योगः कर्मसु कौशलम्
IN PURSUIT OF PERFECTION

VIVEKANANDA INSTITUTE OF PROFESSIONAL STUDIES - TECHNICAL CAMPUS
Grade A++ Accredited Institution by NAAC
NBA Accredited for MCA Programme; Recognized under Section 2(f) by UGC;
Affiliated to GGSIP University, Delhi; Recognized by Bar Council of India and AICTE
An ISO 9001:2015 Certified Institution

SCHOOL OF ENGINEERING & TECHNOLOGY

B. Tech Programme: AI-ML (A) (4th Semester)

Course Title: Computer Network and Internet Protocol Lab

Course Code: AIML - 208

Submitted To:

Dr. Nisha Chugh

Submitted By:

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Enrolment No: 01117711623

VIPS

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Continuous Evaluation Scheme

S. No	EXP.	Date	Marks			Remarks	Updated Marks	Faculty Signature
			Laboratory Assessment (15 Marks)	Class Participation (5 Marks)	Viva (5 Marks)			
1	Intro to CPT.	24/1/25	15	5	5	A+ Good		H 31/1/25
2	Networking Commands	24/1/25	15	5	5	A+ Good		H 31/1/25
3	Hub/Switch LAN	31/1/25	15	5	5	A+ Good		H 7/2/25
4	Topologies	31/1/25	15	5	5	A+ Good		H 7/2/25
5	HTTP Protocol	7/2/25	15	5	5	A+ Good		H 14/2/25
6	TCP/UDP Protocols	14/2/25	15	5	5	A+ Good		H 28/3/25
7	OSPF Algorithm	28/3/25	15	5	5	A+		H 4/4/25
8	Subnetting	4/4/25	15	5	5	A+		H 11/4/25
9	Networking tools	11/4/25	15	5	5	A+		H 18/4/25
10	Project → Solo	18/4/25	15	5	5	A+		H
TOTAL								

Index

S. No.	Name of the Experiment	Page No.	Date of Experiment	Date of Submission	Remarks
1.	Introduction to Network Simulator - Packet Tracer and establish a peer to peer Network		24/1/25	31/1/25	
2.	Networking Commands - Running and using commands related to Networking.		24/1/25	31/1/25	
3.	Create a LAN network using Hub/switch. Establish inter lan communication using a router		31/1/25	7/2/25	
4.	Create, Ring, Bus, Star and Mesh topology using Cisco Packet Tracer.		31/1/25	7/2/25	
5.	Explore various aspects of HTTP Protocols.		7/2/25	14/2/25	
6.	Analyzing various parameters for TCP Protocol in action		14/2/25	21/2/25	
7.	Implement shortest path algorithm using Open shortest path first (OSPF) in Cisco Packet Tracer		28/3/25	11/4/25	
8.	To implement subnetting between 2 groups of PC's in Cisco Packet Tracer		4/4/25	11/4/25	
9.	Introduction to basic networking tools → Wireshark, Network Miner and Datadog → to show their installation &		11/4/25	18/4/25	

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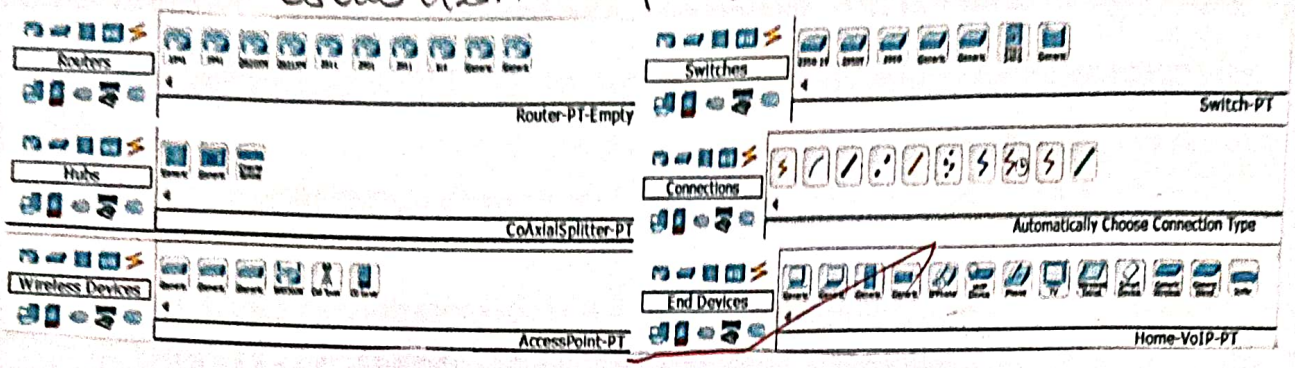
S. No.	Name of the Experiment	Page No.	Date of Experiment	Date of Submission	Remarks
	perform one exercise in each tool.				
10.	Small office / Home office (SOHO) Network Design and implementation.		18/4/25	25/4/25	

24/1/2

Exp-1 — Introduction to Network simulator - Pocket Tracer and establish a peer to peer network



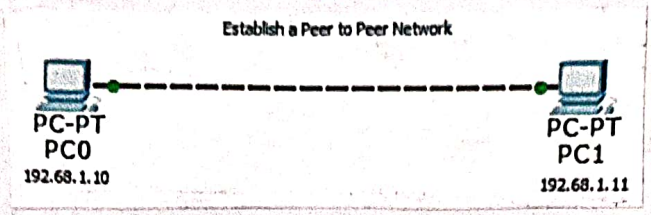
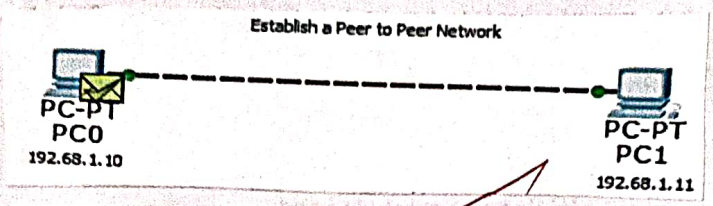


Fig-1
Peer to Peer Network



Vis.	Time(sec)	Last De	At Dev	Type	Info
	0.000	--	PC0	ICMP	
	0.001	PC0	PC1	ICMP	
	0.002	PC1	PC0	ICMP	

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC0	PC1	IC...		0.000	N	0	(ed...	(delete)

```
Packet Tracer PC Command Line 1.0
PC>ping 192.68.1.11

Pinging 192.68.1.11 with 32 bytes of data:

Reply from 192.68.1.11: bytes=32 time=1ms TTL=128
Reply from 192.68.1.11: bytes=32 time=0ms TTL=128
Reply from 192.68.1.11: bytes=32 time=0ms TTL=128
Reply from 192.68.1.11: bytes=32 time=0ms TTL=128

Ping statistics for 192.68.1.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
PC>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address.................: 0006.2AED.7C75
   Link-local IPv6 Address.........:
FE80::206:2AFF:FEED:7C75
   IP Address.......................: 192.68.1.10
   Subnet Mask......................: 255.255.255.0
   Default Gateway..................: 0.0.0.0
   DNS Servers......................: 0.0.0.0
   DHCP Servers.....................: 0.0.0.0
   DHCPv6 Client DUID...............:
00-01-00-01-28-47-07-51-00-06-2A-ED-7C-75
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::206:2AFF:FEED:7C75
   IP Address.......................: 192.68.1.10
   Subnet Mask......................: 255.255.255.0
   Default Gateway..................: 0.0.0.0
```

Fig-2
Ping, ipconfig and ipconfig /all commands

Date 24/1/25

Expt. No. 1 Page No.

Experiment - 1

→ **Aim:-** Introduction to Network Simulator - Packet Tracer and establish a peer to peer Network

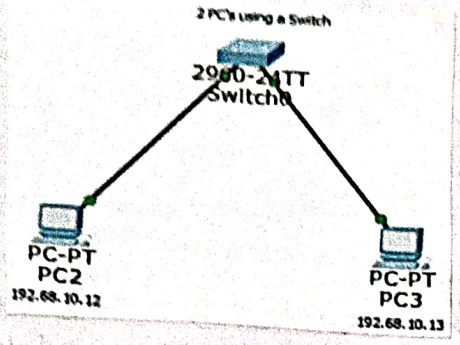
→ **Objectives:-** 1) Introduction to Packet Tracer Interface
2) To learn how to use different components and build a simple network.

→ **Theory:-** Cisco Packet Tracer is a protocol simulator developed by Dennis Frezzo and his team at Cisco Packet Systems. Cisco Packet Tracer (CPT) is a powerful and dynamic tool that displays the various protocols used in networking, in either Real time or Simulation Mode.

→ **Steps to install Cisco Packet Tracer:-** To obtain and install Cisco Packet Tracer (https://skillsforall.com/resources/lab-downloads), follow these simple steps:-

Step1:- Download the version of Packet Tracer you require.
Packet Tracer 8.2.1 MacOS 64-bit
Packet Tracer 8.2.1 Ubuntu 64-bit
Packet Tracer 8.2.1 Windows 64-bit

Teacher's Signature



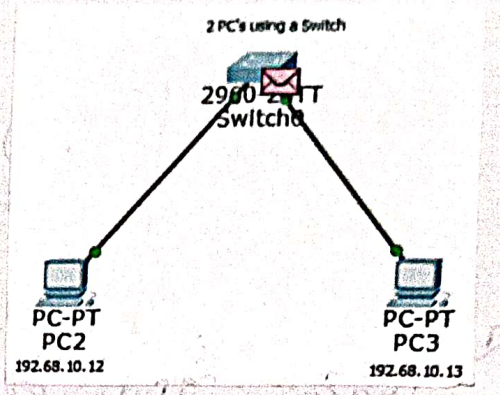


Fig. 3
2 PC's using a switch

Vis.	Time(sec)	Last De	At Dev	Type	Info
	5.472	Switch0	PC2	STP	
	5.472	Switch0	PC3	STP	
	7.474	--	Switc...	STP	
	7.475	Switch0	PC2	STP	
	7.475	Switch0	PC3	STP	

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC0	PC1	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC2	PC3	IC...		0.000	N	1	(ed...	(delete)

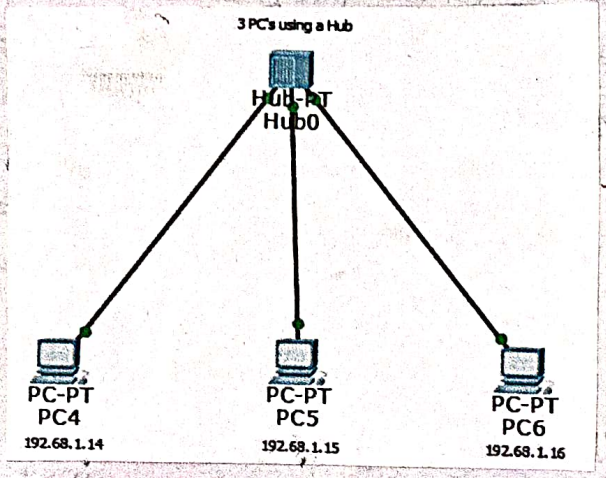


Fig. 4
3 PC's using Hub

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC4	PC6	IC...		0.000	N	0	(ed...	(delete)

Vis.	Time(sec)	Last De	At Dev	Type	Info
	1.525	Switch0	PC2	STP	
	1.525	Switch0	PC3	STP	
	3.521	--	Switc...	STP	
	3.522	Switch0	PC2	STP	
	3.522	Switch0	PC3	STP	

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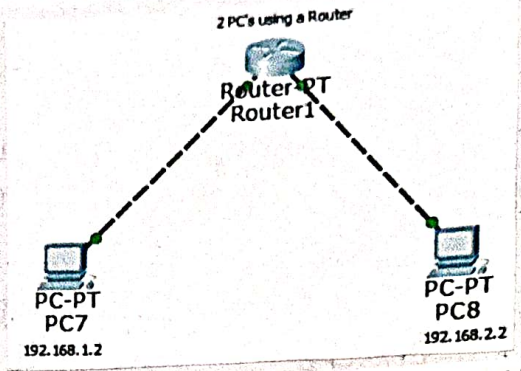
Step2:- Launch the Packet Tracer Install Program.
Step3:- Lauch Cisco Packet Tracer by selecting the appropriate icon.
Step4:- When prompted, click on Skills for All green button to authenticate.
Step5:- Cisco Packet Tracer will launch and you are ready to explore its features.

→ Packet Tracer Interface and how to create a topology:-

Step1:- Start Packet Tracer and enter into Simulation Mode.
Step2:- Choose devices and connections.
Step3 Building the topology - Adding Hosts in following way:-
- Single click on End devices.
- Single click on Generic Host.
- Move the cursor into topology area. You will notice it turns into a plus "+" sign. Single click in the topology area and it copies the device.

Step4:- Building Connections amongst devices - Connecting the Hosts PC's to other end devices or network components :-
- Click once on Copper Straight-through Cable when connecting different device types.
- Click once on Copper Cross-over Cable when connecting with devices with similar types

Teacher's Signature



Fire	Last Statu	Sourc	Destinatio	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC7	PC8	IC...		0.000	N	0	(ed...	(delete)

Vis.	Time(sec)	Last De	At Dev	Type	Info
	0.003	PC8	Rout...	ICMP	
	0.004	Router1	PC7	ICMP	
	0.570	--	Switc...	STP	
	0.571	Switch0	PC2	STP	
	0.571	Switch0	PC3	STP	

Fig. 5
2 PC's using a Router

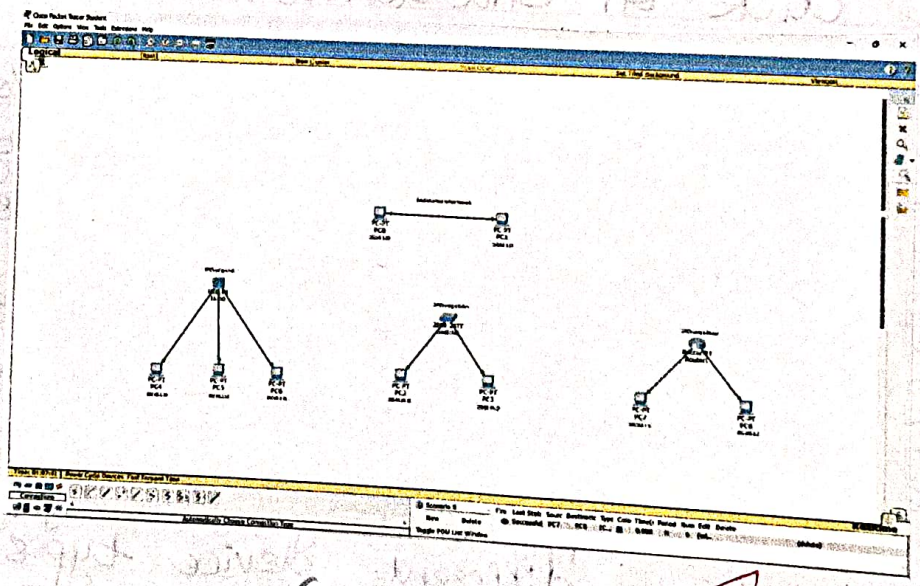


Fig. 6
User Interface of Cisco Packet Tracer

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Step5:- Configuring IP Addresses and Subnet Masks on Hosts.

- Click once on PC0.
- Choose the Config tab
- Click on FastEthernet
- Enter IP address and Subnet Mask.

→ Excercises:-

1) Design a peer to peer network by establishing a connection between two PC's
2) Assign IP address to them as mentioned

Host	IP Address	Subnet Mask
PC0	192.68.1.10	255.255.255.0
PC1	192.68.1.11	255.255.255.0

3) Observe the flow of data from host to host by creating network traffic.
4) Use commands such as ipconfig, ipconfig /all, ping to check their functions and outputs on CPT-command prompt.

Good

31/1/25

Teacher's Signature

Exp2:- Running and using services/commands related to network

24/1/25

```
C:\Users\DeLL>ping google.com

Pinging google.com [142.250.193.238] with 32 bytes of data:
Reply from 142.250.193.238: bytes=32 time=9ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=15ms TTL=118

Ping statistics for 142.250.193.238:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 15ms, Average = 8ms
```

Fig. 7 Ping Command

```
C:\Users\DeLL>tracert google.com

Tracing route to google.com [142.250.193.238]
over a maximum of 30 hops:

  1     1 ms     1 ms    <1 ms  MYGROUP [192.168.1.1]
  2     3 ms     2 ms     2 ms  del-vp-bngs-09 [103.212.157.16]
  3     *        7 ms     8 ms  103.212.157.1
  4     9 ms     8 ms     6 ms  103.212.157.41
  5     5 ms     4 ms     5 ms  72.14.208.36
  6     7 ms     7 ms     7 ms  142.251.66.175
  7     4 ms     3 ms     4 ms  142.251.54.101
  8     4 ms     4 ms     6 ms  del11s18-in-f14.1e100.net [142.250.193.238]

Trace complete.
```

Fig. 8 tracert Command

```
C:\Users\DeLL>pathping google.com

Tracing route to google.com [142.250.193.238]
over a maximum of 30 hops:
  0  Kunsh-Laptop [192.168.1.3]
  1  MYGROUP [192.168.1.1]
  2  del-vp-bngs-09 [103.212.157.16]
  3  103.212.157.1
  4  103.212.157.41
  5  72.14.208.36
  6  142.251.66.175
  7  142.251.54.101
  8  del11s18-in-f14.1e100.net [142.250.193.238]

Computing statistics for 200 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Kunsh-Laptop [192.168.1.3]
                                 0/ 100 =  0%   |
  1    1ms     0/ 100 =  0%      0/ 100 =  0%  MYGROUP [192.168.1.1]
                                 0/ 100 =  0%   |
  2    3ms     0/ 100 =  0%      0/ 100 =  0%  del-vp-bngs-09 [103.212.157.16]
                                 0/ 100 =  0%   |
  3    4ms     0/ 100 =  0%      0/ 100 =  0%  103.212.157.1
                                 0/ 100 =  0%   |
  4    7ms     0/ 100 =  0%      0/ 100 =  0%  103.212.157.41
                                 0/ 100 =  0%   |
  5    7ms     0/ 100 =  0%      0/ 100 =  0%  72.14.208.36
                                 0/ 100 =  0%   |
  6    7ms     0/ 100 =  0%      0/ 100 =  0%  142.251.66.175
                                 0/ 100 =  0%   |
  7    6ms     0/ 100 =  0%      0/ 100 =  0%  142.251.54.101
                                 0/ 100 =  0%   |
  8    5ms     0/ 100 =  0%      0/ 100 =  0%  del11s18-in-f14.1e100.net [142.250.193.238]

Trace complete.
```

Fig. 9 Pathping Command

```
C:\Users\DeLL>getmac

Physical Address    Transport Name
=================== ==========================================================
04-BF-1B-1F-D7-69   Media disconnected
DC-21-48-75-17-E6   \Device\Tcpip_{96CADA9B-715E-4244-A008-81CF074E0EFC}
DC-21-48-75-17-EA   Media disconnected
```

Fig. 10 getmac Command

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Experiment - 2

→ Aim :- Running and using services / Commands related to networking.

