Powerful Protocols (Instructor Version)

**Instructor Note**: Red font color or Gray highlights indicate text that appears in the instructor copy only.

1. Objective

A review of EIGRP and OSPF routing protocol configuration and verification commands.

Students will review EIGRP and OSPF commands to complete the end-of-course Capstone Projects.

1. Scenario

At the end of this course, you are asked to complete two Capstone Projects where you will create, configure, and verify two network topologies using the two main routing protocols taught in this course, EIGRP and OSPF.

To make things easier, you decide to create a chart of configuration and verification commands to use for these two design projects. To help devise the protocol charts, ask another student in the class to help you.

Refer to the PDF for this chapter for directions on how to create a design for this modeling project. When complete, share your work with another group or with the class. You may also want to save the files created for this project in a network portfolio for future reference.

1. Resources
* Previous curriculum chapter content for EIGRP and OSPF
* Word processing software
1. Directions
	1. Create a matrix for each routing protocol (EIGRP and OSPF).
		1. Within each routing protocol matrix, design two sections.
			1. one section for configuration commands
			2. one section for verification or **show** commands
		2. Use a word processing program to save your matrix designs, one for EIGRP and one for OSPF.
	2. Review the chapters in this curriculum.
		1. Refer to the different sections and activities presented in the curriculum.
			1. Content
			2. Labs
			3. Packet Tracer Activities
		2. Record configuration commands for each protocol on their respective matrix. **Note**: Some commands are universal, and some are used only for IPv4 or IPv6.
		3. Record verification commands used for each protocol on their respective matrix. **Note**: Some of these commands are universal, and some are used only with IPv4or IPv6.
		4. Leave extra, blank rows for the group or classroom portion of this activity.
	3. Meet as a class or with another group.
		1. Compare configuration commands.
		2. Compare verification commands.
		3. Add any commands to each matrix mentioned in the full- or group-setting that you did not record in your own group.
		4. Save your work for use with the two Capstone projects which summarize this entire course.
2. Instructor Resource Example

The information listed in this section is only one depiction of what students could see as a result of this activity. Other designs may vary per student groups.

