
CERTIFICATE

It is to certify the bona fide record of the work done in Computer Network Lab by Mr. T. Nikhil of Computer Science Engineering Department bearing ID No B161029 during the year 2020-2021.

Signature of the Examiner

Signature of the Branch Coordinator

Signature of the Lab Instructor

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# 1. Fabrication of Cables

## a) Objective:

i. To practise the colour code for different cables.
ii. Observe the Lan Tester and make the decision accordingly.

## b) Theory:

A twisted pair consists of two insulated conductors twisted together in the shape of a spiral. It can be shielded or unshielded. The unshielded twisted pair cables are very cheap and easy to install. But they are very badly affected by the electromagnetic noise interference.

There are 3 types of UTP cables

1) Straight-through cable
2) Crossover cable
3) Roll-over cable

**A. Straight-through cable**

Straight-Through refers to cables that have the pin assignments on each end of the cable. In other words, Pin 1 on connector A goes to Pin 1 on connector B, Pin 2 to Pin 2 etc. Straight-Through wired cables are most commonly used to connect a host to client. For Example: cat5e patch cables

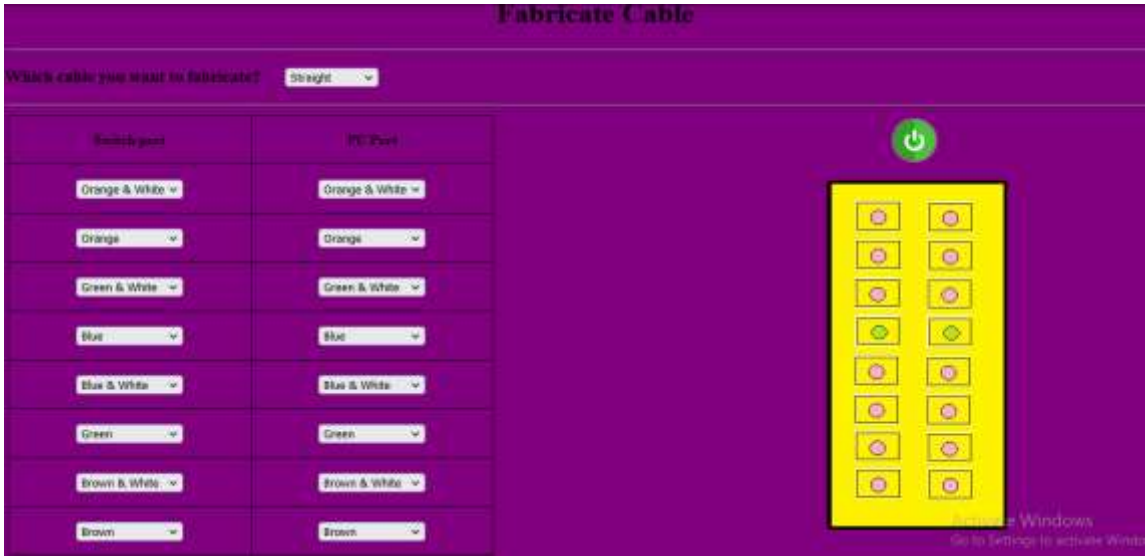
**B. Crossover cable**

Crossover wired cables (commonly called crossover cables) are very much like Straight-Through cables with the exception that TX and RX lines are crossed (they are at opposite positions on either end of the cable. Using the 568-B standard as an example below you will see that Pin 1 on connector A goes to Pin 3 on connector B. Pin 2 on connector A goes to Pin 6 on connector B etc. Crossover cables are most commonly used to connect two hosts directly. Examples would be connecting a computer directly to another computer, connecting a switch directly to another switch, or connecting a router to a router.

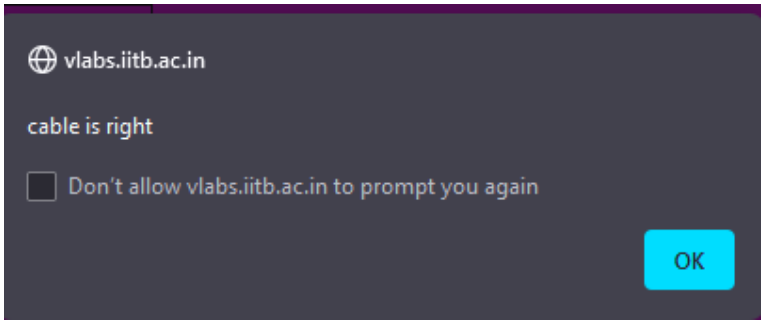
**C. Roll-over cable**

Rollover wired cables most commonly called rollover cables, have opposite Pin assignments on each end of the cable or in other words it is "rolled over". Pin 1 of connector A would be connected to Pin 8 of connector B. Pin 2 of connector A would be connected to Pin 7 of connector B and so on. Rollover cables, sometimes referred to as Yost cables are most commonly used to connect to a devices console port to make programming changes to the device.

## c) Diagram/ Connections:




## d) Results:



# 2. Simulation of Peer to Peer Network (With Two PC's)

## a) Objective:

To construct Peer to Peer Topology

## b) Theory:

The geometric representation of such a relationship of links and nodes is known as the topology of that network.
These topologies can be classified into two types: -
1. Peer to peer
2. Primary - Secondary

Peer to peer is the relationship where the devices share the link equally. The examples are ring and mesh topologies.
In Primary - Secondary relationship, one device controls and the other devices have to transmit through it. For example, star and tree topology.

→ Features of Peer to peer: -
In peer-to-peer architecture every node is connected to other node directly.
Every computer node is referred as peer.
Every peer provides services to other peers as well as uses services of them.
There is no central server present.

→ Advantages of Peer to peer: -
1) It is easy to install and so is the configuration of computers on this network,
2) All the resources and contents are shared by all the peers

→ Disadvantages of Peer to peer: -
1) In this network, the whole system is decentralised thus it is difficult to administer. That is one person cannot determine the whole accessibility setting of whole networks.
2) Data recovery or backup is very difficult. Each computer should have its own back-up system

## c) Topology Diagram:


## d) Commands Used:

i. Configure IP address for each PC
ii. Check their network connectivity using ping Command
PING IP address

