# Supported Underlay Configuration Examples

This appendix provides examples of supported underlay template configuration.



## Supported Underlay Configuration Examples

| Configuration Area | Sample Configuration | Device Type | Device Role |
|---|---|---|---|
| **Note** Prerequisite: You should enable the following configuration for the device configuration to work. | `feature telnet`<br>`feature nxapi`<br>`feature ospf`<br>`feature bgp`<br>`feature pim`<br>`feature udld`<br>`feature interface-vlan`<br>`feature vn-segment-vlan-based`<br>`feature hsrp`<br>`feature lacp`<br>`feature vpc`<br>`feature lldp`<br>`feature nv overlay`<br>`feature pbr`<br>`feature sla sender`<br>`feature sla responder`<br>`feature vrrpv3`<br>`feature bfd` | | |
| UNDERLAY IGP ROUTING OSPF routing process | `router ospf 10` | N9K | Leaf |
| | `router ospf 10` | ASR9K | DCI |
| OSPF Area | `interface ethernet 1/5`<br>`  ip ospf router 10 area 0.0.0.0` | N9K | Leaf |
| | `interface ethernet 1/5`<br>`  ip ospf router 10 area 0.0.0.0` | N9K | Leaf |
| | `router ospf 10`<br>`  area 0` | ASR9K | DCI |

| | | | |
|---|---|---|---|
| OSPF router-id | `router ospf 10`<br>`  router-id 10.218.20.15` | N9K | Leaf |
| | `router ospf 10`<br>`  router-id 10.218.20.15` | ASR9K | DCI |
| OSPF auto-cost reference | `router ospf 10`<br>`!`<br>`  auto-cost reference-bandwidth 800000` | ASR9K | DCI |
| OSPF Network type | `interface ethernet1/5`<br>`  ip ospf network point-to-point` | N9K | Leaf |
| | `interface vlan10`<br>`  ip ospf network point-to-point` | N9K | Leaf |
| | `router ospf 10`<br>`  area 0`<br>`  interface GigabitEthernet0/0/1/3`<br>`  network point-to-point` | ASR9K | DCI |
| OSPF Authentication | `interface Ethernet1/5`<br>`  ip ospf authentication message-digest` | N9K | Leaf |
| | `interface Ethernet1/5`<br>`  ip ospf message-digest-key 1 md5 0 xxx` | N9K | Leaf |
| | `router ospf 10`<br>`  area 0`<br>`  interface <Fabric Interface>`<br>`  authentication message-digest`<br>`  message-digest-key 1 md5 encrypted`<br>`202cb962ac59075b964b07152d234b70` | ASR9K | DCI |
| OSPF Passive-interface | `interface loopback3`<br>`  ip router ospf 100 area 0.0.0.0` | N9K | Leaf |
| | `router ospf 10`<br>`  area 0`<br>`  interface Loopback10`<br>`  passive enable` | ASR9K | DCI |
| OSPF Convergence | `router ospf 10`<br>`  timers lsa arrival 15`<br>`  timers throttle lsa 0 20 5000`<br>`  timers throttle spf 50 100 5000` | N9K | Leaf |
| | `router ospf 10`<br>`  timers throttle lsa all 0 20 5000`<br>`  timers throttle spf 50 100 5000`<br>`  timers lsa min-arrival 15` | ASR9K | DCI |
| OSPF BFD (per-link) | `feature bfd`<br>`router ospf 10`<br>`  bfd` | N9K | Leaf |
| | `interface Ethernet1/5`<br>`  no ip redirects` | N9K | Leaf |
| | `router ospf 10`<br>`  bfd minimum-interval 150`<br>`  bfd multiplier 3`<br>`  area 0`<br>`  interface TenGigE0/0/2/1`<br>`  bfd fast-detect` | ASR9K | DCI |
| | `interface vlan 10`<br>`  no bfd echo` | N9K | Leaf |

| | | | |
|---|---|---|---|
| Multicast Routing | `feature pim` | N9K | Leaf |
| | `interface loopback1`<br>`  ip address 10.10.10.10/24`<br>`  ip router ospf 10 area 0.0.0.0`<br>`  ip pim sparse-mode` | N9K | Spine |
| | `ip pim rp-address 10.218.20.250 group-list 239.255.0.0/16 override` | N9K | Spine |
| | `ip pim anycast-rp 10.218.20.250 10.218.20.249`<br>`ip pim anycast-rp 10.218.20.250 10.218.20.248` | N9K | Spine |
| | `feature pim` | N9K | Leaf |
| | `ip pim rp-address 10.218.20.250 group-list 239.255.0.0/16 override` | N9K | Leaf |
| | `interface Vlan10`<br>`  ip pim sparse-mode` | N9K | Leaf |
| | `interface loopback0`<br>`  ip pim sparse-mode` | N9K | Leaf |
| | `interface Ethernet2/1`<br>`  ip pim sparse-mode` | N9K | Leaf |
| | `interface Ethernet2/2`<br>`  ip pim sparse-mode` | N9K | Leaf |
| L2 Technologies | `interface Ethernet 1/10`<br>`  switchport mode trunk` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  switchport trunk allowed vlan none` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  spanning-tree port type edge trunk` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  spanning-tree bpduguard enable` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  spanning-tree bpdufilter enable` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  storm-control broadcast level 20.0` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  storm-control multicast level 30.0` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  storm-control unicast level 50.0` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  storm-control action shutdown` | N9K | Spine |
| vPC Role and Priority | `vpc domain 1`<br>`  role priority 100` | N9K | Leaf |
| | `vpc domain 1`<br>`  role priority 200` | N9K | Leaf |
| vPC Peer Keep-alive Link | `vrf context management` | N9K | Leaf |
| | `interface mgmt 0`<br>`  vrf member management` | N9K | Leaf |
| | `interface mgmt 0`<br>`  ip address 10.10.10.10/24`<br>`  no shutdown` | N9K | Leaf |
| | `vpc domain 1`<br>`  peer-keepalive destination 172.20.118.20` | N9K | Leaf |

