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Routing

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CCNP™ Routing The Cram Sheet

This Cram Sheet contains the distilled key facts about *CCNP Routing Exam*. Review this information right before you enter the test room, paying special attention to those areas where you feel you need the most review. You can transfer any of these facts onto a blank sheet of paper before beginning the exam.

SCALABLE INTERNETWORKS

1. Router roles:
   - *Core*—At the top of your internetwork hierarchy
   - *Distribution*—In the midsections of your hierarchy, providing connectivity from the core backbone to the individual sites
   - *Access*—At the bottom of the hierarchy, providing end-user access to internetwork resources
2. Compression is best utilized on low-speed serial links.

ROUTING PROTOCOL OVERVIEW

3. Routing protocol metrics:
   - *OSPF*—Cost (based on bandwidth)
   - *EIGRP*—Bandwidth, delay, load, reliability, and MTU
4. Administrative distance is the believability of a route learned by a particular routing protocol:
   - *OSPF*—110
   - *EIGRP*—90
   - *Directly connected*—0
   - *Static route*—0 or 1 for administrative distance with static routes depends on whether a next hop address is specified (1) or an outbound interface (0).
   - Use the **distance** command to manipulate administrative distance from the **config-router** prompt

IP ADDRESSING USING VLSM

5. VLSM
   - Routing protocol must be capable of passing the prefix in routing updates to support VLSM.
   - RIP and IGRP do not support VLSM.
   - OSPF does support VLSM.
   - EIGRP support for VLSM must be enabled (**no auto-summary** under the EIGRP configuration).
   - Further subdivides the address space.
   - Mask for serial links is 255.255.255.252 to provide for only two hosts.
6. Route summarization:
   - Find a common bit boundary in the sequence of network addresses.
   - Count the number of bits the addresses have in common to create the prefix.
   - Use the command **area *<number>* range *<network address>* *<prefix>*** for OSPF route summarization. This command is entered under the OSPF configuration.
   - Use the command **ip summary-address eigrp *<as number>* *<network address>***

<prefix> for EIGRP route summarization. This command is entered on the outbound interface that will be advertising the summary route. Enter the command **no auto-summary** under EIGRP to support summarization.

7. Network Address Translation (NAT) is used to convert private internal IP addresses to public external IP addresses, which should exist in your registered space.

SCALABLE ROUTING PROTOCOLS

8. Distance-vector routing protocols:
   - RIP
   - RIP v.2
   - IGRP
9. Link-state routing protocols:
   - OSPF
   - IS-IS
10. Advanced distance-vector routing protocols:
    - EIGRP
11. Classful routing protocols do not support VLSM.
12. Classful routing protocols:
    - RIP
    - IGRP
13. Classless routing protocols (which do support VLSM):
    - RIP v.2
    - OSPF
    - IS-IS
    - EIGRP

OSPF

14. OSPF is a link-state routing protocol.
15. Developed to overcome RIP limits:
    - Fast convergence.
    - No hop count limit.
    - Support for VLSM.
    - Metric is cost based on bandwidth.
    - Efficient routing updates via multicast.
16. Uses Hello protocol to establish neighbor relationship.
17. DR election:
    - Highest priority is DR.
    - Second highest priority is BDR.
    - Router ID used to break tie on priority.
    - Router ID is highest IP address or IP address of Loopback 0 interface.
    - Election of DR/BDR will occur only on broadcast media (such as Ethernet and token ring).
18. Routing updates:
    - Routing updates sent to DR and BDR if present via 224.0.0.6.
    - DR forwards routing updates to other OSPF routers via 224.0.0.5.
    - If no DR/BDR, simply forward update to neighbor(s).
    - Routing updates, called *LSAs*, are disseminated in flooding fashion.
19. Required information for OSPF neighbors:
    - Neighbor ID
    - Area ID
    - Router priority
    - DR IP address
    - BDR IP address
    - Authentication type
    - Authentication password
    - Stub area flag
20. OSPF router designations:
    - *Internal router*—Any router with all interfaces in one area
    - *Area border router*—Any router with interfaces in multiple areas
    - *Backbone router*—Any router with an interface in area 0
    - *Autonomous system boundary router*—Any router with a connection to an external autonomous system
21. Stub areas:
    - *Stub area*—Contains only one exit point (via the ABR to area 0), all intra-area routes, summary routes to other areas, and a default route.
    - *Totally stubby area*—Contains only one exit point (via the ABR to area 0), all intra-area routes, and a default route. It contains no external routes or summary routes.
    - All routers in stub or totally stubby area must agree that the area is a stub.

