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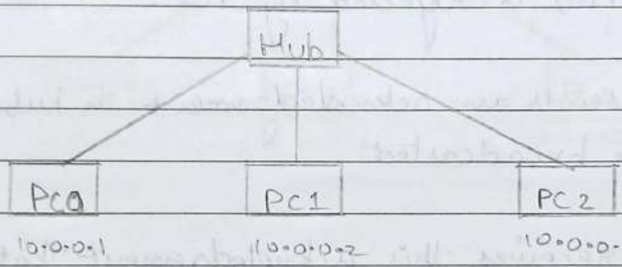
Experiment - 1

(i) Create a topology consisting of 3 or more devices connected with the help of a hub.

Aim: To understand the working of a hub.

Topology:



Procedure:

1. Add a generic hub and 3 PCs. Connect the PC0 to hub using Copper Straight-through wire from FastEthernet0 port on PC0 to Port 0 on Hub. Similarly do it for the rest of the PC1 and PC2 to Port 1 and Port 2 of the hub respectively.

2. Set the static IP address of all PCs under Config → Interface → FastEthernet0 → IP address

3. ~~Send a simple PDU message from one PC to another PC in Simulation mode.~~

4. In real-time mode, click on PC 0 and under Desktop, open Command Prompt and ping one of the end devices on the network.

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(Eg: ping 10.0.0.2)

Result: (In Simulation Mode)

1. The simple PDU is sent from PC0 to Hub

2. Hub sends the PDU to all ports except the input port.

3. The PDU is rejected by PC2.

4. PC1 sends an acknoledgement to hub, which is again broadcasted.

5. PC0 receives this acknoledgement that the transfer is completed.

(In Real-time Mode)

PC > ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

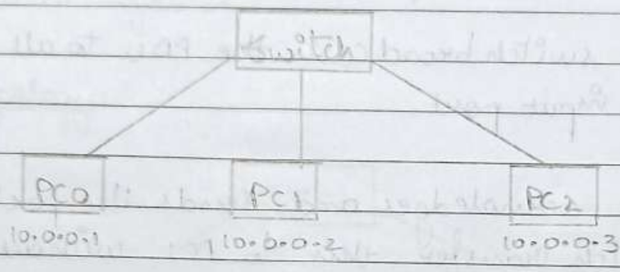
Observation:

Hub doesn't store any data and all incoming packets are broadcasted to all ports except the input port. The receiver should acknoledge the packet when received

(ii) Create a topology consisting of 3 or more devices connected with the help of a switch.

Aim: To understand the working of a switch.

Topology:



Procedure:

1. Add a Generic Switch and 3 PCs. Connect the PC0 to switch using Copper Straight-through wire from FastEthernet0 port on PC0 to FastEthernet0/ port on the switch. Similarly connect PC1, PC2 to switch using FastEthernet0 ports on PC1 and PC2 to FastEthernet 1/1 and FastEthernet 2/1 port on switch respectively.

2. ~~Wait for PC and switch connectors to be established.~~

3. Set-up IP-addresses for all end devices. Click on PC0 → Config → Interface → FastEthernet0 → IP-address (10.0.0.1, 10.0.0.2, 10.0.0.3)

4. Send a simple PDU from PC0 to PC2 in Simulation mode.

5. In realtime mode, ping PC2 from PC0
Click on PC0 → Desktop → Command prompt

Result:

In Simulation Mode:

1. PDU is sent from PC0 to PC2

2. The switch broadcasts the PDU to all ports except the input port.

3. PC2 acknowledges and sends the packet. The switch transfer this to PC1 without broadcast.

In Real-time Mode.

PC > ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes data:

Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.3
Packets : Sent = 4, Received = 4, Lost = 0 (0% loss).
Approximate round trip times in milli-seconds:
Minimum = 0 ms, Maximum = 1ms, Average = 0ms

Observation:
Switch takes time for new connections to be established. In the first transfer, the switch broadcasts the packet to all end devices. In following transfer, the switch transfer the packets to destination end device.

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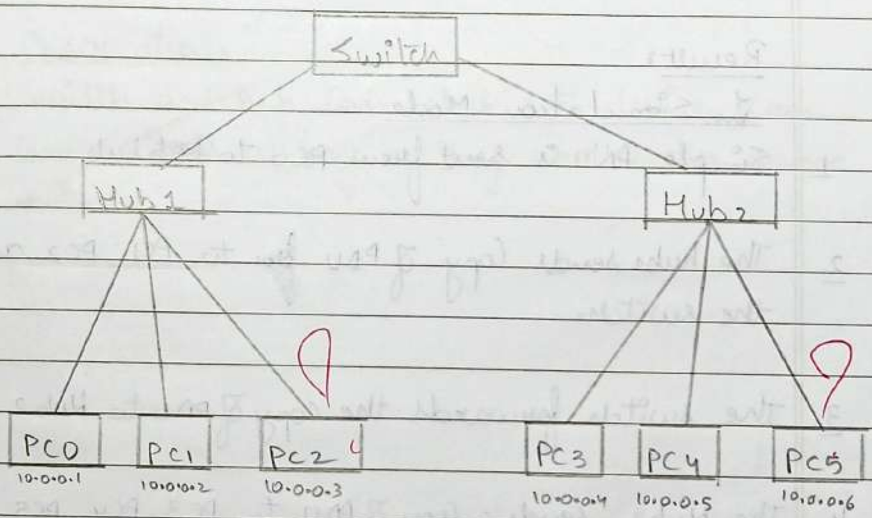
(iii) Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

Aim: To understand the working of hub and switch together

Topology:



Procedure:

1. Add a generic hub, 2 switches and 6 PCs.
~~Connect PC to switch using Copper Straight-through wire from Fast Ethernet0 port of PC to FastEthernet0/1 port of switch.~~ Similarly do this for all end devices to connect them to switch.
Connect the switch to Hub using Copper Cross-over wire.

2. Wait for the switch-Hub connection to be established.

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3. Set IP addresses for all PCs such that they are in the same network.
(IP addresses - 10.0.0.1, 10.0.0.2, 10.0.0.3, 10.0.0.4, 10.0.0.5, 10.0.0.6)

4. Send a simple PDU from PC0 to PC5 in Simulation mode.

5. In real-time mode, ping PC5 from PC0.

Result:

In Simulation Mode:

1. Simple PDU is sent from PC0 to ~~hub~~ hub

2. The hub1 sends copy of PDU ~~for~~ to PC1, PC2 and the switch.

3. The switch forwards the copy of PDU to Hub2

4. The Hub2 sends a copy of PDU to PC3, PC4, PC5

5. PC5 accepts the message and sends an acknoledgement to the Hub2.

6. This acknoledgement is sent to switch, then to Hub1 and finally to PC0 and transfer of message is complete.

In Realtime Mode:

PC>ping 10.0.0.6

Pinging 10.0.0.6 with 32 bytes of data:

→

Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128
Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.6:
Packets: Sent = 4, Received = 4, lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

Observation:
Switch and hub connected end-devices can communicate as long as they are on the same network.

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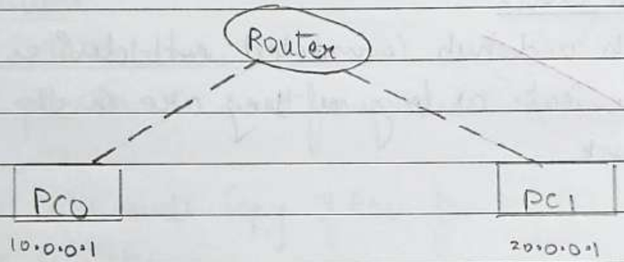
Experiment - 2

Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

Aim: To understand different ping messages and when they are caused.

(i) Topology:



Procedure:

1. Add 2 PCs and a router.
   Connect PC to router using Copper Cross-Over wire from FastEthernet0 port on PC0 to FastEthernet0/0 port on switch. Similarly do this for PC1 and switch.

2. Configure the PCs by setting their IP address to 10.0.0.1 and 20.0.0.1 respectively to PC0 and PC1.

3. Click on Router → CLI

4. Type no for "Continue with configuration dialog? [yes/no]" and press Enter.

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5. Router > enable
Router # configure terminal
Router (config)# interface Fa0/0
Router (config-if) # ip address 10.0.0.2 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# exit.

6. Repeat step 5 for Fa 1/0 interface with ip address 20.0.0.2 and Subnet mask 255.0.0.0.

7. Ping PC1 from PC0

8. Set default gateway for PC0 as 10.0.0.2 and 20.0.0.2 for PC1. (click on PC0 → Config → Gateway

Result:
In Real-time Mode:

=> Before setting the default gateway
PC > ping 20.0.0.1
Pinging 20.0.0.1 with 32 bytes of data.

Request timed out
Request timed out
Request timed out
Request timed out.

Ping statistics for 20.0.0.1 :
Packets : Sent = 4, Received = 0, Lost = 4 (100% Loss)

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⇒ After setting default gateway

PC > ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

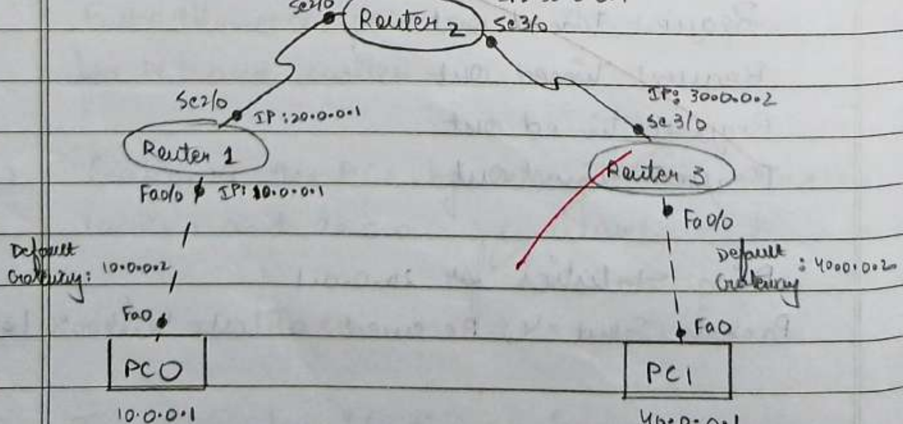
Reply from 20.0.0.1: bytes = 32 time = 0ms TTL = 128
Reply from 20.0.0.1: bytes = 32 time = 0ms TTL = 128
Reply from 20.0.0.1: bytes = 32 time = 0ms TTL = 128
Reply from 20.0.0.1: bytes = 32 time = 0ms TTL = 128

Ping statistics for 20.0.0.1:
Packets: Sent = 4, Received = 4, lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 0 ms, Maximum = 1ms, Average = 0ms.

Observation:

For 2 end devices to communicate, default gateway is required during inter-network communication.

(ii) Topology:



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Procedure:

1. Add 3 routers and 2 end devices.
Connect the end devices (PC0 and PC1) to Router 1 and Router 3 using Copper cross-over wire from FastEthernet0 port on PC to FastEthernet 0/0 port on the Router 1 and 3.
Connect Router 1 and Router 3 to Router 2 using Serial DCE wire from Serial 2/0 port to Serial 2/0 port

2. Set the IP address of end devices. Here each end device is considered to be a seperate network.

3. Go to CLI of routers and configure the IP address of the ports. (Router → CLI)

4. Type "no" for 'Continue with configuration dialog? [yes/no]'. and press Enter.

5. Router > enable
Router # configure terminal
Router(config)# interface Fa0/0
Router(config-if)# ip address 10.0.0.2 255.0.0.0
Router (config-if)# no-shutdown
Router (config-if)# exit.

