running a Cisco Nexus Release prior to 9.2(1), follow this procedure to disable sending the gateway IP address to that peer.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**router bgp** *number* **Example:** `switch(config)# router bgp 2000000`	Configure BGP.
Step 3	**neighbor** *address* **remote-as** *number* **Example:** `switch(config-router)# neighbor 8.8.8.8 remote-as 2000000`	Define neighbor.
Step 4	**address-family l2vpn evpn** **Example:** `switch(config-router-neighbor)# address-family l2vpn evpn`	Configure address family Layer 2 VPN EVPN.
Step 5	**no advertise-gw-ip** **Example:** `switch(config-router-neighbor-af)# no advertise-gw-ip`	Disables the BGP EVPN Mixed-path and Proportional Layer-3 Multipath feature for a legacy peer.

Configuring a User-Defined Profile for Maintenance Mode

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**configure maintenance profile maintenance-mode** **Example:**	Configure maintenance mode profile.

	Command or Action	Purpose
	`switch(config)# configure maintenance profile maintenance-mode`	
Step 3	**route-map** *name* **deny** *sequence* **Example:** `switch(config-mm-profile)# route-map GIR deny 5`	Configure route map. The value of *sequence* is from 0 to 65535. Default is 10.

Configuring a User-Defined Profile for Normal Mode

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**configure maintenance profile normal-mode** **Example:** `switch(config)# configure maintenance profile normal-mode`	Configure maintenance mode.
Step 3	**route-map** *name* **permit** *sequence* **Example:** `switch(config-mm-profile)# route-map GIR permit 5`	Configure route map. The value of *sequence* is from 0 to 65535. Default is 10.

Configuring a Default Route Map

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**route-map** *name* **permit** *sequence* **Example:** `switch(config-mm-profile)# route-map GIR permit 5`	Configure route map. The value of *sequence* is from 0 to 65535. Default is 10.

Applying a Route Map to a Route Reflector

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**router bgp** *number* **Example:** `switch(config)# router bgp 2`	Configure BGP.
Step 3	**neighbor** *ip-address* **Example:** `switch(config-router)# neighbor 10.1.1.1`	Configure the IP address of a BGP neighbor which is the route reflector. *ip-address* can be an IPv4 or IPv6 address or prefix.
Step 4	**address-family l2vpn evpn** **Example:** `switch(config-router-neighbor)# address-family l2vpn evpn`	Configure a Layer 2 VPN EVPN address family.
Step 5	**route-map** *name* **out** **Example:** `switch(config-router-neighbor-af)# route-map GIR out`	Apply the route map to the neighbor route reflector.

Verifying Proportional Multipath for VNF

Command	Purpose
show bgp ipv4 unicast	Displays Border Gateway Protocol (BGP) information for the IPv4 unicast address family.
show bgp l2vpn evpn	Displays BGP information for the Layer-2 Virtual Private Network (L2VPN) Ethernet Virtual Private Network (EVPN) address family.
show ip route	Displays routes from the unicast RIB.
show maintenance profile maintenance-mode	Displays the GIR user-defined profile for the maintenance mode.

Command	Purpose
show maintenance profile normal-mode	Displays the GIR user-defined profile for the normal mode.

The following example shows how to display BGP information for the L2VPN EVPN address family:

```
switch# show bgp l2vpn evpn 11.1.1.0
BGP routing table information for VRF default, address family L2VPN EVPN
Route Distinguisher: 13.13.13.13:3       //     Remote route
BGP routing table entry for [5]:[0]:[0]:[24]:[11.1.1.0]/224, version 1341
Paths: (3 available, best #1)
Flags: (0x000002) on xmit-list, is not in l2rib/evpn, is not in HW
Multipath: eBGP

  Advertised path-id 1
  Path type: external, path is valid, is best path
             Imported to 2 destination(s)
  Gateway IP: 11.1.1.133
  AS-Path: 2000000 100000 , path sourced external to AS
    11.11.11.11 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 3
      Extcommunity: RT:23456:22001 Route-Import:11.11.11.11:2001 ENCAP:8
          Router MAC:003a.7d7d.1dbd

  Path type: external, path is valid, not best reason: Neighbor Address, multipath
             Imported to 2 destination(s)
  Gateway IP: 11.1.1.233
  AS-Path: 2000000 100 , path sourced external to AS
    33.33.33.33 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 2
      Extcommunity: RT:23456:22001 Route-Import:33.33.33.33:2001 ENCAP:8
          Router MAC:e00e.da4a.589d

  Path type: external, path is valid, not best reason: Neighbor Address, multipath
             Imported to 2 destination(s)
  Gateway IP: 11.1.1.100
  AS-Path: 2000000 500000 , path sourced external to AS
    22.22.22.22 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 1
      Extcommunity: RT:23456:22001 Route-Import:22.22.22.22:2001 ENCAP:8
          Router MAC:e00e.da4a.62a5

  Path-id 1 not advertised to any peer

Route Distinguisher: 4.4.4.4:3    (L3VNI 22001)       //   Local L3VNI
BGP routing table entry for [5]:[0]:[0]:[24]:[11.1.1.0]/224, version 3465
Paths: (3 available, best #1)
Flags: (0x000002) on xmit-list, is not in l2rib/evpn, is not in HW
Multipath: eBGP

  Advertised path-id 1
  Path type: external, path is valid, is best path
             Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  Gateway IP: 11.1.1.100
  AS-Path: 2000000 500000 , path sourced external to AS
```

```
    22.22.22.22 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 1
      Extcommunity: RT:23456:22001 Route-Import:22.22.22.22:2001 ENCAP:8
          Router MAC:e00e.da4a.62a5

  Path type: external, path is valid, not best reason: newer EBGP path, multipat
h
            Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  Gateway IP: 11.1.1.233
  AS-Path: 2000000 100 , path sourced external to AS
    33.33.33.33 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 2
      Extcommunity: RT:23456:22001 Route-Import:33.33.33.33:2001 ENCAP:8
          Router MAC:e00e.da4a.589d

  Path type: external, path is valid, not best reason: newer EBGP path, multipat
h
            Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  Gateway IP: 11.1.1.133
  AS-Path: 2000000 100000 , path sourced external to AS
    11.11.11.11 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 3
      Extcommunity: RT:23456:22001 Route-Import:11.11.11.11:2001 ENCAP:8
          Router MAC:003a.7d7d.1dbd

  Path-id 1 not advertised to any peer
```