| | | | |
|---|---|---|---|
| vPC Peer-Link | `interface Ethernet 1/1`<br>`  spanning-tree port type network`<br>`  channel-group 1 mode active no shutdown` | N9K | Leaf |
| | `interface Ethernet 1/2`<br>`  spanning-tree port type network`<br>`  channel-group 1 mode active no shutdown` | N9K | Leaf |
| | `interface port-channel1`<br>`  switchport`<br>`  switchport mode trunk`<br>`  spanning-tree port type network`<br>`  vpc peer-link` | N9K | Leaf |
| vPC Port | `interface Ethernet 2/9`<br>`  channel-group mode active id 51` | N9K | Leaf |
| | `interface port-channel 51`<br>`  switchport` | N9K | Leaf |
| | `interface port-channel 51`<br>`  switchport`<br>`  vpc 51` | N9K | Spine |

| | | | |
|---|---|---|---|
| vPC Peer-Switch Option | `vpc domain 1`<br>`  peer-switch` | N9K | Leaf |
| vPC ARP Synchronization | `vpc domain 1`<br>`  ip arp synchronize` | N9K | Leaf |
| vPC in VXLAN environment adjustment | `vpc domain 10`<br>`  peer-switch`<br>`  system-priority 100 ( could not find this option)`<br><br>`  peer-keepalive destination 172.20.118.120`<br>`  delay restore 200`<br>`  peer-gateway`<br>`  ip arp synchronize` | N9K | Leaf |
| | `interface port-channel1`<br>`description vPC peer-link` | N9K | Spine |
| | `interface port-channel1`<br>`  description vPC switchport mode trunk` | N9K | Leaf |
| | `interface port-channel 1`<br>`  description vPC switchport mode trunk` | N9K | |
| | `interface port-channel 1`<br>`  description vPC spanning-tree port type network` | N9K | |
| | `interface port-channel 1`<br>`  vpc peer-link` | N9K | |
| | `interface port-channel 10`<br>`  switchport trunk allowed vlan` | N9K | |
| | `interface port-channel 10`<br>`  spanning-tree port type edge trunk` | N9K | |
| | `interface port-channel 10`<br>`  spanning-tree bpdufilter enable` | N9K | |
| | `interface port-channel 10`<br>`  spanning-tree bpduguard enable` | N9K | |
| | `interface port-channel 10`<br>`  vpc 10` | N9K | Spine |
| | `interface Ethernet 1/10`<br>`  switchport trunk allowed vlan none` | N9K | Spine |
| | `interface Ethernet 1/10`<br>`  spanning-tree port type edge trunk` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  spanning-tree bpduguard enable` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  spanning-tree bpdufilter enable` | N9K | Leaf |
| | `interface Ethernet 1/10`<br>`  channel-group 10 mode active` | N9K | Leaf |
| | `interface loopback 0`<br>`  ip address 10.10.10.10/24` | N9K | Leaf |
| | `interface loopback 0`<br>`  ip address 10.10.10.10/24 secondary` | N9K | Leaf |
| | `interface loopback 0`<br>`  ip router ospf 100 area 0.0.0.0` | N9K | Leaf |
| | `interface loopback 0`<br>`  ip pim sparse-mode` | N9K | Leaf |
| | `interface Vlan 10`<br>`  ip address 10.10.10.10/24` | N9K | Leaf |
| | | | |

Supported Underlay Configuration Examples

| | | | |
|---|---|---|---|
| | interface Vlan 10<br>  description Underlay vPC Backup link<br>  no shutdown<br>  no bfd echo | N9K | Spine |
| | interface Vlan 10<br>  ip ospf network point-to-point | N9K | Leaf |
| | interface Vlan 10<br>  ip router ospf 100 area 0.0.0.0 | N9K | Leaf |
| | interface Vlan10<br>  ip pim sparse-mode | N9K | Leaf |

| | | | |
|---|---|---|---|
| STP | interface Ethernet 1/10<br><br>switchport mode trunk | N9K | Leaf |
| | interface Ethernet 1/10<br>switchport mode trunk allowed vlan 10 | N9K | Leaf |
| | interface Ethernet 1/10<br>spanning-tree port type edge trunk | N9K | Leaf |
| | interface Ethernet 1/10<br>spanning-tree bpduguard enable | N9K | Leaf |
| | nx:interface Ethernet 1/10<br>spanning-tree bpdufilter enable | N9K | Leaf |
| | interface Ethernet 1/10<br>no shutdown | N9K | |
| | interface port-channel 10<br>switchport mode trunk | N9K | Leaf |
| | interface port-channel 10<br>switchport mode trunk trunk allowed vlan ids 1 | N9K | Leaf |
| | interface port-channel 10<br>spanning-tree port type edge | N9K | Leaf |
| | interface port-channel 10<br>spanning-tree bpduguard enable | N9K | Leaf |
| | interface port-channel 10<br>spanning-tree bpdufilter enable | N9K | Leaf |
| | interface port-channel 10<br>no shutdown | N9K | Leaf |
| | interface port-channel 10<br>vpc port-channel-number 10 | N9K | Leaf |
| | interface Ethernet 1/10<br>switchport mode trunk | N9K | Leaf |
| | interface Ethernet 1/10<br>switchport mode trunk allowed vlan 10 | N9K | Leaf |
| | interface Ethernet 1/10<br>spanning-tree port type edge trunk | N9K | Leaf |
| | interface Ethernet 1/10<br>spanning-tre guard root | N9K | Leaf |
| | interface Ethernet 1/10<br>no shutdown | N9K | Leaf |
| | interface ethernet <xxxx><br>description <leaf/Spine Fabric> ip address | N9K | Leaf |
| | interface Ethernet 1/10<br>description leaf mtu 9216 | N9K | Leaf |
| | interface Vlan 1<br>description <attachment/border facing intf> | N9K | Leaf |
| | interface Vlan 1<br>description ip address <addr> | N9K | Leaf |
| | interface Vlan 1<br>description ip address mtu 1500 | N9K | Leaf |
| | interface <To Spine><br>mtu 9214 | N9K | Leaf |
| | interface <To Border Leaf><br>mtu 1518 | N9K | Leaf |
| | | | |