6. Repeat step-5 for port Se2/0, Se3/0 of routers Router 1, 2, 3.

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(For Router 1, port Se2/0)
Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

(For Router 2, port Se2/0)
Router(config) # interface Se2/0
Router (config-if) # ip address 20.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (Config-if) # exit.

(For Router 2, port Se 3/0)
Router (config) # interface Se 3/0
Router (Config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

(For Router 3, port Se 3/0)
Router (Config) # interface Se 3/0
Router (config-if) # ip address 30.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (Config-if) # exit.

(For Router 3, port Fa0/0)
Router (config) # interface Fa0/0
Router (config-if) # ip address 40.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit

7. The connection b/w routers 1, 2, 3 is now green.

8. Set default gateways for PC0 and PC1 to 10.0.0.2 and 40.0.0.2 respectively

9. Send a ping from PC0 to PC1.

Observation-f
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10. Go to CLI in Router configuration. Enter the following command : "show ip route".
This command is used to display the IPv4 routing table of a router. The router provides additional route information, including how the route was learned, how long the route has been in the table, and which specific interface to use to get to a predefined destination.

11. Set the ip route for all the 3 routers.

<u>For Router 1:</u>
Router > enable
Router # configure terminal
Router (config) # ip route 40.0.0.0 255.0.0.0 20.0.0.2
Router (config) # exit.

<u>Output for above:</u>
Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, Serial 2/0
S 40.0.0.0/8 [1/0] via 20.0.0.2

<u>For Router 2:</u>
Router > enable
Router # configure terminal
Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router (config) # exit.

<u>Output for above:</u>
Router # show ip route

→

S 10.0.0.0/8 [1/0] via 20.0.0.1
C 20.0.0.0/8 is directly connected, Serial 2/0
C 30.0.0.0/8 is directly connected, Serial 3/0
S 40.0.0.0/8 [1/0] via 30.0.0.2

For Router 3:

Router # enable
Router # configure terminal
Router (config) # ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router (config) # exit.

Output for above.

Router # show ip route.

S 10.0.0.0/8 [1/0] via 30.0.0.1
C is directly connected, Serial 2/0
C is directly connected, FastEthernet 0/0

Result:

Initial Ping (without setting ip route)

PC > ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable

Ping statistics for 40.0.0.1 :
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)

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PC > ping 20.0.0.2

Pinging 20.0.0.2 with 32 bytes of data:

Request timed out
Request timed out
Request timed out
Request timed out.

Ping statistics for 20.0.0.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)

Ping (After adding routes)
PC > ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 40.0.0.1: bytes = 32, time = 11ms, TTL = 125
Reply from 40.0.0.1: bytes = 32, time = 8ms, TTL = 125
Reply from 40.0.0.1: bytes = 32, time = 7ms, TTL = 125
Reply from 40.0.0.1: bytes = 32, time = 6ms, TTL = 125

Ping statistics for 40.0.0.1
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 6ms, Maximum = 11ms, Average = 8ms.

Observation:
The ~~packets~~ reach destination successfully but this time ~~default~~ routing was used on routers connected to end devices. Default routing implies it can go to any of the connected networks ~~without specify the network address~~

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Experiment -3

Configure default route, static route to the Router

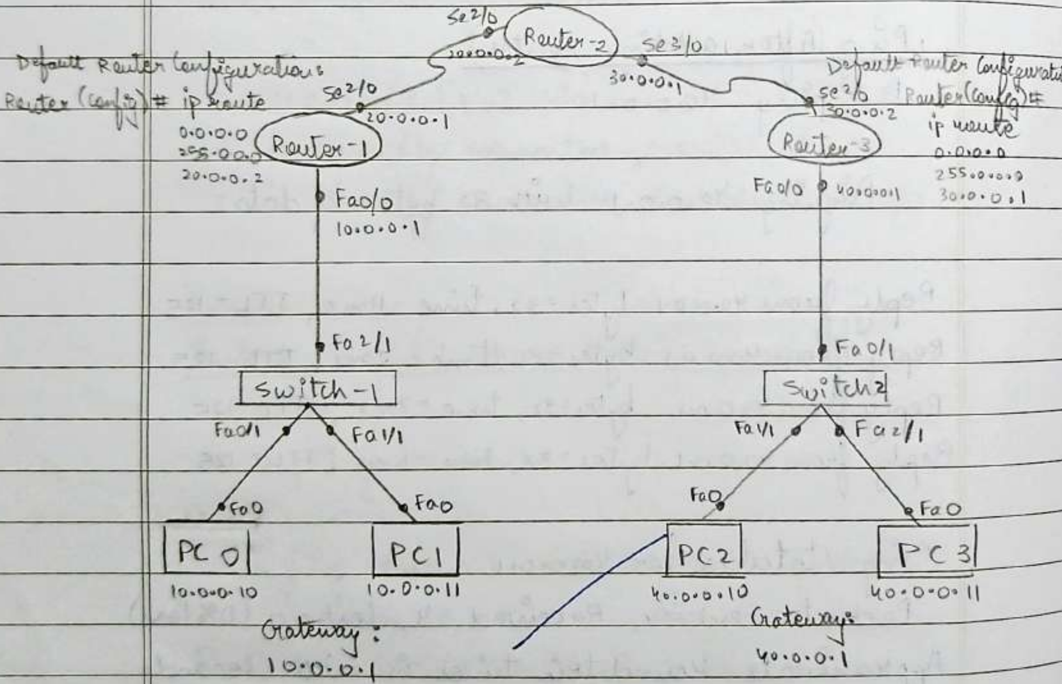
Aim: To create a topology of routers in order to depict default and static connection

Topology

Static Router Configuration

Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1

Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2



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Procedure:

1. Add 3 routers, 2 switches and 4 end devices.
Connect the end devices (PC0 and PC1) to switch-1 using Copper-straight through wire from FastEthernet 0 port of PC0 and FastEthernet 0 port of PC1 to FastEthernet 0/1 and FastEthernet 1/1 port of switch-1 respectively.
Repeat the same procedure to connect switch-2, PC2, PC3.

2. Connect switch-1 and switch-2 to Routers 1 and Router 3 using ~~Serial DCE~~ Copper straight through wire from FastEthernet 2/1 port on switch-1 and FastEthernet 2/1 port on switch 2 to FastEthernet 0/0 of Router-1 and FastEthernet 0/0 of Router-3 respectively.

3. Connect Router-1 and Router-3 to Router-2 using Serial DCE wire from Serial 2/0 port of Router 1 and Serial 2/0 port of Router-3 to Serial 2/0 port of Router 2 and Serial 3/0 port of Router-2 respectively.

4. Set IP addresses of all end devices.

5. ~~Go to~~ CLI of routers and configure the IP address of the ports. (Router → CLI)

6. Type "no" for 'Continue with configuration dialog? [yes/no]:" and press enter.

7.

⇒

For Router-1

Router > enable
Router # Configure terminal
Router (Config) # interface Fa0/0
Router (config-if) # ip address 10.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit
Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit
Router (config) # exit.

For Router-2

Router > enable
Router # Configure terminal
Router (Config) # interface Se2/0
Router (config-if) # ip address 20.0.0.2 255.0.0.0
Router (Config-if) # no shutdown.
Router (config-if) # exit
Router (Config) # interface Se3/0
Router (config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit
Router (config) # exit.

For Router-3

Router > enable
Router # Configure terminal
Router ~~(~~config) # interface Fa0/0
Router (config-if) # ip address 40.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (Config-if) # exit

* → (A static route is a pre-defined/determined pathway that a packet must travel to reach a specific host or network.)

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Router(config)# interface Se 2/0
Router (config-if) # ip address 30.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if)# exit
Router(config) # exit

8. The Connection b/w all devices is green.

9. Set default gateways for PC0, PC1 as 10.0.0.1.
Set default gateways for PC2, PC3 as 40.0.0.1.

10. Configure Router-2 as static router.
Configure Router-1 & 3 as default routers.

11. First Configure Static router: (Router-2) *

Router # configure terminal.
Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router (config) # exit.

Router # show ip route.

S 10.0.0.0/8 [1/0] via 20.0.0.1
C 20.0.0.0/8 is directly connected, Serial 2/0
C 30.0.0.0/8 is directly connected. Serial 3/0
S 40.0.0.0/8 [1/0] via 30.0.0.2

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(A default route is used if a known route does not exist for a given destination address)

12. Now Configure Default routers. (Router 1 & 3)

Router-1:

Router # configure terminal

Router(config) # ip route 0.0.0.0 0.0.0.0 20.0.0.2

Router (config) # exit

Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0/0

C 20.0.0.0/8 is directly connected, Serial 2/0

S* 0.0.0.0/0 [1/0] via 20.0.0.2

Router-3:

Router # configure terminal

Router (config) # ip route 0.0.0.0 0.0.0.0 30.0.0.1

Router (config) # exit

Router # show ip route.

C 30.0.0.0/8 is directly connected, Serial 2/0

C 40.0.0.0/8 is directly connected, FastEthernet 0/0

S* 0.0.0.0/0 [1/0] via 30.0.0.1

Result:

Pinging from PC-PT(10.0.0.10) to PC-PT(40.0.0.10):

PC> ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=9 ms TTL=125

Reply from 40.0.0.10: bytes=32 time=2 ms TTL=125

Reply from 40.0.0.10: bytes=32 time=3 ms TTL=125

Reply from 40.0.0.10: bytes=32 time=17 ms TTL=125

Ping statistics for 40.0.0.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 2 ms, Maximum = 17ms, Average = 7 ms

Pinging from PC-PT(10.0.0.10) to PC-PT(40.0.0.11):

PC > ping 40.0.0.11

Pinging 40.0.0.11 with 32 bytes of data:

Reply from 40.0.0.11: bytes=32 time = 12 ms TTL = 125
Reply from 40.0.0.11: bytes=32 time = 12 ms TTL = 125
Reply from 40.0.0.11: bytes=32 time = 3 ms TTL = 125
Reply from 40.0.0.11: bytes=32 time = 7 ms TTL = 125

Ping statistics for 40.0.0.11:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round-trip times in milli-seconds:
Minimum = 3 ms, Maximum = 12 ms, Average = 8 ms.

Observation:
The packets reach destination succefully by setting default and static router connections.

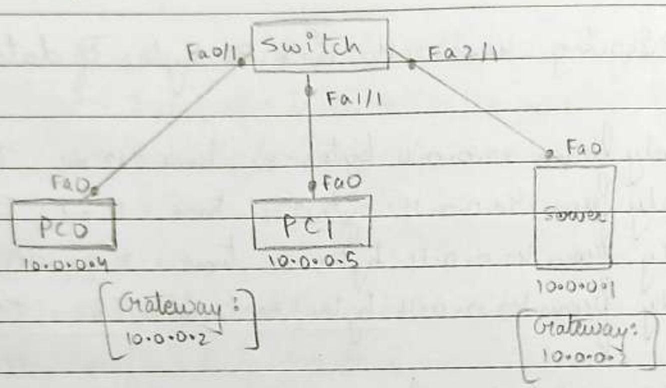
Experiment - 4

Configure DHCP within a LAN and outside LAN

Aim: TO Configure DHCP within a LAN

Topology:

(a)



Procedure:

1. Add 2 Computers, 1 server and a switch. Connect the PC0 and PC1 to switch via Copper Straight through wire. Connect FastEthernet0 port of PC0 and FastEthernet0 of PC1 to FastEthernet 0/1 and FastEthernet 1/1 port of Switch. Connect server to switch via Copper Straight through wire. Connect FastEthernet0 port of Server to FastEthernet 2/1 port of Switch.

