Name: Muhammad Uzair Roll No: 22SW106

Score: \_\_\_\_\_\_\_\_\_\_\_\_Signature of the Lab Tutor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: 10/30/2024

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**OBJECTIVES**

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| --- | --- | --- | --- | --- | --- |
| **#** | **Topic** | **#. Of**  **Lectures** | | **CLO** | **Taxonomy level** |
| 9 | To **understand** static a routing. Design the required network and **configure** the static routing. | 3 | | 1,2 | C3, P2 |
| **OUTCOME(S)** | |  | | | |
| a. An ability to apply knowledge of math, science, and engineering | |  | **PLO1**: Engineering Knowledge: | | |

**RUBRICS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Performance Metric** | **Exceeds expectation (4-5)** | **Meets expectations (2-3)** | **Does not meet expectations (0-1)** | **Score** |
| Knowledge and  application  [PLO1] | Applies the appropriate knowledge and concepts to the problem with accuracy and  proficiency; shows precise understanding of these knowledge and concepts. | Applies the relevant knowledge and concept to the problem, possibly in a roundabout way; understands the major points of the knowledge, with possible misunderstanding or failure to recall minor points; | Fails to apply relevant knowledge and concepts to  the problem; misunderstands or fails to recall critical points. |  |
|  |  |  | **Total Score** |  |

**PERFORMANCE OBJECTIVE**

**Upon successful completion of this experiment, the student will be able to learn:**

1. **To configure the STATIC routes between three routers to allow data transfer without the use of dynamic routing protocols.**

**EQUIPMENT**

* Two PC
* Two Routers with console
* Two RJ-45 TO DB-9 adapter
* Two RJ-45 TO RJ 45 rollover cable

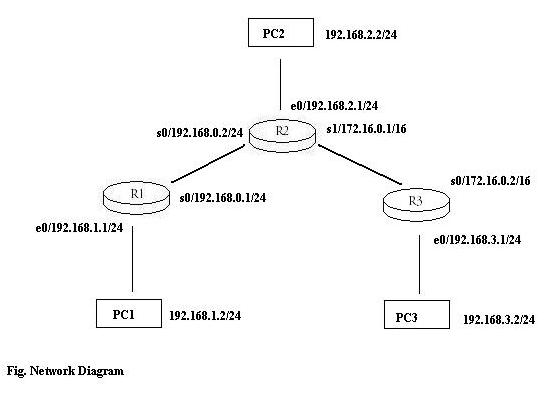
**DISCUSSION**

Routing is a set of directions to get from one network to another. These directions, also know as routes, can be dynamically given to the router by another route, or they can be statically assigned to the router by an administrator. OR,

Routing is process that a router uses to forward packets toward the destination network. A router makes decisions based upon the destination IP address of a packet. All devices along the way use the destination IP address to send the packet in the right direction to reach its destination. To make the correct directions, router must learn how to reach remote networks.

When static routing is used, a network administrator configures information about remote networks manually.

* The process in which Administrator manually adding routes in Routers table.
  + No overhead on Router CPU
  + No bandwidth usage between routers
  + Security
  + IP route, destination N/W, subnet mask, next hop address,



Setup a network similar to the one in the diagram. Any router that meets the interface requirements may be used. And follow the steps required to achieve this lab activity.

**Step 1: Configuring both Routers**

**For Router1**

Press Enter to Start

Router>

Router>**en**

Router#**config t**

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#**hostname Router1**

Router1(config)#**^Z**

%SYS-5-CONFIG\_I: Configured from console by console

Router1(config)#**int s0**

Router1(config-if)#**ip address 192.168.0.1 255.255.255.0**

Router1(config-if)#**clock rate 64000**

Router1(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Serial0, changed state to up

%LINK-3-UPDOWN: Interface Serial0, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to down

Router1(config-if)#exit

Router1(config)#**int e0**

Router1(config-if)#**ip address 192.168.1.1 255.255.255.0**

Router1(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up

Router1(config-if)#**^Z**

%SYS-5-CONFIG\_I: Configured from console by console

%LINK-3-UPDOWN: Interface Serial0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up

1. Why is the interface serial0 changed to down?

**Answer:** The interface Serial0 is in the "down" state because it is not connected to another device or there is no physical connection (crossover cable) established with the second router. The "no shut" command was executed to bring the interface up, but until there’s a physical connection, it will remain down \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**For Router2**

Router>

Router>**en**

Router#**config t**

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#**hostname Router2**

Router2(config)#**int s0**

Router2(config-if)#**ip address 192.168.0.2 255.255.255.0**

Router2(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Serial0, changed state to up

Router2(config-if)#**exit**

Router2(config)#**int s1**

Router2(config-if)#**ip address 172.16.0.1 255.255.0.0**

Router2(config-if)#**clock rate 64000**

Router2(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Serial1, changed state to up

%LINK-3-UPDOWN: Interface Serial1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1, changed state to down

Router2(config-if)#**^Z**

%SYS-5-CONFIG\_I: Configured from console by console

Router2#**config t**

Enter configuration commands, one per line. End with CNTL/Z.