→ Commands :-

1) Ping :- The ping command is a command prompt command used to test the ability of the source computer to reach a specified destination computer.

2) Traceroute :- Traceroute is a command which shows the path a packet of information takes from one computer to another. It will list all the routers it passes through until it reaches its destination, or fails to and is discarded. In addition to this, it will tell how long each hop from router to router takes.

3) Pathping :- The pathping tool is a route tracing tool that combines features of Ping and Traceroute with additional information that neither of those tools provide. Pathping sends packets to each router on the way to a final destination over a period of time, and

Teacher's Signature

```
C:\Users\DeLL>ipconfig

Windows IP Configuration


Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . . . : fe80::465d:e85d:bd93:eab6%11
   IPv4 Address. . . . . . . . . . . . : 192.168.1.3
   Subnet Mask . . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . . : fe80::1%11
                                         192.168.1.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

Fig. 11
Ip Config
Comma

```
C:\Users\DeLL>arp

Displays and modifies the IP-to-Physical address translation tables used by
address resolution protocol (ARP).

ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr] [-v]

  -a            Displays current ARP entries by interrogating the current
                protocol data.  If inet_addr is specified, the IP and Physical
                addresses for only the specified computer are displayed.  If
                more than one network interface uses ARP, entries for each ARP
                table are displayed.
  -g            Same as -a.
  -v            Displays current ARP entries in verbose mode.  All invalid
                entries and entries on the loop-back interface will be shown.
  inet_addr     Specifies an internet address.
  -N if_addr    Displays the ARP entries for the network interface specified
                by if_addr.
  -d            Deletes the host specified by inet_addr. inet_addr may be
                wildcarded with * to delete all hosts.
  -s            Adds the host and associates the Internet address inet_addr
                with the Physical address eth_addr.  The Physical address is
                given as 6 hexadecimal bytes separated by hyphens. The entry
                is permanent.
  eth_addr      Specifies a physical address.
  if_addr       If present, this specifies the Internet address of the
                interface whose address translation table should be modified.
                If not present, the first applicable interface will be used.
Example:
  > arp -s 157.55.85.212   00-aa-00-62-c6-09  .... Adds a static entry.
  > arp -a                                    .... Displays the arp table.
```

Fig. 12
Arp
Comma

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then computes results based on the packets returned from each loop/hop.

4) **IpConfig:-** Displays all current TCP/IP network configurations values and refreshes Dynamic Host configuration protocol (DHCP) and domain Name system (DNS) settings. Used without parameters, ipconfig displays the IP address, subnet masks, and default gateway for all adapters.

5) **Getmac:-** Used to get the mac addresses.

6) **ARP:-** ARP stands for Address Resolution Protocol. Network nodes use this protocol to match IP addresses to MAC addresses, ARP is used to view and modify the ARP table entries on the local computer.

7) **Nslookup:-** Query a DNS domain nameserver to lookup and find IP addresses information of computers in the internet. Convert a host or domain name into an IP address.

8) **Route:-** To view the routing table.

Teacher's Signature

```
C:\Users\DeLL>nslookup google.com
1.1.168.192.in-addr.arpa
        primary name server = a.gtld-servers.net
        responsible mail addr = nstld.verisign-grs.com
        serial  = 1800
        refresh = 1800 (30 mins)
        retry   = 900 (15 mins)
        expire  = 604800 (7 days)
        default TTL = 86400 (1 day)
Server:  UnKnown
Address:  192.168.1.1

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4002:82c::200e
          142.250.206.142
          142.250.77.238
          142.250.194.238
          142.250.192.174
          142.250.193.238
```

Fig. 13
Lookup
Command

```
C:\Users\DeLL>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49694        Kunsh-Laptop:49695     ESTABLISHED
  TCP    127.0.0.1:49695        Kunsh-Laptop:49694     ESTABLISHED
  TCP    127.0.0.1:49698        Kunsh-Laptop:49699     ESTABLISHED
  TCP    127.0.0.1:49699        Kunsh-Laptop:49698     ESTABLISHED
  TCP    127.0.0.1:49701        Kunsh-Laptop:49702     ESTABLISHED
  TCP    127.0.0.1:49702        Kunsh-Laptop:49701     ESTABLISHED
  TCP    127.0.0.1:49713        Kunsh-Laptop:49714     ESTABLISHED
  TCP    127.0.0.1:49714        Kunsh-Laptop:49713     ESTABLISHED
  TCP    127.0.0.1:49749        Kunsh-Laptop:49750     ESTABLISHED
  TCP    127.0.0.1:49750        Kunsh-Laptop:49749     ESTABLISHED
  TCP    127.0.0.1:49765        Kunsh-Laptop:49766     ESTABLISHED
  TCP    127.0.0.1:49766        Kunsh-Laptop:49765     ESTABLISHED
  TCP    127.0.0.1:49777        Kunsh-Laptop:65001     ESTABLISHED
  TCP    127.0.0.1:49780        Kunsh-Laptop:49829     ESTABLISHED
  TCP    127.0.0.1:49817        Kunsh-Laptop:49818     ESTABLISHED
  TCP    127.0.0.1:49818        Kunsh-Laptop:49817     ESTABLISHED
  TCP    127.0.0.1:49829        Kunsh-Laptop:49780     ESTABLISHED
  TCP    127.0.0.1:65001        Kunsh-Laptop:49777     ESTABLISHED
  TCP    192.168.1.3:58084      20.198.119.84:https    ESTABLISHED
  TCP    192.168.1.3:58185      20.192.44.68:https     ESTABLISHED
  TCP    192.168.1.3:58186      20.192.44.80:https     ESTABLISHED
  TCP    192.168.1.3:58187      40.78.238.4:8883       ESTABLISHED
  TCP    192.168.1.3:58189      20.198.119.84:https    ESTABLISHED
  TCP    192.168.1.3:58196      52.108.44.3:https      ESTABLISHED
  TCP    192.168.1.3:58197      52.108.44.3:https      ESTABLISHED
  TCP    192.168.1.3:58219      ldrv:https             ESTABLISHED
  TCP    192.168.1.3:58220      ldrv:https             ESTABLISHED
  TCP    192.168.1.3:58255      whatsapp-chatd-edge-shv-02-del1:http  TIME_WAIT
  TCP    192.168.1.3:58273      a23-217-111-99:https   CLOSE_WAIT
  TCP    192.168.1.3:58277      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58278      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58279      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58280      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58281      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58303      a23-217-111-40:https   CLOSE_WAIT
  TCP    192.168.1.3:58311      20.190.146.36:https    TIME_WAIT
  TCP    192.168.1.3:58315      ec2-54-190-203-212:https  CLOSE_WAIT
  TCP    192.168.1.3:58318      20.50.73.10:https      TIME_WAIT
  TCP    192.168.1.3:58319      static:http            TIME_WAIT
  TCP    192.168.1.3:58322      ec2-52-35-97-121:http  TIME_WAIT
  TCP    192.168.1.3:58323      52.109.56.129:https    TIME_WAIT
  TCP    192.168.1.3:58324      ldrv:https             ESTABLISHED
                                52.109.56.129:https    TIME_WAIT
```

Fig. 14
netstat
Command

Expt. No. 2 Page No.

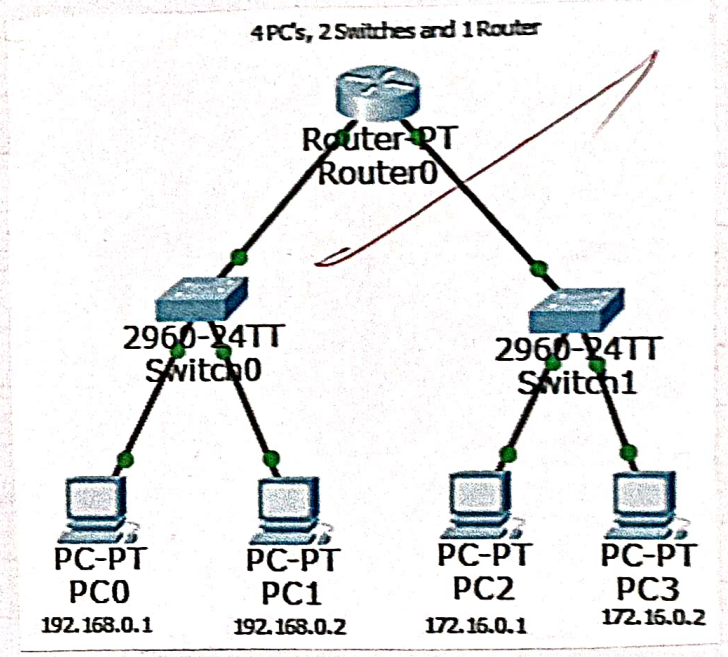
a) Netstat :- The netstat command is used to show detailed network status.

Fig. 15 Route Command

```
C:\Users\DeLL>route

Manipulates network routing tables.

ROUTE [-f] [-p] [-4|-6] command [destination]
                  [MASK netmask]  [gateway] [METRIC metric]  [IF interface]

  -f           Clears the routing tables of all gateway entries.  If this is
               used in conjunction with one of the commands, the tables are
               cleared prior to running the command.

  -p           When used with the ADD command, makes a route persistent across
               boots of the system. By default, routes are not preserved
               when the system is restarted. Ignored for all other commands,
               which always affect the appropriate persistent routes.

  -4           Force using IPv4.

  -6           Force using IPv6.

  command      One of these:
                 PRINT     Prints  a route
                 ADD       Adds    a route
                 DELETE    Deletes a route
                 CHANGE    Modifies an existing route
  destination  Specifies the host.
  MASK         Specifies that the next parameter is the 'netmask' value.
  netmask      Specifies a subnet mask value for this route entry.
               If not specified, it defaults to 255.255.255.255.
  gateway      Specifies gateway.
  interface    the interface number for the specified route.
  METRIC       specifies the metric, ie. cost for the destination.

All symbolic names used for destination are looked up in the network database
file NETWORKS. The symbolic names for gateway are looked up in the host name
database file HOSTS.

If the command is PRINT or DELETE. Destination or gateway can be a wildcard,
(wildcard is specified as a star '*'), or the gateway argument may be omitted.

If Dest contains a * or ?, it is treated as a shell pattern, and only
matching destination routes are printed. The '*' matches any string,
and '?' matches any one char. Examples: 157.*.1, 157.*, 127.*, *224*.

Pattern match is only allowed in PRINT command.
Diagnostic Notes:
    Invalid MASK generates an error, that is when (DEST & MASK) != DEST.
    Example> route ADD 157.0.0.0 MASK 155.0.0.0 157.55.80.1 IF 1
             The route addition failed: The specified mask parameter is invalid. (Destination & Mask) != Destination.

Examples:

    > route PRINT
    > route PRINT -4
    > route PRINT -6
    > route PRINT 157*          .... Only prints those matching 157*

    > route ADD 157.0.0.0 MASK 255.0.0.0  157.55.80.1 METRIC 3 IF 2
              destination^      ^mask      ^gateway     metric^    ^
                                                        Interface^
      If IF is not given, it tries to find the best interface for a given
      gateway.
    > route ADD 3ffe::/32 3ffe::1

    > route CHANGE 157.0.0.0 MASK 255.0.0.0 157.55.80.5 METRIC 2 IF 2

      CHANGE is used to modify gateway and/or metric only.