Supported Underlay Configuration Examples

| | | | |
|---|---|---|---|
| | interface GigabitEthernet0/0/1/5<br>  mtu 9214 | ASR9K | DCI |
| Nexus 9500 QOS | system qos<br>  service-policy type queuing output<br>default-out-policy | N9K | Leaf |
| | policy-map type network-qos Jumbo-nq-policy<br>  class type network-qos c-nq3 | N9K | Leaf |
| | policy-map type network-qos Jumbo-nq-policy<br>class type network-qos c-nq3<br>  match qos-group 3 | N9K | Leaf |
| | policy-map type network-qos Jumbo-nq-policy<br>class type network-qos c-nq3<br>  mtu 9216 | N9K | Leaf |
| | class type network-qos c-nq3<br>  match qos-group 3<br>  mtu 9216<br>class type network-qos c-nq2<br>  match qos-group 2<br>  mtu 9216<br>class type network-qos c-nq1<br>  match qos-group 1<br>  mtu 9216<br>class type network-qos c-nq-default<br>  match qos-group 0<br>  mtu 9216 | N9K | Leaf |
| | system qos<br>service-policy type network-qos Jumbo-nq-policy | N9K | Leaf |
| QoS Hardware resources configuration | "hardware access-list tcam region racl 0<br>hardware access-list tcam region e-racl 0<br>hardware access-list tcam region span 0<br>hardware access-list tcam region vqos 256<br>hardware access-list tcam region e-qos 256<br>hardware access-list tcam region arp-ether 256" | N9K | Leaf |
| N 9500 QoS | system qos<br>service-policy type queuing output<br>default-out-policy | N9K | Leaf |
| | system qos<br>service-policy type network-qos Jumbo-nq-policy | N9K | Leaf |
| N 9500 QoS Queuing policy | policy-map type queuing default-out-policy<br>class type queuing c-out-q3<br>  priority level 1<br>class type queuing c-out-q2<br>  bandwidth remaining percent 0<br>class type queuing c-out-q1<br>  bandwidth remaining percent 0<br>class type queuing c-out-q-default<br>bandwidth remaining percent 100 | N9K | Leaf |
| | System qos<br>  Service-policy type queuing out<br>default-out-policy | N9K | Leaf |

| | | | |
|---|---|---|---|
| N 9500 QoS Queuing Policy | policy-map type queuing default-out-policy<br>class type queuing c-out-q3<br>priority level 1<br>class type queuing c-out-q2<br>bandwidth remaining percent 0<br>class type queuing c-out-q1<br>bandwidth remaining percent 0<br>class type queuing c-out-q-default<br>bandwidth remaining percent 100 | N9K | Leaf |
| | System qos<br>Service-policy type queuing out<br>default-out-policy | N9K | Leaf |
| Network Management Ethernet (Mgmt0) | interface mgmt0<br>ip address 10.10.10.10/24 | N9K | Leaf |
| | vrf context management<br>ip route 0.0.0.0/0 10.218.23.254 | N9K | Leaf |
| Configuring Hostname on Nexus 9000 | hostname nw_lf_cnx9_001.41gebz_o01_s01 | N9K | Leaf |
| Time Zone and day-light saving | clock timezone EET 2 0<br>clock summer-time EEST 4 Sunday March 02:00 4 Sunday October 03:00 60 | N9K | Leaf |
| DNS | ip domain-name <cust_name><br>no ip domain-lookup | N9K | Leaf |
| SNMP | snmp-server contact <contact_name><br>snmp-server location <location_name> | N9K | Leaf |
| | snmp-server host 85.29.26.36 traps version 2c <SNMP_Community_1><br>snmp-server host 85.29.56.136 traps version 2c <SNMP_Community_1><br>snmp-server host 85.29.60.191 traps version 2c <SNMP_Community_1><br>snmp-server host 85.29.60.235 traps version 2c <SNMP_Community_1><br>snmp-server host 213.74.189.232 traps version 2c <SNMP_Community_1><br>snmp-server host 213.74.189.233 traps version 2c <SNMP_Community_1> | N9K | Leaf |
| | snmp-server host 85.29.26.36 use-vrf management<br>snmp-server host 85.29.56.136 use-vrf management<br>snmp-server host 85.29.60.191 use-vrf management<br>snmp-server host 85.29.60.235 use-vrf management<br>snmp-server host 213.74.189.232 use-vrf management<br>snmp-server host 213.74.189.233 use-vrf management | N9K | Leaf |
| | snmp-server source-interface trap mgmt0 | N9K | Leaf |
| | snmp-server community <community> group network-admin | N9K | Leaf |
| | 15 permit ip host 213.74.197.43 any<br>...<br>390 permit ip host 176.43.250.25 any | N9K | Leaf |