## e) Results:

i. Checking connection at PC0 with pc1:

```
Packet Tracer PC Command Line 1.0
C:\>ping 10.1.2.4

Pinging 10.1.2.4 with 32 bytes of data:

Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.2.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

# 3. Simulation of STAR TOPOLOGY USING HUB:

## a) Objective:

To Construct Star Topology using HUB.

## b) Theory:

Star topology is a network topology in which each network component is physically connected to a central node such as a router, hub or switch. When the central node receives a packet from a connecting node, it can pass the packet on to other nodes in the network.

i. Features of Star Topology: -

1) Every node has its own dedicated connection to the hub.
2) Hub acts as a repeater for data flow.
3) Can be used with twisted pair, Optical Fibre or coaxial cable.

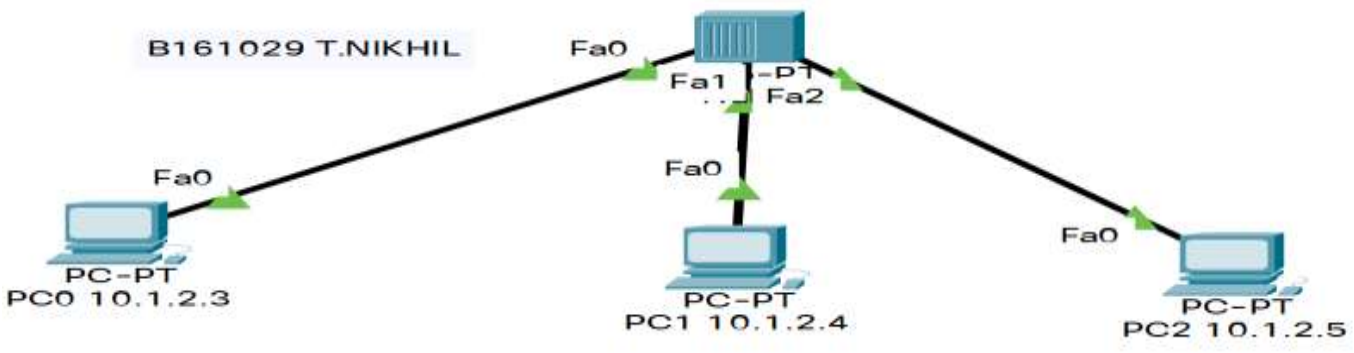
ii. Advantages of Star Topology: -

1) Fast performance with few nodes and low network traffic.
2) Hub can be upgraded easily.
3) Easy to troubleshoot.
4) Easy to setup and modify.

iii. Disadvantages of Star Topology: -

1) Cost of installation is high.
2) Expensive to use.
3) If the hub fails then the whole network is stopped because all the nodes depend on the hub.
4) Performance is based on the hub that is it depends on its capacity.

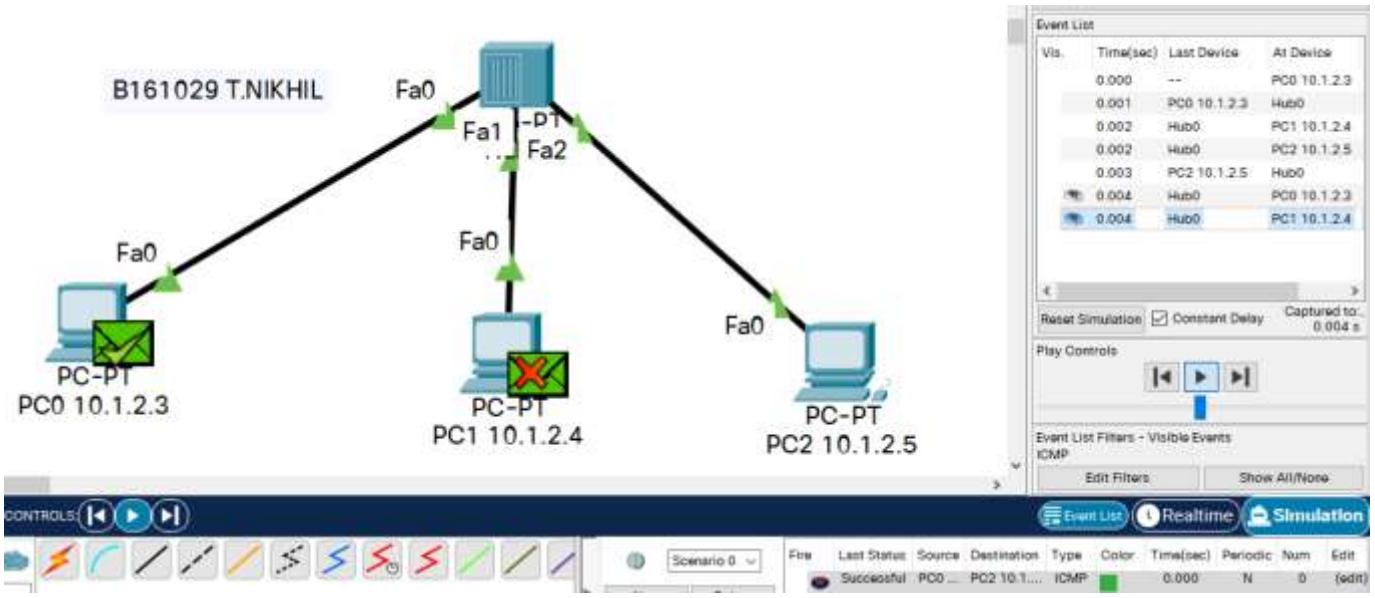
## c) Topology Diagram:



## d) Commands Used:

i. Configure Ip address for all PC's
ii. Check network connection using PING command
PING IP address
iii. Send packets and trace routes (simulation)

## e) Results:




```
Packet Tracer PC Command Line 1.0
C:\>ping 10.1.2.4

Pinging 10.1.2.4 with 32 bytes of data:

Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time=10ms TTL=128
Reply from 10.1.2.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.2.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 2ms

C:\>ping 10.1.2.5

Pinging 10.1.2.5 with 32 bytes of data:

Reply from 10.1.2.5: bytes=32 time=1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.2.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

# 4. Simulation of STAR TOPOLOGY USING SWITCH:

## a) Objective:

To Construct Star Topology Using SWITCH.

## b) Theory:

Star topology is a network topology in which each network component is physically connected to a central node such as a router, hub or switch. When the central node receives a packet from a connecting node, it can pass the packet on to other nodes in the network.

i. Features of Star Topology: -

1) Every node has its own dedicated connection to the hub.
2) Hub acts as a repeater for data flow.
3) Can be used with twisted pair, Optical Fibre or coaxial cable.