The following example shows how to display BGP information for the IPv4 unicast address family:

```
switch# show bgp ipv4 unicast 11.1.1.0 vrf cust_1
BGP routing table information for VRF cust_1, address family IPv4 Unicast
BGP routing table entry for 11.1.1.0/24, version 4
Paths: (3 available, best #1)
Flags: (0x80080012) on xmit-list, is in urib, is backup urib route, is in HW
  vpn: version 1093, (0x100002) on xmit-list
Multipath: eBGP iBGP

  Advertised path-id 1, VPN AF advertised path-id 1
  Path type: external, path is valid, is best path, in rib
            Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  AS-Path: 2000000 500000 , path sourced external to AS
    11.1.1.100 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 1
      Extcommunity: RT:23456:22001 Route-Import:22.22.22.22:2001 ENCAP:8
          Router MAC:e00e.da4a.62a5

  Path type: external, path is valid, not best reason: Neighbor Address, multipath, in rib
            Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  AS-Path: 2000000 100 , path sourced external to AS
    11.1.1.233 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 2
      Extcommunity: RT:23456:22001 Route-Import:33.33.33.33:2001 ENCAP:8
          Router MAC:e00e.da4a.589d
```

```
  Path type: external, path is valid, not best reason: Neighbor Address, multipath, in rib
             Imported from 13.13.13.13:3:[5]:[0]:[0]:[24]:[11.1.1.0]/224
  AS-Path: 2000000 100000 , path sourced external to AS
    11.1.1.133 (metric 5) from 102.102.102.102 (102.102.102.102)
      Origin incomplete, MED not set, localpref 100, weight 0
      Received label 22001
      Received path-id 3
      Extcommunity: RT:23456:22001 Route-Import:11.11.11.11:2001 ENCAP:8
          Router MAC:003a.7d7d.1dbd

  VRF advertise information:
  Path-id 1 not advertised to any peer

  VPN AF advertise information:
  Path-id 1 not advertised to any peer
```

The following example shows how to display routes from the unicast RIB after the Proportional Multipath for VNF feature has been configured:

```
switch# show ip route 1.1.1.0 vrf cust_1
IP Route Table for VRF "cust_1"
…
1.1.1.0/24, ubest/mbest: 22/0, all-best (0x300003d)
    *via 3.0.0.1, [1/0], 08:13:17, static
         recursive next hop: 3.0.0.1/32
    *via 3.0.0.2, [1/0], 08:13:17, static
         recursive next hop: 3.0.0.2/32
    *via 3.0.0.3, [1/0], 08:13:16, static
         recursive next hop: 3.0.0.3/32
    *via 3.0.0.4, [1/0], 08:13:16, static
         recursive next hop: 3.0.0.4/32
    *via 2.0.0.1, [200/0], 06:09:19, bgp-2, internal, tag 2 (evpn) segid: 3003802 tunnelid:
 0x300003e encap: VXLAN
          BGP-EVPN: VNI=3003802 (EVPN)
         client-specific data: 3b
         recursive next hop: 2.0.0.1/32
         extended route information: BGP origin AS 2 BGP peer AS 2
    *via 2.0.0.2, [200/0], 06:09:19, bgp-2, internal, tag 2 (evpn) segid: 3003802 tunnelid:
 0x300003e encap: VXLAN
          BGP-EVPN: VNI=3003802 (EVPN)
         client-specific data: 3b
         recursive next hop: 2.0.0.2/32
         extended route information: BGP origin AS 2 BGP peer AS 2
```

The following example shows how to display the GIR user-defined profile for the maintenance mode:

```
switch# show maintenance profile maintenance-mode
  [Maintenance Mode]
  ip pim isolate
  router bgp 2
   isolate
  router isis 1
   isolate
  route-map GIR deny 5
```

The following example shows how to display the GIR user-defined profile for the normal mode:

```
switch# show maintenance profile normal-mode
  [Normal Mode]
  no ip pim isolate
  router bgp 2
   no isolate
  router isis 1
```

```
 no isolate
route-map GIR permit 5
```

Configuring Proportional Multipath for VNF