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SP-ROUTE (642-883)

OSPFv2 and OSPFv3 Routing in Service Provider Environments

- Describe multi-area OSPFv2 and OSPFv3 operations
- Implement multi-area OSPFv2 and OSPFv3 on IOS-XR and IOS-XE
- Implement different OSPF areas (stubby, totally stubby, NSSA) on IOS-XR and IOS-XE
- Implement OSPF neighbor authentication on IOS-XR and IOS-XE
- Troubleshoot OSPF configuration errors on IOS-XR and IOS-XE

IS-IS, IPv4, and IPv6 in Service Provider Environments

- Describe multi-area IS-IS operations
- Implement multi-area IS-IS for IPv4 and IPv6 on IOS-XR and IOS-XE
- Implement IS-IS neighbor authentication on IOS-XR and IOS-XE
- Troubleshoot IS-IS IOS-XR and IOS-XE configuration errors

BGP Routing in Service Provider Environments

- Describe the Internet routing hierarchy: Network Service Providers (NSP), Network Access Point (NAP), ISP Tiers (Tier 1, 2 and 3)
- Describe connectivity between an enterprise network and an SP that requires the use of BGP
- Describe connectivity between a SP and upstream SPs
- Describe BGP transit AS operations
- Implement EBGP and IBGP on IOS-XR and IOS-XE
- Implement BGP neighbor authentication on IOS-XR and IOS-XE
- Influence BGP route selection by using various BGP attributes on IOS-XR and IOS-XE
- Troubleshoot BGP IOS-XR and IOS-XE configuration errors

Route Manipulations in Service Provider Environments

- Implement Routing Policy Language (RPL) to configure a desired routing policy on IOS-XR
- Implement Route-Maps to configure a desired routing policy on IOS-XE
- Implement route filterings using prefix-list, distribute-list, and as-path list on IOS-XE
- Implement route redistributions on IOS-XR and IOS-XE

High Availability Routing Features

- Implement NSF/NSR/Graceful Restart for OSPF on IOS-XR and IOS-XE
- Implement NSF/NSR/Graceful Restart for IS-IS on IOS-XR and IOS-XE
- Implement Bidirectional Forwarding Detection (BFD) for OSPF on IOS-XR and IOS-XE
- Implement Bidirectional Forwarding Detection (BFD) for IS-IS on IOS-XR and IOS-XE

SP-ADV-ROUTE (642-885)

BGP Routing Features in a Service Provider IP NGN Environment

- Describe the BGP routing processes in IOS-XR
- Configure the BGP timers on IOS-XR and IOS-XE
- Describe the need for BGP confederations in BGP transit backbones
- Design and implement BGP route reflectors to scale IBGP in BGP transit backbones on IOS-XR and IOS-XE
- Implement BGP route dampening on IOS-XR and IOS-XE
- Troubleshoot BGP IOS-XR and IOS-XE configuration errors in service provider environments
- Optimize BGP IOS-XR configurations using af-groups, session-groups, and neighbor-groups
- Optimize BGP IOS-XE configurations using peer-groups

Multicast Routing in a Service Provider IP NGN Environment

- Describe Multicast Concepts (MDT, multicast routing protocols and IGMP operations)
- Describe Intra Domain versus Inter Domain Multicast Routing
- Describe the mapping of multicast IP addresses to MAC addresses
- Describe multiprotocol BGP functions in mroute distribution
- Describe the principles and operations of PIM-SM
- Describe multicast source discovery protocol (MSDP) operations
- Describe methods used to secure multicast
- Implement PIM-SM operations on IOS-XR and IOS-XE
- Implement Auto-RP, PIMv2 BSR, Anycast RP on IOS-XR and IOS-XE
- Implement Bi-Dir PIM operations in SP IP NGN environment on IOS-XR and IOS-XE
- Implement MSDP operations on IOS-XR and IOS-XE
- Troubleshoot multicast routing IOS-XR and IOS-XE configurations errors in service provider environments

IPv6 in a Service Provider IP NGN Environment

- Describe DNS and DHCP operation in IPv6
- Describe the fields that are used in the IPv6 header to support QoS functions
- Describe dual-stack implementations
- Configure static IPv6-in-IPv4 tunnels on IOS-XR and IOS-XE
- Configure dynamic 6to4 tunnels on IOS-XR and IOS-XE

High Availability Routing Features

- Implement NSF/NSR/Graceful Restart for BGP on IOS-XR and IOS-XE
- Implement Bidirectional Forwarding Detection (BFD) for BGP on IOS-XR and IOS-XE

Implement high availability and optimization multicast routing features on IOS-XR and IOS-XE

SP-CORE (642-887)