| | | | |
|---|---|---|---|
| LLDP on Nexus 9000 | `feature lldp` | N9K | Leaf |
| Network Security Disable IP Redirects | `interface Ethernet slot#/port#`<br>`  no ip redirects`<br>`  no ipv6 redirects` | N9K | Leaf |
| Device Access Security | `NX-OS(config)#no ssh server enable`<br>`NX-OS(config)#ssh key {dsa [force] \| rsa [bits [force]]}`<br>`NX-OS(config)#ssh server enable`<br>`NX-OS#show ssh key`<br>`**********`<br>`rsa Keys generated:Fri Apr 10 20:13:21 2010`<br>`<clipped> !` | N9K | Leaf |
| AAA-N | `NX-OS(config)#feature tacacs+`<br>`NX-OS(config)#tacacs-server host {ipv4-address \| ipv6-address \| host-name}`<br>`NX-OS(config)#tacacs-server key [0 \| 7] key-value`<br>`NX-OS(config)#aaa group server tacacs+ group-name`<br>`  server {ipv4-address \| ipv6-address \| host-name}`<br>`deadtime minutes`<br>`  use-vrf <demo_name>`<br>`NX-OS(config)#tacacs-server timeout seconds`<br>`NX-OS(config)#tacacs-server host {ipv4-address \| ipv6-address \| host-name} port`<br>`tcp-port`<br>`NX-OS(config)#tacacs-server deadtime minutes` | N9K | Leaf |
| | `feature tacacs+`<br>`aaa group server tacacs+ TacacsGroup`<br>`  use-vrf management`<br>`  server 10.35.175.1`<br>`aaa authentication login console group TacacsGroup`<br>`aaa authentication login default group TacacsGroup`<br>`aaa authentication login error-enable`<br>`!`<br>`tacacs-server host 10.35.175.1 key <shared-key>`<br>`port 49`<br>`tacacs-server directed-request`<br>`ip tacacs source-interface mgmt 0`<br>`!`<br>`! Device Login Authorisation with AAA`<br>`!` | N9K | Leaf |
| | `aaa authorization config-commands default group TacacsGroup local`<br>`aaa authorization commands default group TacacsGroup local`<br>`!`<br>`! Device Login Accounting with AAA`<br>`!`<br>`aaa accounting default group TacacsGroup`<br>`!`<br>`! Local User Configuration`<br>`!`<br>`username admin Pword <Pword> role network-admin` | N9K | Leaf |

| | | | |
|---|---|---|---|
| Device Hardening 3.9.9.4 COPP policy and class maps | policy-map type control-plane<br>copp-system-p-policy-strict<br>  class copp-system-p-class-l3uc-data<br>  set cos 1<br>  police cir 250 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-critical<br>  set cos 7<br>  police cir 19000 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-important<br>  set cos 6<br>  police cir 3000 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-multicast-router<br>  set cos 6<br>  police cir 3000 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-management<br>  set cos 2<br>  police cir 3000 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-multicast-host<br>  set cos 1<br>  police cir 2000 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-l3mc-data<br>  set cos 1<br>  police cir 3000 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-normal<br>  set cos 1<br>  police cir 1500 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-ndp<br>  set cos 6<br>  police cir 1500 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-normal-dhcp<br>  set cos 1<br>  police cir 300 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class<br>copp-system-p-class-normal-dhcp-relay-response<br>  set cos 1<br>  police cir 400 pps bc 64 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-normal-igmp<br>  set cos 3<br>  police cir 6000 pps bc 64 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-redirect<br>  set cos 1<br>  police cir 1500 pps bc 32 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-exception<br>  set cos 1<br>  police cir 50 pps bc 32 packets conform transmit<br>violate drop | N9K | Leaf |
| | | | |

| | | | |
|---|---|---|---|
| | class copp-system-p-class-exception-diag<br>  set cos 1<br>  police cir 50 pps bc 32 packets conform transmit<br> violate drop | N9K | Leaf |
| | class copp-system-p-class-monitoring<br>  set cos 1<br>  police cir 300 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-l2-unpoliced<br>  set cos 7<br>  police cir 20000 pps bc 8192 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-undesirable<br>  set cos 0<br>  police cir 15 pps bc 32 packets conform transmit<br> violate drop | N9K | Leaf |
| | class copp-system-p-class-fcoe<br>  set cos 6<br>  police cir 1500 pps bc 128 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-nat-flow<br>  set cos 7<br>  police cir 100 pps bc 64 packets conform<br>transmit violate drop | N9K | Leaf |
| | class copp-system-p-class-l2-default<br>  set cos 0<br>  police cir 50 pps bc 32 packets conform transmit<br> violate drop | N9K | Leaf |
| | class class-default<br>  set cos 0<br>  police cir 50 pps bc 32 packets conform transmit<br> violate drop | N9K | Leaf |
| | N9k-ST-Leaf-01# sh copp status<br>Last Config Operation: None<br>Last Config Operation Timestamp: None<br>Last Config Operation Status: None<br>Policy-map attached to the control-plane:<br>copp-system-p-policy-strict | N9K | Leaf |
| | N9k-ST-Leaf-01# sh copp profile ?<br>dense  Display dense profile<br>lenient  Display lenient profile<br>moderate Display moderate profile<br>strict  Display strict profile | N9K | Leaf |
| BFD | feature bfd<br>bfd interval 50 min_rx 50 multiplier 3 | N9K | Leaf |
| | router ospf UNDERLAY<br>  bfd | N9K | Leaf |
| | router bgp 65539<br>vrf <demo_name><br>  address-family ipv4 unicast | N9K | Leaf |
| | router bgp 65539<br>  vrf <demo_name><br>  local-as 65539 | N9K | Leaf |
| | router bgp 65539<br>vrf <demo_name><br>  neighbor 10.23.65.0 remote-as 65541<br>  bfd | N9K | Leaf |