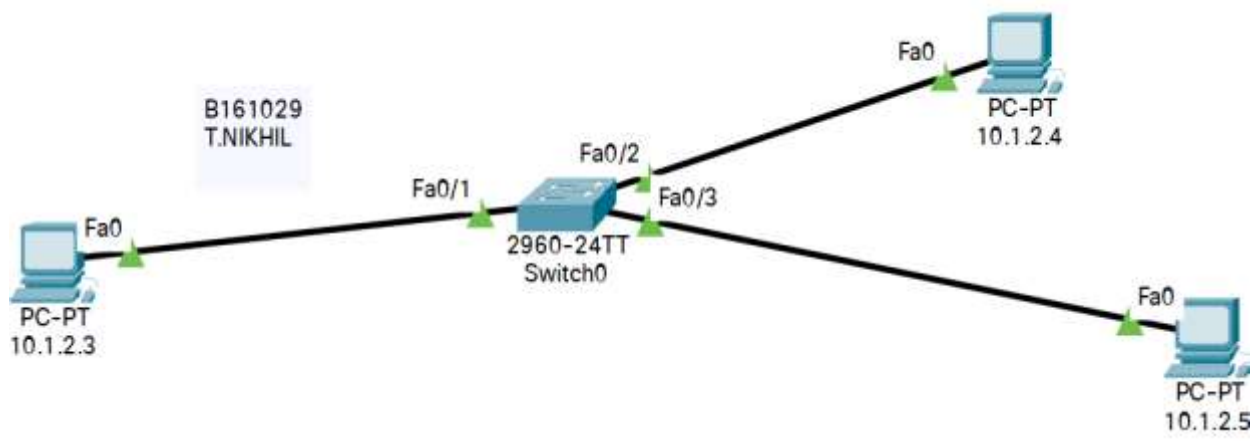
ii. Advantages of Star Topology: -

1) Fast performance with few nodes and low network traffic.
2) Hub can be upgraded easily.
3) Easy to troubleshoot.
4) Easy to setup and modify.

iii. Disadvantages of Star Topology: -

1) Cost of installation is high.
2) Expensive to use.
3) If the hub fails then the whole network is stopped because all the nodes depend on the hub.
4) Performance is based on the hub that is it depends on its capacity.

## c) Topology Diagram:

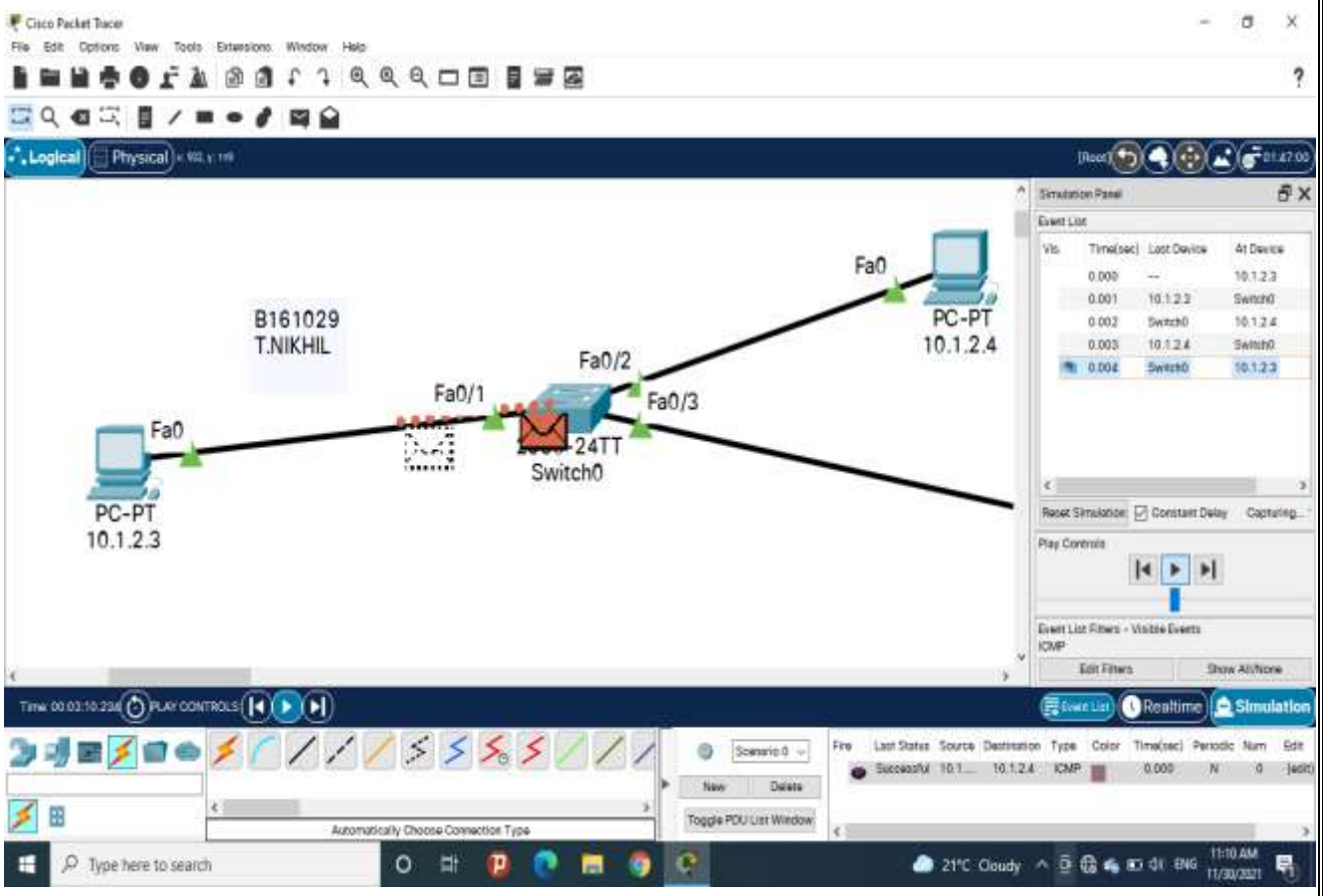


## d) Commands Used:

i. Configure Ip address for all PC's
ii. Check network connection using PING command
PING IP address
iii. Send packets and trace routes (simulation)