    > route DELETE 157.0.0.0
    > route DELETE 3ffe::/32
```

31/2/23

Exp-3 - Create LAN network using Hub, Switch. Establish InterLAN communication using a router.



Fire	Last Statu	Sourc	Destination	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC0	PC3	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC1	PC2	IC...		0.000	N	1	(ed...	(delete)

Fig. 16

Switches, PC's and Router

Date 31/1/25

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Experiment-3

→ Aim :- Create LAN network using Hub, switch. Establish InterLAN communication using a router.

→ Objective :- To install and configure Network Devices HUB, Switch and Routers PC's are interfaced using Connectivity devices.

→ Theory :- 1) Repeater : Functioning at Physical Layer. A repeater is an electronic device that receives a signal and retransmits it at a higher and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. Repeater has 2 ports, so can't be used to connect for more than 2 devices.

2) Hub :- An Ethernet hub, active hub, network hub, repeater hub, hub or concentrator is device for connecting multiple twisted pair or fiber optic. Ethernet devices together and making them together act as a single network segment. Hub's work at the physical layer (layer 1) of the OSI Model. The device is a form of

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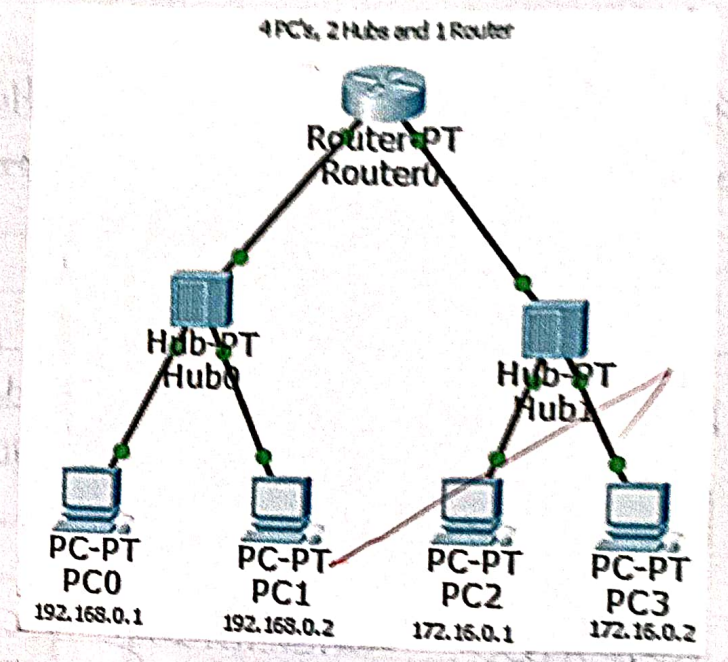

Fire	Last Statu	Sourc	Destination	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC0	PC3	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC1	PC2	IC...		0.000	N	1	(ed...	(delete)

Fig. 17

Hubs, PC's and Router

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Multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision.

3) Switch :- A network switch or switching hub is a computer networking device that connects network segments. The term commonly refers to a network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. Switches that additionally process data at the network layer (layer 3 and above) are often reffered to as layer 3 switches or multilayer switches.

4) Bridge :- A network bridge connects multiple network segments at the data link layer (layer 2) of the OSI model. In Ethernet networks, the term bridge formally means a device that behaves according to the IEEE 802.1D standards. A bridge and switch are very much alike; a switch being a bridge with numerous ports. Switch or layer 2 switch is often used interchangeably with bridge. Bridges can be used to analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.

5) Router :- A router is an electronic device that inter-connects two or more computer networks

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and electively, interchanges packets of data between them. Each data packet contains address information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transformed/transferred from one network to another. Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table, showing the preffered paths between any 2 systems on the interconnected networks.

6) Gateway :- In a communications network, a network node equipped for interfacing with another network that uses different protocols. A gateway may contain devices such as protocol translators, impedence matching devices, rate converters, fault isolators or signal translators as necessary to provide system interoperability. It also requires the establishment of mutually acceptable administrative procedures between both networks. A protocol translation/mapping gateway interconnects networks with different network protocol techniques/technologies by performing the required protocol conversions.

→ Result :- Thus install and configure Network devices PC's are interfaced using connectivity devices- Hub, router and switch have been done successfully.

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Exp4 – Create Ring, Bus, Star & Mesh Topology using Cisco Packet Tracer

Devices used in each topology:–

S.No	Device	Model-Name
1.	PC	PC
2.	switch	PT-switch

IP Addressing Table for Ring Topology

S. No.	Device	IPv4 Address	Subnet Mask
1.	PC4	172.16.0.4	255.255.255.0
2.	PC5	172.16.0.1	255.255.255.0
3.	PC6	172.16.0.2	255.255.255.0
4.	PC7	172.16.0.3	255.255.255.0

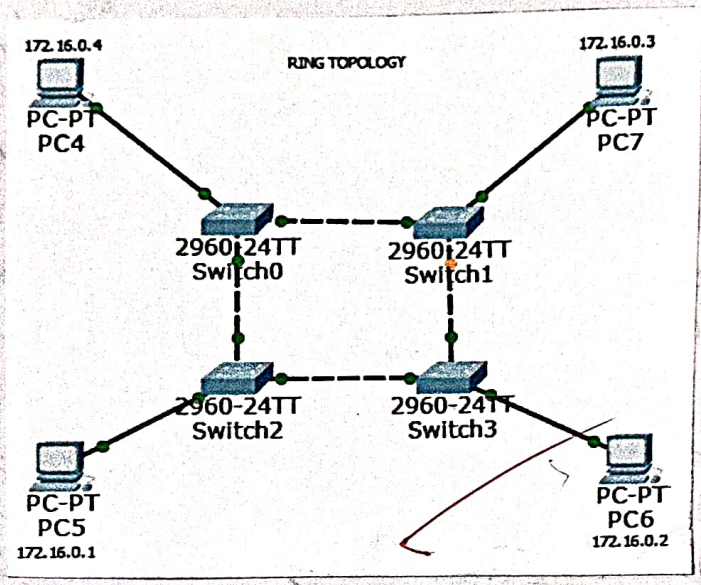
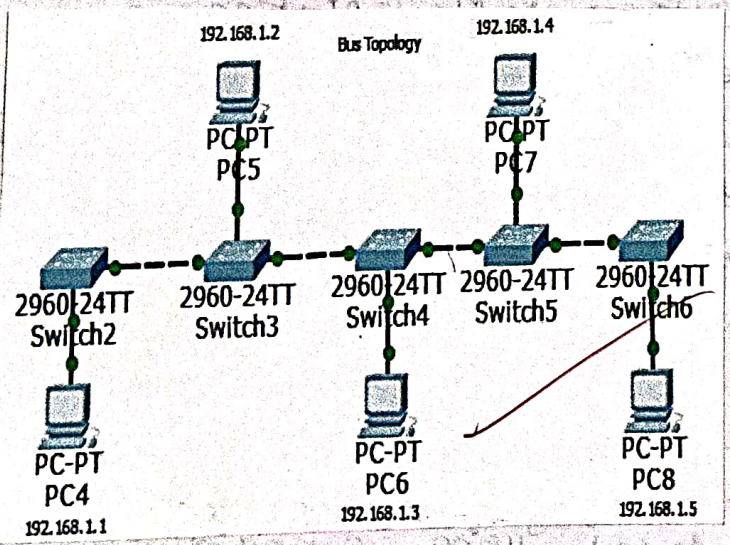


Fig. 18 Ring Topology

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC4	PC6	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC5	PC7	IC...		0.000	N	1	(ed...	(delete)

IP Addressing Table for Bus Topology

S. No.	Device	IPv4 Addresses	Subnet Mask
1.	PC4	192.168.1.1	255.255.255.0
2.	PC5	192.168.1.2	255.255.255.0
3.	PC6	192.168.1.3	255.255.255.0
4.	PC7	192.168.1.4	255.255.255.0
5.	PC8	192.168.1.5	255.255.255.0



Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC10	PC11	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC9	PC12	IC...		0.000	N	1	(ed...	(delete)

Fig. 19 Bus Topology

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Experiment-4

→ Aim:- Create Ring, Bus, Star and Mesh topology using Cisco Packet tracer.

→ Objectives :- 1) To learn to implement different network topologies in CPT.
2) To analyse their working & applications.

→ Implementation of Ring Topology :- Ring Topology is a kind of arrangement of the network in which every device is linked 2 other devices. This makes a circular ring of interconnected devices which gives it its name. Data is usually transmitted in one direction along the ring, known as a unidirectional ring. The data is delivered from one device to the next until it reaches the decided destination. In a bidirectional ring, data can travel in any direction.

Steps to configure and setup Ring Topology in CPT:-

1) open the CPT desktop and select the devices, then create a network topology as shown. Use automatic connecting cable to connect the devices with others.

2) Configure the PC's (hosts) with IPv4 address and

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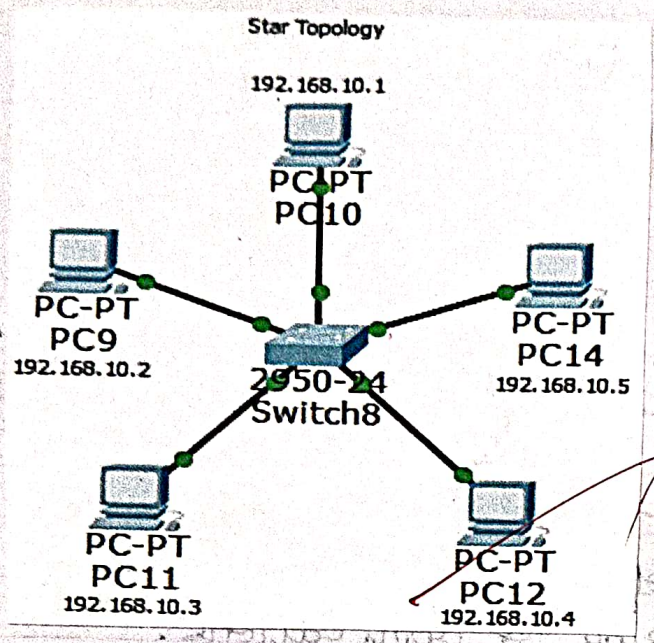
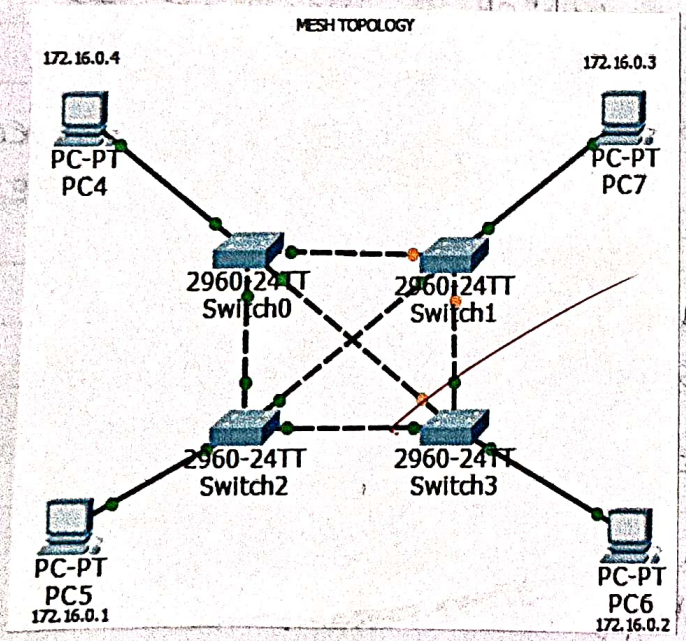


IP Addressing Table for Star Topology

S. No.	Device	IPv4 Address	Subnet Mask
1.	PC9	192.168.10.2	255.255.255.0
2.	PC10	192.168.10.1	255.255.255.0
3.	PC11	192.168.10.3	255.255.255.0
4.	PC12	192.168.10.4	255.255.255.0
5.	PC14	192.168.10.5	255.255.255.0

Fire	Last Statu	Sourc	Destinatio	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC4	PC6	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC5	PC8	IC...		0.000	N	1	(ed...	(delete)

Fig. 20 Star Topology



IP Addressing Table for Mesh Topology

S. No.	Device	IPv4 Address	Subnet Mask
1.	PC4	172.16.0.4	255.255.255.0
2.	PC5	172.16.0.1	255.255.255.0
3.	PC6	172.16.0.2	255.255.255.0
4.	PC7	172.16.0.3	255.255.255.0

Fire	Last Statu	Sourc	Destinatio	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC4	PC6	IC...		0.000	N	0	(ed...	(delete)
	Successful	PC5	PC7	IC...		0.000	N	1	(ed...	(delete)

Fig. 21 Mesh Topology

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Subnet masks according to the IP addressing table given behind. To assign an IP addresses in PC0, click on PC0. Then, goto desktop and then IP configuration and there you will find IPv4 configuration. Fill the IPv4 address and subnet mask.

Assigning IP address using the ipconfig command, or we can also assign an IP address with the help of a command. Go to PC's command terminal, then type ipconfig <IPv4 address><sub-net mask><defaultgateway>(if needed).

Example :- ipconfig 192.168.01 255.255.255.0

Repeat the same with all PC's to configure them

3) Verify the connection by pinging the IP address of any host in PC0. Use ping command to verify the connection. As we can see we are getting replies from a targetted node on both PC's. Hence the connection is verified.

#Simulation Result :- Check a simulation of the experiment by sending 2 PDU packets one targeted from PC5 to PC7 and another targeted from PC4 to PC6.

→ Implementation of Bus Topology :- A bus topology is a network in which nodes are directly linked with a common half-duplex link. A host on a bus topology is called a station. In a bus

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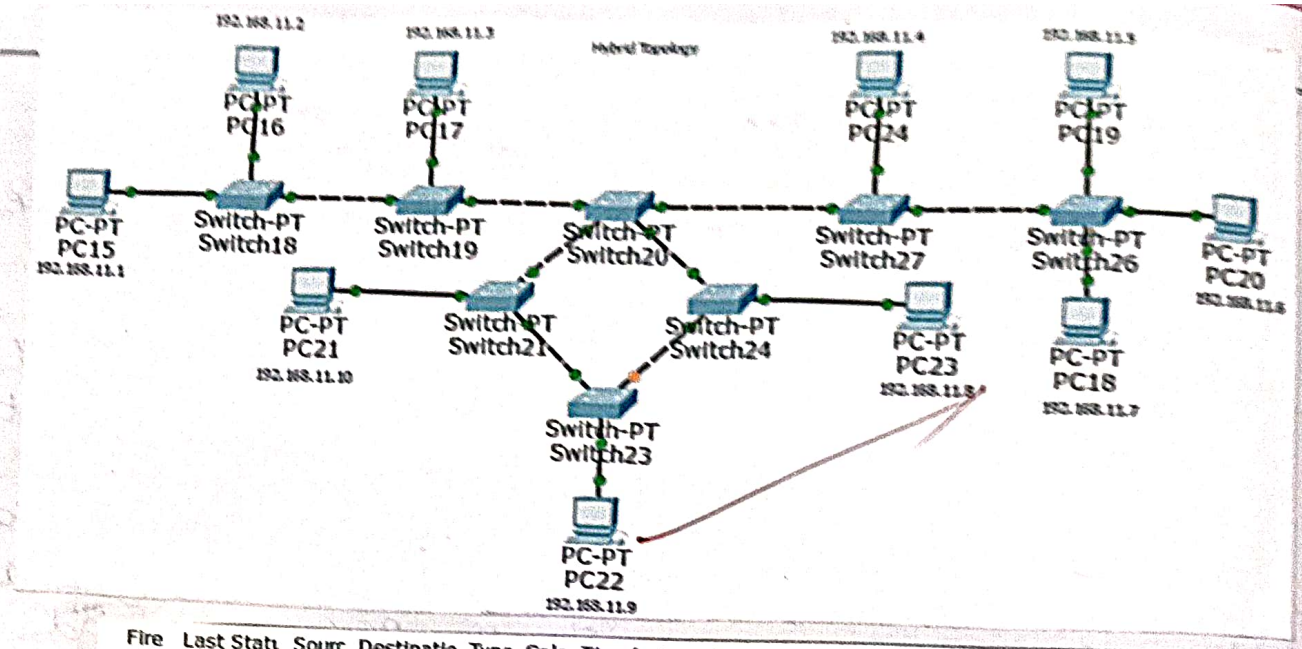

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC15	PC20	IC...		0.000	N	0	(ed...	
	Successful	PC16	PC22	IC...		0.000	N	1	(ed...	(delete)
	Successful	PC24	PC21	IC...		0.000	N	2	(ed...	(delete)
										(delete)

Fig. 22 Hybrid Topology

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 172.16.0.3

Pinging 172.16.0.3 with 32 bytes of data:

Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128

Ping statistics for 172.16.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::209:7CFF:FE24:C02D
   IP Address......................: 172.16.0.4
   Subnet Mask.....................: 255.255.0.0
   Default Gateway.................: 0.0.0.0
```

Fig. 23 Ping & Ipconfig for Ring Topology

Command Prompt

```
Packet Tracer PC Command Line 1.0
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=1ms 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 = 1ms, Average = 0ms
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::201:C9FF:FE2D:458A
   IP Address......................: 192.168.1.1
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 192.168.2.1

PC>
```

Fig. 24 Ping & ipconfig for Bus Topology

network, every station will accept all packets, and these packets generated by each station have equal information priority. A bus network includes a single network segment and collision domain.

(same steps as ring topology to configure Bus Topology)

Simulation Result:- Check a simulation of the experiment of this topology by sending 2 PDU packets one from PC10 to PC11 and other from PC 9 to PC12.

→ Implementing Star topology:- A star topology for a Local Area Network (LAN) is one in which each node is connected, to a central connection point such as a hub or a switch. Whenever a node tries to connect with another node then the transmission of the message must be happening with the help of the central node. The best part of star topology is the addition and removal of a node in the network but too many nodes can cause suffering to the network.

(same steps as bus topology to configure Star Topology).

Simulation result:- Check a simulation of the experiment of this topology by sending 2 PDU packets, one from PC4 to PC6 and

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.10.4

Pinging 192.168.10.4 with 32 bytes of data:

Reply from 192.168.10.4: bytes=32 time=1ms TTL=128
Reply from 192.168.10.4: bytes=32 time=2ms TTL=128
Reply from 192.168.10.4: bytes=32 time=0ms TTL=128
Reply from 192.168.10.4: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.10.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::260:70FF:FEC8:A4A2
   IP Address......................: 192.168.10.2
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 0.0.0.0

PC>
```

Fig. 25 Ping & ipconfig Command for Star Topology

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 172.16.0.3

Pinging 172.16.0.3 with 32 bytes of data:

Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128
Reply from 172.16.0.3: bytes=32 time=0ms TTL=128

Ping statistics for 172.16.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::209:7CFF:FE24:C02D
   IP Address......................: 172.16.0.4
   Subnet Mask.....................: 255.255.0.0
   Default Gateway.................: 0.0.0.0
```

Fig. 26 Ping & ipconfig Commands for Mesh topology

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.11.6

Pinging 192.168.11.6 with 32 bytes of data:

Reply from 192.168.11.6: bytes=32 time=0ms TTL=128
Reply from 192.168.11.6: bytes=32 time=0ms TTL=128
Reply from 192.168.11.6: bytes=32 time=1ms TTL=128
Reply from 192.168.11.6: bytes=32 time=14ms TTL=128

Ping statistics for 192.168.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 14ms, Average = 3ms
```