| | | | |
|---|---|---|---|
| OSPF Routing Process | feature ospf<br>!<br>router ospf UNDERLAY<br>log-adjacency-changes detail<br>bfd | N9K | Leaf |
| OSPF Router ID | router ospf UNDERLAY<br>log-adjacency-changes detail<br>bfd<br>router-id <loopback17-ip-address> | N9K | Leaf |
| Enabling OSPF on interfaces | router ospf UNDERLAY<br>passive-interface default | N9K | Leaf |
| | continue from the above...<br>interface Ethernet1/5<br>ip router ospf UNDERLAY area 0.0.0.1<br>ip ospf bfd<br>ip ospf network point-to-point<br>no ip ospf passive-interface | N9K | Leaf |
| | interface loopback<id><br>ip router ospf UNDERLAY area 0.0.0.1 | N9K | Leaf |
| OSPF Authentication | interface eth <slot>/<port><br>ip ospf authentication message-digest<br>ip ospf message-digest-key <key-id> md5 0<br><clear-text-key> | N9K | Leaf |
| OSPF Reference-Bandwidth | router ospf UNDERLAY<br>auto-cost reference bandwidth 100Gbps | N9K | Leaf |
| Underlay OSPF Configuration on Leaf<br>Underlay OSPF Configuration on Spine | interface loopback17<br>ip router ospf UNDERLAY area 0.0.0.1 | N9K | Leaf |
| | interface eth<slot>/<port><br>ip router ospf UNDERLAY area 0.0.0.1<br>ip ospf network point-to-point<br>no ip ospf passive-interface<br>ip ospf bfd<br>ip ospf authentication message-digest<br>ip ospf message-digest-key <key-id> md5 0<br><clear-text-key> | N9K | Leaf / Spine |
| Enabling Multicast Routing - PIM | feature pim | N9K | Leaf |
| | ip pim long-neighbor-changes | N9K | Spine |
| | interface ethernet 1/10<br>ip pim sparse-mode | N9K | Spine |
| | interface ethernet 1/10<br>ip pim bfd-instance | N9K | Spine |
| | interface loopback<id><br>ip pim sparse-mode | N9K | Leaf |

| | | | |
|---|---|---|---|
| Mapping Layer 2 VNI VXLAN segment to ASM group | interface nve<id><br>member vni <L2-VNID><br>mcast-group 239.239.0.1<br>member vni <L2-VNID><br>mcast-group 239.239.0.2 | N9K | Leaf |
| PIM Anycast RP (RFC 4610) | interface loopback18<br>ip pim sparse-mode | N9K | Leaf |
| | interface loopback17<br>ip pim sparse-mode | N9K | Leaf |
| | ip pim rp-address <loopback18> group-list 239.239.0.0/16 | N9K | Leaf |
| Multicast configuration for Leaf | ip pim rp-address <anycast-loopback> group-list 239.239.0.0/16 | N9K | Leaf |
| | feature pim<br>ip pim log-neighbor-changes | N9K | Leaf |
| | interface loopback17<br>ip pim sparse-mode | N9K | Leaf |
| | interface ethernet<slot>/<port><br>ip pim sparse-mode<br>ip pim bfd-instance | N9K | Leaf |
| | interface nve1<br>member vni <L2-VNID><br>mcast-group 239.64.64.1<br>member vni <L2-VNID><br>mcast-group 239.64.64.2 | N9K | Leaf |
| | ip pim rp-address <anycast-loopback> group-list 239.239.0.0/16 | N9K | Leaf |
| Multicast configuration for Spine | feature pim<br>ip pim log-neighbor-changes | N9K | Spine |
| | interface ethernet 1/10<br>ip pim sparse-mode | N9K | Spine |
| | interface ethernet 1/10<br>ip pim bfd-instance | N9K | Spine |
| | interface loopback17<br>ip pim sparse-mode | N9K | Spine |
| | interface loopback18<br>ip pim sparse-mode | N9K | Spine |
| | ip pim rp-address <loopback18> group-list 239.239.0.0/16 | N9K | Spine |
| | ip pim anycast-rp <loopback18> <loopback17> | N9K | Spine |
| Service Extensions for OSPF routing | vlan 17<br>vn-segment 10019 | N9K | |
| | interface Vlan17<br><br>mtu 9216<br>vrf member <demo_name><br><br>ip ospf cost 10<br>ip ospf passive-interface<br>ip router ospf 1 area 0.0.0.0 | N9K | |

| | | | |
|---|---|---|---|
| Service Extensions for Static routing | `vrf context <demo_name>`<br><br>`ip route 0.0.0.0/0 Vlan1605 11.0.23.30` | N9K | |
| Service Extension for default route injection on N9K BL/redistribute mode. | `router bgp 65542`<br>`vrf <demo_name>`<br>`address-family ipv4 unicast`<br>`network 0.0.0.0/0` | N9K | |
| route-map | `route-map RM-IN-S2 permit 10`<br>`match tag 1000`<br>`route-map RM-IN-S3 permit 10`<br>`match tag 1000` | N9K | |
| | `route-map RM-S-to-O permit 10`<br>`match tag 131 132 133 139 134 135`<br>`set metric-type type-1` | N9K | |
| vrf context <demo_name> | `vrf context <demo_name>`<br>`ip route 9.59.207.0/24 Vlan1603 11.0.34.30 name <test_name> tag 1000 50` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 9.59.207.0/24 Ethernet1/46.2 11.0.40.142 name <test_name> tag 1000 10` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 10.0.0.0/12 Vlan1603 11.0.34.30 tag 1000 50` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 10.0.0.0/12 Ethernet1/46.2 11.0.40.142 tag 1000 10` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 10.2.52.0/24 Vlan6 10.2.42.3 tag 1000` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 192.168.0.0/16 Vlan1603 11.0.34.30 name <test_name> tag 1000`<br>`rd auto`<br>`address-family ipv4 unicast`<br>`route-target both auto`<br>`route-target both auto evpn` | N9K | |
| vrf context <demo_name> | `vrf context <demo_name>`<br>`ip route 10.2.0.0/19 Vlan1607 11.0.34.14 tag 131 50` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 10.2.0.0/19 Ethernet1/45.1 11.0.40.145 tag 131 10` | N9K | |
| | `vrf context <demo_name>`<br>`ip route 10.2.96.0/19 Vlan3203 11.0.39.14 tag 134` | N9K | |