## e) Results:

```
Packet Tracer PC Command Line 1.0
C:\>ping 10.1.2.4

Pinging 10.1.2.4 with 32 bytes of data:

Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time=10ms TTL=128
Reply from 10.1.2.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.2.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 2ms

C:\>ping 10.1.2.5

Pinging 10.1.2.5 with 32 bytes of data:

Reply from 10.1.2.5: bytes=32 time=1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.2.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```



# 5. Simulation of BUS TOPOLOGY USING SWITCH:

## a) Objective:

To Construct Bus Topology Using Switch

## b) Theory:

Bus topology is a network type in which every computer and network device is connected to a single cable. It transmits the data from one end to another in a single direction.

i. Features of Bus Topology:

1. Simplicity is the simplest and most common method used in Ethernet networks.
2. A long cable acts as a backbone network that connects all devices in the network.
3. The bus topology has all its nodes connected directly to a link and has no other connection between nodes.
4. There is no signal generation on each node or router.

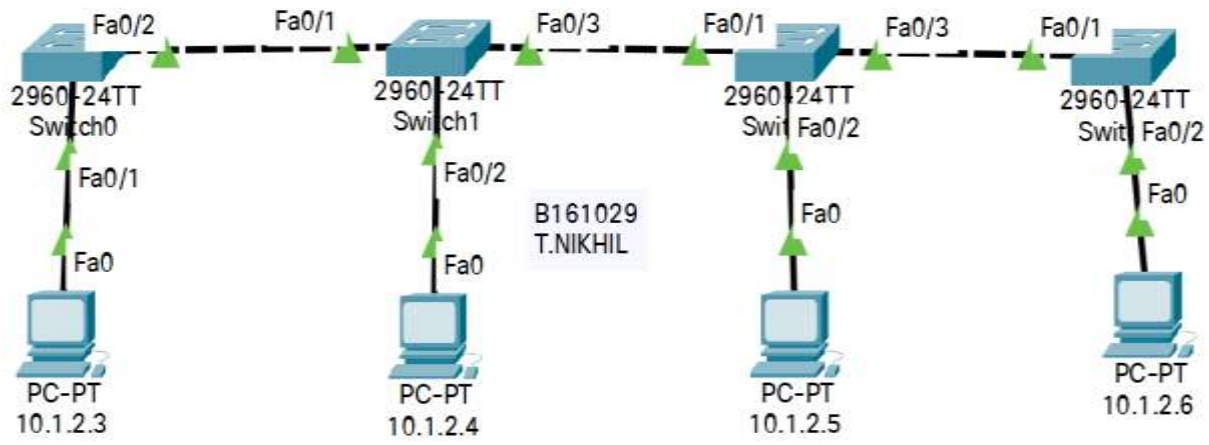
ii. Advantages of Bus Topology:

1. It is the easiest network topology for connecting peripherals or computers in a linear fashion.
2. It works very efficient well when there is a small network.
3. Length of cable required is less than a star topology.

iii. Disadvantages of Bus Topology:

1. Bus topology is not great for large networks.
2. Identification of problem becomes difficult if whole network goes down.
3. Troubleshooting of individual device issues is very hard.

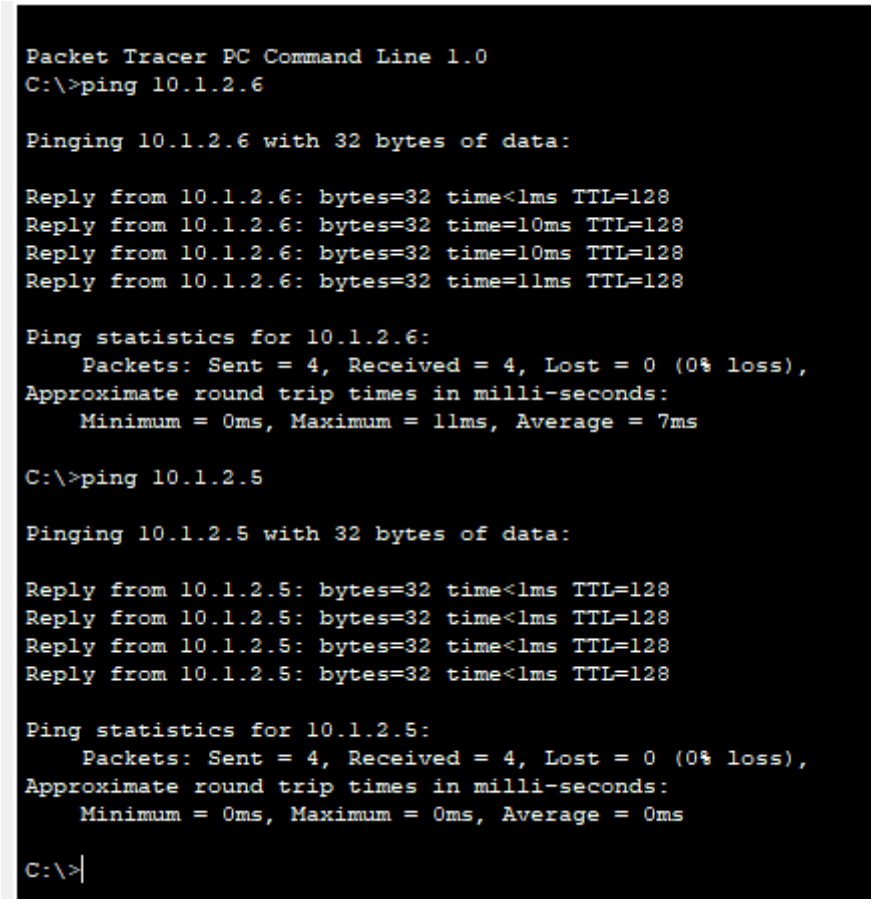
## c) Topology Diagram:



## d) Commands Used:

i. Configure Ip address for all PC's
ii. Check network connection using PING command
PING IP address
iii. Send packets and trace routes (simulation)

## e) Results:



# 6. Simulation of MESH (PEER TO PEER) TOPOLOGY USING SWITCH:

## a) Objective:

To Construct Mesh Topology Using Switch

## b) Theory:

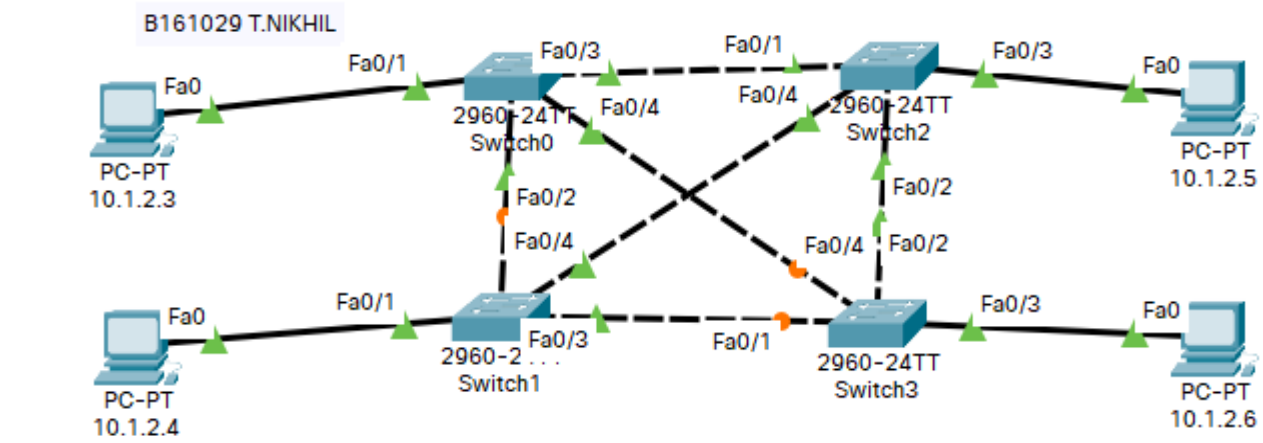
In mesh, all the computers are interconnected to every other during a network. Each computer not only sends its own signals but also relays data from other computers. The nodes are connected to every other completely via a dedicated link during which information is travel from nodes to nodes and there are N(N-1)/2 links in mesh if there are N nodes. Every node features a point-to-point connection to the opposite node.

i. Features of Mesh Topology:
   1. Fully connected
   2. Robust
   3. Not flexible
   4. Poor expandability

ii. Advantages of Mesh Topology:
   1. Failure during a single device won't break the network.
   2. There is no traffic problem as there is a dedicated point to point links for every computer.
   3. This topology provides multiple paths to succeed in the destination and tons of redundancy.
   4. It provides high privacy and security.

iii. Disadvantages of Mesh Topology:
   1. It's costly as compared to the opposite network topologies i.e., star, bus, point to point topology.
   2. Installation is extremely difficult in the mesh.
   3. Power requirement is higher as all the nodes will need to remain active all the time and share the load.

## c) Topology Diagram:




## d) Commands Used:

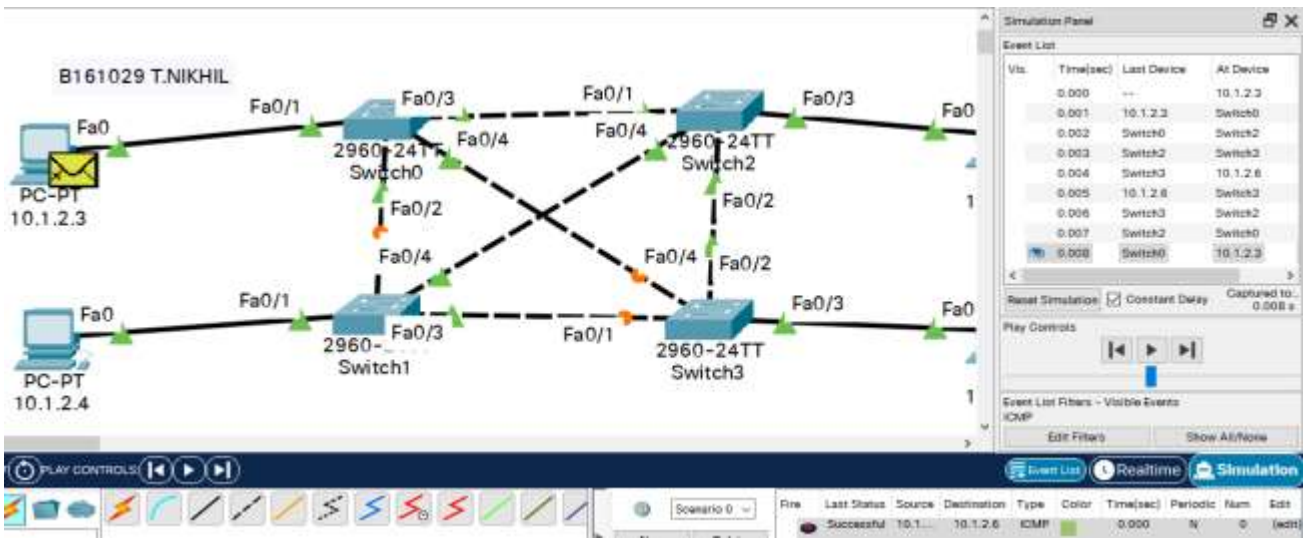
i. Configure Ip address for all PC's

ii. Check network connection using PING command
PING IP address

iii. Send packets and trace routes (simulation)

## e) Results:

```
Packet Tracer PC Command Line 1.0
C:\>ping 10.1.2.4

Pinging 10.1.2.4 with 32 bytes of data:

Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time<1ms TTL=128
Reply from 10.1.2.4: bytes=32 time=10ms TTL=128
Reply from 10.1.2.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.2.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 2ms

C:\>ping 10.1.2.5

Pinging 10.1.2.5 with 32 bytes of data:

Reply from 10.1.2.5: bytes=32 time=1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.2.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```



# 7. Simulation of HYBRID TOPOLOGY (TREE) USING SWITCH:

## a) Objective:

To construct Hybrid Topology (Tree) using Switch

## b) Theory:

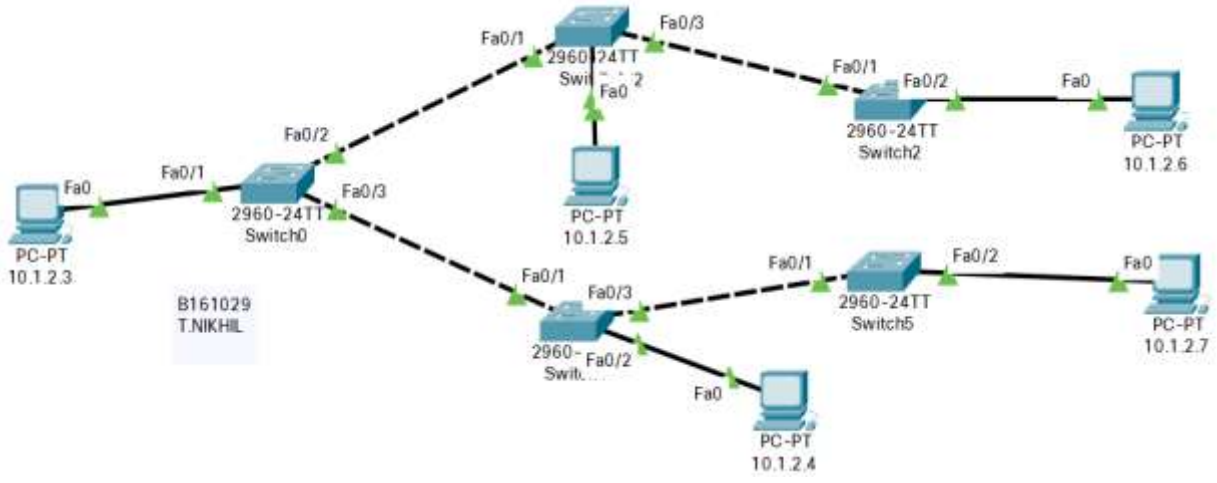
A hybrid network topology is an interconnection of two or more basic network topologies, each of which contains its own nodes. Ex: tree. A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a linear bus backbone cable

i. Features of Tree Topology:
   1. It is a combination of two or topologies
   2. Ideal if workstations are located in groups.
   3. Used in Wide Area Network.

ii. Advantages of Tree Topology:
   1. Extension of bus and star topologies.
   2. Expansion of nodes is possible and easy.
   3. Easily managed and maintained.
   4. Error detection is easily done.

iii. Disadvantages of Tree Topology:
   1. Heavily cabled.
   2. Costly.
   3. If more nodes are added maintenance is difficult.
   4. Central hub fails, network fails.