2. Configure Server:
Click on Server. Then go to Interface → FastEthernet0. Enter the Static IP address (i.e 10.0.0.1 and subnet mask: 255.0.0.0).
Click on Config → Global → Settings.
Set Gateway (i.e. static: 10.0.0.2)

→ (Server Pool decides the pool of IP addresses from which end devices can choose their IP)

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Click on services → DHCP.
Turn Service → ON
Set Pool Name (i.e serverPool)
Set Default Gateway (i.e 10.0.0.2)
Set Start IP address (i.e 10.0.0.3)
Then Click on Save button.

3. Configure PC0.
Click on PC0 → Config → Interface → FastEthernet0.
Under IP Configuration, select DHCP.
Go to Global Setting → Gateway/DNS. Select DHCP.

Similarly repeat step 3 for PC1 Configuration.

Result:
For PC0, when we select DHCP, the server assigns an available IP address to PC0 with default gateway.
Similarly, the server does the same for PC1.

For PC0:
Gateway: 10.0.0.2
DNS Server: 0.0.0.0
IP address: 10.0.0.4
Subnet Mask: 255.0.0.0

For PC1:
Gateway: 10.0.0.2
DNS Server: 0.0.0.0
IP address: 10.0.0.5
Subnet mask: 255.0.0.0

Ping from PC0 (10.0.0.4) to PC1 (10.0.0.5):

PC > ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

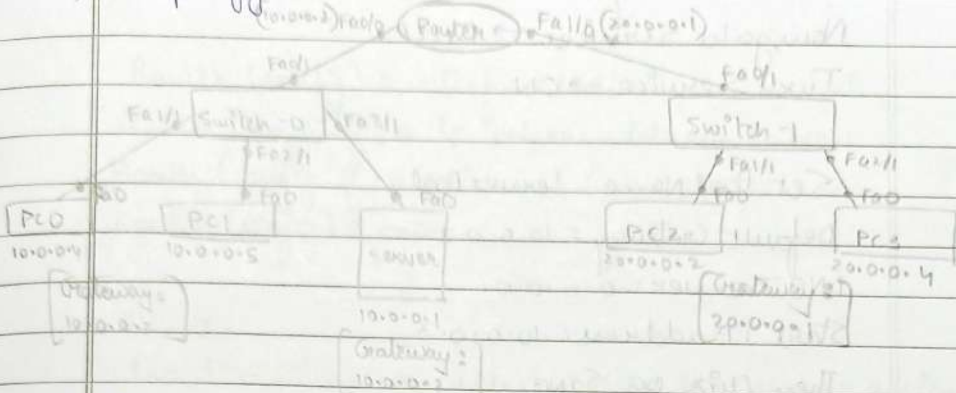
Reply from 10.0.0.5: bytes=32 time=0 ms TTL=128
Reply from 10.0.0.5: bytes=32 time=1ms TTL=128
Reply from 10.0.0.5: bytes=32 time=0ms TTL=128
Reply from 10.0.0.9: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.5:
Packets: Sent=4, Received=4, Lost=0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum=0ms Maximum=1ms, Average=0ms

Observation:
DHCP servers are used to allocate IP addresses for end devices in networks where the no. of users is very high. DHCP can allocate IP addresses, default gateway and DNS server address

Aim: To configure DHCP for 2 networks connected via router

(b) Topology:



Procedure:

1. Add 4 PCs, 2 switches, 1 router, 1 server.
Connect PC0 and PC1 to switch 0 through copper straight through wire via FastEthernet0 port on PC0 and FastEthernet0 port on PC1 to FastEthernet 1/1 and FastEthernet 2/1 ports on switch0 respectively. Connect switch to Server via Copper straight through wire via FastEthernet0 port on server to FastEthernet 3/1 port on switch.

Similiarly repeat the same steps to connect PC2 and PC3 to switch-1.

Connect Switch-0 and switch-1 to Router-0 through copper straight through wire via FastEthernet 0/1 port on Switch-0 and FastEthernet 0/1 to FastEthernet 0/0 and FastEthernet 1/0 ports on Router-0 respectively.

2. Configure server:
Click on Server → Config → Interface → FastEthernet0
Under IP-configuration, set static IP address (i.e: 10.0.0.1) and subnet mask: 255.0.0.0.
Now, Goto Config → Global → Settings.

Set Gateway → 10.0.0.2.
Now, go to Services → DHCP.
Turn Service → ON.

Set Pool Name: Server Pool
Default Gateway: 10.0.0.2
DNS Server: 0.0.0.0
Start IP address: 10.0.0.3
Then Click on Save.

Now,
Set Pool Name: ServerPool-2
Default Gateway: 20.0.0.1
DNS Server: 0.0.0.0
Start IP address: 20.0.0.2
Then Click on Save.

3. Router Configuration:
Click on Router → CLI
Set IP addresses for interfaces Fa0/0 & Fa1/0
Router > enable
Router # Configure terminal
Router (config) # interface Fa0/0
Router (config-if) # ip address 10.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

Router (config) # interface Fa1/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit

Now,

Router (config) # interface Fa1/0.
Router (config-if) # ip helper-address 10.0.0.1
Router (config-if) # exit.
Router (config) # exit

Result:

For PC0 when we select DHCP, the server assigns an available IP address to PC0.
IIly for PC1, PC2 & PC3.

For PC0:

Gateway: 10.0.0.2
DNS Server: 0.0.0.0
IP address: 10.0.0.4
Subnet Mask: 255.0.0.0

For PC1:

Gateway: 10.0.0.2
DNS Server: 0.0.0.0
IPaddress: 10.0.0.5
Subnet Mask: 255.0.0.0

For PC2:

Gateway: 20.0.0.1
DNSServer: 0.0.0.0
IP address: 20.0.0.2
Subnet Mask: 255.0.0.0

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For PC3:

Gateway: 20.0.0.1
DNS Server: 0.0.0.0
IP address: 20.0.0.4
Subnet Mask: 255.0.0.0

Ping from PC0 (10.0.0.4) to PC3 (20.0.0.4):

PC > ping 20.0.0.4

Pinging 20.0.0.4 with 32 bytes of data:

Reply from 20.0.0.4: bytes=32 time=0ms TTL=127
Reply from 20.0.0.4: bytes=32 time=0ms TTL=127
Reply from 20.0.0.4: bytes=32 time=0ms TTL=127
Reply from 20.0.0.4: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.4:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round-trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms.

Observation:
To configure ip ~~helper~~ address of a network with no DHCP server, the interface of router it is connected to should be provided with ip helper address that is same as ip of DHCP server.

Aim: To Configure DHCP server for 3 networks connected via 2 routers.

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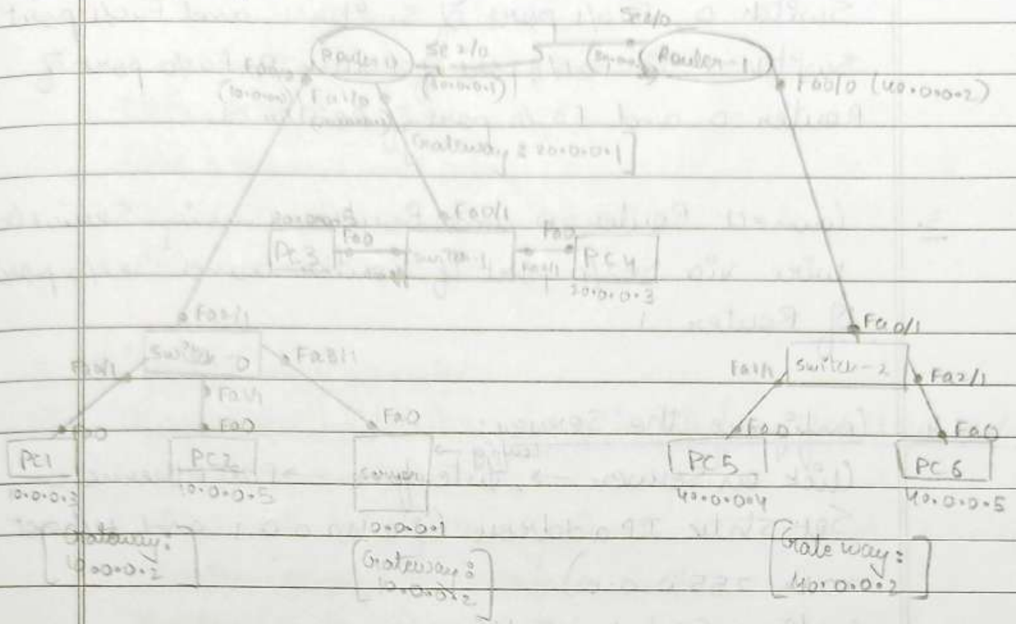
(C) Topology:



Procedure:

1. Add 6-PCs, 2-routers, 3-switches and 1-server. Connect PC(PC1, PC2) and server to switch using Copper Straight through wire via Fa0 port of PC1, Fa0 port of PC2, Fa0 port of server to Fa0/1, Fa1/1 and Fa3/1 ports of Switch-0 respectively.

Similarly Connect PC3 and PC4 to switch using Copper-straight through wire via Fa0 port on PC3 and Fa0 port on PC4 to Fa1/1 and Fa2/1 ports on Switch-1 respectively.

Similarly Connect PC5 and PC6 to switch using Copper-straight through wire via Fa0 port on PC5 and Fa0 port on PC6 to Fa1/1 and Fa2/1 ports on Switch-2 respectively.

2. Now Connect Switch-0, Switch-1, ~~Switch-2~~ to Router-0 and Switch-2 to Router-1 using

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Copper Straight through wire via port Fa2/1 of Switch-0, Fa0/1 port of Switch-1 and Fa0/1 port of Switch-2 to Fa0/0 port of Router-0, Fa1/0 port of Router-0 and Fa0/0 port of Router-1.

3. Connect Router-0 and Router-1 using Serial DCE wire via Se2/0 port of Router-0 and Se2/0 port of Router-1.

4. Configure the Server:
Click on Server → config → Interface → FastEthernet0
Set static IP address (i.e 10.0.0.1 and subnet mask: 255.0.0.0)
Config → Global → Settings
Set Gateway (i.e 10.0.0.2)

Then Click on Services. → DHCP
→ Server pool decides the pool of IP addresses from which the end devices can choose their IP
Set Pool Name: Server Pool
Default Gateway: 10.0.0.2
DNS Server: 0.0.0.0
Start IP address: 10.0.0.3
Click on Save

Now,

Set Pool Name: ServerPool - 2
Default Gateway: 20.0.0.1
DNS Server: 0.0.0.0
Start IP address: 20.0.0.3
Click on Add

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Now,

Set Pool Name : serverPool-3
Default Gateway: 40.0.0.2
DNS Server : 0.0.0.0
Start IP address : 40.0.0.3
Click on ~~Save~~ Add.

5\. Router Configuration:

a)(i) Router-0 : (set ip addresses to interfaces Fa0/0, Fa1/0, Se2/0).

Router >enable
Router # Configure terminal
Router (config) # interface Fa0/0
Router (config-if) # ip address 10.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

Router (config) # interface Fa1/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0.
Router (config-if) # no shutdown
Router (config-if) # exit

Router (config) # interface Se2/0
Router (config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shutdown.

Now, we use ip helper address command which allows the router to forward local DHCP requests to one or more DHCP servers.
Router (config) # interface Fa1/0
Router (config-if) # ip helper-address 10.0.0.1
Router (config-if) # exit.
Router (config) # exit.

→

A static route is a pre-defined/determined pathway that a packet must travel to reach a specific host or network.