```
PC>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........:
FE80::206:2AFF:FE82:DAB0
   IP Address......................: 192.168.11.1
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 0.0.0.0
```

Fig. 27 Ping & ipconfig Commands for Hybrid Topology

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other from PC5 to PC7.

→ Implementation of Mesh topology :- In the Mesh topology of network-ing, each and every device sends its own signal to other devices that are present in the arrangement of the network.

(same steps for Mesh Topology to configure, as for Bus/Ring Topology.)

Simulation Result:- Check a simulation of the experiment by sending 2 PDU packets one targetted from PC4 to PC6 and other from PC5 to PC7.

→ Implementation of Hybrid Topology :- Hybrid Technology is a network structure that combines 2 or more different types of topologies such as star, ring, bus or mesh. Its designed to leverage the strengths and minimize the weaknesses of the individual topologies it incorporates.

Simulation Result:- Check a simulation of the experiment by sending 3 PDU packets one targetted from PC24 to PC21 and one from PC16 to PC22 and last from PC15 to PC20.

Teacher's Signature 7/2/25

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Exp 5:- Explore various aspects of HTTP Protocols.

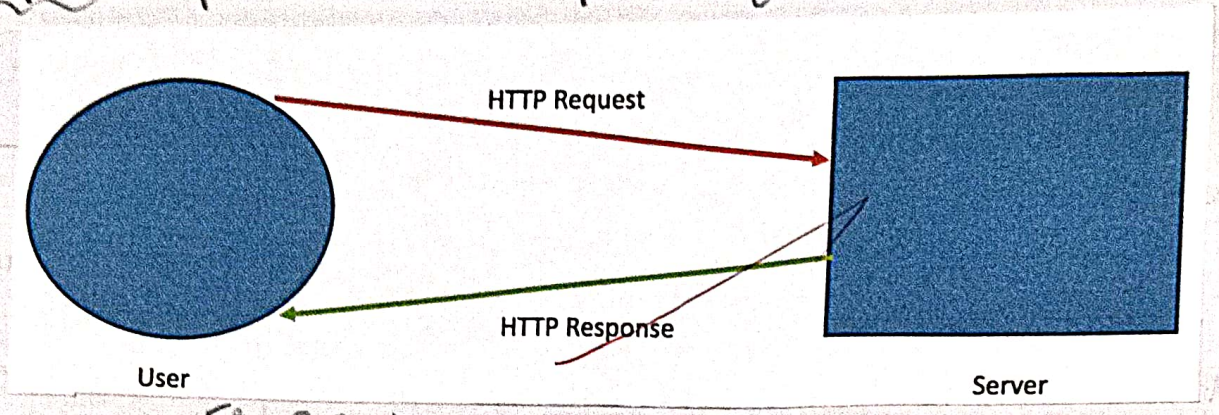

Fig. 28 User & Server Interaction

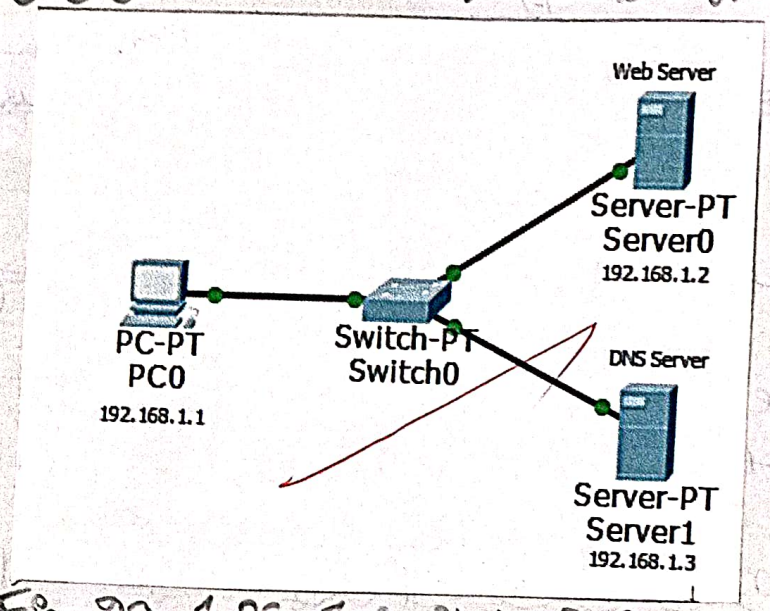

Fig. 29 1 PC, 1 switch, 2 servers (Web & DNS)

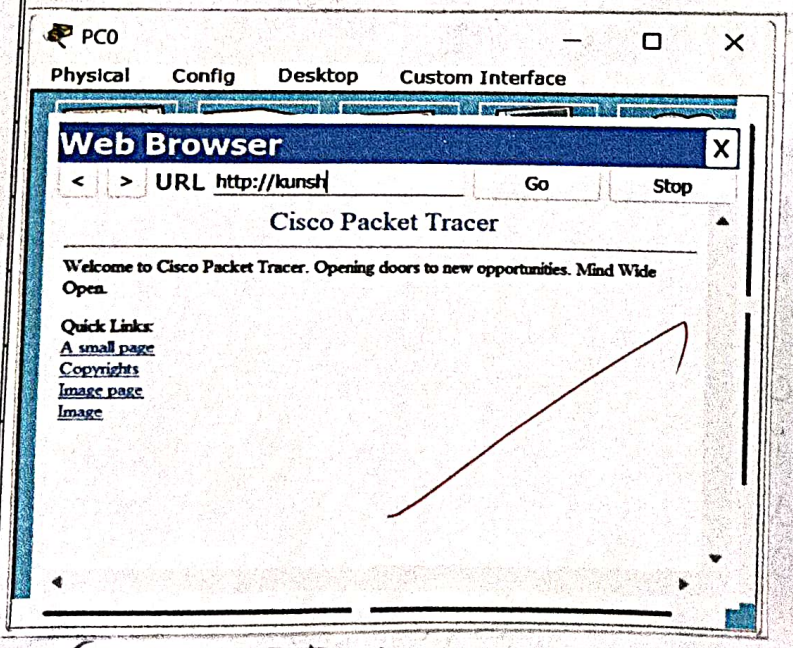

Fig. 30 CPT Webpage

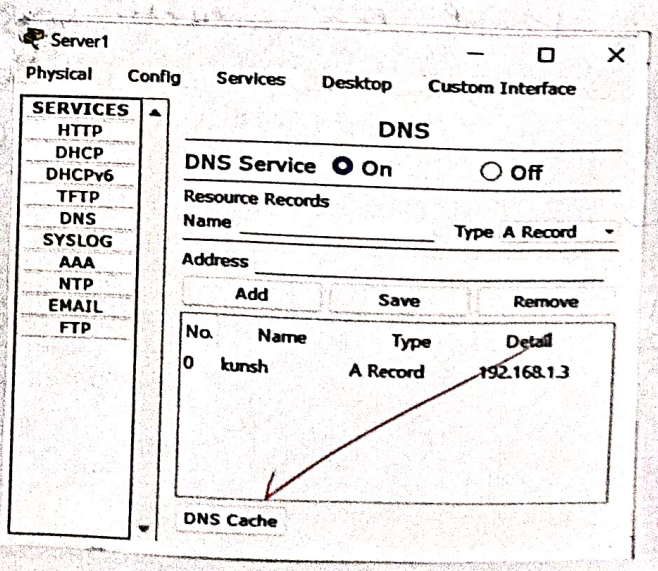

Fig. 31 DNS Service PC0

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Expt. No. 5 Page No.

Experiment - 5

→ Aim :- Explore various aspects of HTTP Protocols.

→ Objectives :- 1. Introduction to HTTP Protocols.
2. To learn how to use different components and build a simple network.

→ Theory :- Hypertext is text that links to other information by clicking on a link in a hypertext document, a user can quickly jump to different content through hypertext. It is associated with webpages and this technology has been around since 1960's. Today, the web is where hypertext reigns, where nearly every page includes links to other pages and both text and images can be used as links to more content. HTTP protocol stands for HyperText Transfer Protocol. Work of DNS server is to map domain name to its corresponding IP Address.

• Steps to configure Web server / HTTP in CPT :-

1) Open Cisco Packet Tracer.
2) Make a topology as shown by connecting a PC, a switch-PT and 2 servers (one Web and other DNS server).

Teacher's Signature

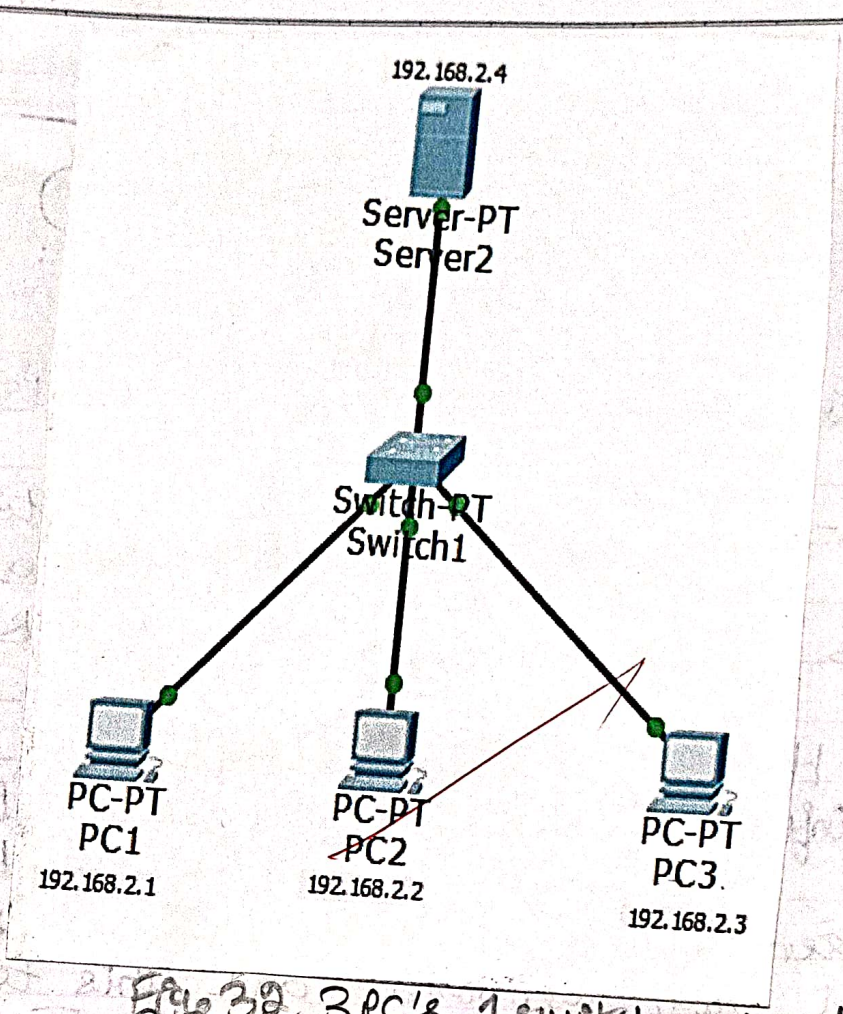

Fig.32 3 PC's, 1 switch and a Web Server

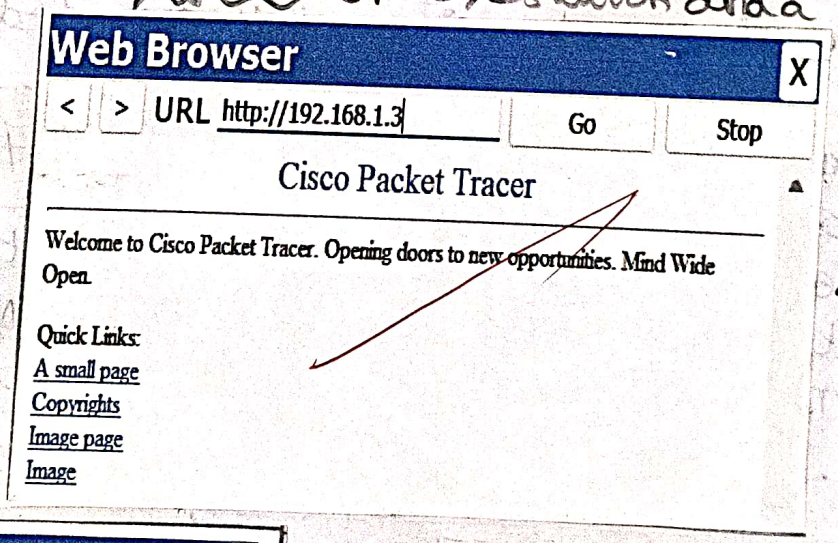

Fig.33 CPT Using IP Address

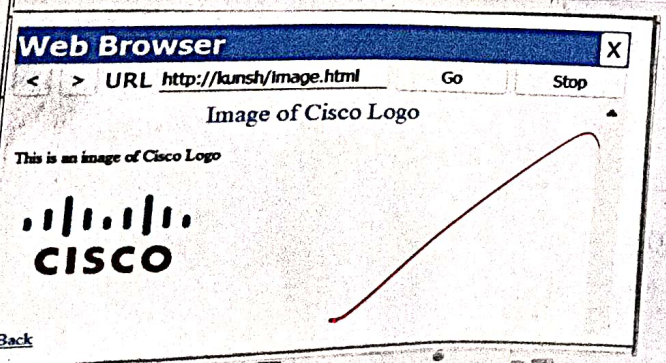

Fig.34 Image in CPT

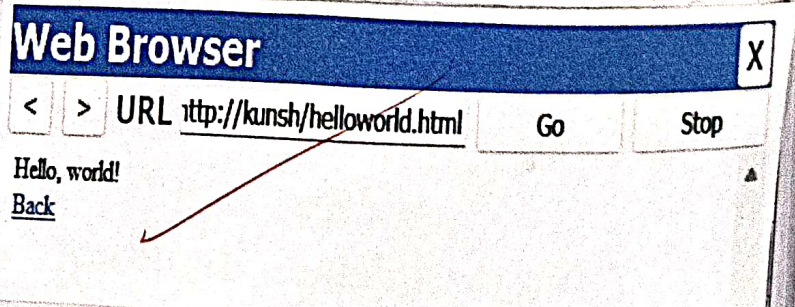

Fig.35 Hello World in CPT

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3) Connect all the devices using copper straight through cable connecting all using Fast Ethernet port

4) Assign the respective IP addresses to all devices.

5) Double click on Web server (Server 0) and select services tab. Go to HTTP option. Open index.html.

6) In index.html file, edit the pre-written code to the code shown below:-

```
<html>
<center><font size='+2' colour='blue'> Cisco Packet Tracer
</font></center>
<h2> Welcome to CNIP Lab to learn about various
aspects of HTTP protocol in Cisco Packet tracer.
<h2> by Dr. Divya Aggarwal <h2>
</html>
```

7) Click on save and in dialog box press Yes.

8) Double click on DNS Server. Under services Tab, select DNS option, turn on the radio button next to DNS. In the DNS tab mention name (Your name) of the website that you created in Web server and in the address option mention web server IP Address and click on save

9) Double click on PC/Laptop Go to services tab and select Web browser option. In the url field write the name of website created / IP Address of Web server. Click OK.

→ Excercises to do:- Task 1 → 1) open Cisco Packet tracer make a topology as shown by

Teacher's Signature

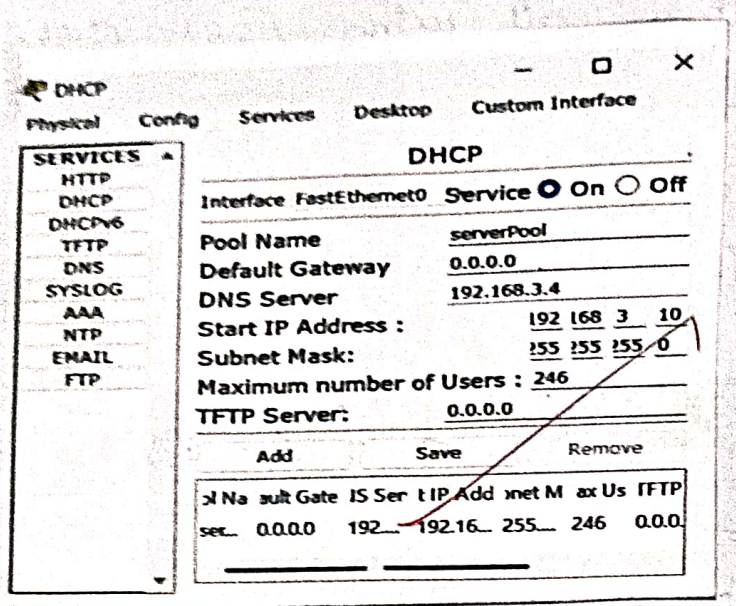

Fig. 36 DHCP setup in server DHCP

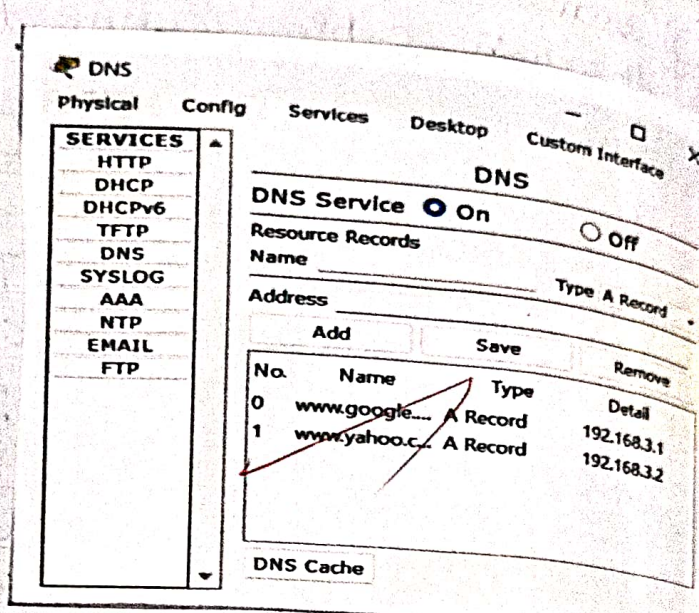

Fig. 37 DNS setup in server DNS

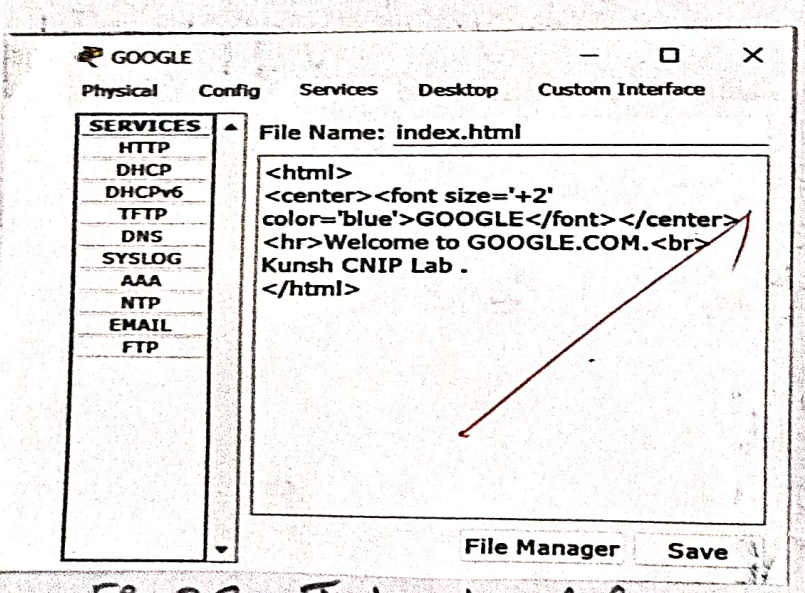

Fig. 38 Index.html for Google server

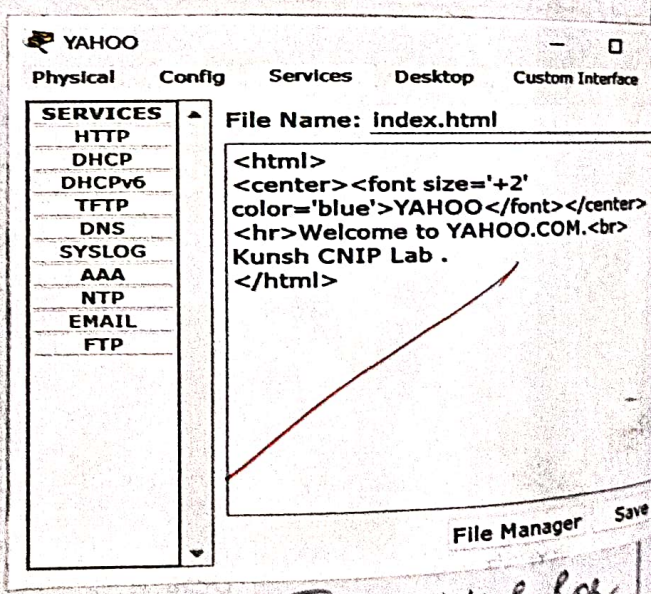

Fig. 39 Index.html for Yahoo server

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selecting 3 PC's, 1 switch-PT and 1 server. (Label server as Web server) Assign IP addresses as given.

2) In index.html edit the pre-written code to the code shown below:-