| | | | |
|---|---|---|---|
| interface Vlan1601 | interface Vlan1601<br>no shutdown<br>vrf member <demo_name><br>no ip redirects<br>  ip address 10.10.10.10/24<br>no ipv6 redirects<br>hsrp version 2<br>hsrp 1601<br>    preempt<br>   priority 110<br>   ip 11.0.34.33 | N9K | |
| interface Vlanxx | interface Vlan1602<br>no shutdown<br>vrf member <demo_name><br>no ip redirects<br>no ipv6 redirects<br>ip ospf cost 10<br>ip ospf passive-interface<br>ip router ospf 100 area 0.0.0.0 | N9K | |
| interface Ethernet<br>(IPv4 and IPv6) | interface ex/y<br>  mac aaaa.bbbb.cccc<br>  vrf member <demo_name><br>  ip address x.x.x.x/31<br>  ipv6 address x:x:x::x<br>  ip policy route-map TO_VPER_OR_FW<br>  ipv6 policy route-map TO_VPER_OR_FW_v6<br>  no shut | N7K | |
| interface Ethernet1/46.1 | interface Ethernet1/36.1<br>mtu 1500 | N9K | |
| | interface Ethernet1/36.1<br>encapsulation dot1q 1602<br>mac-address 0000.0000.2222<br>vrf member <demo_name><br>no ip redirects<br>ip address 10.10.10.10/24 | N9K | |
| interface Ethernet1/47.1 | interface Ethernet1/37.1<br>mtu 1500<br>encapsulation dot1q 1608<br>vrf member <demo_name><br>no ip redirects<br>ip address 10.10.10.10/24<br>ip ospf dead-interval 20<br>ip ospf hello-interval 5<br>ip ospf network point-to-point<br>ip router ospf 100 area 0.0.0.0 | N9K | |
| router ospf 1 | router ospf 1<br>vrf <demo_name><br>   router-id 55.2.32.5<br>vrf <demo_name><br>   router-id 55.2.32.5<br>vrf <demo_name><br>   router-id 55.2.32.5<br>   redistribute static route-map RM-S-to-O | N9K | |
| router bgp 65543 | router bgp 65543<br>vrf <demo_name><br>   address-family ipv4 unicast<br>     advertise l2vpn evpn<br>     redistribute direct route-map<br>vts-subnet-policy<br>     redistribute static route-map RM-IN-S2 | N9K | |
| | nv overlay evpn | N9K | |
| | clock protocol ntp vdc 1 | N9K | |

| | | | |
|---|---|---|---|
| role name nsdcheck | role name nsdcheck<br>rule 4 permit command show *<br>rule 3 permit command terminal length *<br>rule 2 permit command ping *<br>rule 1 permit read | N9K | |
| | role name devcheck<br>rule 8 permit command tac-pac *<br>rule 7 permit command dir *<br>rule 6 permit command ssh *<br>rule 5 permit command traceroute *<br>rule 4 permit command ping * | N9K | |
| | role name devopera<br>rule 1 permit read-write | N9K | |
| ip name-server 55.6.8.73 55.22.8.3 | ip name-server 55.6.8.73 55.22.8.3 | N9K | |
| username | username user password 5 $1$lDuqR.60$eNzZ5I22WxJT58gdEm88N0 role network-operator | N9K | |
| | username vtsadmin password 5 $5$MmpswImI$vbZhP/52dNjHY5KWj4yBvmiDvuOZZ9gd2vo2oZc61b4 role network-admin | N9K | |
| | username nsdcheck password 5 $5$dpIXMjZs$jDIZVf6grMu1yq79vTts2mcgPlt0QWp5z3tDnw3N5W8 role nsdcheck | N9K | |
| snmp-server | snmp-server source-interface trap loopback1 | N9K | |
| | snmp-server user user network-operator auth md5 0x3eaa4221f6bbf8722cbdea7ea6bf2f11 priv 0x3eaa4221f6bbf8722cbdea7ea6bf2f11 localizedkey | N9K | |
| | snmp-server host 55.6.8.1 traps version 2c COMMUNITY1<br>snmp-server host 55.6.8.1 use-vrf default | N9K | |
| | snmp-server enable traps bgp<br>snmp-server enable traps ospf<br>snmp-server enable traps callhome event-notify<br>snmp-server enable traps callhome smtp-send-fail<br>snmp-server enable traps cfs state-change-notif<br>snmp-server enable traps lldp lldpRemTablesChange<br>snmp-server enable traps aaa server-state-change<br>snmp-server enable traps hsrp state-change<br>snmp-server enable traps feature-control FeatureOpStatusChange<br>snmp-server enable traps sysmgr cseFailSwCoreNotifyExtended<br>snmp-server enable traps config ccmCLIRunningConfigChanged<br>snmp-server enable traps snmp authentication<br>snmp-server enable traps link cisco-xcvr-mon-status-chg<br>snmp-server enable traps vtp notifs<br>snmp-server enable traps vtp vlancreate<br>snmp-server enable traps vtp vlandelete<br>snmp-server enable traps bridge newroot<br>snmp-server enable traps bridge topologychange<br>snmp-server enable traps stpx inconsistency<br>snmp-server enable traps stpx root-inconsistency<br>snmp-server enable traps system Clock-change-notification<br>snmp-server enable traps feature-control ciscoFeatOpStatusChange | N9K | |
| | snmp-server community COMMUNITY1 group network-operator | N9K | |

