



CCIE Enterprise Infrastructure v1.0 Bootcamp

MPLS



MPLS

- + Core MPLS Goals
 - + Establish LDP Label Switch Path (LSP) between Provider Edge (PE) routers
 - + Establish VPNv4 BGP between PEs
 - + Establish IGP/BGP PE-CE routing connectivity

LDP Considerations

- + LDP transport uses UDP Multicast & TCP Unicast port 646
 - + Multicast to discover neighbors
 - + TCP to peer and exchange labels
- + LDP Router-ID is the default transport source
 - + Like IGP/BGP, the highest Loopback is the router-id
 - + TCP packets are sourced from transport source
 - + Implies IP reachability is needed, like BGP
 - + Can be modified per link
 - + **mpls ldp discovery transport-address**

LDP Workflow

- + Enable LDP per-link
 - + **mpls ip**
- + Alternatively, enable it under OSPF
 - + **mpls ldp autoconfig**
- + Verify LDP is enabled
 - + **show mpls interfaces**
- + Verify that adjacencies have formed
 - + **show mpls ldp neighbor**
- + Verify that labels are bound
 - + **show mpls forwarding-table**
- + Like IGP, only best routes are installed
 - + View all possible labels with **show mpls ldp bindings**

LDP Label Allocation Considerations

- + LDP is an IGP based label protocol
 - + All IGP learned routes have labels bound by default
 - + BGP learned routes cannot be bound by LDP
 - + Label allocations/advertisements can be filtered

LDP Verifications

- + Traceroute between PEs
 - + Path between loopbacks should be labeled path
 - + VPNv4 BGP update source (loopback) is tunnel destination
 - + Break in LSP implies that customer traffic will be dropped in core

VPNv4 BGP

- + Goal is to establish iBGP VPNv4 between PEs
 - + Same transport rules apply for IPv4 Unicast BGP
 - + Same peering options as IPv4 Unicast BGP
 - + iBGP full mesh (of PEs)
 - + Route Reflection (of PEs)
 - + Confederation (of PEs)
 - + VPNv4 path selection rules are the same as IPv4 unicast
- + Transit P devices do not need VPNv4
 - + Traffic is tunneled over them through LDP based MPLS LSPs

VPNv4 BGP (cont.)

- + VPNv4 BGP adds 2 key attributes
 - + Route Distinguisher (RD)
 - + Makes the route unique
 - + Route Target (RT)
 - + Defines the VPN membership
- + RD must be globally unique per-customer
 - + Can be unique per-customer per-PE too
- + RT may overlap for central services VPNs
 - + E.g. service provider hosts central email service for VPN customers

PE-CE Routing Considerations

- + All protocols are VRF aware
 - + RIPv2
 - + EIGRP
 - + OSPFv2/v3
 - + BGP
 - + Static
 - + Policy Routing

PE-CE Routing Considerations (cont.)

- + Loop prevention rules change per protocol
 - + EIGRP uses BGP Cost Community by default
 - + OSPF uses down-bit and domain-tag
 - + OSPF area hierarchy changes with MPLS
 - + MPLS is “super backbone”
 - + BGP uses AS-Path
 - + AS Override can break this