Router2(config)#**int e0**

Router2(config-if)#**ip address 192.168.2.1 255.255.255.0**

Router2(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up

Router2(config-if)#**^Z**

%SYS-5-CONFIG\_I: Configured from console by console

%LINK-3-UPDOWN: Interface Serial1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1, changed state to up

**For Router 3**

Press Enter to Start

Router>**en**

Router#**config t**

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#**hostname Router3**

Router3(config)#int s0

Router3(config-if)#**ip address 172.16.0.2 255.255.0.0**

Router3(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Serial0, changed state to up

Router3(config-if)#**exit**

Router3(config)#**int e0**

Router3(config-if)#**ip address 192.168.3.1 255.255.255.0**

Router3(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up

Router3(config-if)#^**Z**

%SYS-5-CONFIG\_I: Configured from console by console

**Step 2: Configuring the work stations**

Configure the workstations with the proper IP address, subnet mask, and default gateway.

a. The configuration for the host connected to the Router1 is:

IP Address: **192.168.1.2**

IP subnet mask: **255.255.255.0**

Default gateway: **192.168.1.1**

Configure the workstations with the proper IP address, subnet mask, and default gateway.

a. The configuration for the host connected to the Router2 is:

IP Address: **192.168.2.2**

IP subnet mask: **255**.**255.255.0**

Default gateway: **192.168.2.1**

Configure the workstations with the proper IP address, subnet mask, and default gateway.

a. The configuration for the host connected to the Router3 is:

IP Address: **192.168.3.2**

IP subnet mask: **255.255.255.0**

Default gateway: **192.168.3.1**

1. Why the hosts have been assigned the same network IP addresses?

**Answer:** The hosts have been assigned IP addresses from different subnets (192.168.1.0/24, 192.168.2.0/24, and 192.168.3.0/24). Each host's IP address belongs to its respective subnet, allowing them to communicate through the routers.

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**Step 3: Check the interface status**

**Router1#sh ip int brief**

Interface IP-Address OK? Method Status Protocol

Serial0 **192.168.0.1 YES unset up up**

Ethernet0 **192.168.1.1 YES unset up up**

**Router2#sh ip int brief**

Interface IP-Address OK? Method Status Protocol

Serial0 **192.168.0.2 YES unset up up**

Serial1 **172.16.0.1 YES unset up up**

Ethernet0 **192.168.2.1 YES unset up up**

**Router3#sh ip int brief**

Interface IP-Address OK? Method Status Protocol

**Serial0 172.16.0.2 YES unset up up**

Ethernet0 **192.168.3.1 YES unset up up**

1. Check the interfaces on both routers with the commands **show ip interface brief** or **show interface.**

**Router1**

Router1#show ip interface brief

Interface IP-Address OK? Method Status Protocol

Serial0 192.168.0.1 YES unset up up

Ethernet0 192.168.1.1 YES unset up up

**Router2**

Router2#show ip interface brief

Interface IP-Address OK? Method Status Protocol

Serial0 192.168.0.2 YES unset up up

Serial1 172.16.0.1 YES unset up up

Ethernet0 192.168.2.1 YES unset up up

**Router3**

Router3#show ip interface brief

Interface IP-Address OK? Method Status Protocol

Serial0 172.16.0.2 YES unset up up

Ethernet0 192.168.3.1 YES unset up up

b. Are all the necessary interfaces up?

**Answer:** Yes, all necessary interfaces should be in the "up" state, meaning they are active and capable of passing traffic.

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**Step 4: Check the routing table entries**

**Router1#sh ip route**

Router1#sh ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

192.168.0.0/24 is subnetted, 1 subnets

C 192.168.0.0 is directly connected, Serial0

192.168.1.0/24 is subnetted, 1 subnets

C 192.168.1.0 is directly connected, Ethernet0

**Router2#sh ip route**

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

192.168.0.0/24 is subnetted, 1 subnets

C 192.168.0.0 is directly connected, Serial0

C 172.16.0.0 is directly connected, Serial1

192.168.2.0/24 is subnetted, 1 subnets

C 192.168.2.0 is directly connected, Ethernet0

**Router3#sh ip route**

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

C 172.16.0.0 is directly connected, Serial0

192.168.3.0/24 is subnetted, 1 subnets

C 192.168.3.0 is directly connected, Ethernet0

1. Can a host on subnet 172.16. 0.0 see a host on network 192.168.3.0?

**Answer:** Yes, if the static routes are configured correctly, a host on subnet 172.16.0.0 can reach a host on network 192.168.3.0 through the routers.