```
<html>
<center><font size='+2' colour='blue'>Cisco Packet Tracer
Task1 </font></center>
<h2> Learning about various aspects of HTTP Protocol
in Cisco Packet tracer.
<h2> by (your name) <h2>
</html>
```

Now call web server ip address, helloworld.html, image.html, copyrights.html from each PC and paste its screenshots.

Task 2 → 1) Open CPT and Make a topology with 3 PC's 2960 switch and 4 servers.

2) Set DNS for DHCP: For it, go to services tab and configure DHCP by enabling DNS IP address and disabling all other services/options. In DHCP, turn it on and set DNS server IP address to be 192.168.3.3 and start IP addresses to be 192.168.3.10.

3) Set IP addresses of PC's by turning on DHCP option instead of static

4) Configure DNS server by double clicking on it, go to the services tab and disable all service options except DNS in order to avoid error due to multiple servers. In the DNS option, turn it on and in the name option type:-

Teacher's Signature

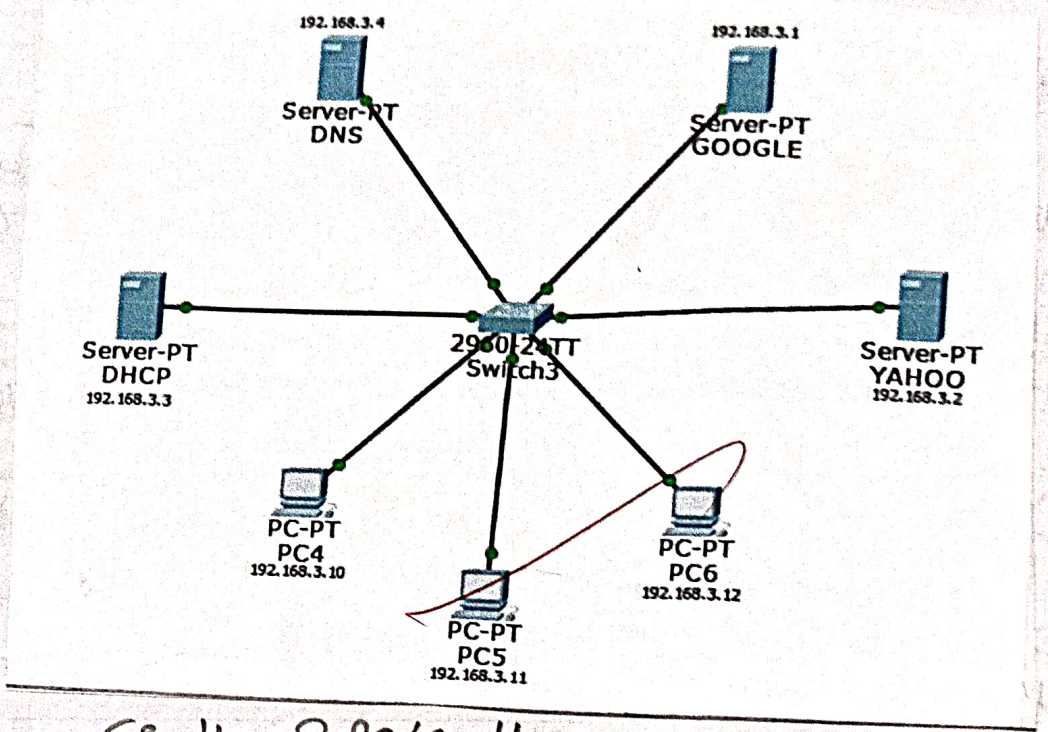

Fig. 40 3 PC's, 4 servers, 1 switch (2960)

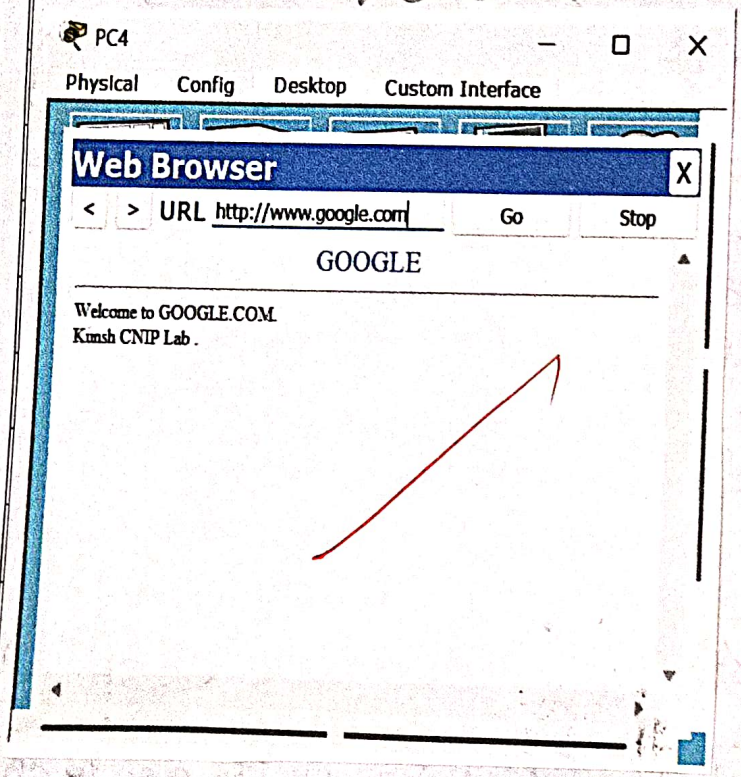

Fig. 41 Google.com on Web server

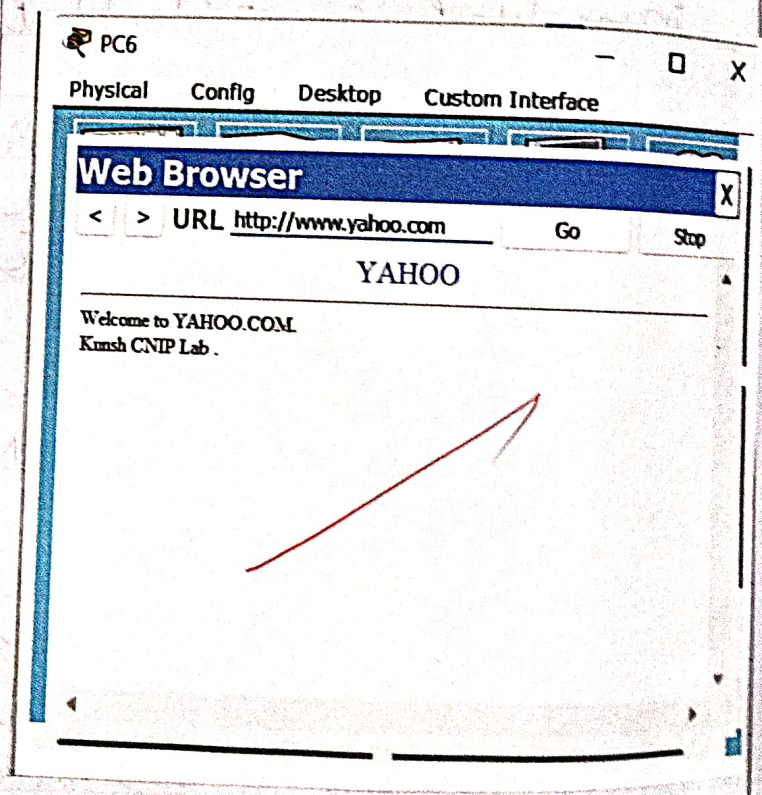

Fig. 42 Yahoo.com on Web server

Result:- I learnt the implementation of the HTTP protocols using CPT.

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a) www.google.com and address to be 192.168.3.1 and click on add.

b) www.yahoo.com and address to be 192.168.3.2 and click on add.

5) Double click on Google server. Go to services tab and select HTML option. In that, edit index.html to be:-

```
<html>
<center><font size='+2' color='blue'>Welcome to google.com</font></center>
<hr> Computer Networks Lab task 2.
</html>
```

Click on save.

6) Double click on Yahoo server. Go to services tab and select HTML option. In that, edit index.html file to be:-