| | | | |
|---|---|---|---|
| ntp | ntp source-interface loopback0<br>ntp logging | N9K | |
| ip pim | ip pim ssm range 232.0.0.0/8 | N9K | |
| spanning-tree | spanning-tree pathcost method long<br>spanning-tree mst 1 priority 4096<br>spanning-tree mst configuration<br>name CFG01<br>revision 1<br>instance 1 vlan 1-4094 | N9K | |
| hardware | hardware access-list tcam region qos 0 | N9K | |
| vpc domain | vpc domain 151<br>peer-keepalive destination 55.2.34.2 source 55.2.34.1 vrf default | N9K | |
| | vpc domain 151<br>auto-recovery | N9K | |
| interface vlan | interface Vlan1602<br>no shutdown<br>vrf member <demo_name><br>no ip redirects<br>fabric forwarding mode anycast-gateway | N9K | |
| interface port-channel | interface port-channel101<br>no switchport<br>mtu 9216<br>no ip redirects<br>ip address 10.10.10.10/24<br>ip ospf cost 10<br>ip ospf dead-interval 20<br>ip ospf hello-interval 5<br>ip ospf network point-to-point<br>ip router ospf 1 area 0.0.0.0<br>ip pim sparse-mode | N9K | |
| interface Ethernet | interface Ethernet1/45<br>no switchport<br>mtu 9216<br>mac-address 0000.0000.1111 | N9K | |
| | interface Ethernet1/47<br>no switchport<br>mtu 9216<br>udld enable | N9K | |
| | interface Ethernet2/5<br>switchport mode trunk<br>switchport trunk allowed vlan 2-4094<br>channel-group 21 mode active | N9K | |

| | | | |
|---|---|---|---|
| interface mgmt0 | `interface mgmt0`<br>`no lldp transmit`<br>`no lldp receive` | N9K | |
| clock timezone | `clock timezone PRC 8 0` | N9K | |
| ip route | `ip route 0.0.0.0/0 Ethernet1/46.452 55.6.34.198 tag 1000 10`<br>`ip route 0.0.0.0/0 Vlan3903 55.6.40.14 tag 1000 50` | N9K | |
| router ospf | `router ospf 1`<br>`redistribute static route-map RM-S-to-O` | N9K | |
| router bgp | `router bgp 65543`<br>`router-id 55.2.32.5`<br>`address-family ipv4 unicast`<br>`address-family l2vpn evpn`<br>`neighbor 55.2.32.1`<br>`remote-as 65543`<br>`update-source loopback1`<br>`address-family ipv4 unicast`<br>`address-family l2vpn evpn`<br>`send-community extended` | N9K | |
| router bgp<br>(IPv4 only) | `router bgp 65539`<br>`router-id 192.168.0.25`<br>`log-neighbor-changes`<br>`address-family ipv4 unicast`<br>`maximum-paths 32`<br>`maximum-paths ibgp 32`<br>`address-family ipv6 unicast`<br>`maximum-paths 32`<br>`maximum-paths ibgp 32`<br>`address-family l2vpn evpn`<br>`neighbor 192.168.0.3`<br>`remote-as 65539`<br>`password 3 2b7cf4643b66b222`<br>`update-source loopback17`<br>`address-family l2vpn evpn`<br>`send-community`<br>`send-community extended` | N9K and N7K | |
| Event manager config<br>(IPv4 and IPv6) | `event manager applet TRACK-PING-FOR-BGP-DOWN`<br>`event track 1 state down`<br>`action 1.0 syslog msg CANNOT PING FW. GOING TO SHUTDOWN BGP PEER`<br>`action 2.0 cli config term`<br>`action 3.0 cli router bgp 65539`<br>`action 4.0 cli vrf <demo_name>`<br>`action 5.0 cli neighbor 175.175.175.175`<br>`action 6.0 cli shutdown`<br>`event manager applet TRACK-PING-FOR-BGP-UP`<br>`event track 1 state up`<br>`action 1.0 syslog msg CAN PING FW. GOING TO NO SHUTDOWN BGP PEER`<br>`action 2.0 cli config term`<br>`action 3.0 cli router bgp 65539`<br>`action 4.0 cli vrf <demo_name>`<br>`action 5.0 cli neighbor 175.175.175.175`<br>`action 6.0 cli no shutdown` | N9K | |
| IP sla config<br>(IPv4 only for N9K)<br>(IPv4 and IPv6 for N7K) | | N9K and N7K | |

Supported Underlay Configuration Examples

| | | | |
|---|---|---|---|
| | !On BL-1 Track the local VPER-1<br>ip sla 1<br>  icmp-echo 69.83.32.36 source-interface vlan 2400<br><br>    vrf <demo_name>     ☐ forward reference to VRF<br>    threshold 500<br>    timeout 500<br>    frequency 1<br>! Start the SLAs<br>ip sla schedule 1 life forever start-time now<br><br><br>! Setup a track object for sla 1<br>track 1 ip sla 1 reachability<br> delay up 180 down 3<br><br>! Set up a track open that returns a DOWN only if both objects 1 and 2 are down.<br>track 111 list boolean or<br>  object 1 | | |
| Track config<br>(IPv4 and IPv6) | track 10 ip route 0.0.0.0/0 reachability<br>  vrf member <demo_name> | N9K and N7K | |
| Interface port channel<br>(IPv4 and IPv6) | interface port-channel 110.2511<br>  encapsulation dot1q 2511<br>  vrf member <demo_name><br>  ip address 10.10.10.10/24<br>  no shut<br>interface port-channel 110.2575<br>  encapsulation dot1q 2575<br>  vrf member <demo_name><br>  ipv6 address 10:10:10:10:10:10:10:10/64 | N9K and N7K | |
| | interface port-channel 110.2577<br>  ip policy route-map FROM_VPER<br><br>interface port-channel 110.2577<br>  ipv6 policy route-map FROM_VPERv6<br>! EEM to track both VPERs, when one is up restore traffic<br>event manager applet VPER_TRACK_UP<br>  event track 111 state up<br>  action 1.0 syslog msg "BOTH VPERS ARE UP. REMOVING BYPASS!"<br>  action 2.0 cli command "config t"<br>  action 3.0 cli command "route-map TO_VPER_OR_FW permit 20"<br>  action 4.0 cli command "no continue 30"<br>  action 5.0 cli command "exit"<br>  action 6.0 cli command "route-map TO_VPER_OR_FWv6 permit 20"<br>  action 7.0 cli command "no continue 30"<br>  action 8.0 cli command "exit"<br>  action 9.0 cli command "route-map FROM_FW_TO_VPER_OR_MOBILE permit 10"<br>  action 10.0 cli command "no continue 20"<br>  action 11.0 cli command "end"<br>  action 12.0 cli command "route-map FROM_FW_TO_VPER_OR_MOBILEv6 permit 10"<br>  action 13.0 cli command "no continue 20"<br>  action 14.0 cli command "end"<br>  action 15.0 syslog msg "TRAFFIC HAS BEEN RESTORED TO VPER" | N7K | |
| | | N9K | |