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a)(ii) Router-0 : (set ip route) (Static Router)

Router # show ip route

C : 10.0.0.0/8 is directly connected, FastEthernet0/0
C : 20.0.0.0/8 is directly connected, FastEthernet1/0
C : 30.0.0.0/8 is directly connected, Serial 2/0

Router # configure terminal.
Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router (config) # exit.
Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, FastEthernet 1/0
C 30.0.0.0/8 is directly connected, Serial 2/0
S 40.0.0.0/8 [1/0] via 30.0.0.2

b)(i) Router-1 : (set ip addresses to interfaces, Se2/0 Fa0/0)
Router > enable
Router # configure terminal
Router (config) # interface Se2/0
Router (config-if) # ip address 30.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

Router (config) # interface Fa0/0
Router (config-if) # ip address 40.0.0.1 255.0.0.0
Router (config-if) # no shutdown.
Router (config-if) # exit

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Now, we use ip helper address command which allows the router to forward local DHCP requests to one or more DHCP servers.

Router (config)# interface Fa0/0
Router (config-if)# ip helper-address 10.0.0.1
Router (config-if)# exit
Router (config)# exit

b)(ii) Router-1: (set ip route) (Default Router): A default route is used if a known route does not exist for a given destination address.

Router # show ip route.

C: 30.0.0.0/8 is directly connected, Serial 2/0
C: 40.0.0.0/8 is directly connected, FastEthernet 0/0.

Router # Configure terminal
Router (config)# ip route 0.0.0.0 0.0.0.0 30.0.0.1
Router (config)# exit.
Router # show ip route.

C 30.0.0.0/8 is directly connected, Serial 2/0
C 40.0.0.0/8 is directly connected, FastEthernet 0/0.
S* 0.0.0.0/0 [1/0] via 30.0.0.1

6. Configure PC(s): config →
Click on a PC → Interface → FastEthernet0
under IP Configuration, select DHCP.
Go to Global → Settings → Gateway/DNS. Select DHCP.

Result:
For all PCs, we select DHCP service. By enabling this service, the server assigns the available IP addresses to the PCs.

→

For PC1 :

Gateway : 10.0.0.2
DNS Server : 0.0.0.0
IP address : 10.0.0.3
Subnet Mask : 255.0.0.0

For PC2 :

Gateway : 10.0.0.2
DNS Server : 0.0.0.0
IP address : 10.0.0.5
Subnet Mask : 255.0.0.0

For PC3 :

Gateway : 20.0.0.1
DNS Server : 0.0.0.0
IP address : 20.0.0.5
Subnet Mask : 255.0.0.0

For PC4 :

Gateway : 20.0.0.1
DNS Server : 0.0.0.0
IP address : 20.0.0.3
Subnet Mask : 255.0.0.0

For PC5 :

Gateway : 40.0.0.2
DNS Server : 0.0.0.0
IP address : 40.0.0.4
Subnet Mask : 255.0.0.0

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For PC6:
Gateway: 40.0.0.2
DNS Server: 0.0.0.0
IP address: 40.0.0.5
Subnet Mask: 255.0.0.0

Ping from PC-1 (10.0.0.3) to PC-4 (20.0.0.3)

PC > ping 20.0.0.3

Pinging 20.0.0.3 with 32 bytes of data:

Reply from 20.0.0.3: bytes = 32 time = 0ms TTL = 127
Reply from 20.0.0.3: bytes = 32 time = 0ms TTL = 127
Reply from 20.0.0.3: bytes = 32 time = 0ms TTL = 127
Reply from 20.0.0.3: bytes = 32 time = 0ms TTL = 127

Ping statistics for 20.0.0.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 0 ms. Maximum = 0 ms. Average = 0 ms.

Ping from PC-1 (10.0.0.3) to PC-6 (40.0.0.5):

PC > ping 40.0.0.5

Pinging 40.0.0.5 with 32 bytes of data:

Reply from 40.0.0.5: bytes = ~~0ms~~ 32 time = 0 ms TTL = 127
Reply from 40.0.0.5: bytes = ~~0ms~~ 32 time = 0 ms TTL = 127
Reply from 40.0.0.5: bytes = ~~0ms~~ 32 time = 0 ms TTL = 127
Reply from 40.0.0.5: bytes = ~~0ms~~ 32 time = 0 ms TTL = 127

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Ping statistics for 40.0.0.5
Packets : Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round-trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0 ms

Observation :

DHCP is a network management protocol used in networks to dynamically assign IP addresses and other network config info like default gateway, Subnet mask, DNS server address, etc. It is an application layer protocol.

To configure ip address of a network with no DHCP server, the interface of the router it is connected to should be provided with ip helper address that is same as ip of DHCP server.

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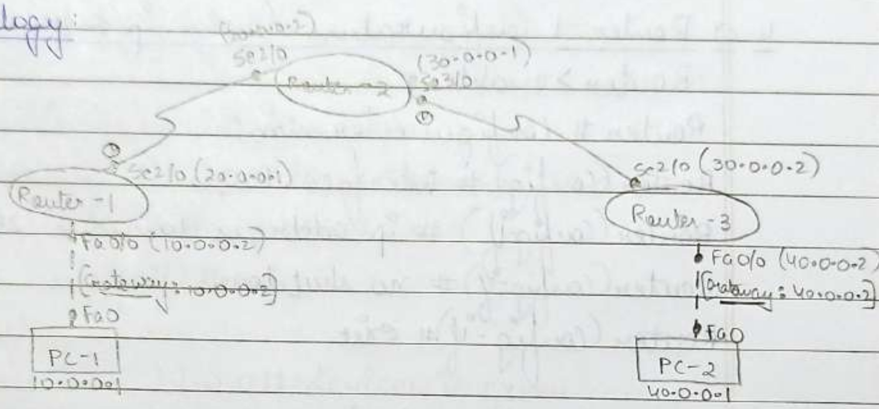
Experiment 5

Configure RIP routing Protocol in Routers.

Aim: Simulate RIP using 3-routers

Topology:



Procedure:

1. Add 3 routers and 2PCs.
Connect PC1 to router1 using Copper cross over wire from Fast Ethernet 0 port of PC1 to FastEthernet0/0 port of router-1. Similarly repeat this step to Connect PC2 to router-3. Now connect router-1 to router-2 using Serial DCE wire from Serial2/0 port of router-1 to Serial 2/0 port of Router-2. Similarly Connect router-3 to router-2 using serial DCE wire from Serial 2/0 port of router-3 to Serial 3/0 port of router-2.

2. PC-1 Configuration:
Click on PC-1 → Config → Interface → FastEthernet0.
Assign Static IP address to PC-1 [(10.0.0.1) and Subnet mask: 255.0.0.0]
Set default gateway → 10.0.0.2

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3. PC-2 Configuration :
Click on PC-2 → Config → Interface → FastEthernet0.
Assign static IP address to PC-2 [i.e 40.0.0.1 and subnet mask : 255.0.0.0].
Set default gateway → 40.0.0.2.

4. a) Router-1 Configuration : (assign ip addresses to interfaces)
Router > enable
Router # configure terminal
Router (config) # interface Fa0/0.
Router (config-if) # ip address 10.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit

Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0
Router (config-if) # no shut down.

b) Router-2 Configuration : (assign ip addresses to interfaces)
Router > enable
Router # Configure terminal
Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.2 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit

Router (config) # interface Se3/0
Router (config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shutdown
Router (config-if) # exit.

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c) Router-3 Configuration (assign ip addresses to interfaces)

Router > enable
Router # configure terminal
Router (config) # interface Se2/0
Router(config-if)# ip address 30.0.0.2 255.0.0.0
Router(config-if)# no shutdown
Router(config-if)# exit.

Router(config)# interface Fa0/0
Router(config-if)# ip address 40.0.0.2 255.0.0.0
Router(config-if)# no shutdown
Router (config-if) # exit.

5. Connection b/w all devices is green.

6. Now we use RIP routing protocol in all routers. RIP stands for Routing information protocol. RIP is a distance vector protocol that uses hop count as its primary metric. RIP defines how routers should share information when moving Traffic among an interconnected group of local area networks.

Point-to-point Protocol (PPP) is a layer 2 communications protocol. PPP encapsulates multiprotocol data over point-to-point lines. PPP encapsulation is the default encapsulation type for physical interfaces.

The clock rate command is used only on serial interfaces that are acting as DCE (data circuit terminating equipment) interfaces. DCE interfaces are responsible for providing the clock signal for the line. If we use 'the clock rate 64000' command on a serial interface, it will physically ~~transfer~~ Transmit at 64 Kbps. →

So a serial interface transmits at 1.544 Mbps by default, we can change that by using the "clock rate" Command to set a transmit rate in Kbps.

7. a) <u>Router-1 Configuration: (apply step-6)</u>

Router (config) # interface Se 2/0
Router (config-if) # encapsulation ppp
Router (config-if) # clock rate 64000
Router (config-if) # exit.

Router (config) # route rip.
Router (config - router) # network 10.0.0.0
Router (Config - router) # network 20.0.0.0
Router (Config - router) # exit.

b) <u>Router-2 Configuration (apply step-6)</u>

Router (config) # interface Se 3/0
Router (config - if) # encapsulation ppp
Router (config - if) # Clock rate 64000
Router (Config - if) # exit.

Router (Config) # route rip.
Router (config-router) # network 20.0.0.0
Router (Config - router) # network 30.0.0.0
Router (Config - router) # exit.

Router (Config) # interface Se 2/0
Router (Config - if) # encapsulation ppp
Router (config - if) # exit.

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c) Router-3 Configuration : (apply step-6)
Router(config)# interface Se2/0
Router(config-if)# encapsulation ppp
Router(config-if)# exit

Router(config)# route rip.
Router(config-router)# network 30.0.0.0
Router(config-router)# network 40.0.0.0
Router(config-router)# exit

Result :

a) Ping from PC-1 to PC-2
PC>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data

Reply from 40.0.0.1: bytes = 32 time = 16 ms TTL = 253
Reply from 40.0.0.1: bytes = 32 time = 2 ms TTL = 253
Reply from 40.0.0.1: bytes = 32 time = 12 ms TTL = 253
Reply from 40.0.0.1: bytes = 32 time = 9 ms TTL = 253.

Ping statistics for 40.0.0.1 :
Packets : Sent = 4 Received = 4, lost = 0 (0% loss)
Approximate round-trip times in milli-seconds :
Minimum = 2 ms, Maximum = 16 ms, Average = 9 ms.

b) Ping from PC-2 to PC-1
PC > ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data :

Reply from 10.0.0.1 : bytes = 32 time = 9 ms TTL = 125
Reply from 10.0.0.1 : bytes = 32 time = 2 ms TTL = 125

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Reply from 10.0.0.1: bytes=32, time=11ms, TTL=125
Reply from 10.0.0.1: bytes=32, time=8ms, TTL=125

Ping statistics for 10.0.0.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 11ms, Average = 7ms.

Observation:

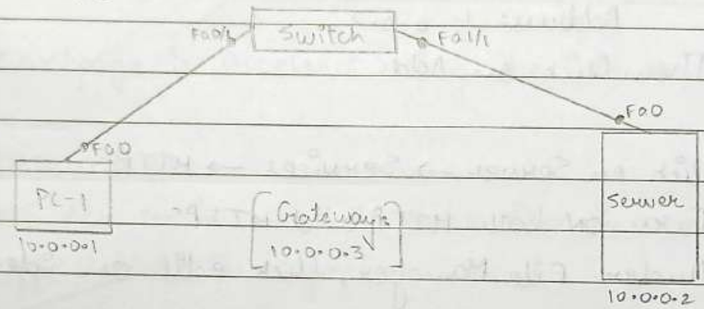
PPP encapsulates multiprotocol data over point-to-point links. The clock rate command is used only on serial interfaces that are acting as DCE. DCE interfaces are responsible for providing clock signal for the line. RIP defines how routers should share info. when moving traffic among an interconnected group of local area networks.

Experiment - 6

Configure Web Server, DNS within a LAN.

Aim: To simulate a simple configuration of web server DNS within a LAN.