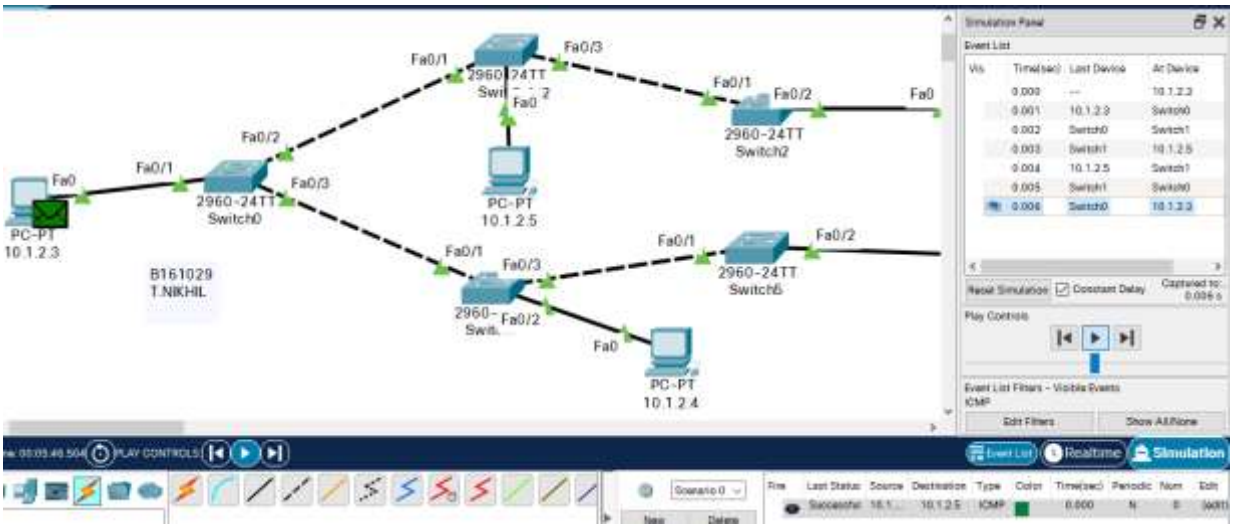
## c) Topology Diagram:




## d) Commands Used:

i. Configure Ip address for all PC's
ii. Check network connection using PING command
PING IP address
iii. Send packets and trace routes (simulation)

## e) Results:




```
Packet Tracer PC Command Line 1.0
C:\>ping 10.1.2.6

Pinging 10.1.2.6 with 32 bytes of data:

Reply from 10.1.2.6: bytes=32 time<1ms TTL=128
Reply from 10.1.2.6: bytes=32 time=10ms TTL=128
Reply from 10.1.2.6: bytes=32 time=10ms TTL=128
Reply from 10.1.2.6: bytes=32 time=11ms TTL=128

Ping statistics for 10.1.2.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 11ms, Average = 7ms

C:\>ping 10.1.2.5

Pinging 10.1.2.5 with 32 bytes of data:

Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128
Reply from 10.1.2.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.2.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

# 8. Remotely Accessing SWITCH using TELNET:

## a) Objective:

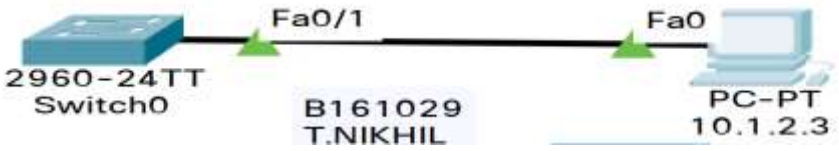
To access switch remotely using TELNET.

## b) Theory:

A network switch is a device that operates at the Data Link layer of the OSI model—Layer 2. It takes in packets being sent by devices that are connected to its physical ports and sends them out again, but only through the ports that lead to the devices the packets are intended to reach.

TELNET: Telnet is a protocol that allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the internet). Once your telnet client establishes a connection to the remote host, your client becomes a virtual terminal, allowing you to communicate with the remote host from your computer.

## c) Diagram:




## d) Commands:

--> Commands at Switch:

```
Switch>enable
Switch #configure terminal
Switch(config)#enable password rgukt
Switch(config)#interface vlan1
Switch(config-if)#IP address 10.1.2.10 255.0.0.0
Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#line vty 0 3
Switch(config-line)#password abcdef
Switch(config-line)#login
Switch(config-line)#exit
Switch(config)#exit
Switch #write memory
Building configuration...
[OK]
```

--> Commands at Remote PC to access switch:

```
C:\>telnet 10.1.2.10
```

Trying 10.1.2.10 ...Open
User Access Verification
Password:
Switch>enable
Password:
Switch#clock
Switch#exit

## e) Results:

```
Press RETURN to get started!

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up


Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#enable password rgukt
Switch(config)#interface vlan1
Switch(config-if)#ip address 10.1.2.10 255.0.0.0
Switch(config-if)#no shutdown

Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

Switch(config-if)#exit
Switch(config)#line vty 0 3
Switch(config-line)#password abcdef
Switch(config-line)#login
Switch(config-line)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#write memory
Building configuration...
[OK]
Switch#
```

```
Packet Tracer PC Command Line 1.0
C:\>telnet 10.1.2.10
Trying 10.1.2.10 ...Open


User Access Verification

Password:
Switch>enable
Password:
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#
```

# 9. Remotely Accessing ROUTER using TELNET:

## a) Objective:

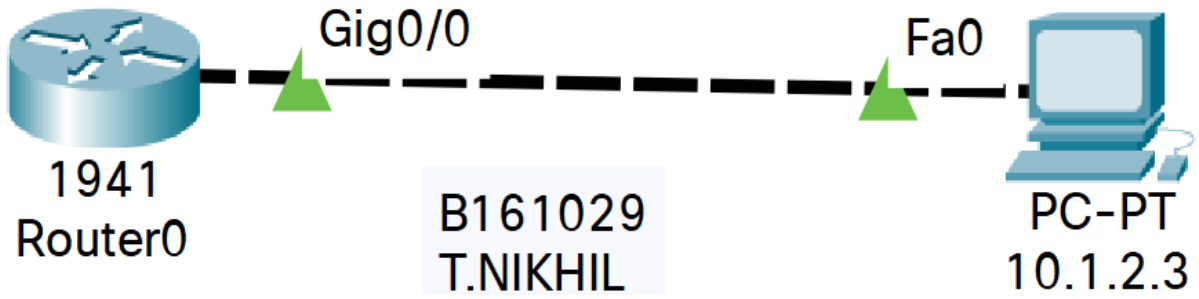
To Access Router remotely using TELNET.

## b) Theory:

A router is a switching device for networks, which is able to route network packets, based on their addresses, to other networks or devices. It serves two primary functions: managing traffic between these networks by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same Internet connection.

TELNET: Telnet is a protocol that allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the internet). Once your telnet client establishes a connection to the remote host, your client becomes a virtual terminal, allowing you to communicate with the remote host from your computer.

## c) Diagram:




## d) Commands:

--> At router:

```
Router>enable
Router#config terminal
Router(config)#enable password rgukt
Router(config)#interface Gig0/0
Router(config-if)#IP address 10.1.2.10 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#line vty 0 3
Router(config-line)#password abcdef
Router(config-line)#login
Router(config-line)#exit
Router(config)#exit
Router#write memory
```

Building configuration...
[OK]

--> <u>At PC:</u>

telnet 10.1.2.10

## e) Results:

```
          --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: no


Press RETURN to get started!



Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#enable password rgukt
Router(config)#interface Gig0/0
Router(config-if)#ip address 10.1.2.10 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#line vty 0 3
Router(config-line)#password abcdef
Router(config-line)#login
Router(config-line)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write memory
Building configuration...
[OK]
Router#
```

```
Packet Tracer PC Command Line 1.0
C:\>telnet 10.1.2.10
Trying 10.1.2.10 ...Open


User Access Verification

Password:
Router>enable
Password:
Router#enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

# 10. Simulation of Connecting two different Networks Using ROUTER:

## a) Objective:

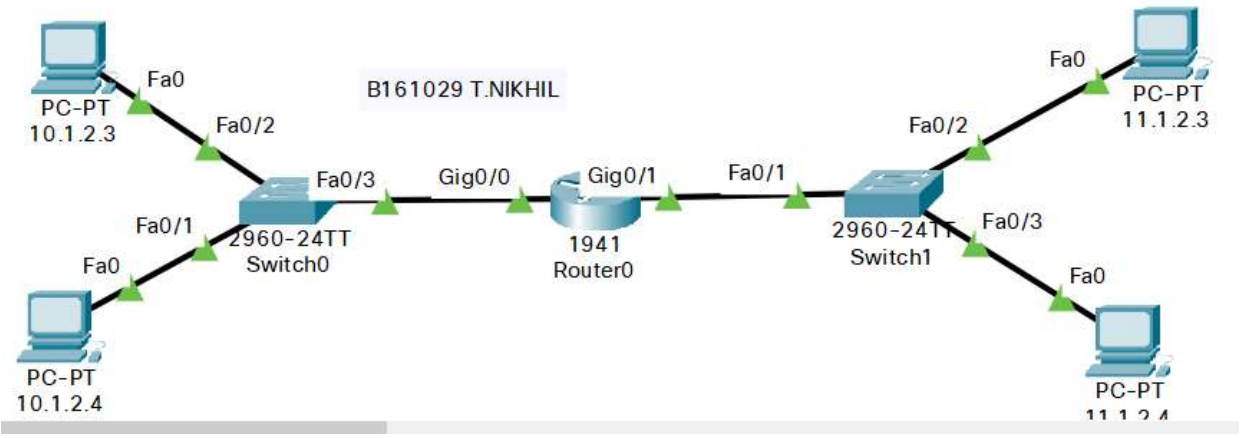
To Connect two different Networks using ROUTER.

## b) Theory:

A router is a switching device for networks, which is able to route network packets, based on their addresses, to other networks or devices. It serves two primary functions: managing traffic between these networks by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same Internet connection.

An example of a router is a mail carrier.

## c) Diagram:




## d) Commands:

--> CLI Commands to configure Router at network1:

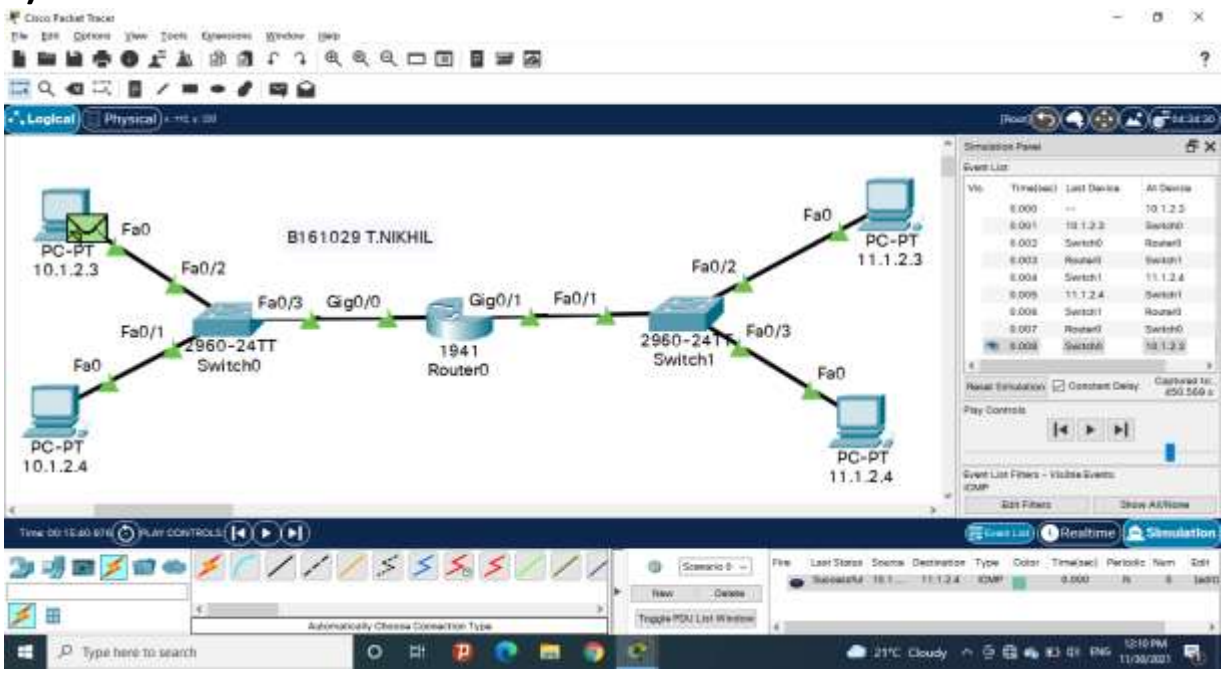
```
Router>enable
Router#config terminal
Router(config)#interface Gig0/0
Router(config-if)#IP address 10.1.2.5 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#write memory
Building configuration...
[OK]
Router#
```