QoS in a Service Provider IP NGN Environment

- Describe the DiffServ and IntServ QoS models
- Describe the QoS mechanisms (classification and marking, congestion management and avoidance, traffic policing and shaping)
- Describe IPv6 Flow Label
- Describe trust boundaries in Enterprise and SP environments
- Describe Cisco MQC for QoS configurations
- Describe hierarchical QoS configurations
- Describe the Cisco NBAR feature for discovering network protocols and for packets classifications
- Describe the typical Edge PE routers and Core P routers QoS requirements
- Implement classification and marking in an interdomain network using QPPB on Cisco IOS-XR and IOS-XE
- Implement class-based markings on Cisco IOS-XR and IOS-XE
- Implement QoS pre-classify on tunnel interface on Cisco IOS-XR and IOS-XE
- Implement CB-WFQ on Cisco IOS-XR and IOS-XE
- Implement LLQ on Cisco IOS-XR and IOS-XE
- Implement WRED on Cisco IOS-XR and IOS-XE
- Implement traffic policing on Cisco IOS-XR and IOS-XE
- Implement traffic shaping on Cisco IOS-XR and IOS-XE
- Describe LPTS and hardware rate limiters on Cisco IOS-XR routers
- Describe MPLS EXP bits
- Describe MPLS QoS implementation concepts and models
- Implement MPLS DiffServ Tunneling on Cisco IOS-XR and IOS-XE
- Troubleshoot QoS IOS-XR and IOS-XE configuration errors

MPLS/LDP in a Service Provider IP NGN Environment

- Describe the CEF, FIB, LFIB and LIB tables on Cisco routers
- Describe MPLS labels and label stack operations on Cisco routers
- Describe LDP operations in Cisco routers
- Describe MPLS OAM (MPLS LSP Ping and MPLS Traceroute)
- Describe MPLS Applications in Service provider environment
- Implement LDP on Cisco IOS-XR and IOS-XE
- Implement LDP high availability features on Cisco IOS-XR and IOS-XE
- Troubleshoot LDP on IOS-XR and IOS-XE configuration errors

MPLS Traffic Engineering in a Service Provider IP NGN Environment

- Describe MPLS traffic engineering (TE) concepts
- Describe MPLS TE constraint-based path computations
- Describe the details of MPLS TE tunnels, including path setup procedures and path maintenance
- Describe methods of assigning traffic into MPLS TE tunnels
- Implement MPLS TE tunnels on Cisco IOS-XR and IOS-XE
- Implement MPLS TE bandwidth control on Cisco IOS-XR and IOS-XE
- Implement MPLS TE link and node protections on Cisco IOS-XR and IOS-XE

Transport Technologies

- Describe the SP core transition from ATM/SONET/SDH based backbone to packet based IP/MPLS backbone
- Implement 10/40/100 GigabitEthernet Interfaces on Cisco IOS-XR routers
- Describe DWDM, IPoDWDM and ROADM
- Implement IPoDWDM controller/interface on Cisco IOS-XR routers

SP-EDGE (642-889)

VPN in Service Provider IP NGN Environments

- Describe VPN implementation models (overlay, peer-to-peer)
- Describe VPN technologies (L2TPv3, GRE, IPsec VPN, SSLVPN, DMVPN, GETVPN)
- Describe layer 2 versus layer 3 VPNs

MPLS layer 3 VPNs in Service Provider IP NGN Environments

- Describe MPLS layer 3 VPN architecture and operations (RDs, RTs, VRFs, MP-BGP, PE-CE routing)
- Describe the design models for combining Internet access with MPLS Layer 3 VPN services
- Describe the various methods used to deploy IPv6 over MPLS (6PE and 6VPE)
- Implement MP-BGP between PE routers on Cisco IOS-XR and IOS-XE
- Implement PE-CE routings (static, EIGRP, OSPF, BGP) on Cisco IOS-XR and IOS-XE
- Implement complex MPLS layer 3 VPNs on Cisco IOS-XR and IOS-XE
- Implement carrier supporting carrier (CSC) on Cisco IOS-XR and IOS-XE
- Troubleshoot MPLS layer 3 VPNs IOS-XR and IOS-XE configuration errors in service provider environments

Layer 2 VPNs in Service Provider IP NGN Environments

- Describe L2TPv3 VPNs over an IP core network
- Describe layer 2 VPNs (AToM and VPLS) over an IP/MPLS core network
- Describe AToM Interworking
- Implement AToM on Cisco IOS-XR and IOS-XE

Carrier Ethernet in Service Provider IP NGN Environments

- Describe Carrier Ethernet forums and standards (MEF, IEEE, IETF)
- Describe the concepts of User PE (U-PE) and Network PE (N-PE)
- Describe E-Line versus E-LAN vs E-Tree
- Describe QinQ tunneling
- Describe Provider Backbone Bridge (PBB - aka MAC-in-MAC)
- Describe VPWS versus VPLS
- Describe VPLS versus H-VPLS
- Describe VPLS signaling using LDP or BGP
- Implement QinQ on Cisco ME 3400 Ethernet Access Switches
- Implement VPLS on Cisco IOS-XR and IOS-XE

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