

BUILD A WAN(WIDE AREA NETWORK) COMMUNICATION NETWORK USING MULTIPLE ROUTERS IN DHCP IP ADDRESS :

INTRODUCTION :

In this network we are build a WAN (Wide Area Network) communication network using multiple router. Hare we assign static IP address. Under each router has minimum one switch and also under each switch has more than one node (pc, laptop, server, printer etc.) .

❖ WAN : (WIDE AREA NETWORK)

A wide area network (WAN) is a geographically distributed private telecommunications network that interconnects multiple local area networks (LANs) . A WAN may consist of connections to a company's headquarters, branch office, cloud service and other facilities. Typically, a router or other multifunction device is used to connect a LAN to a WAN.

WAN are not restricted to the same geographical location.

❖ ROUTER :

A router is a networking device that forwards data packets between computer networks. Router perform the traffic directing functions on the internet. Data sent through the internet, such as a web page or email, is in the form of data packets. A packet is typically forwarded from one router to another router through the networks that constitute an internetwork until it destination node.

A router is connected to two or more data lines from different IP networks. When a data packet comes in on one of the lines, the router reads the network address information in the packet header to determine the ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey.

❖ DHCP IP ADDRESS : (DYNAMIC HOST CONFIGARATION PROTOCOL)

A DHCP server dynamically assigns an IP address and other network configuration parameters to each device on a network so they can communicate with other IP networks. DHCP is an enhancement of an older protocol called BOOTP. DHCP is an important part of the DDI solution (DNS - DHCP – IPAM). It relies on the standard protocol known as Dynamic Host Configuration Protocol or DHCP to respond to broadcast queries by clients.

REQUIRMENTS :

- I. THREE 2811 ROUTER.
- II. THREE 2950 – 24 SWITCH.
- III. NINE NODES.
 1. FOUR LAPTOP.
 2. THREE PC.
 3. ONE SERVER.
 4. ONE PRINTER.

➤ **2811 ROUTER:** The Cisco 2811 router is a multiple – chip standalone cryptographic module. The router has a processing speed of 350MHz. Depending on configuration, either the internal NetGX chip or the IOS software is used for cryptographic operations. The cryptographic boundary of the module is the device's case.

It has –

- One enhanced network module slot.
- Two integrated 10/100 Fast Ethernet ports.
- etc.

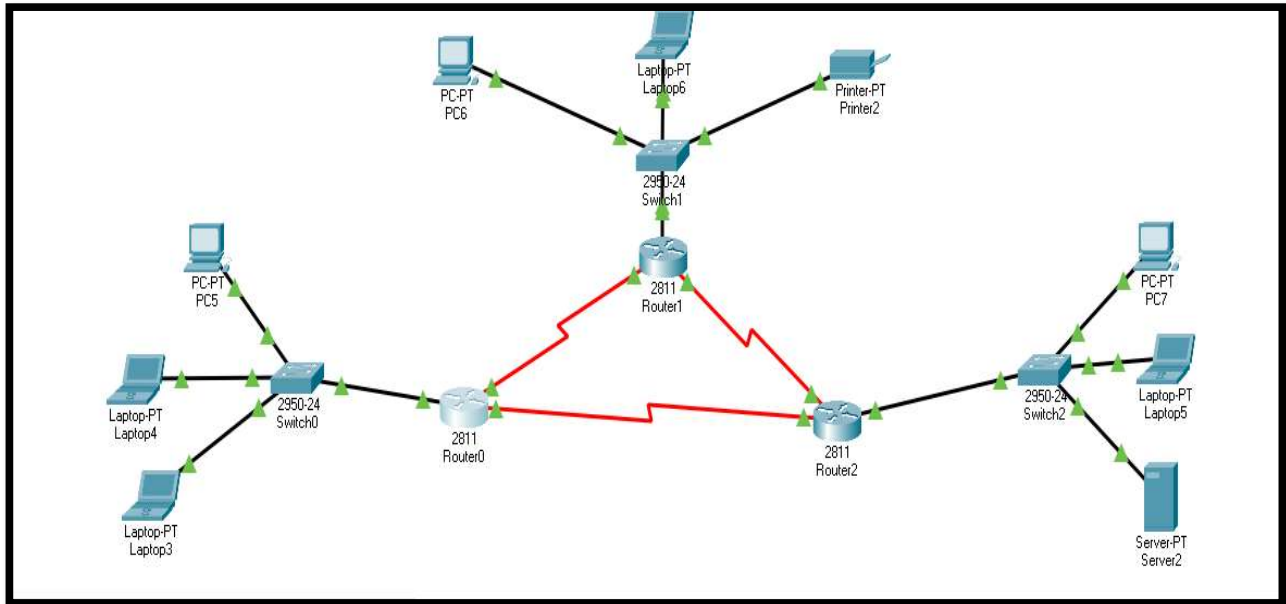
Hare in this practical we add two serial port (WIC – 1T) in this router.

➤ **2950 – 24 SWITCH:** The Cisco Catalyst 2950 Series, are standalone, fixed-configuration, managed 10/100 Mbps switches providing basic workgroup connectivity for small to midsize networks.

It has –

- 24 10/100 Mbps fast Ethernet ports (first 4 are up link and remaining are down link).

NETWORK DIAGRAM :



WAN Network using DHCP IP address

Hare in this diagram three 2811 router are used, and each router connected with a switch(2950-24) via Copper Straight cable. Each switch connected three nodes via Copper Straight cable. Three routers are connected each other via serial DCE cable.