--> CLI Commands to configure Router at network2:

```
Router>enable
Router#config terminal
```

```
Router(config)#interface Gig0/1
Router(config-if)#IP address 11.1.2.5 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#write memory
Building configuration...
[OK]
Router#
```

## e) Results:



# 11. Configuration of DHCP Service on Router :

## a) Objective:

To configure DHCP Service on Router

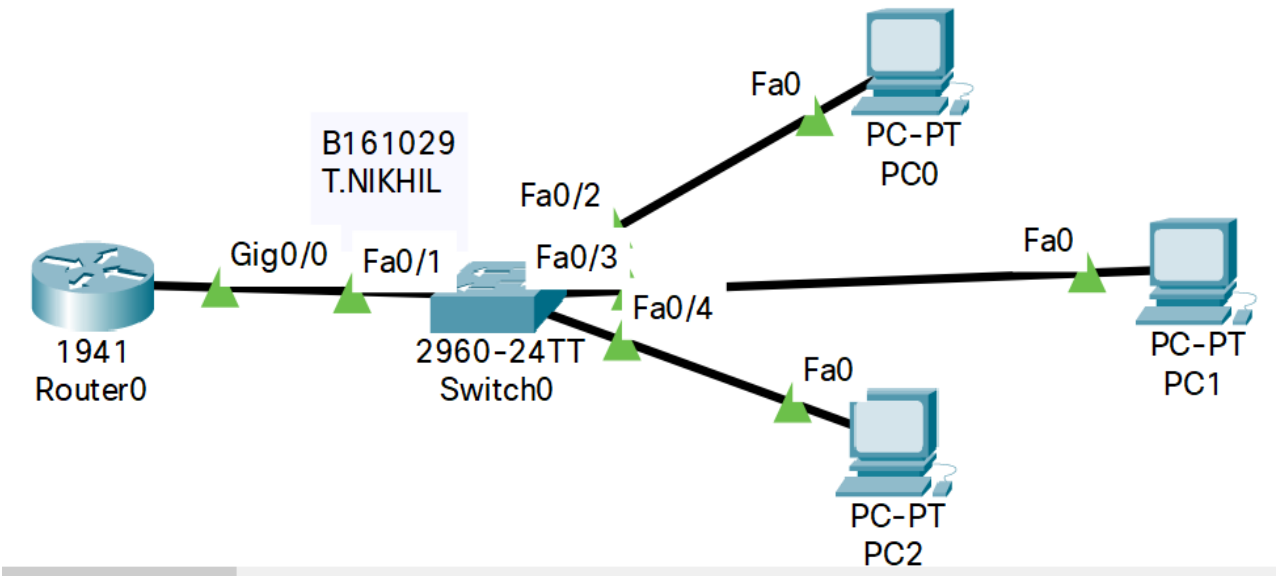
## b) Theory:

DHCP stands for Dynamic Host Configuration Protocol (DHCP). It is a Network management protocol used on Internet Protocol (IP) networks for automatically assigning IP addresses and other communication parameters to devices connected to the network.

--> Reliable IP address configuration: DHCP minimizes configuration errors caused by manual IP address configuration, such as typographical errors, or address conflicts caused by the assignment of an IP address to more than one computer at the same time.

--> Reduced network administration: Centralized and automated TCP/IP configuration. The ability to define TCP/IP configurations from a central location.

## c) Diagram:




## d) Commands:

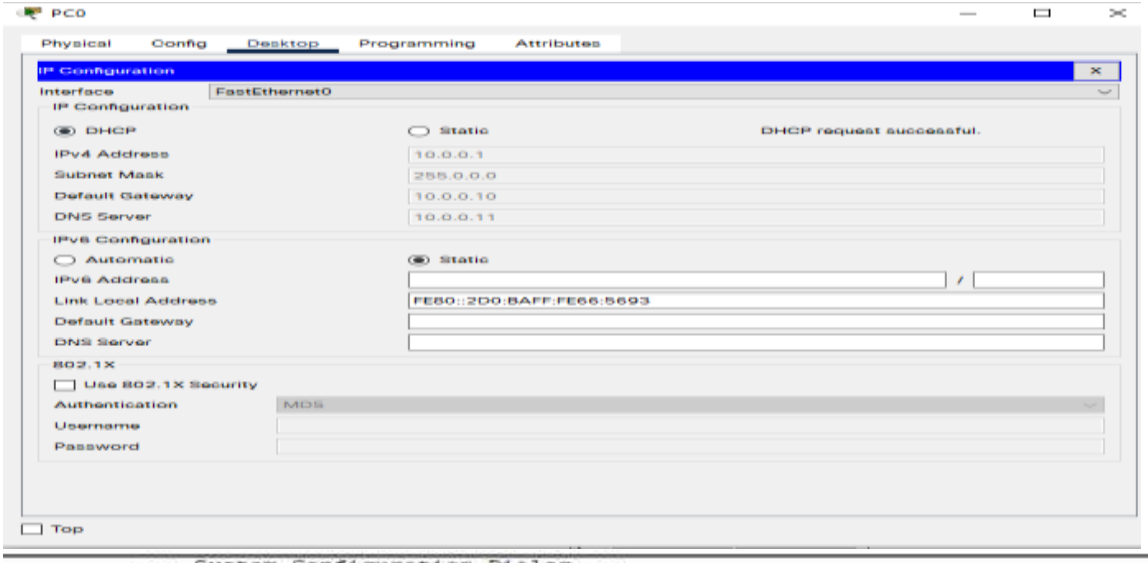
--> CLI commands to Configure Router

```
Router>enable
Router#config terminal
Router(config)#interface Gig0/0
Router(config-if)#IP address 10.0.0.10 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
```

--> CLI commands to Configure DHCP Server and DNS on the router and Default Gateway:

```
Router(config)#ip DHCP pool game
Router(dhcp-config)#network 10.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 10.0.0.10
Router(dhcp-config)#dns-server 10.0.0.11
Router(dhcp-config)#exit
Router(config)#exit
Router#write memory
Building configuration...
[OK]
```

## e) Results:




```
         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: no

Press RETURN to get started!


Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Gig0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#ip dhcp pool game
Router(dhcp-config)#network 10.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 10.0.0.10
Router(dhcp-config)#dns-server 10.0.0.11
Router(dhcp-config)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write memory
Building configuration...
[OK]
Router#
```