```
<html>
<center><font size='+2' colour='blue'> Welcome to yahoo.com
</font></center>
<hr> Computer Network Lab task 2.
</html>
```

Now call www.google.com, www.yahoo.com from each PC using web browser service option.

→ Result:- I learnt the implementation of the HTTP protocols using CPT.

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Teacher's Signature

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Exp 6:- Analyzing various parameters for TCP protocol in action.

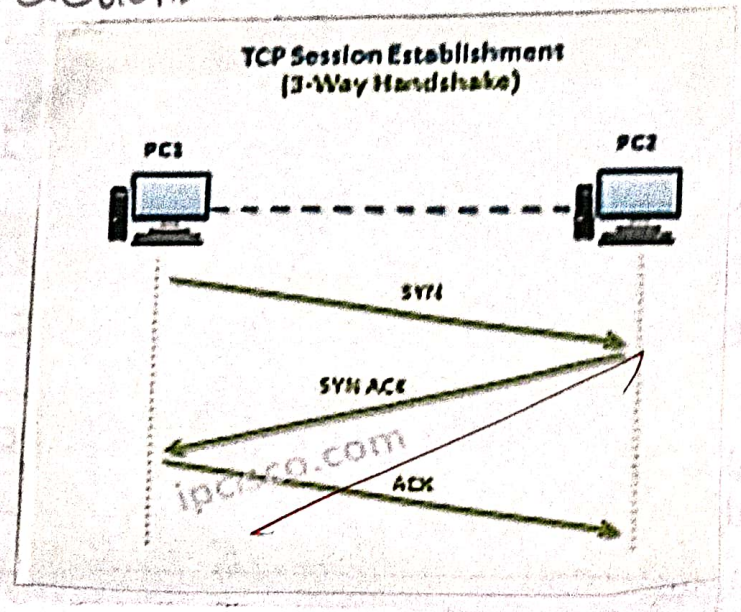

Fig. 43 3-Way TCP Handshake

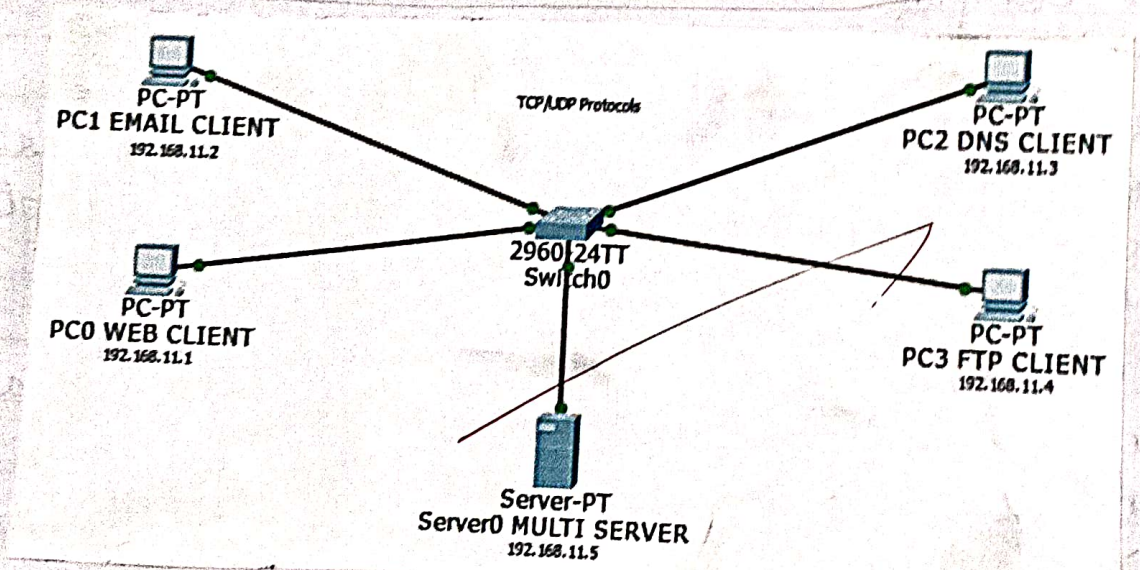

Fig. 44 4 PC's, 1 Server & 1 Switch

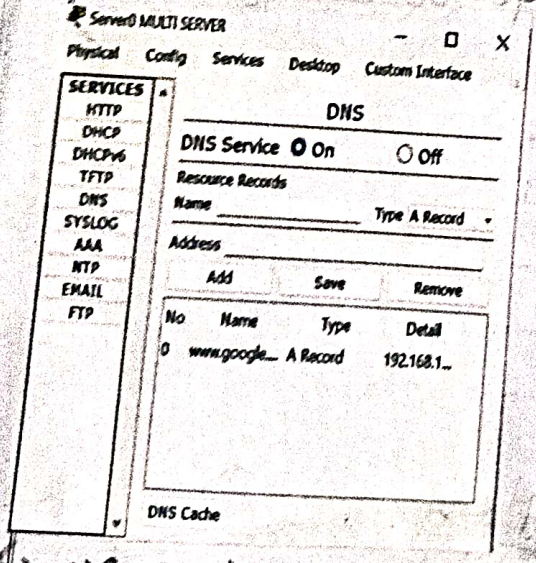

Fig. 45 DNS service

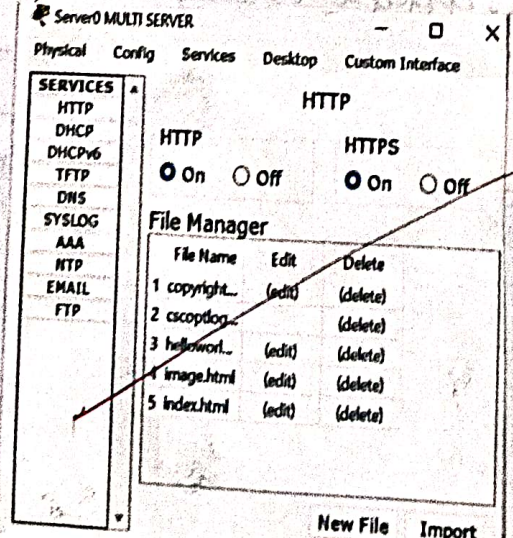

Fig. 46 HTTP service

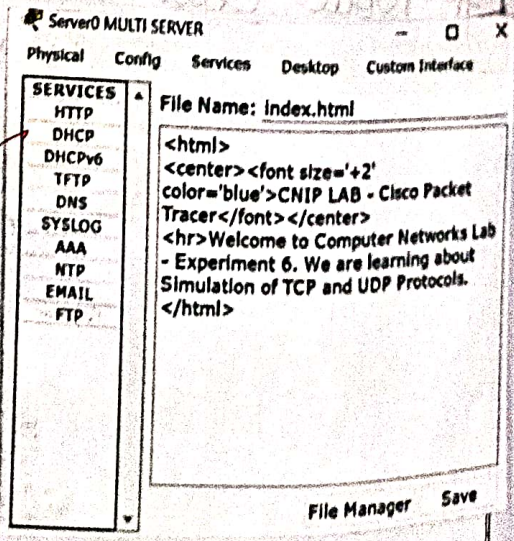

Fig. 47 Index.html file code

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Experiment-6

→ **Aim:-** Analyzing various parameters for TCP protocol in action.

→ **Objectives:-** • To generate Network Traffic in simulation-mode.

• This simulation activity is intended to provide a foundation for understanding the TCP and UDP in detail.

• Examine the functionality of the TCP and UDP protocols in a network setup and its demonstration through Cisco Packet Tracer Tool.

→ **Theory:-** Simulation mode provides the ability to view the functionality of the different protocols. As data moves through the network, it is broken down into smaller piece and identified in some fashion so that the pieces can be put back together. Each of these pieces is assigned a specific name (protocol data unit (PDU)) and associated with a specific layer. Packet Tracer Simulation Mode enables the user to view each of the protocols and the associated PDU. The steps outlined below lead the user through the process of requesting services using various applications available on a client PC. This activity provides an opportunity

Teacher's Signature

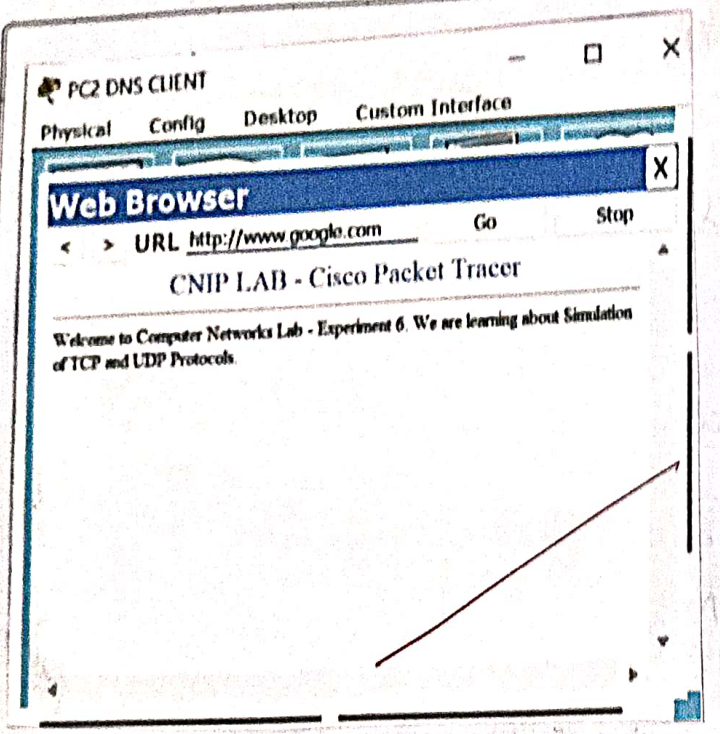

Fig. 48 Web Browser
www.google.com

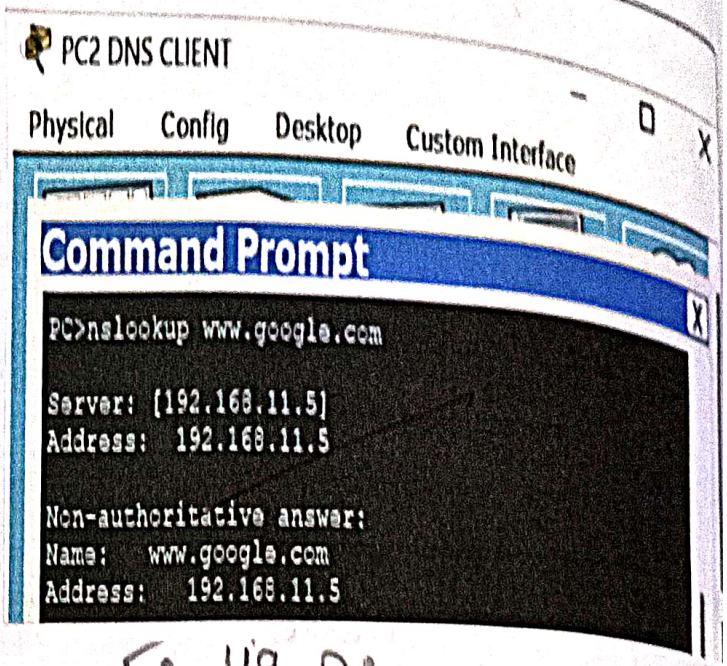

Fig. 49 Ping command

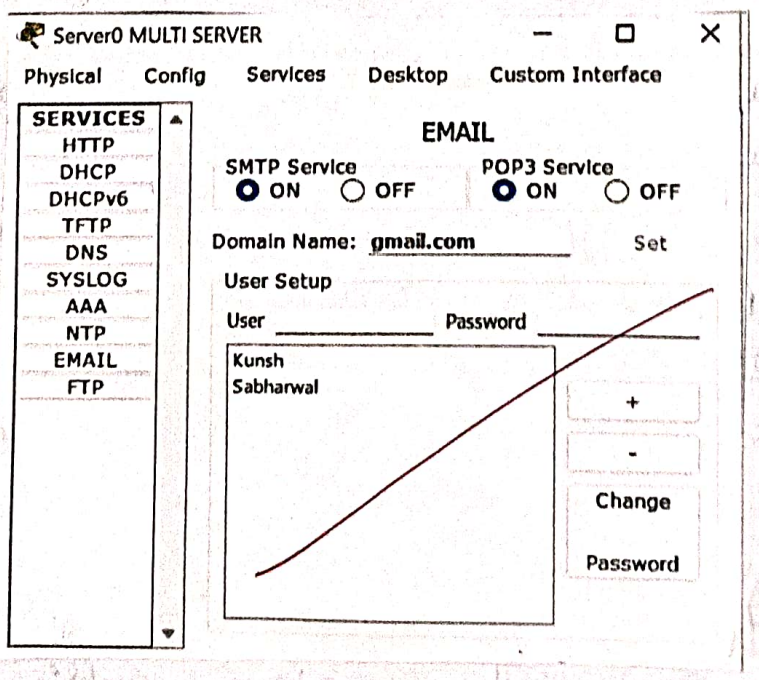

Fig. 50 EMAIL service

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to explore the functionality of the TCP and UDP protocols, multiplexing and the function of port numbers, in determining which local application requested the data or is sending the data.

- Transmission Control Protocol (TCP) is a transport protocol that is used on top of IP to ensure reliable transmission of packets. TCP includes mechanisms to solve many of the problems that arise from packet-based messaging, such as lost packets, out of order packets, duplicate packets, and corrupted packets. TCP is a connection oriented protocol. A TCP session must be established to use TCP. This TCP session is established with a Three-Way Handshake mechanism. And it can be terminated with Four-Way Handshake mechanism.
- Three-Way Handshake mechanism consists of 3 messages as its name implies. These messages are: SYN, SYN-ACK, ACK. In these segments, related TCP Header Flags are set to 1 i.e. if it is a SYN message, SYN bit is set to 1; if it is a SYN-ACK message, SYN and ACK bits are set to 1; or if it is an ACK, ACK bit is set to 1.

Steps to configure TCP and UDP protocol simulation in Cisco Packet Tracer :-

Step 1:- Open Cisco Packet Tracer

Teacher's Signature

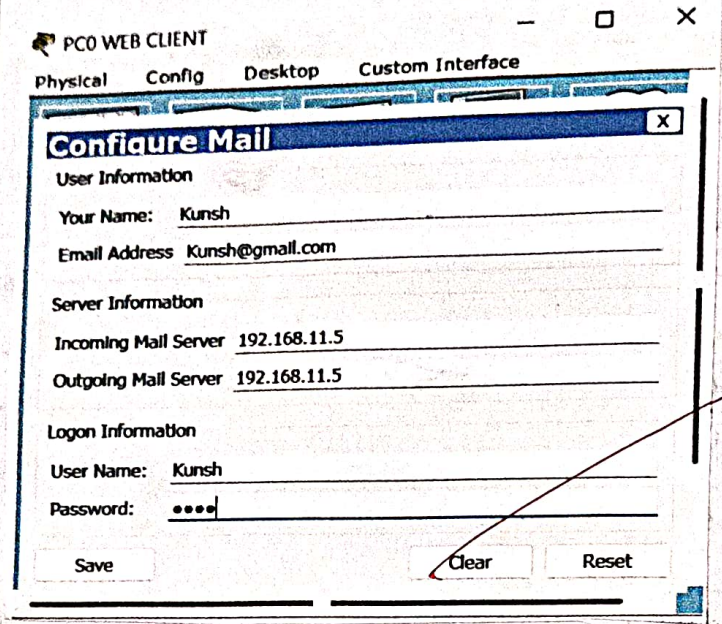

Fig. 51 Mail for Web Client

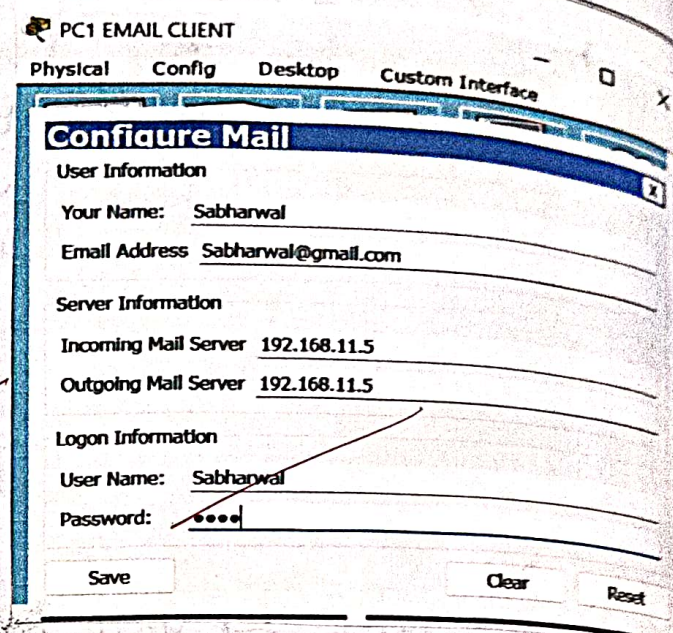

Fig. 52 Mail for EMAIL client

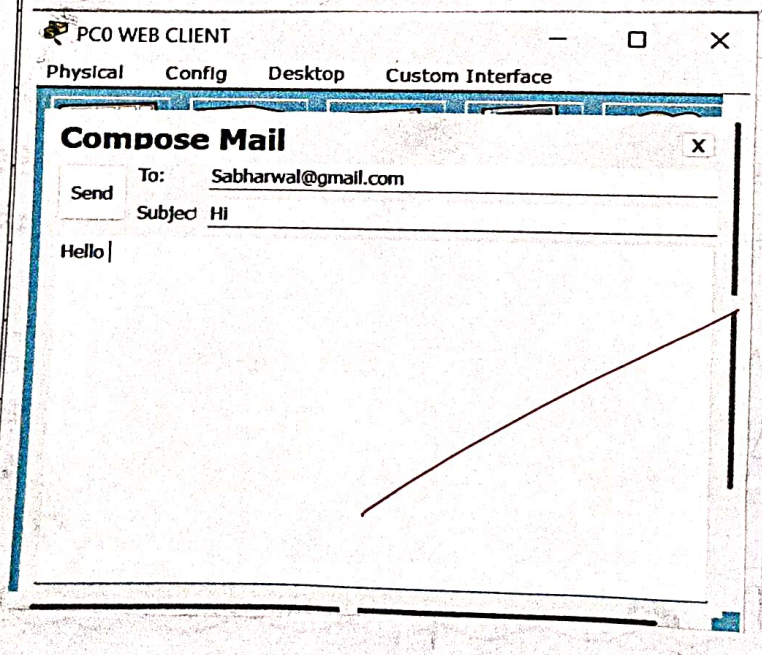

Fig. 53 Mailing Email Client

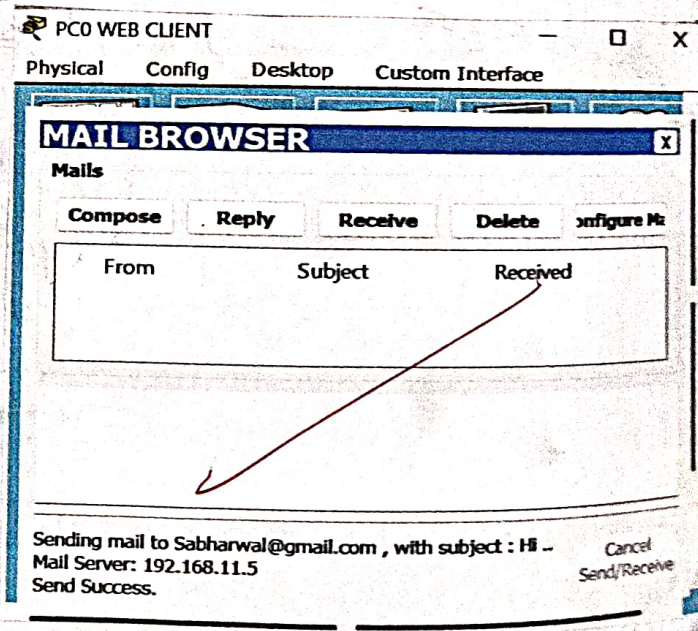

Fig. 54 Mail sent from (PC0) Web Client

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Step 2:- Make a topology as shown by selecting 4 PC's, 1 switch (2960) and 1 server (label server as multi server and PC's as Web Client, Email Client, FTP Client and DNS Client)

Step 3:- Connect all the devices using Copper straight through Cable, connecting all using Fast Ethernet port.

Step 4:- Assign respective IP addresses to all devices

Step 5:- Double Click on Multi-server, from the pop-up window, select services tab,

- Under services select DNS service
- Turn on DNS service.
- Within DNS, name record to be www.google.com; address 192.168.11.5
- Click on Add record.

Step 6:- Double click on Multi-server, from the pop-up window, select services tab,

- Under services select HTTP service
- Turn on HTTP and HTTPS options.
- Select index.html and click on edit option.
- Type the following text:-

<html>
Welcome to Computer Networks Lab - Experiment No. 6
We are learning about simulation of TCP and UDP protocols.
<html>

- Click on save and yes.

Teacher's Signature

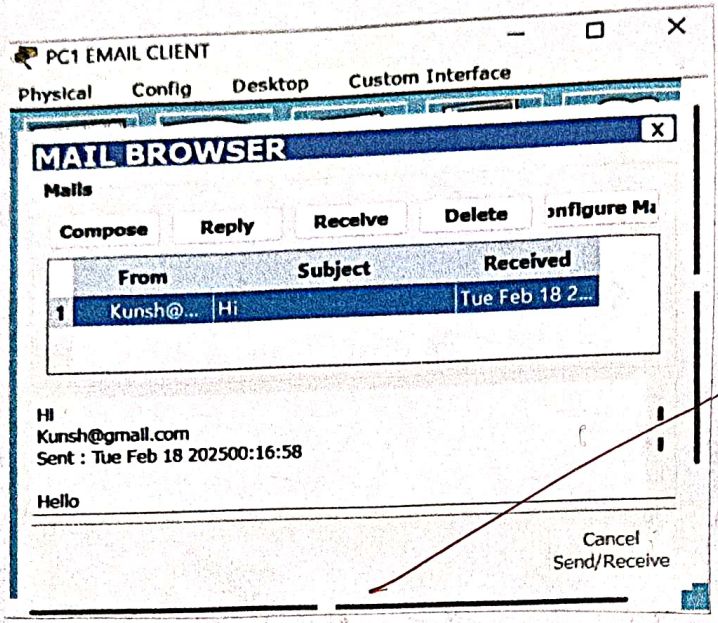

Fig. 55 Mail Received on (PC1) email client

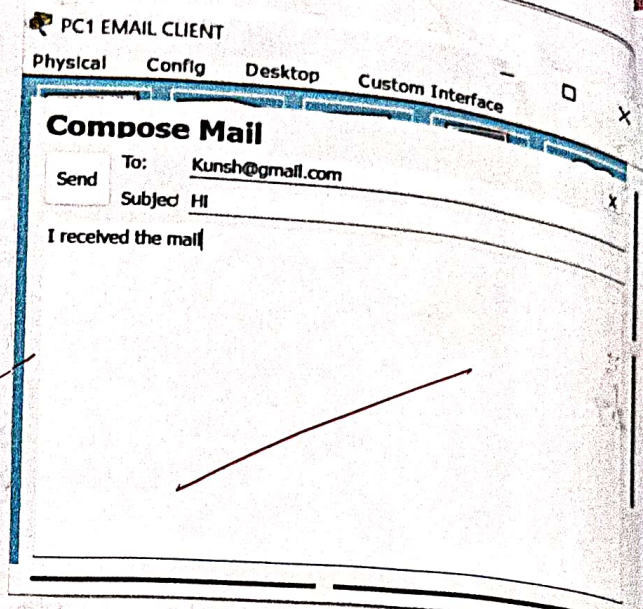

Fig. 56 Sending ACK mail from PC1

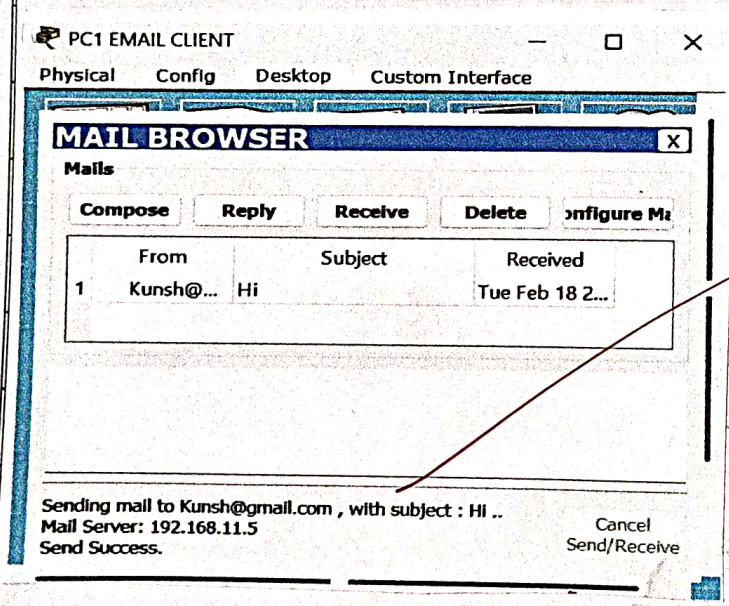

Fig. 57 Mail sent from (PC1) Email client

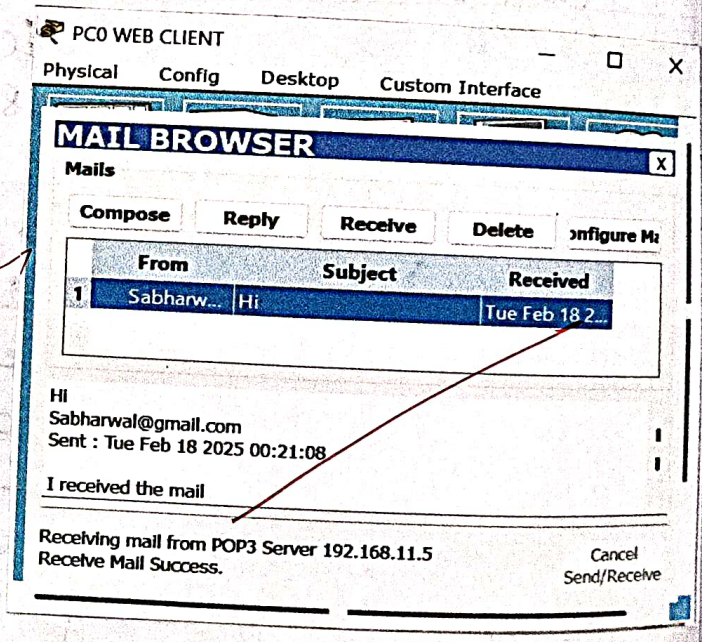

Fig. 58 Mail received on (PC0) Web client

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Step 7:- • Double click on DNS client.
- Within the desktop tab using it select Command Prompt
- Type nslookup www.google.com
- This statement lets you know whether DNS client can connect to a server or not and resolve the IP address issues.
- Within the Desktop tab select Web browser.
- In the url type www.google.com

Step 8:- • Double click on Web Client