CONFIGURATION OF NETWORKS :

UNDER SWITCH - 0 :

NAME OF THE NODE	IP ADDRESS	SUBNET MASK	DEFAULT GATEWAY
PC - 5	192.168.1.2	255.255.255.0	192.168.1.1
LAPTOP - 3	192.168.1.4	255.255.255.0	192.168.1.1
LAPTOP - 4	192.168.1.3	255.255.255.0	192.168.1.1

UNDER SWITCH - 1 :

NAME OF THE NODE	IP ADDRESS	SUBNET MAST	DEFAULT GATEWAY
PC - 6	192.168.0.3	255.255.255.0	192.168.0.1
LAPTOP - 6	192.168.0.4	255.255.255.0	192.168.0.1
PRINTER - 2	192.168.0.2	255.255.255.0	192.168.0.1

UNDER SWITCH -2 :

NAME OF THE NODE	IP ADDRESS	SUBNET MASK	DEFAULT GATEWAY
PC – 7	192.168.2.2	255.255.255.0	192.168.2.1
LAPTOP – 5	192.168.2.3	255.255.255.0	192.168.2.1
SERVER - 1	192.168.2.4	255.255.255.0	192.168.2.1

ROUTER – 0 :

NAME OF THE PORT	IP ADDRESS	SUBNET MASK
SERIAL 0/0/0	192.168.4.2	255.255.255.0
SERIAL 0/0/1	192.168.5.1	255.255.255.0
FAST ETHERNET 0/0	192.168.1.1	255.255.255.0

ROUTER – 1 :

NAME OF THE PORT	IP ADDRESS	SUBNET MASK
SERIAL 0/0/0	192.168.4.1	255.255.255.0
SERIAL 0/0/1	192.168.3.1	255.255.255.0
FAST ETHERNET 0/0	192.168.0.1	255.255.255.0

ROUTER – 2 :

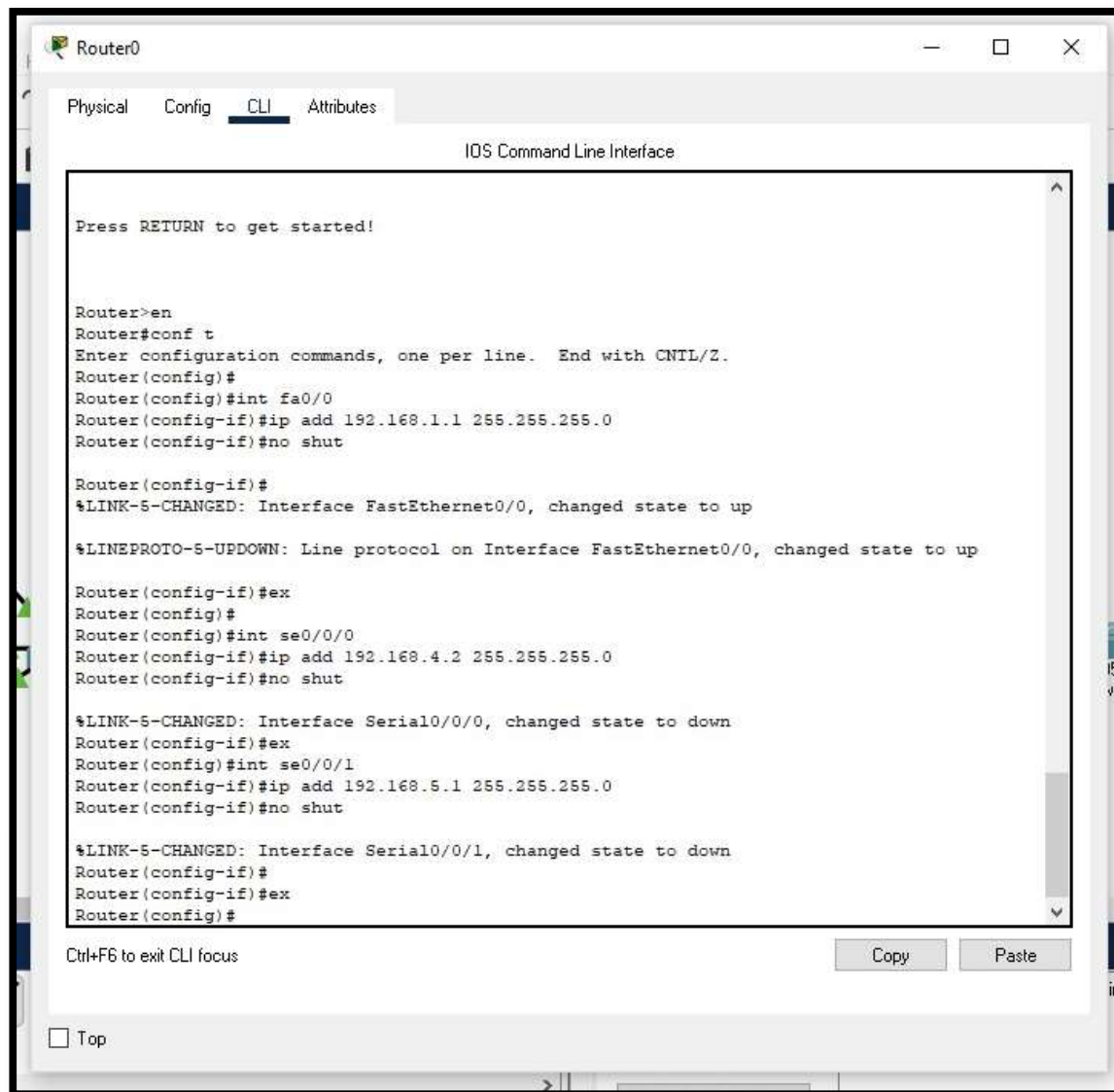
NAME OF THE PORT	IP ADDRESS	SUBNET MASK
SERIAL 0/0/0	192.168.3.2	255.255.255.0
SERIAL 0/0/1	192.168.5.2	255.255.255.0
FAST ETHERNET 0/0	192.168.2.1	255.255.255.0

After configure all IP address , the connection is done and to check the connection by pinging from one node to another node. If all IP address are configure correctly then the ping operation will perform rightly.