- Use the **area <*number*> stub no-summary** command on the ABR to create totally stubby area.
- Use the **area <*number*> stub** command on internal routers to tell them they're part of a stub area.
- Do not configure area 0 as a stub area.

22. Virtual links must be configured on areas that cannot connect directly to area 0.
23. Show commands:
    - **show ip protocols**—Shows active routing protocols
    - **show ip ospf neighbor**—Shows neighbor database

EIGRP

24. Routes for IP, IPX, and AppleTalk.
25. Metric is composite of bandwidth, delay, load, reliability, and MTU.
26. Best route is called *successor* or *current successor*. Selected based on lowest feasible distance.
27. Second best route is called *feasible successor*. Advertised distance of this route must be lower than feasible distance of best route to be considered a feasible successor.
28. Automatic redistribution between EIGRP and IGRP if AS numbers are same.
29. Use the **ip summary-address eigrp <*as number*> <*network address*> <*prefix*>** command on the outbound interface to configure summarization.
30. Show commands:
    - **show ip eigrp neighbors**—Displays the EIGRP IP neighbor table.
    - **show ip eigrp topology**—Displays the EIGRP IP topology table.
    - **show ip route**—Displays the IP routing table.

BGP OPERATION

31. Use BGP to connect to ISP when you need multiple exit points or when specified by ISP.
32. EBGP is a BGP connection to an external AS, whereas IBGP is a BGP connection within the local AS.
33. Use a default route to point your AS to the ISP rather than redistributing.
34. BGP uses TCP to ensure guaranteed delivery of routing updates.
35. A peer group is a group of BGP neighbors that share the same update policies.
36. When load-balancing, BGP only operates properly if it's receiving identical updates from the same provider.
37. BGP uses route maps for route filtering.
38. A route reflector is based on the idea of specifying a concentration router to act as a focal point for internal BGP sessions. Multiple BGP routers can peer to a central router, and then multiple route reflectors can peer together.
39. A BGP confederation is based on the concept that an AS can be broken into multiple sub-ASes.

TRAFFIC MANAGEMENT

40. IP standard access lists:
    - Filter only on source IP address.
    - Use list numbers between 1 and 99.
41. IP extended access lists:
    - Filter on source IP address, destination IP address, protocol, and port number.
    - Use list numbers between 100 and 199.
42. A wildcard mask is the inverse value of a subnet mask. To find an appropriate wildcard mask for a specific subnet, change the binary value of each bit in the subnet mask. For example, a subnet mask of 255.255.255.240 would use a wildcard mask of 0.0.0.15.
43. Standard access lists should be placed as close as possible to the destination of the filtered traffic.
44. Extended access lists should be placed as close as possible to the source of the filtered traffic.
45. Any traffic not specifically permitted by an access list is denied. The last line of all access lists is an implicit **deny**.
46. A static route specifying an outbound interface of null 0 is a good alternative to access lists.

47. The command **line vty 0 4** will move you to the virtual terminal configuration prompt.
48. IP helper addresses should be placed on the inbound interface that will be receiving the broadcast to be forwarded.
49. Required information for tunnel configuration:
    - *Tunnel source*—The outbound interface through which to depart this router.
    - *Tunnel destination*—The next logical hop IP address where the tunnel terminates.
    - *Tunnel mode*—The definition of the mode used to encapsulate the traffic to be carried. **tunnel mode gre ip** is the command to set it to generic route encapsulation.
    - *Encapsulated protocol attributes*—Includes IPX network number, AppleTalk, cable range, and zone.