- Within the desktop tab select email option.
- In the configure mail dialog box write
- Name : Your Name (Kunsh)
- email address :- Kunsh @ gmail.com
- Incoming Mail server :- 192. 168. 11. 5
- Outgoing Mail server :- 192. 168. 11. 5
- User Name :- Kunsh
- Password :- AIML
- Click on save.

Step 9:- • Double click on email client, within the email option:-
- In the configure mail dialog box write:-
- Name :- Your surname (Sabharwal)
- Email address :- Sabharwal @ gmail.com
- Incoming / Outgoing Mail Server :- 192. 168. 11. 5
- User Name :- Sabharwal
- Pass word :- AIML
- Click on save.

Teacher's Signature

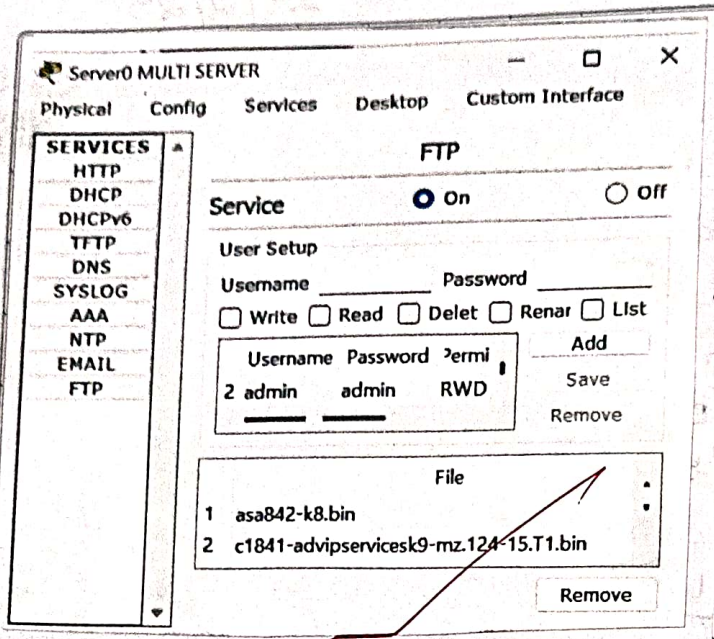

Fig.59 FTP service

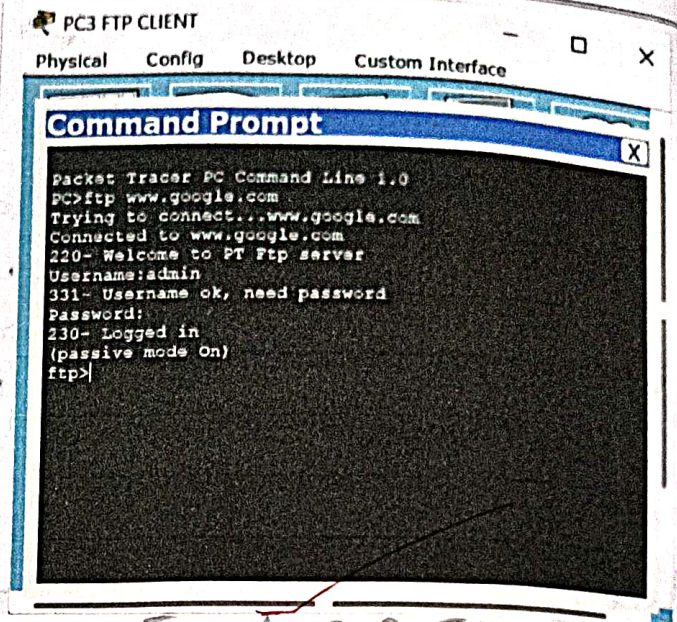

Fig.60 PC3 FTP Command

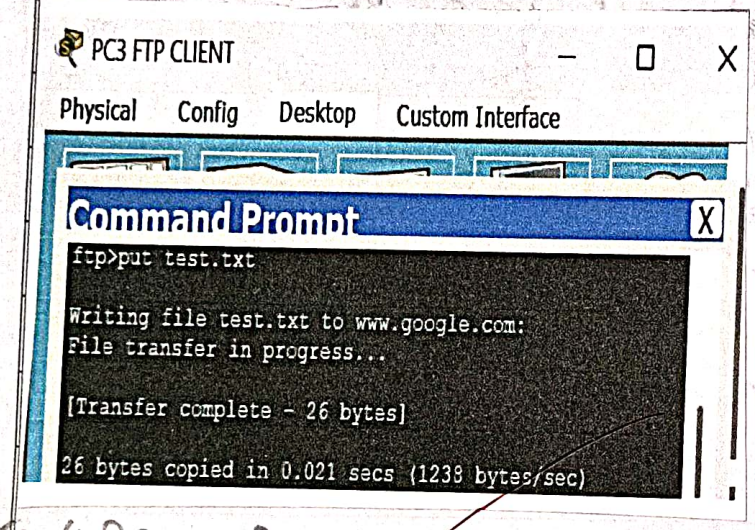

Fig.61 PC3 Put Command

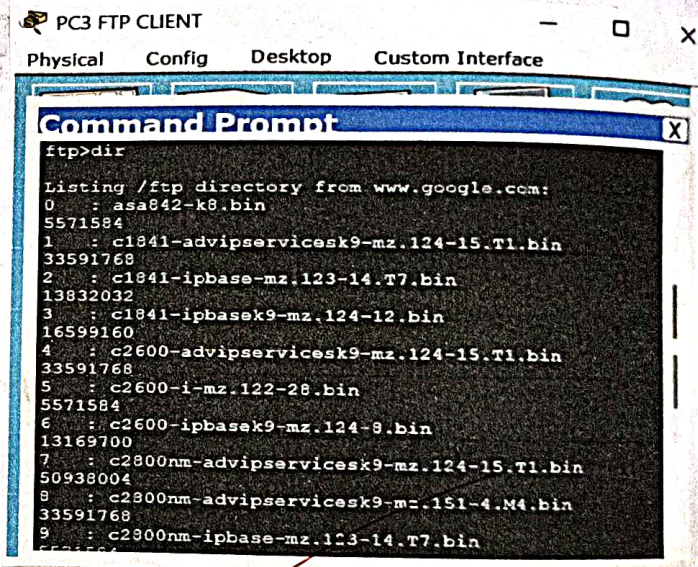

Fig.62 dir command

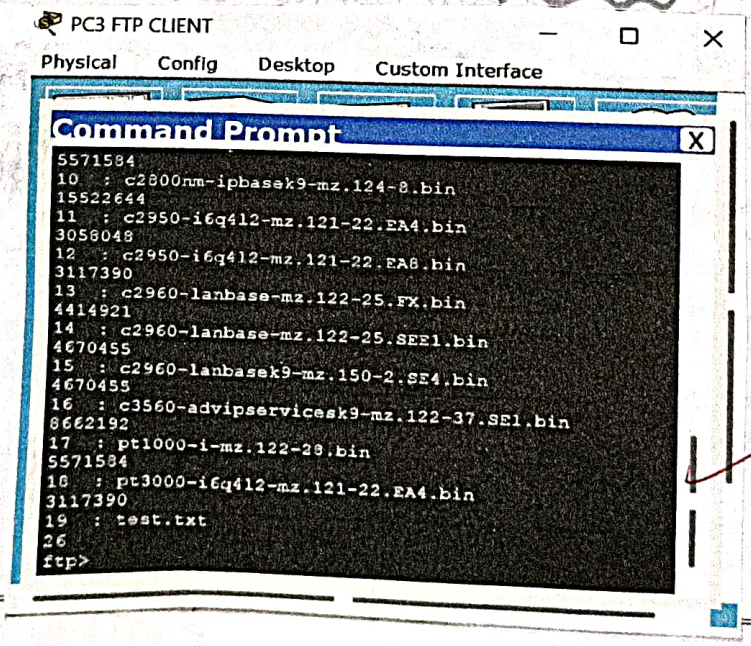

Fig.63 dir Command

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Step 10:- Double click on Multi-server, within services tab select email option.

- Switch on SMTP and POP3 service
- Type domain name : gmail.com
- Under user setup : Name : Kunsh ; Password : AIML
- Click on Add
- Under User setup : Name : Sabharwal ; Password : AIML
- Click on Add.

Step 11:- Double click on Web Client, within the desktop tab, select email option.

- Send a mail by composing a mail.
- In the 'To' section write :- Sabharwal@gmail.com
- Subject : Hi ; Mail-Box :- Hello
- Click on send mail

Step 12:- Double click on Email client, within the email options, select receive option

Step 13:- Double click on Email client, within the desktop tab, select email option

- Send a mail by composing a mail
- In the 'To' section write :- Kunsh@gmail.com
- Subject Hi ; Mail-Box : I received the mail.
- Click on send mail.

Step 14:- Double click on Web Client, within email option select receive option.

Teacher's Signature

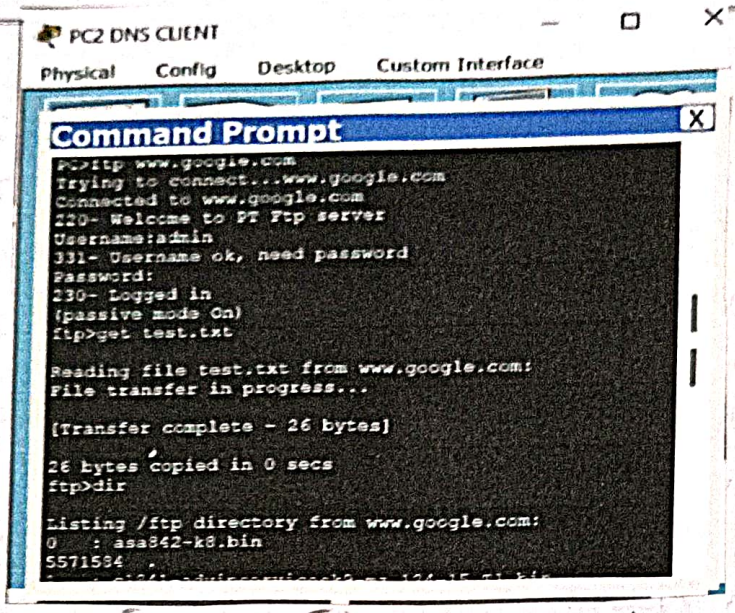

Fig.64 FTP command

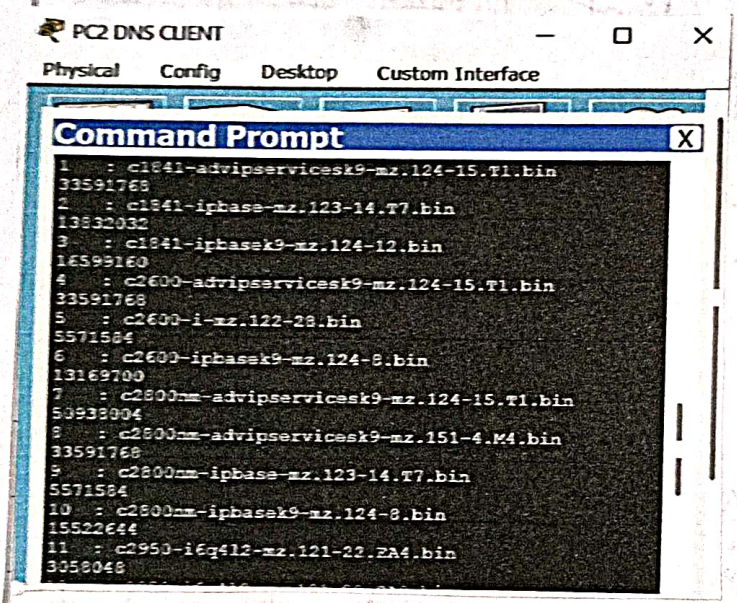

Fig.65 dir Command

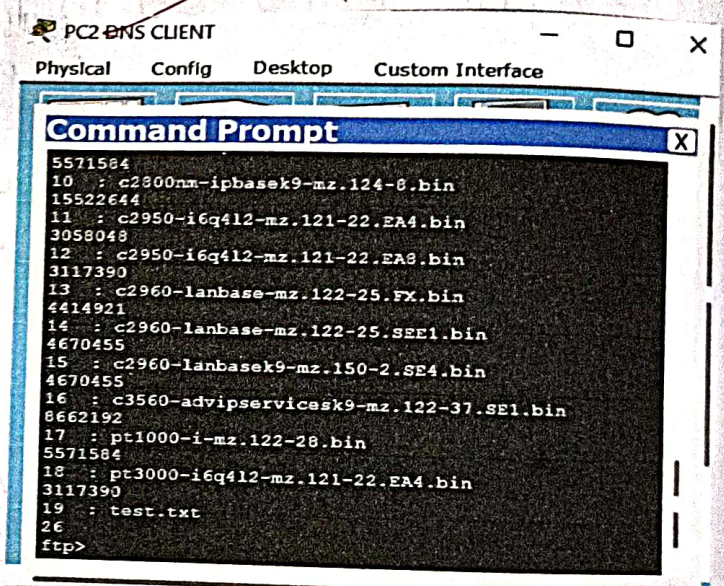

Fig.66 dir Command

Result :- I learnt to analyze various parameters for TCP protocols in action and implement TCP/UDP along with HTTP/HTTPS and FTP.

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Step15:- Double click on Multi-server, from the pop-up window, select services tab,

- Under services select FTP service
- Set username and Password as admin
- Enable all options : write, read, delete, rename and list.
- Click on Add record.

Step16:- Double click on FTP client, within Command prompt type ftp www.google.com

- Username: admin ; Password: Admin
- Close command prompt & open text editor services
- type any message and save it as test.txt
- Again open command prompt, type: put test.txt, also type dir (directory option to check whether test.txt is put up in server or not)

Step17:- Double click on DNS client, within the desktop tab select Command prompt option, type:- ftp www.google.com

- Username : admin ; Password: admin
- Type:- get test.txt
- Type:- dir (directory option to check whether test.txt is put up in server or not).

Result:- I learnt to analyze various parameters for TCP protocols in action and implement TCP/UDP along with FTP and HTTP/HTTPS.

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Teacher's Signature

Exp7:- To implement shortest path algorithm using Open Shortest Path First (OSPF) in Cisco Packet Tracer.

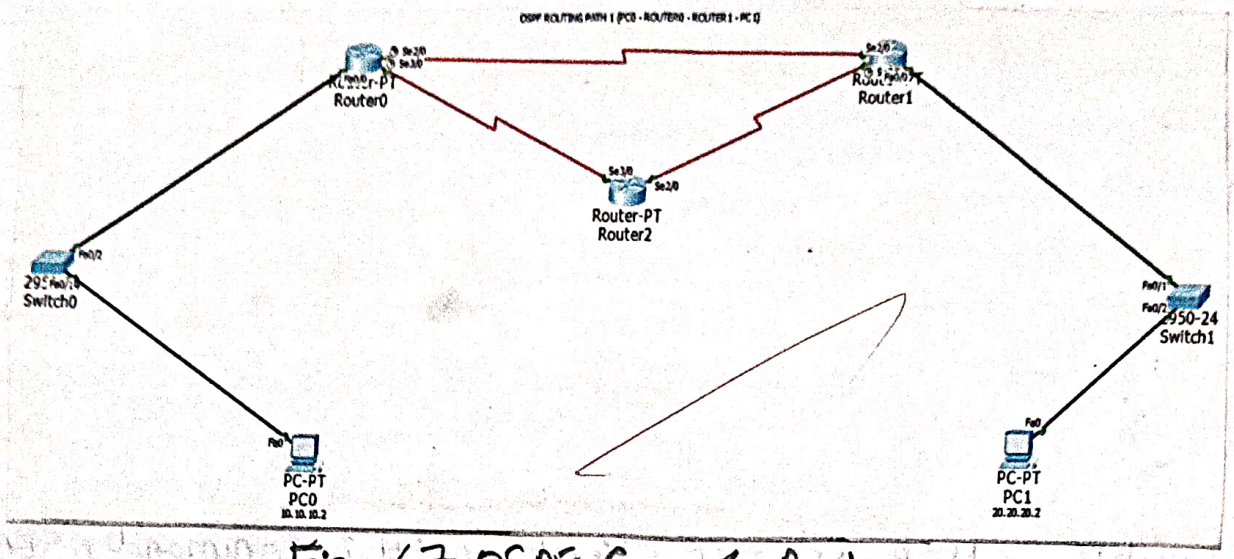

Fig. 67 OSPF Case 1 Route

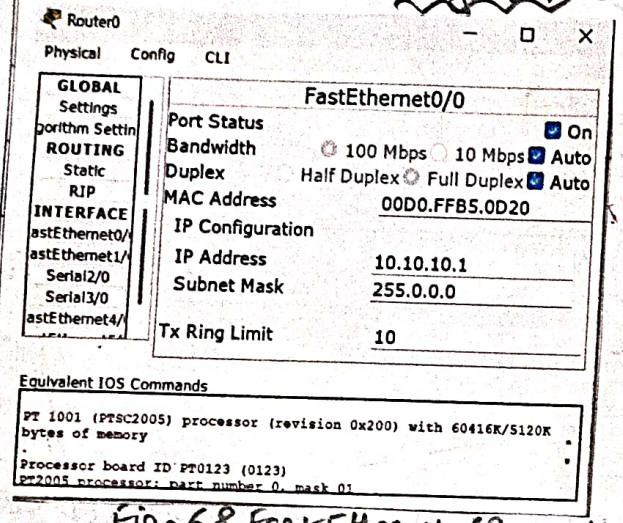

Fig. 68 Fast Ethernet (Router0)

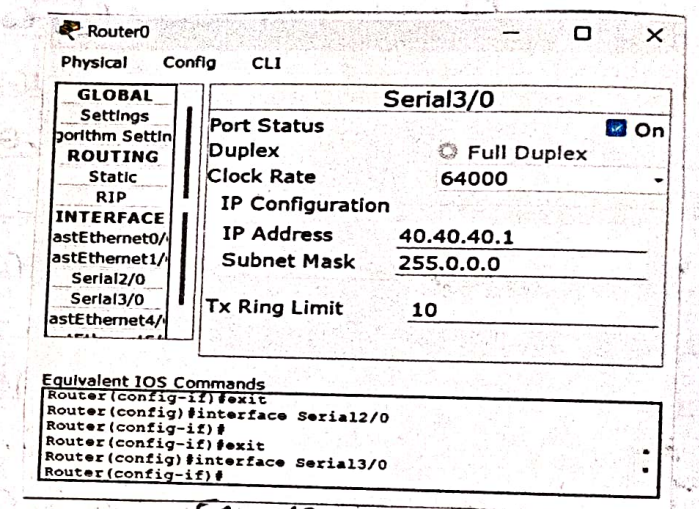

Fig. 69 Serial 3/0 (Router0)

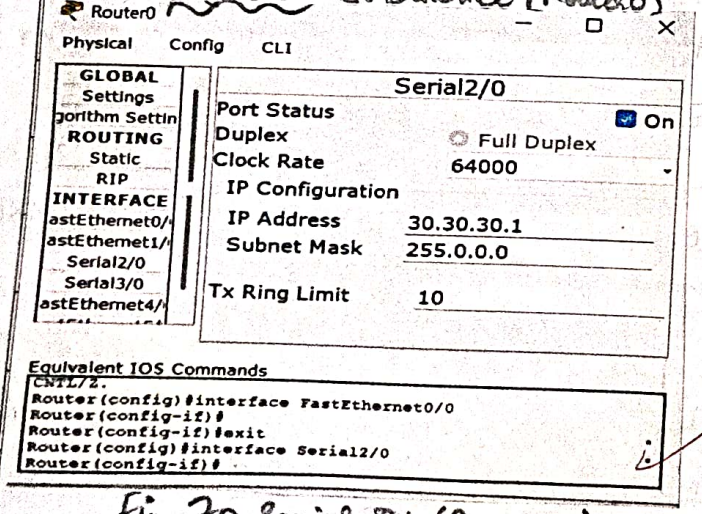

Fig. 70 Serial 2/0 (Router 0)

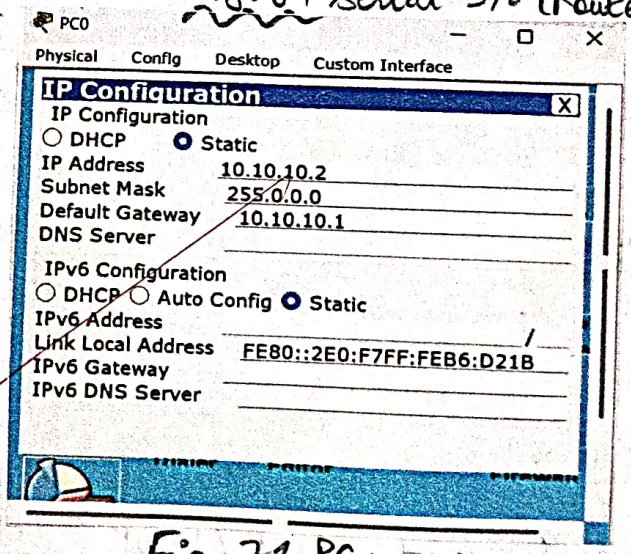

Fig. 71 PC0 IP configuration

Fire	Last Statu	Sourc	Destinatic	Type	Colo	Time(s	Period	Num	Edit	Delete
	Successful	PC0	PC1	IC...		0.000	N	0	(ed...	(delete)

Fig. 72 Case 1 Real time

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Experiment - 7

→ Aim :- To implement shortest path algorithm using Open Shortest Path First (OSPF) in Cisco Packet Tracer.

→ Objective :- To show that the path chosen to send data from one network to the other is always chosen as the shortest path between the sender and the receiver.

→ Theory :- 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 OSPF, networks router 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 (LSA's) that it receives from all the other routers or systems in the same area and the LSA's that itself generates. An LSA is a packet that contains information about neighbours and path cost. 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.

Teacher's Signature

PC1

Physical Config Desktop Custom Interface

IP Configuration

IP Configuration
DHCP Static
IP Address 20.20.20.2
Subnet Mask 255.0.0.0
Default Gateway 20.20.20.1
DNS Server

IPv6 Configuration
DHCP Auto Config Static
IPv6 Address /
Link Local Address FE80::2E0:8FFF:FE1E:D987
IPv6 Gateway
IPv6 DNS Server

Fig.73 PC1 IP Configuration

Router1

Physical Config CLI

GLOBAL
Settings
Algorithm Settin
ROUTING
Static
RIP
INTERFACE
FastEthernet0/
FastEthernet1/
Serial2/0
Serial3/0
FastEthernet4/

FastEthernet0/0

Port Status On
Bandwidth 100 Mbps 10 Mbps Auto
Duplex Half Duplex Full Duplex Auto
MAC Address 00E0.A357.CEBE
IP Configuration
IP Address 20.20.20.1
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#
```