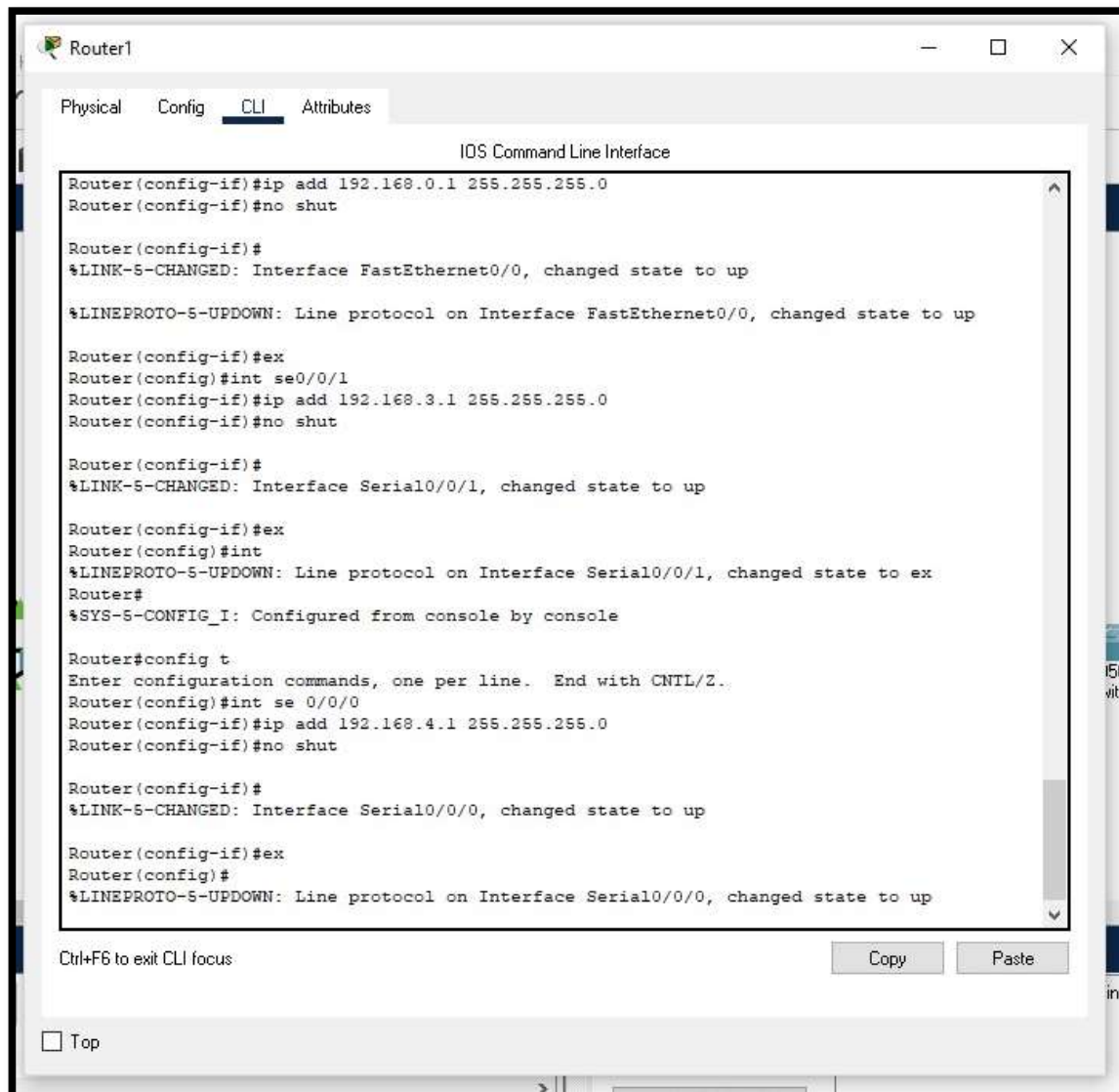
Here I use class C type of IP address and it is also IPv4 address. Class C network addresses range from **192.0.0.0 TO 223.255.255.0** . In this type of network first three bytes are Net ID and last byte is Host ID.