OPTIMIZING ROUTING UPDATES

50. Static routes:
    - **ip route <*dest.network*> <*dest. netmask*> <*next hop addr I out int*> <*distance*>**
    - Specifying outbound interface sets administrative distance to 0 and automatically redistributes.
    - Specifying next hop address sets administrative distance to 1 and requires manual redistribution.
    - Manipulating administrative distance to a high number so that the dynamic route will show and use the static route as a backup is called a *floating static route.*
51. Default route:
    - Use the **ip default network <*network address*>** command to set on each router.
    - Use **ip route 0.0.0.0 0.0.0.0 <*out int I next hop address*>** to set static default route.
52. Stopping routing updates:
    - Use the **passive interface <*int*>** command to force a routing protocol to stop sending updates.
    - Use distribute lists with access lists to filter routes.

IP ADDRESSING

53. IP addressing:
    - Routing decision is based on longest match of routing table entry to destination address.
    - *Class A*—1 to 126.
    - *Class B*—128 to 191.
    - *Class C*—192 to 223.
    - To find number of subnets created or number of hosts per subnet, use the 2^X-2 formula.
    - Subnet address is derived through *logical AND* process.
54. Private internetwork space:
    - *Class A*—10.0.0.0 to 10.255.255.255
    - *Class B*—172.16.0.0 to 172.31.255.255
    - *Class C*—192.168.0.0 to 192.168.255.255

About the Authors

Eric McMasters is a Cisco Certified Network Professional (CCNP) and a Cisco Certified Design Professional (CCDP) working for Sprint PCS as a Senior Network Systems Engineer in Lenexa, Kansas. Eric has been involved in communications over the past ten years and has spent the last four years working in the network field, focusing on Cisco products and solutions.

Prior to working for Sprint PCS, Eric spent nine years in the U.S. Air Force as a Communications Control System Technician working with various communications systems. His first six years were spent dealing with mobile communications and setting up mobile/deployable communications networks utilizing various satellite and wide-band technologies. Eric's last three years in the Air Force were spent working with multiple networking technologies, which was his first introduction to Cisco equipment. During this time Eric achieved his Cisco Certified Network Associate (CCNA) and Cisco Certified Design Associate (CCDA) certifications. During his nine years in the Air Force, Eric was stationed around the world, including England, South Korea, Panama, and Saudi Arabia.

Currently Eric is working on varying projects within Sprint PCS to ensure that new product releases are supported on the production network. Eric is also an active member of an Internet Cisco studygroup, located at **www.groupstudy.com**.

Eric is married to Sally and is the proud father of a new three-month-old baby boy. Eric and his family currently reside in Overland Park, Kansas.

Brian Morgan is a CCIE (#4865) as well as a CCSI for Chesapeake Network Solutions. He has been instructing for nearly four years and in the networking industry for over ten years. During that time he has taught Cisco Dial Access Solutions boot camp classes for the internal Service Provider Tiger Teams. The classes he teaches for Chesapeake are ICRC, ACRC, ICND, BSCN, CVOICE, and CATM.

Prior to teaching, Brian spent a number of years with IBM in Network Services, where he attained MCNE, ECNE, and MCSE certifications. He was involved with a number of larger LAN/WAN installations for many of IBM's Fortune 500 companies.

This book is dedicated to my wife Sally and my son Shane, who was born while working on this book. Their love and patience has given me the insight to life's true goals and rewards.
—Eric McMasters

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This book is dedicated to my wife Beth and my daughters Emma and Amanda for their patience in putting up with me during its production. Also included in this dedication is Michelle Smith. Her willingness to give a kid a chance so long ago made this possible.
—Brian Morgan

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This book is dedicated to my wife Dianne, whose love and support makes all things possible.
—Mike Shroyer

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Contents at a Glance

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