



CCIE Routing & Switching  
Advanced Troubleshooting Bootcamp

MPLS L3VPN Troubleshooting

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## MPLS L3VPN Workflow

- MPLS L3VPN operation can be subdivided into five discrete steps...
  - SP IGP control plane
  - SP label distribution control plane
  - SP MP-BGP control plane
  - PE-CE VRF routing control plane
  - CE-CE data plane

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## SP IGP Control Plane

- Goal is to establish internal IGP path between all PEs
- MPLS inside the SP network requires IGP routing through OSPF or IS-IS
  - Static/RIP/EIGRP possible but highly unlikely
- Same troubleshooting considerations as normal IGP

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## SP Label Distribution Control Plane

- Goal is to establish Label Switch Path (LSP) between all PEs
- Requires label distribution protocol
  - TDP
  - LDP
    - Our case
  - RSVP
  - BGP
  - Static

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## MPLS LDP Troubleshooting

- Requires two phases of transport
  - Neighbor discovery
    - Multicast UDP to 224.0.0.2 at port 646
  - Peering establishment
    - Unicast TCP at port 646 to transport address
- Troubleshooting considerations
  - CEF
  - UDP filtering
  - TCP client/server relationship & filtering
  - Transport address reachability
  - Authentication
  - IGP vs LDP advertisement mismatch
    - IGP summarization, OSPF loopback, etc.

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## Common LDP Commands

- `show mpls interfaces`
- `show mpls ldp discovery`
- `show mpls ldp neighbor`
- `show mpls ldp password`
- `show mpls forwarding-table`  
`[prefix] [detail]`
- `debug ip tcp transactions`
- `debug mpls ldp transport events`

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## MP-BGP Troubleshooting

- Goal is to advertise VPNv4 routes between PEs
- Troubleshooting considerations
  - Same requirements as IPv4 unicast BGP
  - Capabilities (address-families)
  - Route Target filtering
  - Extended communities

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## Common MP-BGP Commands

- `show bgp vpnv4 unicast [all|rd|vrf]`
- `show bgp vpnv4 unicast all summary`
- `show bgp vpnv4 unicast all labels`
- `debug bgp vpnv4 unicast updates`

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## PE-CE Routing Troubleshooting

- Goal is to advertise customer routes into MP-BGP and vice-versa
- Troubleshooting considerations
  - VRFs
    - RD, and RT import/export policy
  - VRF aware routing
    - Protocol specific
      - E.g. OSPF domain-id, sham-links, EIGRP SoO, etc.
  - MP-BGP exchange
    - Redistribution considerations
      - Metrics, filtering, etc.

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## Common VRF Commands

- `show ip vrf [detail]`
- `show ip vrf interfaces`
- `show ip route vrf [*|vrf]`
- `show ip cef vrf [vrf] [address]  
[internal]`
- `ping vrf`
- `traceroute vrf`
- `telnet /vrf`

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## Further Reading

- [MPLS Troubleshooting](#)
- [Troubleshooting LSP Failure in MPLS VPN](#)
- [How to Troubleshoot the MPLS VPN](#)