ROUTER CONFIGARATION :

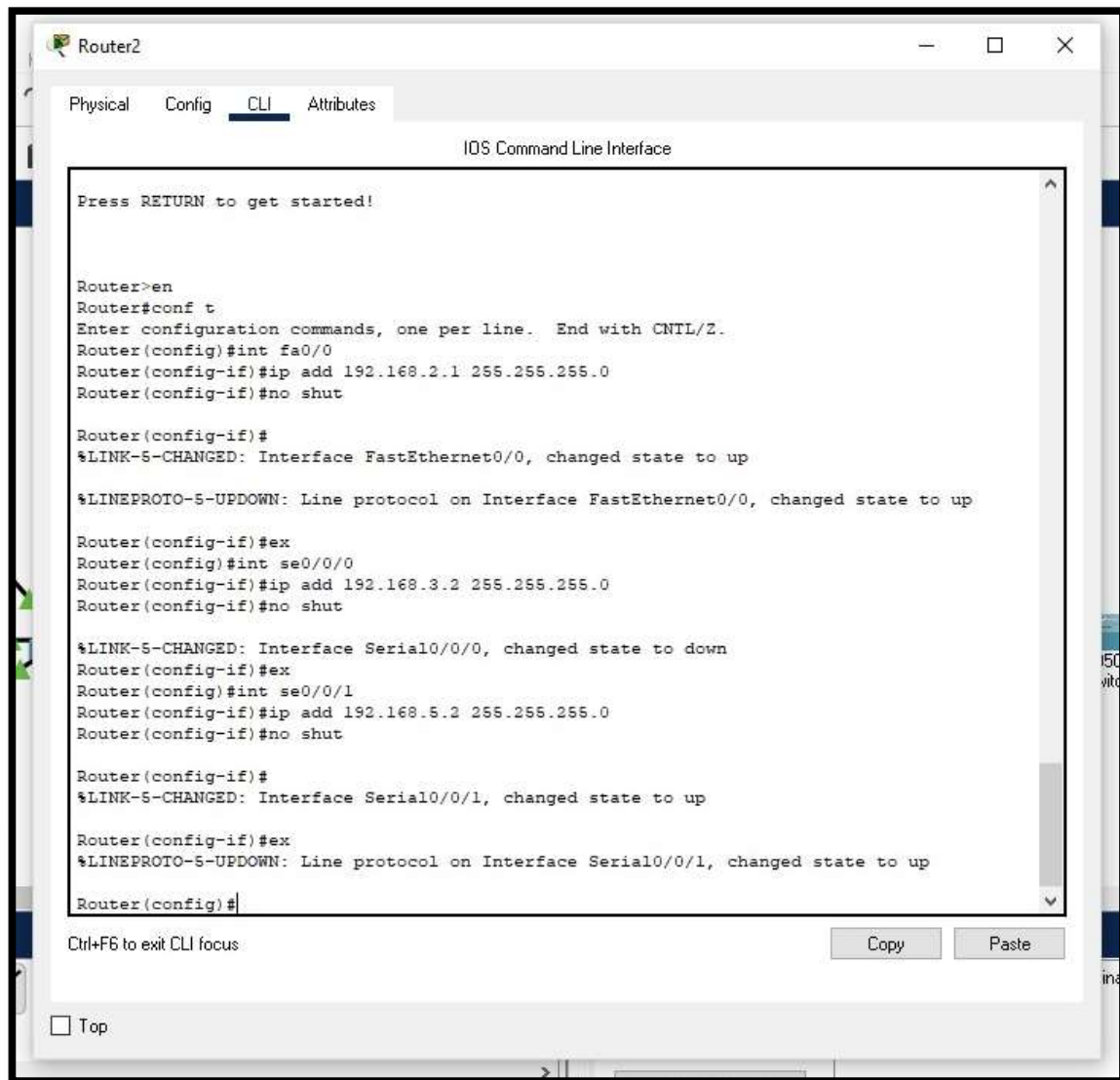
ROUTER - 0:



ROUTER - 1:



ROUTER - 2:



DHCP IP CONFIGARATION :

ROUTER - 0:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool dhcp
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#ex
Router(config)#
```

Ctrl+F6 to exit CLI focus

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ROUTER - 1:

```
Router(config-if)#ex
Router(config)#ip dhcp pool dhcp
Router(dhcp-config)#default-router 192.168.2.1
Router(dhcp-config)#network 192.168.2.0 255.255.255.0
Router(dhcp-config)#ex
Router(config)#
```

Ctrl+F6 to exit CLI focus

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ROUTER - 2:

```
Router(config-if)#ex
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

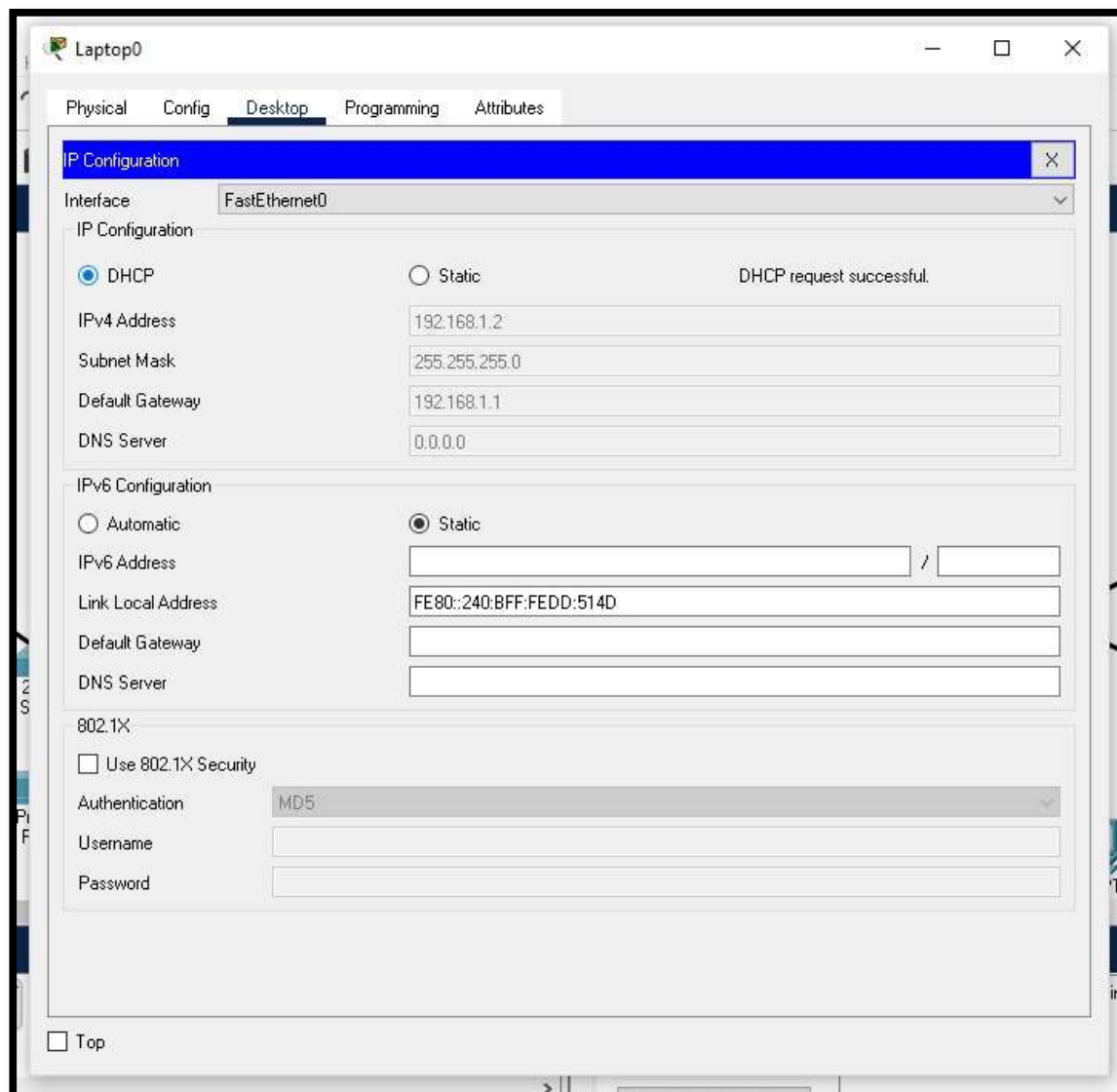
Router(config)#ip dhcp pool dhcp
Router(dhcp-config)#default-router 192.168.0.1
Router(dhcp-config)#network 192.168.0.0 255.255.255.0
Router(dhcp-config)#ex
Router(config)#
```

Ctrl+F6 to exit CLI focus

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DHCP IP CONFIGURATION IN A NODE :

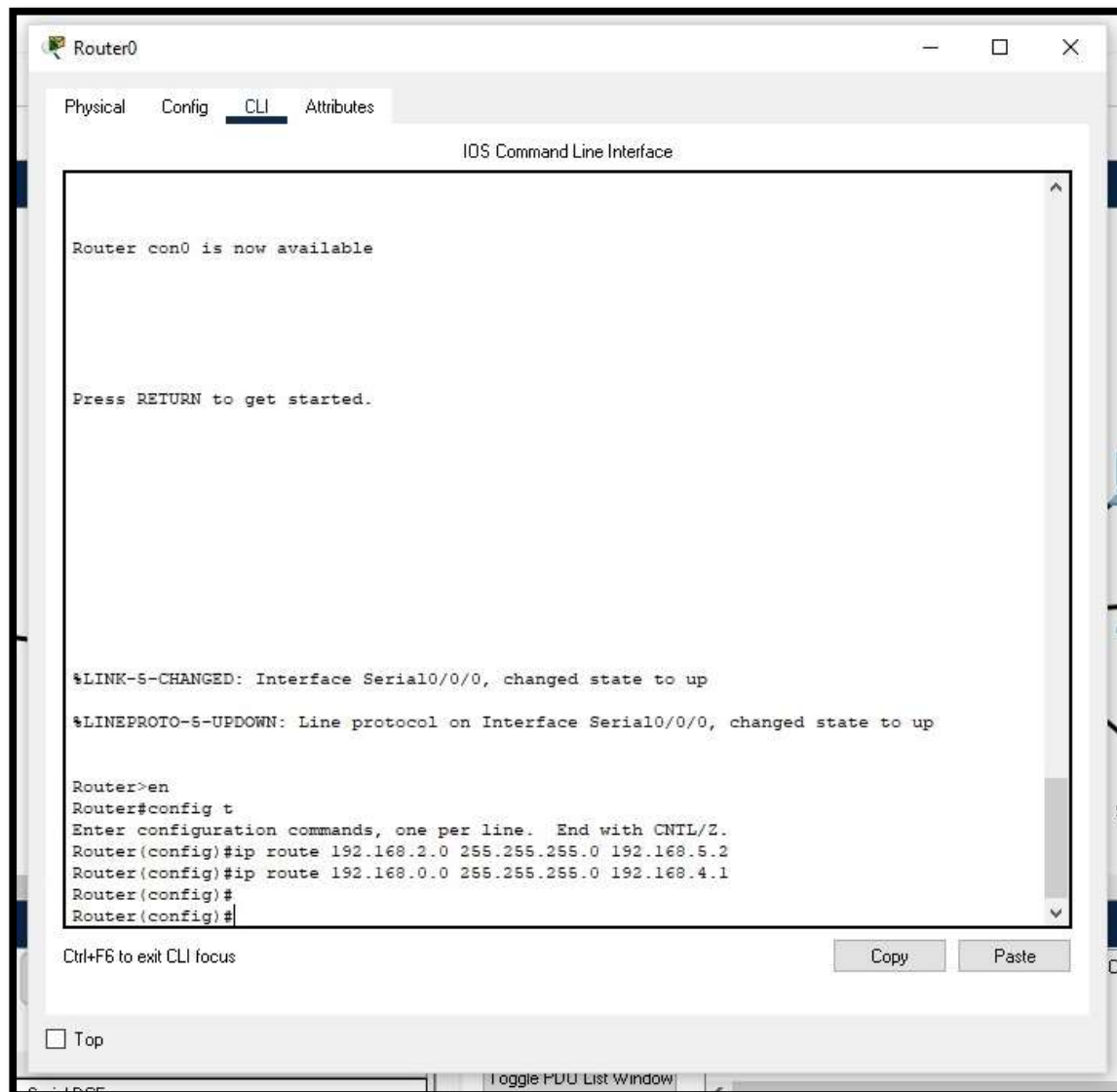


LAPTOP – 0 (NODE) IP CONFIGARATION USING DHCP

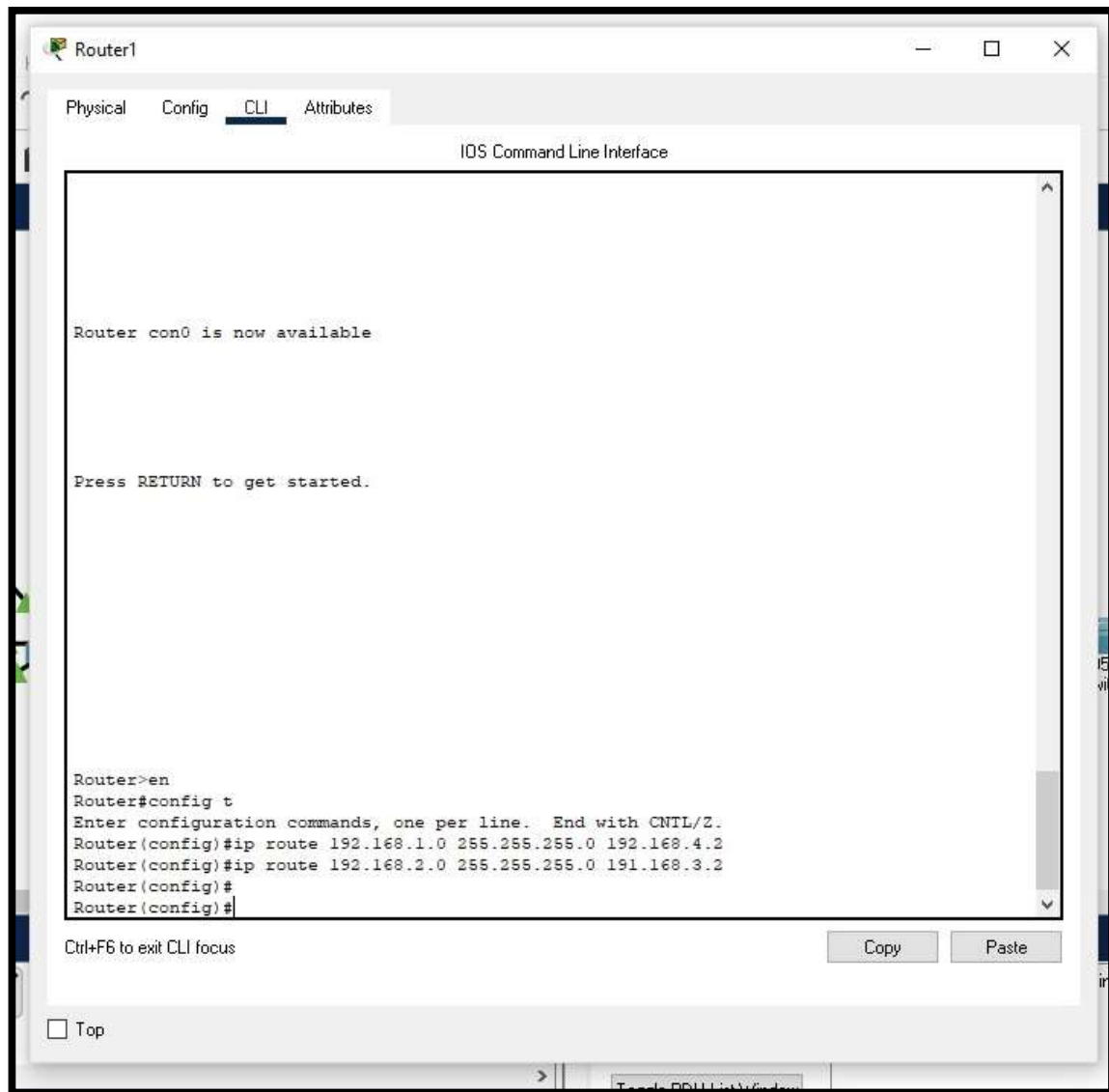