**EIGRP Configuration and Verification Commands (summary)**

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| --- | --- |
| Configuration Command | Purpose |
| R1(config)# router eigrp 1 | Enables the EIGRP routing process on R1 using a process ID of 1 |
| R1(config-router)# network 172.16.1.0 0.0.0.255R1(config-router)# network 172.16.3.0 0.0.0.3R1(config-router)# network 192.168.10.4 0.0.0.3 | Configures EIGRP to advertise the specific directly connected subnets |
| R1(config)# ipv6 unicast-routing | \*Enables IPv6 routing on each router |
| R1(config)# ipv6 router eigrp 1R1(config-rtr)# no shutdown | \*Configures EIGRP for IPv6 routing on each router |
| R1(config-rtr)# router-id 1.1.1.1 | Manual assignment of a router ID to that particular router |
| R1(config)# int g0/0R1(config-if)# ipv6 eigrp 1R1(config)# int s0/0/0R1(config-if)# ipv6 eigrp 1R1(config)# int s0/0/1R1(config-if)# ipv6 eigrp 1 | \*Interface configuration directions for assigning IPv6 EIGRP to an interface – must be done on each interface using the IPv6 EIGRP routing protocol |
| R1(config)# interface Serial0/0/0R1(config-if)# ip summary-address eigrp 1 172.31.8.0 255.255.252.0 | Allows R1 to send a manually computed summary route network address and prefix through S0/0/0 |
| R1(config)# interface Serial0/0/0R1(config-if)# ipv6 summary-address eigrp 1 2001:DB8:ACAD:8::/62 | Allows R1 to advertise a manually computed IPv6 summary route network address and prefix through S0/0/0 |
| R1(config)# ip route 0.0.0.0 0.0.0.0 Serial0/1/0 | Configures an IPv4 default route |
| R1(config)# router eigrp 1R1(config-router)# redistribute static | Allows the EIGRP IPv4 default route to be propagated |
| R1(config)# ipv6 route ::/0 Serial0/1/0 | Configures an IPv6 default route |
| R1(config)# ipv6 router eigrp 1R1(config-rtr)# redistribute static | Allows the IPv6 default route to be propagated |
| R1(config)# interface s0/0/0R1(config-if)# ip hello-interval eigrp 1 10 | Changes the EIGRP hello time period to 10 seconds as advertised out of s0/0/0 |
| R1(config)# router eigrp 1R1(config-router)# passive-interface gigabitethernet 0/0 | Changes Gi0/0 to not send hello packet for the EIGRP process to its neighbors |
| R1(config)# interface s 0/0/0R1(config-if)# bandwidth 64 | Sets a particular bandwidth value for a particular interface for EIGRP DUAL calculations |
| R1(config)# interface s 0/0/1R1(config-if)# ipv6 address fe80::1 link-localR1(config-if)# exit | Sets a link-local address for a router’s interface – in this case, s0/0/1 |
| R1(config)# router eigrp 1R1(config-router)# auto-summary | Allows the EIGRP process to use auto-summarization for the routing table output |
| R1 (config)# key chain name-of-chainR1 (config-keychain)# key key-idR1 (config-keychain-key)# key-string key-string-textR1(config)# interface type numberR1(config-if)# ip authentication mode eigrp as-number md5R1(config-if)# ip authentication key-chain eigrp as-number name-of-chain | Creates security parameters to use for authentication with EIGRPConfigures actual authentication using the keychain parameters configured above |
| Verification Command | Purpose |
| R1# show ip route | Displays the known networks on each router |
| R1# show ip eigrp neighbors | Displays the neighbors discovered by EIGRP – neighbor adjacencies |
| R1# show ip protocols | Shows parameters and other information about the current state of any active IPv4 routing protocol processes  |
| R1# show ip eigrp topology | Displays successor paths and the networks recorded in the topology table |
| R1# show ipv6 eigrp neighbors | Verifies adjacencies with directly-connected neighbors – link local addresses |
| R1# show ipv6 route | Displays IPv6 EIGRP routes  |
| R1# show ipv6 protocols | Verifies parameters and current state of the active IPv6 routing protocol processes |
| R1# show ip eigrp topology all-links | Shows entries in the routing table for EIGRP only – also shows successors and feasible successors and FD |
| R1# show ip int brief | Shows link status on a particular router using IPv4 |
| R1# show ipv6 interface brief | Shows link status on a particular router using IPv6 |
| R1# show running-configuration | Displays configuration information currently operating on the router |

