Part #: VPND-ROUTE

Who should attend

Network professionals, such as network engineers, network operations center (NOC) technical support personnel, and help desk technicians, who want to correctly implement routing-based solutions given a network design using Cisco IOS services and features, where implementation of routing includes planning, configuration, and verification. Any individual involved in implementation and verification of routing protocols in enterprise networks

Prerequisites
CCNA certification or familiarity with internetworking technologies and the ability to perform basic configuration of Cisco routers, including practical experience installing, operating, and maintaining Cisco routers and switches in an enterprise environment. Knowledge of IP, including the ability to perform IP subnetting on non-octal boundaries, configure IP standard and extended access lists, operate and configure distance vector routing protocol, configure serial interface, and interpret a Cisco routing table

Course Description

ROUTE is a new course that replaces BSCI as part of Cisco's recent changes to the CCNP and CCDP certification programs. In this course, administrators of medium-to-large network sites will learn to use advanced routing to provide scalability for Cisco routers that are connected to WANs. Networking professionals will learn to dramatically increase the number of routers and sites using these techniques instead of redesigning the network when additional sites or wiring configurations are added. Hands-on labs ensure you thoroughly understand how to implement advanced routing within your network.

Course Outline
1. Planning Routing Services to Requirements

Assessing Complex Enterprise Network Requirements
Cisco conceptual network models, such as Cisco Enterprise Architectures and the Cisco hierarchical network model
Cisco Enterprise Architecture
Traffic conditions in a converged network
Cisco SONA framework
Routing and routing protocols
Common Maintenance Processes and Procedures
Create a typical implementation plan
Typical implementation plan information and tasks
Implementation documentation
Lab 1-1 Debrief
2. Implementing an EIGRP-Based Solution
Planning Routing Implementations with EIGRP
Four key technologies employed by EIGRP
How EIGRP operates
Five components of the metric used by EIGRP
Calculate the EIGRP metric for a range of pathways between routers
Create a typical implementation plan for an EIGRP-based solution
Document EIGRP implementation, operations, and maintenance processes
Implementing and Verifying Basic EIGRP for the Enterprise LAN Architecture
Commands used in a basic EIGRP configuration task
Select the interfaces and networks that will participate in EIGRP routing use the network command and wildcard masks
Verify basic EIGRP operations and that the router recognizes EIGRP neighbors and their routes

Create neighbor relationships using the neighbor command and verify that the router recognizes EIGRP neighbors and routes
Control routing update advertisements using the passive-interface command
Configure and verify the last-resort gateway or default route
Why administrators may need to use manual route summarization over default automatic route summarization
Configure and verify route summarization
Lab 2-1 Debrief
Configuring and Verifying EIGRP for the Enterprise WAN Architecture
Effect on EIGRP operations when operating over a circuit emulation link such as Metro Ethernet or EoMPLS
Effect on EIGRP operations when operating over MPLS VPNs
Effect on EIGRP operations when operating over Frame Relay
Physical interface: dynamic DLCI mapping, static DLCI mapping, broadcast vs. non-broadcast
Logical multipoint interface: dynamic DLCI mapping, static DLCI mapping, broadcast vs. non-broadcast
Logical point-to-point interface
Configure and verify EIGRP operating over Frame Relay
Features of load balancing across equal paths
Configure and verify EIGRP load balancing across unequal cost paths
Evaluate why EIGRP defaults may need to be changed to ensure efficient use of bandwidth across WAN links
Configure EIGRP bandwidth use across WAN links
Lab 2-2 Debrief
Implementing and Verifying EIGRP Authentication
Evaluate router authentication
Message Digest 5 (MD5) authentication used in EIGRP
Configure MD5 authentication
Troubleshoot MD5 authentication
Lab 2-3 Debrief
Advanced EIGRP Features in an Enterprise Network
Factors affecting scalability in large internetworks
How EIGRP uses queries to update its routing tables in the event that a route is lost and there is no feasible successor
Mark the spokes of a large network as stubs to reduce EIGRP queries and thus improve network scaling
Why stuck-in-active (SIA) connections occur
Minimize active routes
Illustrate how graceful shutdown prevents loss of packets when routers go down
Lab 2-4 Debrief
3. Implementing a Scalable Multiarea Network OSPF-Based Solution
Planning Routing Implementations with OSPF as Scalable Routing Protocol
Link-state routing protocols
The two-tier hierarchy structure of OSPF
How routers running a link-state routing protocol establish neighbor adjacencies with their neighboring routers
How OSPF calculates the best path to each destination network
How routers use link-state updates (LSUs) to verify that links are still active
Different OSPF area types
Create a typical implementation plan for an OSPF-based solution
Create a typical implementation documentation package for an OSPF-based solution
How OSPF Packet Processes Work
Five OSPF packet types
How OSPF neighbor adjacencies are established
Process of exchanging and synchronizing the link-state databases (LSDBs or topology tables) between routers
How OSPF maintains synchronization of the LSDBs (topology tables) of all routers in the network
Process of maintaining a database of only the most recent link-state sequence numbers
How to verify that OSPF packets are flowing properly between two routers
Improving Routing Performance in a Complex Enterprise Network