Here similarly, we assign all nodes IP address using DHCP configuration.

ROUTE CONFIGURATION :

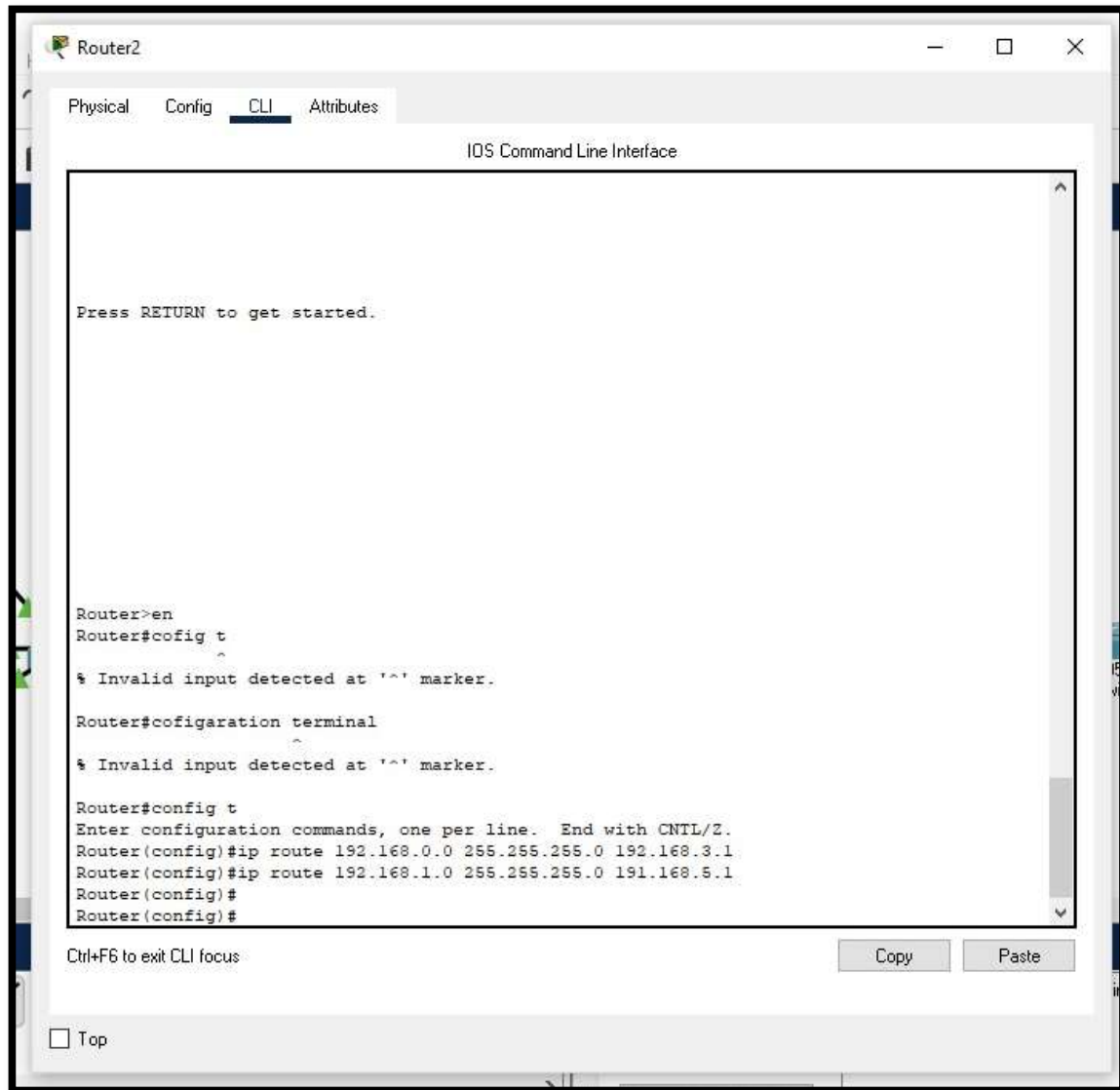
FROM ROUTER-0 TO ROUTER-1 AND ROUTER-2 :



FROM ROUTER-1 TO ROUTER-0 AND ROUTER-2 :



FROM ROUTER-2 TO ROUTER-0 AND ROUTER-1 :

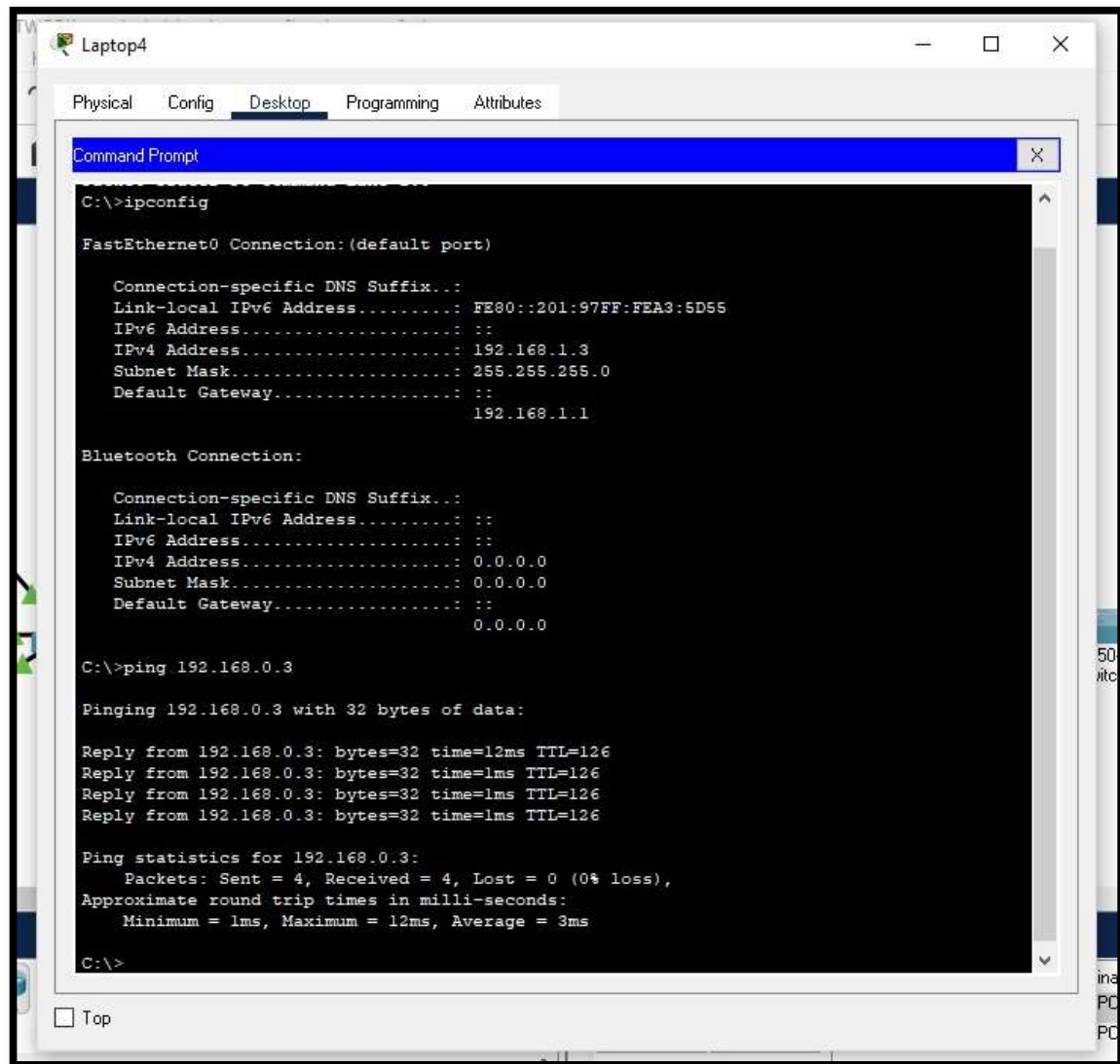


OUTPUT :

❖ PINGING THE NETWORK :

SENDER :- 192.168.1.3

RECIEVER :- 192.168.0.3



The screenshot shows a Windows Command Prompt window titled "Laptop4" with tabs for Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is active. The command prompt displays the output of the `ipconfig` command, showing details for the FastEthernet0 and Bluetooth connections. The FastEthernet0 connection is the default port and shows an IPv4 address of 192.168.1.3. The Bluetooth connection shows all-zero addresses. Following this, the `ping 192.168.0.3` command is executed, showing four successful replies with 32 bytes of data, response times between 1ms and 12ms, and a TTL of 126. Ping statistics for 192.168.0.3 are also displayed, showing 4 packets sent, 4 received, and 0% loss.