Topology:



Procedure:

1. Add a PC, Switch and a Server.
Connect the PC to the Switch using Copper Straight-Through wire from FastEthernet0 port on PC to FastEthernet 0/1 port of Switch.
Connect the Server to the switch using Copper Straight Through wire from FastEthernet 0 port on Server to FastEthernet 1/1 port on Switch.

2. PC-1 Configuration:
Click on PC-1 → Config → Interface → FastEthernet 0
Assign a static ip address to PC-1 [i.e 10.0.0.1 & Subnet Mask: 255.0.0.0]
Set Gateway: 10.0.0.3

3. Server Configuration:
Click on Server → Config → Interface → FastEthernet 0.
Assign a static ip address to Server [i.e 10.0.0.2 &

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Subnet Mask: 255.0.0.0].
Set Gateway: 10.0.0.3

4. <u>Configuring DNS in Server:</u>
Click on Server → Services → DNS
Turn ON the DNS Service.
Under Resource Records:
Set Name : sanchay.com
Address: 10.0.0.2
Then Click on Add.

Click on Server → Services → HTTP
Turn ON both HTTP and HTTPS
Under File Manager, Click edit on index.html.

<u>File name</u>: index.html

```
<html>
<center><font size='+2' color='blue'> Details</font>
</center>
<hr> Personal Details :
<p> USN: 1BM21CS186
<br> Name: Sanchay Agrawal
<br> E-mail: sanchay.cs21@bmsce.ac.in
</html>
```

Click on Save.

<u>Result:</u>
To access the Web-page, Click on PC-1 → Web-Browser
In URL, type: sanchay.com (OR 10.0.0.2)

⇒

Our web-page will open.

Details

Personal Details:

USN : 1BM21CS186

Name : Sanchay Agrawal

E-mail : sanchay.cs21@bmsce.ac.in.

The webpage is accessed using the server.

Observation:

DNS server is used to store Domain names mapped to their respective IPs.

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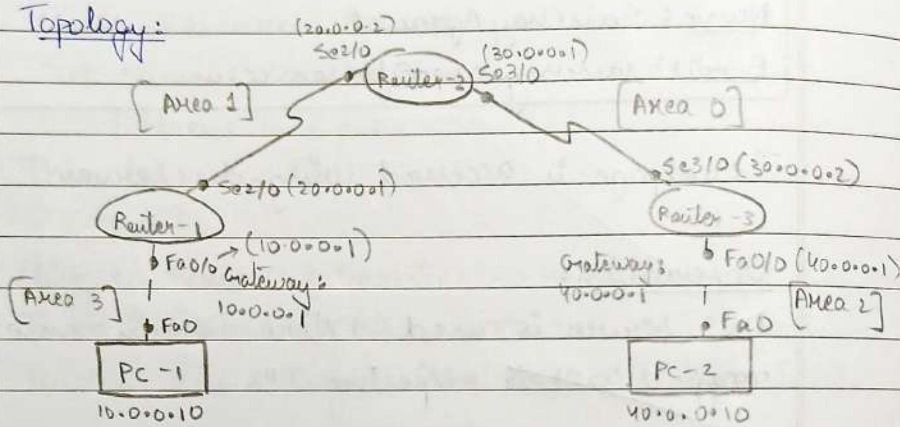
Experiment - 7

Configure OSPF routing protocol

Aim: To demonstrate OSPF protocol in routers

Topology:



Procedure:

1. Place 3 routers and 2 PCs.
Connect PC-1 to Router-1 using Copper cross-over wire from FastEthernet 0 port of PC-1 to FastEthernet 0/0 port of Router-1.
Connect PC-2 to Router-3 using Copper cross-over wire from FastEthernet 0 port of PC-2 to FastEthernet 0/0 port of Router 3.
Connect Router-1 to Router-2 using Serial DCE wire from Serial 2/0 port of Router-1 to Serial 2/0 port of Router-2
Connect Router-2 to Router-3 using Serial DCE wire from serial 3/0 port of Router-2 to Serial 3/0 port of Router-3.

2. PC-1 Configuration:
Click on PC-1 → Config → Interface → FastEthernet0

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Assign static IP address to PC-1 [10.0.0.10 and Subnet Mask: 255.0.0.0]
Set default gateway: 10.0.0.1

3. PC-2 Configuration:
Click on PC-2 → Config → Interface → Fast Ethernet0
Assign static IP address to PC-2 [40.0.0.10 and Subnet Mask: 255.0.0.0]
Set default gateway: 40.0.0.1

4. a) Router-1 Configuration: (assign ip addresses to interfaces)
Router > enable
Router# config t.
Router(config) # interface Fa0/0
Router(config-if) # ip address 10.0.0.1 255.0.0.0
Router(config-if) # no shut
Router(config-if) # exit.

Router(config) # interface Se2/0
Router(config-if) # ip address 20.0.0.1 255.0.0.0
Router(config-if) # encapsulation ppp
Router(config-if) # clock rate 64000
Router(config-if) # no shut
Router(config-if) # exit.

b) Router-2 Configuration: (assign ip addresses to interfaces)
Router > enable
Router # config t.
Router(config) # interface Se 2/0
Router(config-if) # ip address 20.0.0.2 255.0.0.0
Router(config-if) # encapsulation ppp
Router(config-if) # no shut
Router(config-if) # exit.

Router(Config)# interface Se 3/0
Router(config-if)# ip address 30.0.0.1 255.0.0.0
Router(config-if)# encapsulation ppp
Router(config-if)# clock rate 64000
Router(config-if)# no shut
Router(config-if)# exit

c) Router-3 Configuration: (assign ip addresses to interfaces)
Router > enable
Router # Config t
Router(config)# interface Se 3/0
Router(config-if)# ip address 30.0.0.2 255.0.0.0
Router(config-if)# encapsulation ppp
Router(config-if)# no shut
Router(config-if)# exit

Router(config)# interface Fa0/0
Router(config-if)# ip address 40.0.0.1 255.0.0.0
Router(config-if)# no shut
Router(config-if)# exit.

5. Now, enable ip routing by configuring ospf routing protocol in all routers.

6. Open Shortest path First (OSPF) is a link-state routing protocol that was developed for IP networks and is based on the Shortest Path First (SPF) algorithm. OSPF is an Interior Gateway Protocol (IGP).
In an OSPF network, routers or systems within the same area maintain an identical link-state database that describes the topology of the area. Each router or system in the area generates its link-state database from the link-state advertisements (LSAs) that it receives from

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all the other routers or systems in the same area and the LSAs that itself generates. An LSA is a packet that contains information about neighbours and path costs. Based on the link-state database, each router or system calculates a shortest-path spanning tree, with itself as the root, using the SPF algorithm.

7.a) Router-1 Configuration : (OSPF)

Router > enable
Router # Config t
Router (Config) # router ospf 1
Router (config-router) # router-id 1.1.1.1
Router (config-router) # network 10.0.0.0 0.255.255.255 area 3
Router (config-router) # network 20.0.0.0 0.255.255.255 area 1
Router (config-router) # exit.

b) Router-2 Configuration : (OSPF)

Router > enable
Router # Config t.
Router (Config) # router ospf 1
Router (config-router) # router-id 2.2.2.2
Router (Config-router) # network 20.0.0.0 0.255.255.255 area 1
Router (Config-router) # network 30.0.0.0 0.255.255.255 area 0
Router (config-router) # exit.

c) Router-3 Configuration : (OSPF)

Router > enable
Router # Config t.
Router (config) # router ospf 1

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Router(Config-router)# router-id 3.3.3.3
Router(config-router)# network 30.0.0.0 0.255.255.255 area 0
Router(Config-router)# network 40.0.0.0 0.255.255.255 area 2
Router(config-router)# exit

8. There must be one interface up to keep ospf process up. So we configure loopback address to routers. It is a virtual interface which never goes down once we configure it.

9. a) Router-1 Configuration: (loopback configuration):
Router(config)# interface Se2/0
Router(config-if)# interface loopback 0
Router(config-if)# ip address 172.16.1.252 255.255.0.0
Router(config-if)# no shut
Router(config-if)# exit.

b) Router-2 Configuration: (loopback configuration):
Router(config)# interface Se2/0
Router(config-if)# interface loopback 0
Router(config-if)# ip address 172.16.1.253 255.255.0.0
Router(config-if)# no shut
Router(config-if)# exit.

c) Router-3 Configuration: (loopback configuration):
Router(config)# interface Se3/0
Router(config-if)# interface loopback 0
Router(config-if)# ip address 172.16.1.254 255.255.0.0
Router(config-if)# no shut
Router(config-if)# exit

→

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10. Create a virtual link between R1 and R2. By this we can create virtual link b/w ~~R1 and R2~~ to connect area 3 to area 0.

11. a) Router-1 Configuration : (virtual link configuration)
Router (config)# router ospf 1
Router (Config-router) # area 1 virtual-link 2.2.2.2
Router (config-router) # exit.

b) Router-2 configuration: (Virtual link configuration)
Router (Config) # router ospf 1
Router (config-router)# area 1 virtual-link 1.1.1.1
Router (Config-router)# exit.

12. R2 and R3 gets updates about Area 3. Now check the routing tables.

13. a) Router-1 : (Routing table).
Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0
20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 20.0.0.0/8 is directly connected, Serial 2/0
C 20.0.0.2/32 is directly connected, Serial 2/0
O 30.0.0.0/8 [110/128] via 20.0.0.2, 00:00:04, Serial 2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:04, Serial 2/0
C 172.16.0.0/16 is directly connected, loopback 0.

→

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b) Router-2 : (Routing table)
Router # show ip route.

O IA 10.0.0.0/8 [110/65] via 20.0.0.1 ,00:00:04, Serial 2/0
20.0.0.0/8 is variably submetted, 2 subnets, 2 masks.
C 20.0.0.0/8 is directly connected, Serial 2/0
20.0.0.1/32 is directly connected, Serial 2/0
30.0.0.0/8 is variably submetted, 2 subnets, 2 masks
C 30.0.0.0/8 is directly connected, Serial 3/0
C 30.0.0.0/8 is directly connected, Serial 3/0
O IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:06:03, Serial 3/0
C 172.16.0.0/16 is directly connected, loopback 0

c) Router-3 : (Routing table)
Router # show ip route.

O IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:00:32, Serial 3/0
O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:06:36, Serial 3/0
30.0.0.0/8 is variably submetted, 2 subnets, 2 masks
C 30.0.0.0/8 is directly connected, serial 3/0
C 30.0.0.1/32 is directly connected, Serial 3/0
C 40.0.0.0/8 is directly connected, FastEthernet 0/0
C 172.16.0.0/16 is directly connected, loopback 0

Result:
1. Pinging from PC-1 to PC-2

PC > ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=7ms TTL=125
Reply from 40.0.0.10: bytes=32 time=10ms TTL=125

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Reply from 40.0.0.10: bytes = 32 time = 5ms TTL = 125
Reply from 40.0.0.10: bytes = 32 time = 2ms TTL = 125

Ping statistics for 40.0.0.10:
Packets: Sent = 4, Received = 4, lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 10ms, Average = 6ms

2. Pinging PC-2 to PC-1

PC > ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:

Reply from 10.0.0.10: bytes = 32 time = 6ms TTL = 125
Reply from 10.0.0.10: bytes = 32 time = 6ms TTL = 125
Reply from 10.0.0.10: bytes = 32 time = 11ms TTL = 125
Reply from 10.0.0.10: bytes = 32 time = 5ms TTL = 125

Ping statistics for 10.0.0.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 5ms, Maximum = 11ms, Average = 7ms

Observation:
Routers connected to networks using Internet Protocol (IP) and OSPF is a router protocol used to find the best path for packets as they pass through a set of connected networks

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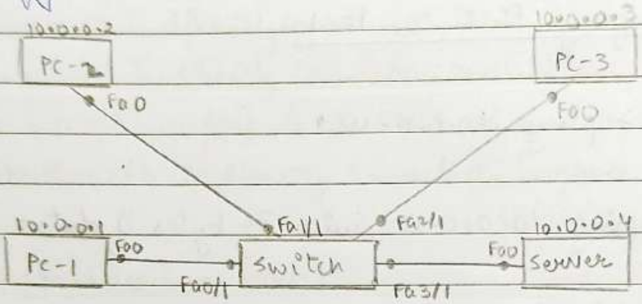
Experiment - 8

To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)

Aim: To demonstrate ARP protocol ~~in routers~~

Topology:



Procedure:

1. Place 4 PCs and 1 switch.
Connect PC-1 to switch using copper straight through wire from FastEthernet0 port of PC-1 to FastEthernet0/1 port of switch.
Similarly repeat this step to connect PC-2, PC-3, PC-4 to Fa1/1, Fa2/1 and Fa3/1 ports of switch respectively.