| | | | |
|---|---|---|---|
| | ! EEM to track both VPERs, when one is up restore traffic<br>event manager applet VPER_TRACK_UP<br>  event track 111 state up<br>  action 1.0 syslog msg BOTH VPERS ARE UP. REMOVING BYPASS<br>  action 2.0 cli command "config t"<br>  action 3.0 cli command "route-map TO_VPER_OR_FW permit 20"<br>  action 4.0 cli command "no continue 30"<br>  action 5.0 cli command "exit"<br>  action 6.0 cli command "route-map TO_VPER_OR_FWv6 permit 20"<br>  action 7.0 cli command "no continue 30"<br>  action 8.0 cli command "exit"<br>  action 9.0 cli command "route-map FROM_FW_TO_VPER_OR_MOBILE permit 10"<br>  action 10.0 cli command "no continue 20"<br>  action 11.0 cli command "end"<br>  action 12.0 cli command "route-map FROM_FW_TO_VPER_OR_MOBILEv6 permit 10"<br>  action 13.0 cli command "no continue 20"<br>  action 14.0 cli command "end"<br>  action 15.0 syslog msg TRAFFIC HAS BEEN RESTORED TO VPER | | |
| IP access list<br>(IPv4 and IPv6) | ip access-list ALL_POOLS<br>  10 permit ip  1.0.0.0/8 any<br>  20 permit ip  any 1.0.0.0/8<br>  30 permit ip  2.0.0.0/8 any<br>  40 permit ip  any 2.0.0.0/8<br><br>! Need to configure a ACL for all All POOLS<br>ipv6 access-list ALL_POOLSv6<br>  10 permit ipv6  2001:1::/32 any<br>  20 permit ipv6  any 2001:1::/32<br>  30 permit ipv6  2001:2::/32 any<br>  40 permit ipv6  any 2001:2::/32 | N9K and N7K | |
| Route-map<br>(IPv4 and IPv6) | set ip next-hop verify-availability 69.83.32.35 track 2<br>route-map TO_VPER_OR_FW permit 30<br>  match ip address ALL_POOLS<br>  ! Set the ip next-hop to the FW VIP<br>  set ip next-hop 69.83.136.129<br><br>route-map TO_VPER_OR_FW_v6 permit 10<br>! Leave room here for the pilot packets<br>route-map TO_VPER_OR_FW_v6 permit 20<br>  match ipv6 address VPER_POOLSv6<br>  set ipv6 next-hop verify-availability 2001:4888:16:2078:1e1:210:: track 1<br>  set ipv6 next-hop verify-availability 2001:4888:16:207a:1e1:210:: track 2<br>route-map TO_VPER_OR_FW_v6 permit 30<br>  match ipv6 address ALL_POOLSv6<br>  ! Set the ipv6 next-hop to the FW VIP<br>  set ipv6 next-hop 2001:4888:39:3080:308:25:: | N9K and N7K | |
| | route-map FROM_FW_TO_VPER_OR_MOBILE permit 10<br>  match ip address VPER_POOLS<br>  set vrf <demo_name>_VPER | N7K | |

Supported Underlay Configuration Examples

| | | | |
|---|---|---|---|
| Monitor erspan | monitor session 1 type erspan-source<br>  erspan-id 5<br>  vrf <demo_name><br>  ip ttl 25<br>  ip dscp 42<br><br>monitor erspan origin ip-address 10.0.0.1 global | N9K and N7K | |
| QOS- class-map | class-map type qos match-any TEST1<br>  match packet length 5 | N9K and N7K | |
| QOS class-map policy-map | class-map type control-plane match-any<br>cust1-copp-system-p-class-exception<br>  match exception ip option<br>  match exception ip icmp unreachable<br>  match exception ipv6 option<br>  match exception ipv6 icmp unreachable<br>class-map type control-plane match-any<br>cust1-copp-system-p-class-fcoe<br>  match access-group name<br>cust1-copp-system-p-acl-mac-fcoe<br><br><br>policy-map type control-plane<br>cust1-copp-system-p-policy-strict<br>  class cust1-copp-system-p-class-exception<br>  set cos 1<br>  police cir 360 kbps bc 250 ms conform<br>transmit violate drop<br>  class cust1-copp-system-p-class-fcoe<br>  set cos 6<br>  police cir 1060 kbps bc 1000 ms conform<br>transmit violate drop | | |
| Tunnel Interface | interface Tunnel1<br>vrf member <demo_name><br>ip address 10.10.10.10/24<br>tunnel source 1.1.1.201<br>tunnel destination 1.1.1.200<br>no shutdown | N9K and N7K | |