```
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...: 
    Link-local IPv6 Address . . . . .: FE80::201:97FF:FEA3:5D55
    IPv6 Address . . . . .: ::
    IPv4 Address . . . . .: 192.168.1.3
    Subnet Mask . . . . .: 255.255.255.0
    Default Gateway . . . . .: ::
                                   192.168.1.1

Bluetooth Connection:

    Connection-specific DNS Suffix...: 
    Link-local IPv6 Address . . . . .: ::
    IPv6 Address . . . . .: ::
    IPv4 Address . . . . .: 0.0.0.0
    Subnet Mask . . . . .: 0.0.0.0
    Default Gateway . . . . .: ::
                                   0.0.0.0

C:\>ping 192.168.0.3

Pinging 192.168.0.3 with 32 bytes of data:

Reply from 192.168.0.3: bytes=32 time=12ms TTL=126
Reply from 192.168.0.3: bytes=32 time=1ms TTL=126
Reply from 192.168.0.3: bytes=32 time=1ms TTL=126
Reply from 192.168.0.3: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 12ms, Average = 3ms

C:\>
```

❖ SIMULATION RESULT:

The screenshot displays a network simulation interface. At the top, a status bar shows '[Root]' and a clock at '13:33:00'. The main window is titled 'Simulation Panel' and contains several sections:

- Event List:** A table showing recent events.

Vis.	Time(sec)	Last Device	At Device
	0.155	--	Switch1
	0.156	Switch1	Printer2
	0.156	Switch1	PC6
	0.156	Switch1	Router1
- Reset Simulation:** A button to reset the simulation.
- Constant Delay:** A checked checkbox.
- Captured to:** A field showing '0.156 s'.
- Play Controls:** Buttons for play, pause, and stop, along with a progress bar.
- Event List Filters - Visible Events:** A list of protocols and services including ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP.
- Edit Filters:** A button to modify the event filters.
- Show All/None:** A button to toggle the visibility of all or none events.

At the bottom, there is a navigation bar with three tabs: 'Event List' (selected), 'Realtime', and 'Simulation'. Below the navigation bar is a table showing the simulation results:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop3	PC6	ICMP		0.000	N	0	(edit)	(delete)

REFERENCES :

- YOUTUBE
- GOOGLE

CONCLUSION :

- Some examples of WAN technologies like leased lines, frame relay, DSL, cable, and Ethernet.
- The difference between circuit switching, packet switching, and cell switching.
- The terminology that used when talking about the WAN network.
- The difference between LAN and WAN.