2. a) **PC-1 Configuration:**
Click on PC-1 → Config → Interface → FastEthernet0
Assign static IP address to PC-1 [10.0.0.1 and Subnet Mask: 255.0.0.0]

b) **PC-2 Configuration:**
Click on PC-2 → Config → Interface → FastEthernet0
Assign static IP address to PC-2 [10.0.0.2 and Subnet Mask: 255.0.0.0]

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c) PC-3 Configuration:
Click on PC-3 → Config → Interface → FastEthernet0
Assign Static IP address to PC-3 [10.0.0.3 and Subnet Mask: 255.0.0.0].

3. Server Configuration:
Click on Server → Config → Interface → FastEthernet0.
Assign static IP address to server [10.0.0.4 and Subnet Mask: 255.0.0.0].

4. Send a PDU from PC-1, PC-2 and PC-3 to Server.
The IP, Hardware addresses of PCs is updated in ARP table of Server and the IP, Hardware address of server gets updated in ARP table of all PCs once a PDU reaches the server and back to PCs.

Result: (in Simulation Mode):

1. Sending PDU from PC-1 to Server:

Outbound PDU details at Device 10.0.0.1:

Dest Mac: FFFF.FFFF.FFFF

SRC MAC: 00F0.B04B.2AC8

This ~~PDU~~ is sent through Switch to Server.

At Server:

Inbound PDU details at Device 10.0.0.4:

Dest Mac: FFFF.FFFF.FFFF

SRC MAC: 00F0.B04B.2AC8

Outbound PDU details at Device 10.0.0.4:

DEST MAC: 00F0.B04B.2AC8

SRC MAC: 0001.6489.8936

→

ARP table of Server is updated with details of PC-1 (IP address, Hardware address, Interface).

The PDU goes back to PC-1 through switch. Upon being reached back successfully, the details of server (like IP address, Hardware address, Interface) is updated in ARP table of PC-1

At PC-1

Inbound PDU details at device 10.0.0.1:

DEST MAC : 00E0.B04B.2AC8

SRC MAC : 0001.6489.8936.

2. Sending PDU from PC-2 to Server:

Outbound PDU details at Device 10.0.0.2:

DEST MAC: FFFF.FFFF.FFFF

SRC MAC: 0090.217E.17D6.

This PDU is sent through Switch to Server.

At Server:

Inbound PDU details at device 10.0.0.4:

DEST MAC: FFFF.FFFF.FFFF

SRC MAC: 0090.217E.17D6

Outbound PDU details at device 10.0.0.4.

DEST MAC : 0090.217E.17D6.

SRC MAC: 0001.6489.8936.

ARP table of Server is Updated with details of PC-2 (IP address, Hardware address, Interface)

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The PDU goes back to PC-2 through Switch. Upon reached back successfully, the details of Server (like IP address, Hardware Address, Interface) is updated in ARP table of PC-2

At PC-2:

Inbound PDU details at Device 10.0.0.2:

DEST MAC: 0090.217E.17D6

SRC MAC: 0001.6489.8936.

3. Sending PDU from PC-3 to Server:

Outbound PDU details at Device 10.0.0.3:

DEST MAC: FFFF.FFFF.FFFF

SRC MAC: 0060.3E17.5ED6.

This PDU is sent through Switch to Server.

At Server:

Inbound PDU details at device 10.0.0.4:

DEST MAC: FFFF.FFFF.FFFF

SRC MAC: 0060.3E17.5ED6

Outbound PDU details at device 10.0.0.4:

DEST MAC: 0060.3E17.5ED6

SRC MAC: 0001.6489.8936.

ARP table of Server is updated with details of PC-3 (IP address, Hardware address, Interface).

The PDU goes back to PC-3 through Switch. Upon being reached back successfully, the details of Server (IP address, Hardware Address, Interface) is updated in ARP table of PC-3.

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At PC-3:

Inbound PDU details at device 10.0.0.3:

DEST MAC : 0060.3E17.5ED6

SRC MAC : 0001.6489.8936

4. ARP Tables for PCs & Server:

ARP Table for 10.0.0.1 (PC-1)

IP address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0

ARP Table for 10.0.0.2 (PC-2)

IP address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0

ARP Table for 10.0.0.3 (PC-3)

IP address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0.

ARP Table for 10.0.0.4 (server)

IP address	Hardware Address	Interface
10.0.0.1	00E0.B04B.2AC8	Fast Ethernet0
10.0.0.2	0090.217E.17D6	FastEthernet0
10.0.0.3	0060.3E17.5ED6	Fast Ethernet0.

5. Checking ARP table through Command Prompt:

a) PC-1

Click on PC-1 → Desktop → Command Prompt.

Before sending PDU:

PC > arp -a

No ARP Entries Found

After successfully Sending PDU:

PC> arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic.

b) PC-2

Click on PC-2 → Desktop → Command Prompt.

Before Sending PDU:

PC> arp -a

No ARP Entries Found.

After successfully Sending PDU:

PC> arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic

c) PC-3

Click on PC-3 → Desktop → Command Prompt.

Before Sending PDU:

PC> arp -a

No ARP Entries Found.

After Successfully Sending PDU:

PC> arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic.

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d) Server:
Click on Server → Desktop → Command Prompt.

Before Sending PDU:
PC> arp -a
No ARP Entries Found.

After Successfully Sending PDU:
PC >arp -a

Internet Address	Physical Address	Type
10.0.0.1	00e0.b04b.2ac8	dynamic
10.0.0.2	0090.217e.17d6	dynamic
10.0.0.3	0060.3e17.5ed6	dynamic.

Observation:
The Address Resolution Protocol is a layer 2 protocol used to map MAC addresses to IP addresses. All hosts on a network are located by their IP address, but NICs do not have MAC addresses. ARP is the protocol used to associate the IP address to a MAC address.

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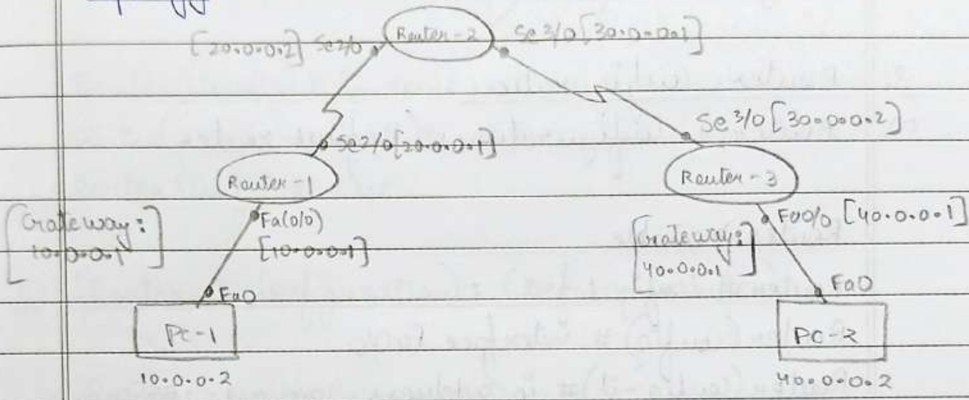
Experiment - 9

Demonstrate the TTL / Life of a Packet

Aim: To demonstrate life of a packet

Topology:



Procedure:

1. Add 3 routers and 2 PCs.
Connect PC-1 to Router-1 using Copper Straight through wire from FastEthernet0 port of PC-1 to FastEthernet0/0 port of Router-1. Similarly connect PC-2 to Router-3 using Copper-Straight through wire from FastEthernet0 port of PC-2 to FastEthernet0/0 port of Router-3.
Connect Router-1 and Router-2 to Router-3 using serial DCE wire from Serial2/0 port of Router-1 and Serial 3/0 of Router-3 to Serial2/0 and Serial3/0 ports of Router-2 respectively.

2. a) PC-1 Configuration:
Click on PC-1 → Config → Interface → FastEthernet0
Assign static IP address [10.0.0.2 and Subnet Mask: 255.0.0.0].

Assign static gateway : 10.0.0.1

b) PC-2 Configuration :
Click on PC-2 → Config → Interface → FastEthernet0.
Assign static IP address [40.0.0.2 and subnet mask : 255.0.0.0].
Assign static gateway : 40.0.0.1

3. Routers Configuration :
a) Router-1 Configuration : (Default router)

Router > enable
Router # config t.
Router (config) # interface Fa0/0
Router (config-if) # ip address 10.0.0.1 255.0.0.0
Router (config-if) # no shut.
Router (config-if) # exit.

Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.1 255.0.0.0
Router (config-if) # no shut.
Router (config-if) # exit.

~~Router (config) # interface Se2/0~~
Router (config) # ip route 0.0.0.0 0.0.0.0 20.0.0.2
Router (config) # exit.

b) Router-2 Configuration : (Static Router) :

Router > enable
Router # Config t
Router (config) # interface Se2/0
Router (config-if) # ip address 20.0.0.2 255.0.0.0

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Router(config-if) # no shut
Router (config-if) # exit.

Router(config) # interface Se3/0
Router(config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shut.
Router(config-if) # exit.

Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router (config) # exit.

c) (Router-3 Configuration) : (Default router)

Router > enable
Router # Config t
Router(config) # interface Se3/0
Router(config-if) # ip address 30.0.0.2 255.0.0.0
Router(config-if) # no shut.
Router (config-if) # exit.

~~Router(config) # interface Fa0/0~~
Router (config-if) # ip address 40.0.0.1 255.0.0.0
Router (config-if) # no shut
Router (config-if) # exit.

Router (config) # ip route 0.0.0.0 0.0.0.0 30.0.0.1
Router (config) # exit.

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4. Show ip route :

a) Router-1 :

Router > enable

Router # show ip route

C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, Serial 2/0
S* 0.0.0.0/0 [1/0] via 20.0.0.2

b) Router - 2 :

Router > enable

Router # show ip route :

S 10.0.0.0/8 [1/0] via 20.0.0.1
C 20.0.0.0/8 is directly connected, Serial 2/0
C 30.0.0.0/8 is directly connected, Serial 3/0
S 40.0.0.0/8 [1/0] via 30.0.0.2

c) Router -3 :

Router > enable

Router # show ip route

C 30.0.0.0/8 is directly connected, Serial 3/0
C 40.0.0.0/8 is directly connected, Fast Ethernet 0/0
S* 0.0.0.0/0 [1/0] via 30.0.0.1

5. Send a PDU from PC-1 to PC-2 and check the value of TTL at every step.

→

Result: (in Simulation Mode):

1. Sending a PDU from PC-1 to PC-2:

Outbound PDU details at Device 10.0.0.2:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 255.