OSPF network types
Determine adjacency behavior in point-to-point links
Determine adjacency behavior in a broadcast network
Determine adjacency behavior in a Metro Ethernet and EoMPLS network
Determine adjacency behavior in MPLS networks
Select a DR and BDR
Implement OSPF over different Frame Relay implementations
Implement OSPF over Frame Relay NBMA
Use subinterfaces in OSPF over Frame Relay
Implement OSPF over a point-to-point Frame Relay network
Implement OSPF over a point-to-multipoint Frame Relay network
Configuring and Verifying OSPF Routing
Configure basic single-area and multiarea OSPF
Enable the route process
Configure a router ID
Enable OSPF on networks and interfaces using the network and ip ospf commands
Configure basic multiarea OSPF operations
Verify basic multiarea OSPF operations
Neighbor relationship
OSPF router types
LSAs defined by OSPF
Interpret the OSPF LSDB and routing table
How routing advertisements can be controlled using the passive-interface command
Effects of a non-contiguous backbone or area that does not connect to area 0 and how
(Design note: Network mergers are a good context) OSPF virtual links are used to
address these issues
Configure and verify an OSPF virtual link
Change the cost metric from default values
Lab 3-1 Debrief
Lab 3-2 Debrief
Configuring and Verifying OSPF Route Summarization
Functions of interarea route summarization and external route summarization
Configure route summarization in OSPF
Benefits of a default route in OSPF
Configure a default route injection into OSPF
Lab 3-3 Debrief
Configuring and Verifying OSPF Special Area Types
OSPF area types
Configure OSPF stub areas
Configure OSPF totally stubby areas
Interpret information shown on routing tables for stub areas and totally stubby
areas
Configure OSPF NSSAs
Verify all types of OSPF stub areas
Lab 3-4 Debrief
Configuring and Verifying OSPF Authentication
Distinguish between the two types of authentication used in OSPF
Configure simple password authentication
Configure MD5 authentication
Troubleshoot simple password authentication
Troubleshoot MD5 authentication
Lab 3-5 Debrief
4. Implement an IPv4-Based Redistribution Solution
Assessing Network Routing Performance and Security Issues
Common network performance issues
How distribution lists work
Use distribution lists to control routing updates
How prefix lists work
Use a prefix list to control routing updates
How route maps work
Use route maps to control routing updates
Use route maps to filter routes
Suppress routing updates using passive interfaces

Operating a Network Using Multiple IP Routing Protocols
The need to use multiple IP routing protocols
Route redistribution
Configure dynamic routing protocol updates for passive interfaces and distribute lists
Use of Policy routing and route maps
Seed metrics used by various routing protocols
Process for points of distribution in a network and identifying possible routing loops
Create a distribution and loop map for a given network
Configuring and Verifying Route Redistribution
Procedures necessary to configure route redistribution
How to redistribute routes into RIP
How to redistribute routes into EIGRP
How to redistribute routes into OSPF
Assess the advantages of administrative distance in terms of routing protocols
Modify administrative distance on the router globally for a particular routing protocol or specifically for certain routes to control path selection
Assess the impact of administrative distance changes on routing tables
Implement route maps with route redistribution to prevent routing loops
Verify route redistribution operations
Lab 4-1 Debrief
5. Implementing Path Control
Assessing Path Control Network Performance Issues
Assess path control network performance
Use filters to determine path selection
Use PBR to determine path selection
Configure and verify PBR
Configure and verify PBR operations on a Cisco router
Lab 5-1 Debrief
References to additional Path Control in E-Learning
ROUTE-01 of 3: Implement Path Control
ROUTE-01 Lesson 1: Parallel Processes when Implementing Path Control
ROUTE-01 Lesson 2: Directed Demo of Procedures to Implement Path Control by Other Methods
ROUTE-01 Lesson 3: Self-Check Assessment
6. Connection of an Enterprise Network to an ISP Network
Planning the Enterprise-to-ISP Connection
Connectivity requirement between an enterprise network and an ISP
Exchanging routing information across an ISP
Static routes
Common IGPs
MPLS VPNs
Circuit Emulation
BGP
Types of enterprise-to-ISP connections and their effect on the selection of an exchange method
Single-homed
Dual-homed
Multihomed
Dual-multihomed
Considering the Advantages of Using BGP
Connectivity between an enterprise network and an ISP that requires the use of BGP, including issues that arise when an enterprise decides to connect to the Internet through multiple ISPs
BGP multihoming options
How BGP routes between autonomous systems
How BGP uses path-vector functionality
Features of BGP in terms of deployment and enhancements over other distance vector routing protocol and database types
Comparing the Functions and Uses of EBGP and IBGP
Terms used to describe BGP routers and their relationships
Requirements for establishing an external BGP (EBGP) neighbor relationship

Requirements for establishing an internal BGP (IBGP) neighbor relationship
Use of metrics
Configuring and Verifying Basic BGP Operations
Initiate basic BGP configuration
Activate a BGP session for external and internal neighboring routers
Administratively shut down and re-enable a BGP neighbor
Select the factors and options to correctly configure BGP
BGP neighbor states
Configure MD5 authentication on the BGP TCP connection between two routers
Configure and verify BGP operations in a single-homed environment
Troubleshoot BGP configuration
Lab 6-1 Debrief
Using the BGP Attributes and Path Selection Process
BGP attributes that affect outbound EBGP path selection
Criteria for selecting a BGP path
Configure the AS path attribute to affect outbound EBGP path selection
How the local preference attribute can be configured to affect outbound path selection
Configure the weight attribute to affect outbound EBGP path selection
Use route maps to set selected attributes for selected routes to control outbound EBGP path selection
AS Path prepending
Local preference
Weight
How the MED attribute can be configured to effect inbound EBGP path selection
How the AS path attribute (AS prepending) can be configured to affect inbound EBGP path selection
How to use route maps to set selected attributes for selected routes to control outbound EBGP path selection
AS Path prepending
MED
Document implementation, operations, and maintenance
Lab 6-2 Debrief
E-Learning Training on IPv6 and Routing for Branch Offices and Remote Workers
Implementing IPv6
Implementing Routing Facilities for Branch Offices and Mobile Workers
Analyzing Mobile Workers Designs and Planning for Mobile Workers Installations
Directed Demo: Implement Special Facilities for Mobile Workers
Lab 3-2 Debrief
Self-Check Assessment