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**Step 5: Adding the static routes**

Router1(config)#**ip route 192.168.2.0 255.255.255.0 192.168.0.2**

Router1(config)#**ip route 192.168.3.0 255.255.255.0 192.168.0.2**

Router1(config**)#ip route 172.16.0.0 255.255.255.0 192.168.0.2**

Router2(config)#**ip route 192.168.1.0 255.255.255.0 192.168.0.1**

Router2(config)#**ip route 192.168.3.0 255.255.255.0 172.16.0.2**

Router3(config)#**ip route 192.168.0.0 255.255.255.0 172.16.0.1**

Router3(config)#**ip route 192.168.1.0 255.255.255.0 172.16.0.1**

Router3(config)#**ip route 192.168.2.0 255.255.255.0 172.16.0.1**

1. Why there are three static route needed on Router1 and Router3?

ANS:

**Answer:** Each static route is necessary to direct traffic to different networks. Router1 needs routes to reach both 192.168.2.0 and 192.168.3.0 networks, while Router3 needs routes to reach the networks associated with Router1 and Router2.

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**Step 6: Verify the new route**

**Router1#sh ip route**

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

192.168.0.0/24 is subnetted, 1 subnets

C 192.168.0.0 is directly connected, Serial0

192.168.1.0/24 is subnetted, 1 subnets

C 192.168.1.0 is directly connected, Ethernet0

192.168.2.0/24 is subnetted, 1 subnets

**S 192.168.2.0 [1/0] via 192.168.0.2**

**S 172.16.0.0 [1/0] via 192.168.0.2**

**192.168.3.0/24 is subnetted, 1 subnets**

**S 192.168.3.0 [1/0] via 192.168.0.2**

**Router2#sh ip route**

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

192.168.0.0/24 is subnetted, 1 subnets

C 192.168.0.0 is directly connected, Serial0

C 172.16.0.0 is directly connected, Serial1

192.168.2.0/24 is subnetted, 1 subnets

C 192.168.2.0 is directly connected, Ethernet0

192.168.1.0/24 is subnetted, 1 subnets

**S 192.168.1.0 [1/0] via 192.168.0.1**

**192.168.3.0/24 is subnetted, 1 subnets**

**S 192.168.3.0 [1/0] via 172.16.0.2**

**Router3#sh ip route**

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, \* - candidate default

U - per-user static route

Gateway of last resort is not set

C 172.16.0.0 is directly connected, Serial0

192.168.3.0/24 is subnetted, 1 subnets

C 192.168.3.0 is directly connected, Ethernet0

192.168.2.0/24 is subnetted, 1 subnets

**S 192.168.2.0 [1/0] via 172.16.0.1**

**192.168.0.0/24 is subnetted, 1 subnets**

**S 192.168.0.0 [1/0] via 172.16.0.1**

**192.168.1.0/24 is subnetted, 1 subnets**

**S 192.168.1.0 [1/0] via 172.16.0.1**

a. List the routes listed in the routing table?

ANS:

**Router1**

Router1#show ip route

C 192.168.0.0/24 is directly connected, Serial0

C 192.168.1.0/24 is directly connected, Ethernet0

**Router2**

Router2#show ip route

C 192.168.0.0/24 is directly connected, Serial0

C 172.16.0.0/24 is directly connected, Serial1

C 192.168.2.0/24 is directly connected, Ethernet0

**Router3**

Router3#show ip route

C 172.16.0.0/24 is directly connected, Serial0

C 192.168.3.0/24 is directly connected, Ethernet0

b. What is the administrative distance?

**Answer:** The administrative distance for static routes is 1, meaning they are preferred over other types of routes.

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**Step 7: Check connectivity from host to host**

**Ping host1 to host2**

**C:>ping 192.168.2.2**

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time=60ms TTL=241

Reply from 192.168.2.2: bytes=32 time=60ms TTL=241

Reply from 192.168.2.2: bytes=32 time=60ms TTL=241

Reply from 192.168.2.2: bytes=32 time=60ms TTL=241

Reply from 192.168.2.2: bytes=32 time=60ms TTL=241

Ping statistics for 192.168.2.2: Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 50ms, Maximum = 60ms, Average = 55ms

**Ping host1 to host3**

**C:>ping 192.168.3.2**

Pinging 192.168.3.2 with 32 bytes of data:

Reply from 192.168.3.2: bytes=32 time=60ms TTL=241

Reply from 192.168.3.2: bytes=32 time=60ms TTL=241

Reply from 192.168.3.2: bytes=32 time=60ms TTL=241

Reply from 192.168.3.2: bytes=32 time=60ms TTL=241

Reply from 192.168.3.2: bytes=32 time=60ms TTL=241

Ping statistics for 192.168.3.2: Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 50ms, Maximum = 60ms, Average = 55ms

If the **ping** was not successful, check routing table to make sure static routes are entered correctly.

**FINAL CHECK LIST**

1. Return all equipment and materials to their proper storage area.

2. Submit your answers to question, before the next laboratory.