At Router-1 :

Inbound PDU details at Device Router-1:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 255

Outbound PDU details at Device Router-1:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 254

At Router-2

Inbound PDU details at Device Router-2:

TTL : 254.

Outbound PDU details at Device Router-2:

TTL : 253.

At Router-3

Inbound PDU details at Device Router-3:

TTL : 253.

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Outbound PDU details at Device Router-3:

TTL: 252

At PC-2:

Inbound PDU details at Device 40.0.0.2:

DEST MAC: 00D0.FF55.5316

SRC MAC: 00021628.2B24

TTL: 252

Outbound PDU details at Device 40.0.0.2

DEST MAC: 0002.1628.2B24

SRC MAC: 00D0.FF55.5316

TTL: 128

At Router-3

Inbound PDU details at Device Router-3

DEST MAC: 0002.1628.2B24

SRC MAC: 00D0.FF55.5316

TTL: 128

Outbound PDU details at Device Router-3:

TTL: 127

At Router-2:

Inbound PDU details at Device Router-2:

TTL: 127

Outbound PDU details at Device Router-2:

TTL: 126

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At Router 1:

Inbound PDU details at Device Router-1:

TTL: 126

Outbound PDU details at Device Router-1:

DEST ~~MA~~: 00E0. F919. E5C7

SRC MAC: 0001. 963C. 4A45

TTL: 125

At PC-1:

Inbound PDU details at Device 10.0.0.2:

DEST MAC: 00E0. F919. E5C7

SRC MAC: 0001. 963C. 4A45.

TTL: 125

2. Pinging From PC-1 to PC-2

PC> ping 40.0.0.2

Pinging 40.0.0.2 with 32 bytes of data:

Reply from 40.0.0.2: bytes =32 time = 14 ms TTL=125
Reply from 40.0.0.2: bytes = 32 time = 7 ms TTL = 125
Reply from 40.0.0.2: bytes = 32 time = 7 ms TTL = 125
Reply from 40.0.0.2: bytes = 32 time = 5 ms TTL = 125

Ping statistics for 40.0.0.2
Packets: Sent = 4, Received = 4, lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 5ms, Maximum = 14 ms, Average = 8 ms

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Observation:

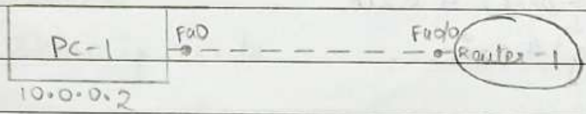
TTL (Time-to-live) is a value in an Internet Protocol (IP) packet that tells a network router when the packet has been in the network too long and should be discarded. The TTL value instructs a network router when a packet should be discarded.

Experiment-10

To understand the operation of TELNET by accessing the router in server room from a PC in IT Office.

<u>Aim:</u> Create a topology to depict TELNET within a LAN

<u>Topology:</u>



<u>Procedure:</u>

1. Add a PC and a Router.
   Connect PC to Router-1 using Copper Cross-Over wire from FastEthernet 0 port of PC to FastEthernet0/0 port of Router-1.

2. <u>PC-1 Configuration:</u>
   Click on PC-1 → Config → Interface → FastEthernet0
   Assign a static ip address [10.0.0.2 and Subnet Mask 255.0.0.0].

3. <u>Router-1 Configuration:</u>

Router>enable
Router # Config t
Router(config) # hostname R_1
R_1(config) # enable secret P_1
R_1(Config) # interface Fa0/0
R_1(Config-if) # ip address 10.0.0.1 255.0.0.0
R_1(Config-if) # no shut.

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R1(config-if)# line vty 0 5
R1(config-line)# login.
% login disabled on line 132, until 'password' is set.
% login disabled on line 133, until 'password' is set
% login disabled on line 134, until 'password' is set
% login disabled on line 135, until 'password' is set.
% login disabled on line 136, until 'password' is set
% login disabled on line 137, until 'password' is set.
R1(config-line)# password PO
R1(config-line)# exit
R1(config)# exit.
R1 # wr
Building configuration...
[ok]

Result:
Pinging Router-1 through PC-1 in Command Prompt:

PC> ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.1
Packets: Sent=4, Received=4, Lost=0(0% loss)
Approximate round trip times in milli-seconds:
Minimum=0ms, Maximum=0ms, Average=0ms

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Accessing router CLI from PC:

PC> telnet 10.0.0.1
Trying 10.0.0.1 ... Open

User Access Verification

Password:
R1>enable
Password:
R1# show ip route

C 10.0.0.0/8 is directly connected, FastEthernet0/0.

[Password for User Access Verification: P0
Password for enable: P1]

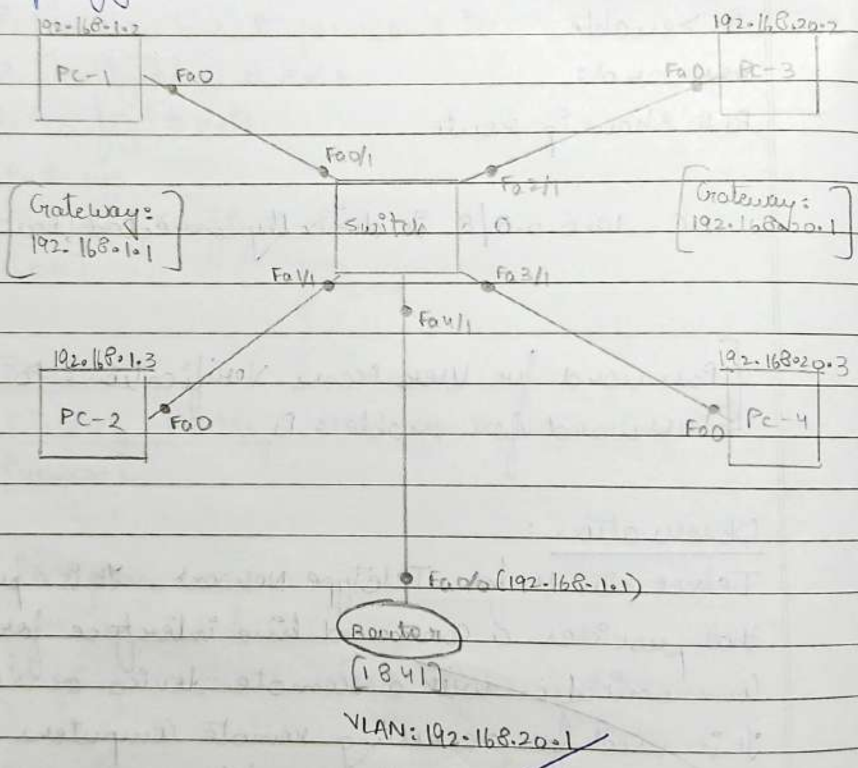
Observation:
Telnet stands for Teletype Network. It is a protocol that provides a command line interface for communication with a remote device or server. It is used for accessing remote computers over TCP/IP networks like the internet.

Experiment - 11

To construct a VLAN and make the PC's communicate among a VLAN.

Aim: To understand communication of PCs among a VLAN

Topology:



Procedure:

1. Place a Router (1841), a switch and 4 PCs.

2. **Switch Configuration:**
Click on Switch → Physical
Turn off the Switch.
Remove the 2 ports (PT-Switch-NM-1FFE) by dragging and dropping them in Modules.
Add the port (PT-SWITCH-NM-1CFE) by dragging it

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from Modules and placing onto the empty slots in Switch.
Now Turn on the Switch.
By doing this, we have 5 Fast Ethernet ports to connect 4 PCs and a router.

3. Connect PC-1, PC-2, PC-3, PC-4 from FastEthernet0 ports of each PCs to Fa0/1, Fa1/1, Fa2/1 and Fa3/1 using Copper straight through wire.
Connect Fa0/0 port of Router to Fa4/1 Port of switch using Copper straight through wire.

4. a) PC-1 Configuration:
Click on PC-1 → Config → Interface → FastEthernet0
Assign a static ip address [192.168.1.2 and Subnet Mask: 255.255.255.0].
Assign static gateway : 192.168.1.1

b) PC-2 Configuration:
Click on PC-2 → Config → Interface → FastEthernet0
Assign a static ip address [192.168.1.3 and Subnet Mask: 255.255.255.0].
Assign static gateway : 192.168.1.1

c) PC-3 Configuration:
Click on PC-3 → Config → Interface → FastEthernet0.
Assign a static ip address [192.168.20.2 and Subnet Mask: 255.255.255.0].
Assign static gateway : 192.168.20.1.

d) PC-4 Configuration:
Click on PC-4 → Config → Interface → FastEthernet0.
Assign a static ip address [192.168.20.3 and Subnet Mask: 255.255.255.0].

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Assign a static gateway: 192.168.2.1

5. a) In Switch, go to Config. Select VLAN database.
VLAN CONFIGURATION
VLAN NUMBER : 2 (Give any no. except →1)
VLAN NAME : NEWVLAN (Give any name)
Then Click on Add.

b) Select the interface [i.e FastEthernet 4/1] (port connecting switch and router).
Change Access to Trunk

VLAN Trunking allows switches to forward frames from different VLAN's over a single link called trunk.

c) Select interface FastEthernet 2/1. Under VLAN, Change from 1 to 2.
Select interface Fast Ethernet 3/1. Under VLAN, Change from 1 to 2.

This makes the switch understand NEWVLAN.

6. Router Configuration -

Router > enable
Router # Config t
Router(Config) # interface FastEthernet 0/0
Router (Config-if)# ip address 192.168.1.1 255.255.255.0
Router (Config-if)# no shut
Router (Config-if)# exit
Router(Config)# exit.

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Now the router is to understand NEWVLAN.

Click on Router → Config → Switching → VLAN Database.
VLAN Configuration
VLAN Number : 2
VLAN Name : NEWVLAN.
Click on add.

(Above step in Router CLI)
Router>enable
Router # vlan database
Router(vlan) # vlan 2 name NEWVLAN
VLAN 2 modified :
Name : NEWVLAN
Router(vlan) # exit
APPLY completed.
Exiting ....

Router # Config t
Router(Config) # interface Fa0/0.1
Router(Config - subif) # encapsulation dot1q 2
Router (Config - subif) # ip address 192.168.20.1 255.255.255.0
Router (config - subif) # exit.
Router (config) # exit.

Router#show ip route.

C 192.168.1.0/24 is directly connected, FastEthernet 0/0
C 192.168.20.0/24 is directly connected, FastEthernet 0/0.1

→

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Result:

a) Pinging PC-1 to PC-2 :

PC> ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes = 32 time = 0ms TTL: 128
Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL: 128
Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL: 128
Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL: 128

Ping statistics for 192.168.1.3:
Packets: Sent = 4, Received = 4, lost = 0 (0% loss)
Approximate round trip times in milli-seconds:
Minimum = 0ms Maximum = 0ms, Average = 0ms

b) Pinging PC-1 to PC-3 :

PC> ping 192.168.20.2

Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127
Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127
Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127
Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127

Ping statistics for 192.168.20.2 :
Packets: Sent = 4, Received = 4, Lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms.

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Observation :

A virtual local area network (VLAN) is a virtualized connection that connects multiple devices and network nodes from different LANs into one logical network.

IEEE 802.1Q, often referred to as DOT1Q or 1Q, is the networking standard that supports virtual LANs (VLANs) on an IEEE 802.3 Ethernet network. It is the most widely used encapsulation method for VLAN tagging.