**OSPF Configuration and Verification Commands (summary)**

|  |  |
| --- | --- |
| Configuration Command | Purpose |
| R1(config)# router ospf 10 | Enters OSPF for the router using 10 as the process id |
| R1(config)# router ospf 10R1(config-router)# router-id 1.1.1.1R1(config-router)# end | Assigns a router identification address for use with OSPF 10 |
| R1(config)# router ospf 10R1(config-router)# network 172.16.1.0 0.0.0.255 area 0R1(config-router)# network 172.16.3.0 0.0.0.3 area 0R1(config-router)# network 192.168.10.4 0.0.0.3 area 0 | Configures OSPF 10 with network addresses and prefixes – area # indicates to which OSPF group the networks will belong |
| R1# clear ip ospf process | Allows old OSPF information to be cleared and new processes to take effect – places old neighbors in down state and allows new adjacencies to be created |
| R1(config)# interface serial 0/0/1R1(config-if)# bandwidth 1024R1(config-if)# end | Adjusts the bandwidth for a particular interface on a router – used for IPv4 and IPv6 |
| R1(config)# ipv6 unicast-routingR1(config)# interface GigabitEthernet 0/0R1(config-if)# description R1 LANR1(config-if)# ipv6 address 2001:DB8:CAFE:1::1/64R1(config-if)# no shut | Allows IPv6 OSPF to be used for OSPFv3 for one interface (Gi0/0) – must be configured for each interface on the router |
| R1(config)# interface GigabitEthernet 0/0R1(config-if)# ipv6 ospf 10 area 0R1(config-if)# nd | Assigns OSPFv3 for IPv6 for processes and areas on specific interfaces – must be configured per interface on the router |
| R1(config)# interface GigabitEthernet 0/0R1(config-if)# ipv6 address fe80::1 link-localR1(config-if)# exit | IPv6 command which assigns a Link Local network address to an interface – configured per interface |
| R1(config)# ipv6 router ospf 10 R1(config-rtr)# router-id 1.1.1.1R1(config-rtr)# auto-cost reference-bandwidth 1000% OSPFv3-1-IPv6: Reference bandwidth is changed. Please ensure reference bandwidth is consistent across all routers.R1(config-rtr)# end | IPv6 commands which assign a router ID and bandwidth to a particular OSPF process and router – configured separately per router |
| R1# clear ipv6 ospf process  | Allows a reset of the IPv6 OSPF processes so that new information can be propagated on the router for OSPF |
| R1(config)# interface GigabitEthernet 0/0R1(config-if)# ip ospf priority 255R1(config-if)# end | Changes the interface/link priority to a higher or lower number for DR/BDR election – changing to 0, leaves that router’s interface out of the election process. Changing the priority to 255 makes it the highest priority available to the election process |
| R1(config)# ip route 0.0.0.0 0.0.0.0 loopback 0 209.165.200.226R1(config)# router ospf 10R1(config-router)# default-information originate R1(config-router)# end | Sets an IPv4 OSPF default route for a router, assigns that route to the OSPF 10 process and propagates the route  |
| R1(config)# ipv6 route 0::/0 loopback0 2001:DB8:FEED:1::2R1(config)# ipv6 router ospf 10R1(config-rtr)# default-information originate R1(config-rtr)# end | Enables OSPFv3 for IPv6 on an interface for the router – propagates the information |
| R1(config)# interface Serial 0/0/0R1(config-if)# ipv6 ospf hello-interval 5R1(config-if)# ipv6 ospf dead-interval 20R1(config-if)# end | Changes IPv6 Hello and Dead timer intervals to lower or higher values for link reporting and neighbor adjacencies using OSPFv3 |
| R1(config)# router ospf 10R1(config-router)# area 0 authentication message-digest R1(config-router)# exitR1(config)# interface GigabitEthernet 0/0R1(config-if)# ip ospf message-digest-key 1 md5 CISCO-123R1(config-if)# exit | Enables area authenticationSets values per interface for authentication type and password or key |
| R1(config)# router ospf 10R1(config-router)# area 1 range 10.1.0.0 255.255.252.0R1(config-router)# exit | Summarizes OSPF routes into a range for OSPF inter-area configurations – used to create Null routes for packets processing and discard |
| Verification Command | Purpose |
| R1# show ip ospf neighbor command. | Shows the Adjacency database and Neighbor tableLists all neighbor routers to which a router has established bidirectional communication.This table is unique for each router. |
| R1# show ip ospf database | Shows the Link-state database and topology table - Lists information about all other routers in the network and shows the network topology.Also shows area numbers and link IDs within the areas |
| R1# show ip protocols  | Displays the router ID, networks recognized for routing, the gateway, distance and last update information for the router and its protocols |
| R1# show ip ospf interface serial 0/0/0 | Displays status of the interface (or link), bandwidth, the internet address of the interface, status of the protocol (up or down), router ID, network type (for example, point-to-point), cost of the interface/link, hello, dead, wait and transmit intervals in seconds, and neighbors adjacenciesShows priority settingAlso shows the interface’s DR or BDR with their accompanying addresses and router IDs |
| R1# show ip ospf | Verifies the router’s OSPF process in its entirety |
| R1# show ip ospf interface brief | Verifies the interfaces/links a particular router, the network assigned to the interfaces, cost, state and number of neighbors on that interface |
| R1# show ipv6 interface brief  | IPv6 command which lists the interfaces participating with OSPF, their Link Local address and their IPv6 address – also lists the status of the interfaces (up or down) |
| R1# show ipv6 protocols  | IPv6 command which shows the process number, router ID, number of areas, etc. |
| R1# show ipv6 route ospf | Shows IPv6 routing table information – includes type of route (OSPF), IPv6 address/prefix of network being reported, and which interface reported the information |
| R2# show ipv6 route static | Displays only static routes for IPv6 as reported through the routing table |

1. **Identify elements of the model that map to IT-related content:**
* EIGRP IPv4 configuration commands
* EIGRP IPv4 verification commands
* OSPF IPv6 configuration commands
* OSPF IPv6 verification commands