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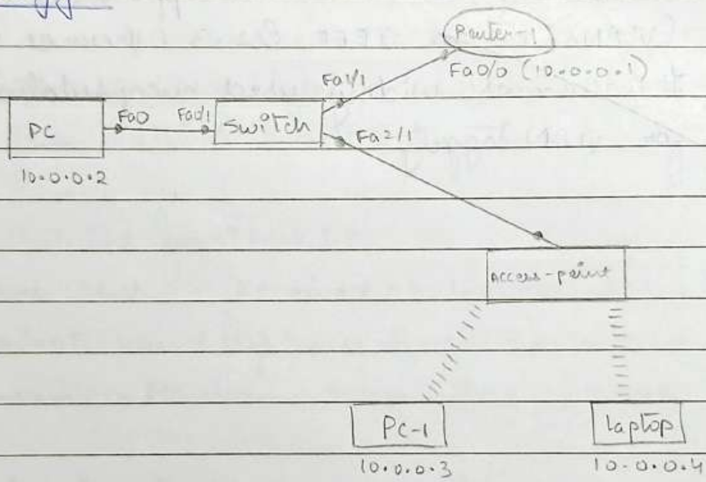
Experiment - 12

To construct a WLAN and make the nodes communicate among a WLAN wirelessly.

Aim: To understand communication of Nodes wirelessly.

Topology:



Procedure:

1. Place 2 PCs, a laptop, a switch, a router, access point.
   Connect PC to switch using Copper straight through wire from Fa0 port of PC to Fa0/1 port of Switch.
   Connect Router to Switch using Copper Straight through wire from Fa1/1 port of Switch to Fa0/0 port of Router.
   Connect Switch to Access-point using Copper Straight through wire from Fa2/1 port of Switch to Port0 port of Access Point.

2. PC Configuration:
Click on PC → Config → Interface → FastEthernet 0.
Assign static ip address [10.0.0.2] and Subnet Mask: 255.0.0.0.

3. Router Configuration:
Router > enable
Router # Config t
Router(config) # interface Fa0/0
Router (config-if) # ip address 10.0.0.1 255.0.0.0
Router (Config-if) # no shut.
Router (config-if) # exit
Router (Config) # exit.

4. Access Point Configuration:
Click on Access-Point → Config → Interface → Port 1
Turn Port Status 'ON'.
SSID : WLAN
Authentication : WEP
WEP Key : 1234567890

5. PC-1 Configuration:
Click on PC-1 → Physical.
Turn off the PC
Remove the port [PT-HOST-NM-1AM] by dragging and dropping it in Modules List.
Drag and place port [WMP300N] in the PC in the empty slot.
Switch on the PC.

In the Config tab, a new wireless interface would have been added.

→

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In Wireless0 Interface,

SSID: WLAN

Authentication: WEP

WEP Key: 1234567890

IP Configuration

Static

IPaddress: 10.0.0.3

Subnet Mask: 255.0.0.0

6. Laptop-1 Configuration:

Click on laptop-1 → Physical

Turn off the laptop

Remove the port [PT-LAPTOP-NM-1AM] by dragging dropping it in the Modules list

Drag and place the port [WPC 300N] in the laptop in the empty slot.

Switch on the laptop

In the Config tab, a new wireless interface would have been added.

In Wireless0 Interface,

SSID: WLAN

Authentication: WEP

WEP KEY: 1234567890

IP Configuration:

Static

IP address: 10.0.0.4

Subnet Mask: 255.0.0.0

7. Ping from one device to every other device

Result:

a) Pinging from PC to PC-1

PC> ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3 : bytes=32 time=25ms TTL=128
Reply from 10.0.0.3 : bytes=32 time=11ms TTL=128
Reply from 10.0.0.3 : bytes=32 time=12ms TTL=128
Reply from 10.0.0.3 : bytes=32 time=8ms TTL=128

Ping statistics for 10.0.0.3:
Packets : Sent = 4, Received = 4, Lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 8ms, Maximum = 25ms, Average = 14ms.

b) Pinging from PC to laptop-1:

PC> ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4 : bytes=32 time=29ms TTL=128
Reply from 10.0.0.4 : bytes=32 time=11ms TTL=128
Reply from 10.0.0.4 : bytes=32 time=6ms TTL=128
Reply from 10.0.0.4 : bytes=32 time=12ms TTL=128

Ping statistics for 10.0.0.4:
Packets : Sent = 4, Received = 4, Lost = 0 (0% Loss)
Approximate round trip times in milli-seconds:
Minimum = 6ms, Maximum = 29ms, Average = 14ms.

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Observation:

A wireless local-area network (WLAN) is a group of colocated computers or other devices that form a network based on radio transmission rather than wired connections. A Wi-Fi network is a type of WLAN. Data is sent in packets. The packets contain layers and instructions that, along with unique MAC (Media Access Control) addresses assigned to end points, enabling routing to intended locations.

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Experiment - 1

Write a program for error detecting code using CRC-CCITT (16-bits)

Program:

```
#include<stdio.h>
#include<string.h>

char data[50], crc[50], gen[20];
int len, i, j;

void calc_crc()
{ for (i=0; i<strlen(gen); i++)
        crc[i] = data[i];
   do
   { if (crc[0] == '1')
       { for(j=1; j<strlen(gen); j++)
            crc[j] = ((crc[j] == gen[j]) ? '0' : '1');
       }
     for (j=0; j<strlen(gen)-1; j++)
          crc[j] = crc[j+1];
     crc[j] = data[i++];
   }
   while(i<= len + strlen(gen) - 1);
}

int main()
{ printf("Enter Bit string: ");
    scanf("%s", data);
  len = strlen(data);
  printf("Enter generating polynomial: ");
    scanf("%s", gen);
```

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```c
printf("Generating Polynomial : %s\n", gen);

for(i = len; i< len + strlen(gen)-1 ; i++)
    data[i] = '0';

printf("Modified Data is : %s\n", data);
calc_crc();
printf("Checksum is : %s\n", crc);

for (i = len ; i< len + strlen(gen) - 1 ; i++)
    data[i]= crc[i - len];

printf("Final Codeword is: %s\n", data);
printf(" Test Error detection\n1(Yes) | 0(No)? : ");
scanf("%d", &i);

if (i == 1)
{   printf("Enter position to insert an error : ");
    scanf("%d", &i);
    data [i] = (data[i]=='0') ? '1' : '0';
    printf("Erroneous data : %s\n", data);
}

calc_crc();

for(i=0; (i< strlen(gen) - 1 )&&(crc [i] != '1'); i++);

if (i<strlen(gen)-1)
    printf(" Error detected\n");
else
    printf(" No Error detected\n");
return 0;
}
```

Output:

Enter Bit String :110110101

Enter generating polynomial : 110110000000001

Generating Polynomial : 1101100000000001

Modified data is :11011000000000000

Checksum is : 0010111011001111

Final Codeword is: 11011010100101111

Test Error detection

1(Yes) /0(No)? : 0

No error detected.

Experiment - 2

Write a program for congestion Control using leaky bucket algorithm

Program:

```
#include < stdio.h>
#include < stdlib.h>

struct packet
{ int time;
  int size;
} p[50];

int main()
{ int i, n, m, k=0;
  int bsize, bfilled, outrate;
  printf("Enter the number of packets: ");
   scanf("%d",&n);
  printf("Enter packets in the order of their
          arrival time");
   for (i=0; i<n; i++)
     { printf(" Enter the time and size: ");
       scanf(" %d %d ", & p[i].time, &p[i].size);
     }
  printf(" Enter the bucket size : ');
   scanf ("%d", &bsize);
  printf(" Enter the outrate : ");
   scanf(" %d", &outrate);

   m = p[n-1].time;
   i = 1;
  k = 0;
```

```
bfilled = 0;
while (i<=m || bfilled != 0)
{ printf("\n\n At time %d", i);

  if (p[k].time == i)
  { if (bsize >= bfilled + p[k].size)
    { bfilled = bfilled + p[k].size;
      printf("\n%d byte packet is inserted",
              p[k].size);
      k = k+1;
    }
    else
    { printf("\n%d byte packet is discarded",
              p[k].size);
      k = k+1;
    }
  }

  if (bfilled == 0)
  { printf("\n No packet transmitted");
  }
  else if (bfilled >= outrate)
  { bfilled = bfilled - outrate;
    printf("\n%d bytes transferred", outrate);
  }
  else
  { printf("\n %d bytes transferred", bfilled);
    bfilled = 0;
  }
  printf("\n Packets in bucket %d byte", bfilled);
  i++;
}
return 0;
}
```

→

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Output:
Enter the number of packets : 2
Enter the packets in the order of their arrival time:
Enter the time and size : 1 5
Enter the time and size : 3 8
Enter the bucket size : 10
Enter the output rate : 6

At time 1:
5 byte packet is inserted
5 bytes transferred
Packets in the bucket : 0 byte.

At time 2:
No packets to transmitte
Packets in the bucket : 0 byte

At time 3:
8 byte packet is inserted
6 bytes transferred
packets in the bucket : 2 byte

At time 4:
2 bytes transferred
Packets in the bucket : 0 byte.

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Experiment - 3

Using a TCP/IP sockets, write a Client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Program:
ClientTCP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName, serverPort))
sentence = input("\nEnter file name: ")

clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
print('\n From server:\n')
print(filecontents)
clientSocket.close()
```

ServerTCP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_STREAM)
serverSocket.bind((serverName, serverPort))
serverSocket.listen(1)
```

⇒

```
while 1:
print ("The server is ready to receive")
Connection Socket, addr = serverSocket.accept()
sentence = connectionSocket.recv(1024).decode()

file = open(sentence, "r").

l = file.read(1024)

connectionSocket.send(l.encode())
print ('\n Sent contents of' + sentence)
file.close()
connectionSocket.close()
```

Output:

1. Run ServerTCP.py

   The server is ready to receive

2. Then run ClientTCP.py

   Enter file name: ServerTCP.py

   From Server:

```
from socket import*
serverName = "127.0.0.1"
Server port = 12000
serverSocket = Socket(AF_INIT, SOCK_STREAM)
server Socket.bind((serverName, serverPort))
server Socket.listen(1)
while 1:
    print ("The server is ready to receive")
    Connection Socket, addr = server Socket.accept()
    sentence = connectionSocket.recv(1024).decode()
```

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```
file = open(sentence, "r")
l = file.read(1024)
connectionSocket.send(l.encode)
print ('\n Sent contents of ' + sentence)
file.close()
connectionSocket.close()
```

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Experiment - 4

Using UDP sockets, write a client - server program to make client sending the file name and the server to send back the contents of the requested file if present.

Program:

ClientUDP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)
sentence = input("\n Enter file name: ")
clientSocket.sendto(bytes(sentence, "utf-8"),
    (serverName, serverPort))

filecontents, serverAddress = clientSocket.recvfrom(2048)
print('\n Reply from Server: \n')
print(filecontents.decode("utf-8"))
# for i in filecontents:
  # print(str(i), end = '')
clientSocket.close
```

ServerUDP.py

```
from socket import*
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind("127.0.0.1", serverPort)
print("The server is ready to receive");
```

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```
while 1:
  sentence, clientAddress = serverSocket.recvfrom(2048)
  sentence = sentence.decode("utf-8")
  file = open(sentence, "r")
  con = file.read(2048)

  serverSocket.sendto(bytes(con, "utf-8"), clientAddress)

  print('\nSent contents of', end=' ')
  print(sentence)
  # for i in sentence
     # print(str(i), end="")
  file.close()
```

Output:

1. Run ServerUDP.py

The server is ready to receive.

2. Run ClientUDP.py

Enter file name : serverUDP.py

Reply from server :

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print("The server is ready to receive");
```

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```
while 1:
    print("The server is ready to receive")
    sentence, clientAddress = serverSocket.recvfrom(2048)
    sentence = sentence.decode("utf-8")
    file = open(sentence, "r")
    l = file.read(2048)

    serverSocket.sendto(bytes(l, "utf-8"), clientAddress)

    print('\nSent contents of', end = ' ')
    print(sentence)
    # for i in sentence
        # print (str(i), end = '')
    file.close()
```

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