Fig. FastEthernet (Rou

Router1

Physical Config CLI

GLOBAL
Settings
Algorithm Settin
ROUTING
Static
RIP
INTERFACE
FastEthernet0/
FastEthernet1/
Serial2/0
Serial3/0
FastEthernet4/

Serial2/0

Port Status On
Duplex Full Duplex
Clock Rate 2000000
IP Configuration
IP Address 30.30.30.3
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
```

Router1

Physical Config CLI

GLOBAL
Settings
Algorithm Settin
ROUTING
Static
RIP
INTERFACE
FastEthernet0/
FastEthernet1/
Serial2/0
Serial3/0
FastEthernet4/

Serial3/0

Port Status On
Duplex Full Duplex
Clock Rate 64000
IP Configuration
IP Address 50.50.50.2
Subnet Mask 255.0.0.0
Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial3/0
Router(config-if)#
```

Fig. and 76 Serial and 3 (Rout

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.001	PC0	Switch0	ICMP	
	0.002	Switch0	Router0	ICMP	
	0.003	Router0	Router1	ICMP	
	0.004	Router1	Switch1	ICMP	
	0.005	Switch1	PC1	ICMP	

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.006	PC1	Switch1	ICMP	
	0.007	Switch1	Router1	ICMP	
	0.008	Router1	Router0	ICMP	
	0.009	Router0	Switch0	ICMP	
	0.010	Switch0	PC0	ICMP	

Fig. 77 & 78 Simulation for Case 1

Router0

Physical Config CLI

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#clock rate 64000
Router(config-if)#ip address 30.30.30.1 255.0.0.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial3/0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#clock rate 64000
Router(config-if)#ip address 40.40.40.1 255.0.0.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
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 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Copy Paste

Fig. 79 Router 0 CLI command

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OSPF has advantages like → 1) It is more suitable for serving large, heterogeneous internetworks and can recalculate the routes in a short amount of time when the network topology changes.

2) OSPF also helps to divide an Autonomous System (AS) into areas and keep area topologies seperate to decrease the OSPF routing traffic and the size of the link-state database of each area.

→ Procedure:- 1) Select and Connect 2 PC's, 2 Switches (2950-24) and 3 Routers according to the topology shown.

2) Assign IPs to each PC and router as the following:-

(a) PC0 - 10.10.10.2 & Default Gateway - 10.10.10.1

(b) PC1 - 20.20.20.2 & Default Gateway - 20.20.20.1

(c) Router 0 - Turn on FastEthernet 0/0 (IP) - 10.10.10.1 with Serial 2/0 (IP) - 30.30.30.1 and serial 3/0 (IP) - 40.40.40.1 with clock rate 64000 in both serials.

(d) Router 1 - Turn on FastEthernet 0/0 (IP) - 20.20.20.1 with serial 2/0 (IP) - 30.30.30.3 and serial 3/0 (IP) - 50.50.50.2 with clock rate 64000.

(e) Router 2 - Turn on serial 2/0 (IP) - 50.50.50.1 and serial 3/0 (IP) - 40.40.40.2.

3) Now open the CLI command tabs one by one for each router and enter the below commands:-

(a) Router 0:-

(i) Exit

(ii) Router ospf 1

Teacher's Signature

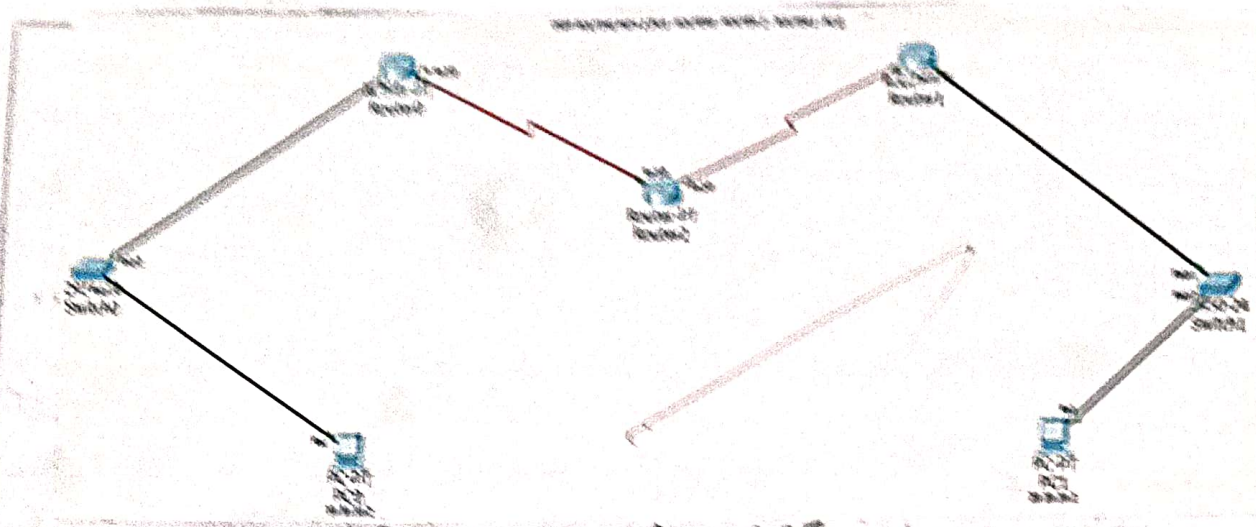


Fig. 80 Case 2 OSPF

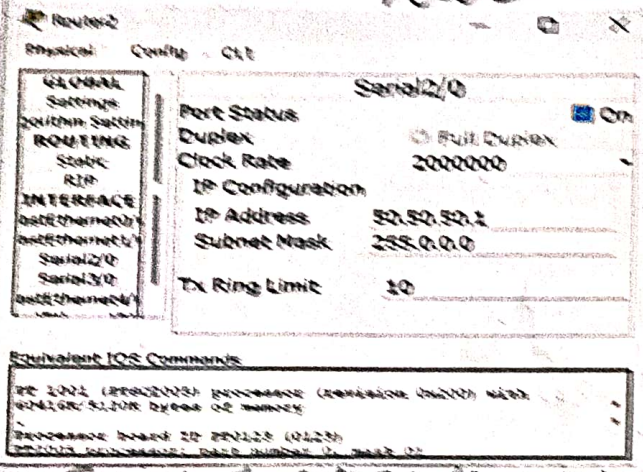


Fig. 81 Serial 2/0 (Router 2)

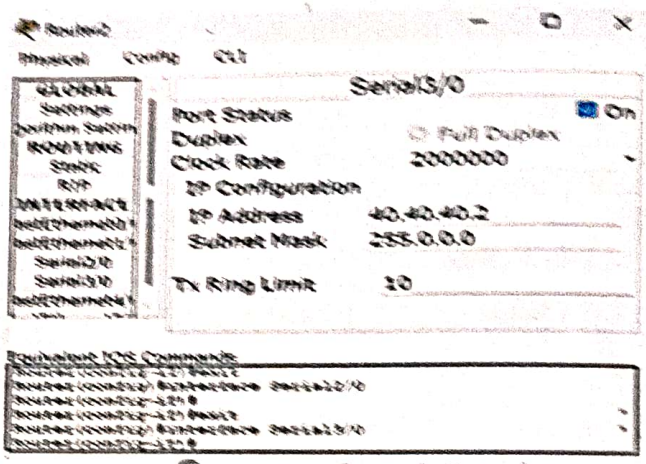
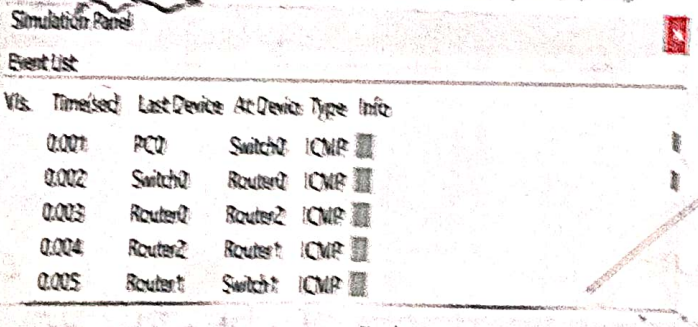
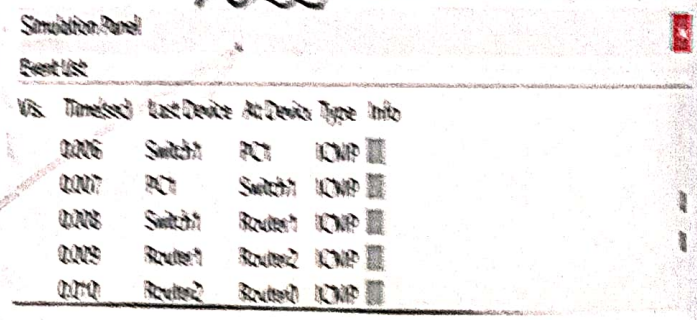


Fig. 82 Serial 3/0 (Router 2)





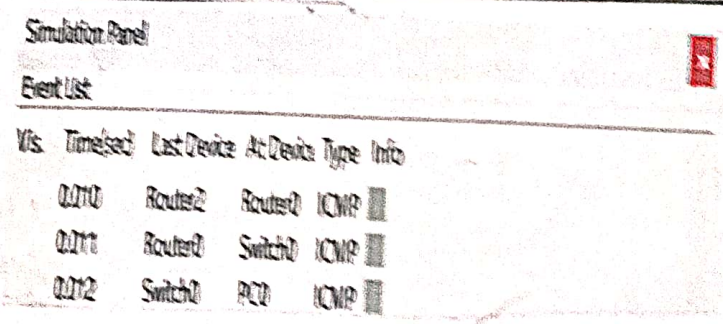


Fig. 83, 84, 85 Simulation Mode for Case 2

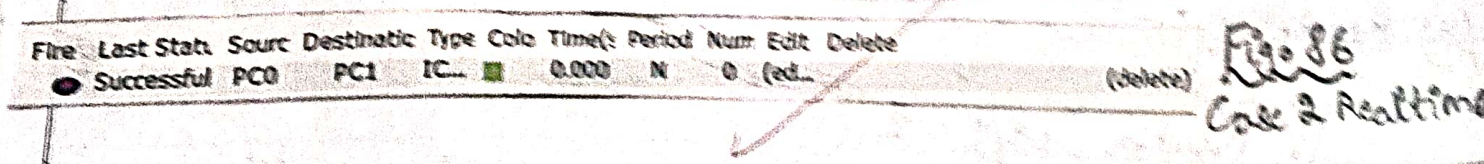


Fig. 86 Case 2 Realtime

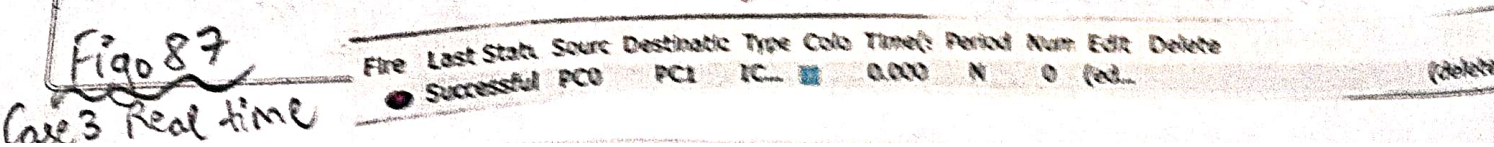


Fig. 87 Case 3 Real time

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iii) Network 10.0.0.0 0.255.255.255 area 0
iv) Network 30.0.0.0 0.255.255.255 area 0
v) Network 40.0.0.0 0.255.255.255 area 0
vi) exit
vii) exit

(b) Router 1 -
i) Exit
ii) Router ospf 1
iii) Network 30.0.0.0 0.255.255.255 area 0
iv) Network 20.0.0.0 0.255.255.255 area 0
v) Network 50.0.0.0 0.255.255.255 area 0
vi) exit

(c) Router 2 -
i) Exit
ii) Router ospf 1
iii) Network 40.0.0.0 0.255.255.255 area 0
iv) Network 50.0.0.0 0.255.255.255 area 0
v) Exit
vi) Exit

4) After configuring these CLI commands in respective routers the setup is ready. Send a simple message from PC0 to PC1 with the same topology connected and observe outputs in real-time and simulation modes.

5) Now disconnect the path from Router 0 to Router 1 making the only path/network connecting the systems being from Router 0 to Router 2 to Router 1.

6) Send a simple message in this topology and observe the outputs. Reconnect the path from Router 0 to Router 1 again sending a message from PC0 to PC1.

Teacher's Signature

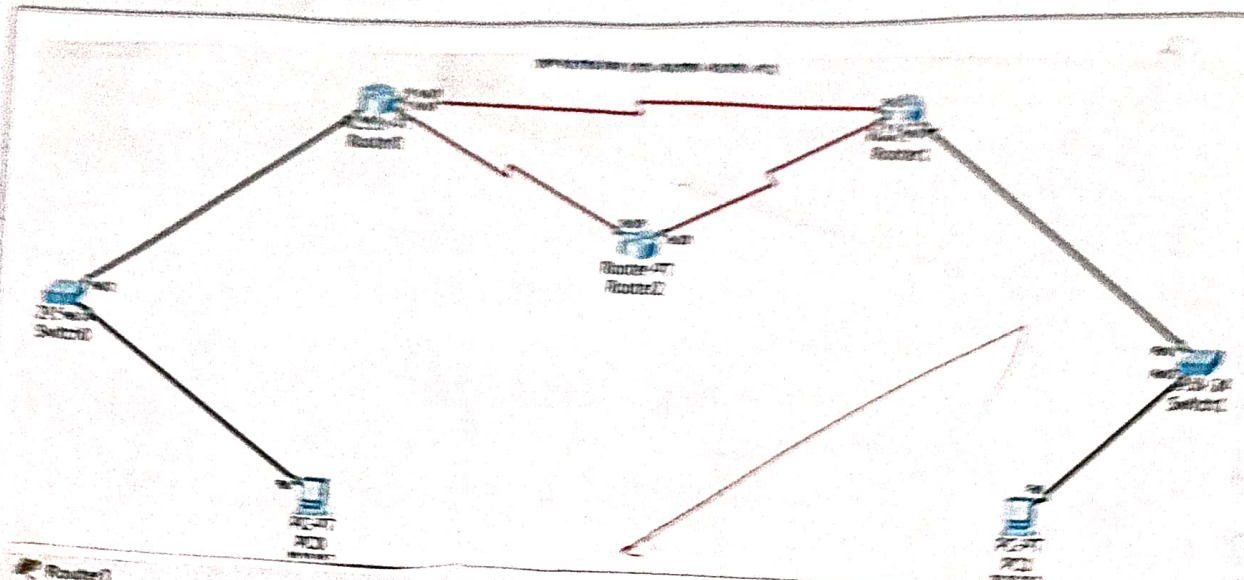

Fig. 88
OSPF

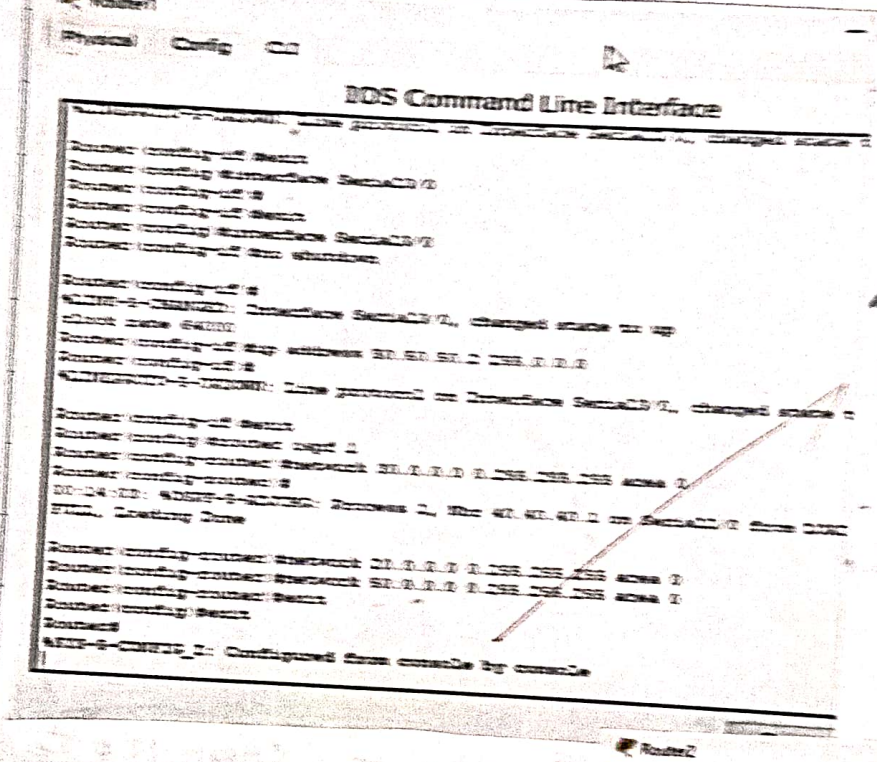

Fig. 89

Router 1 CLI commands

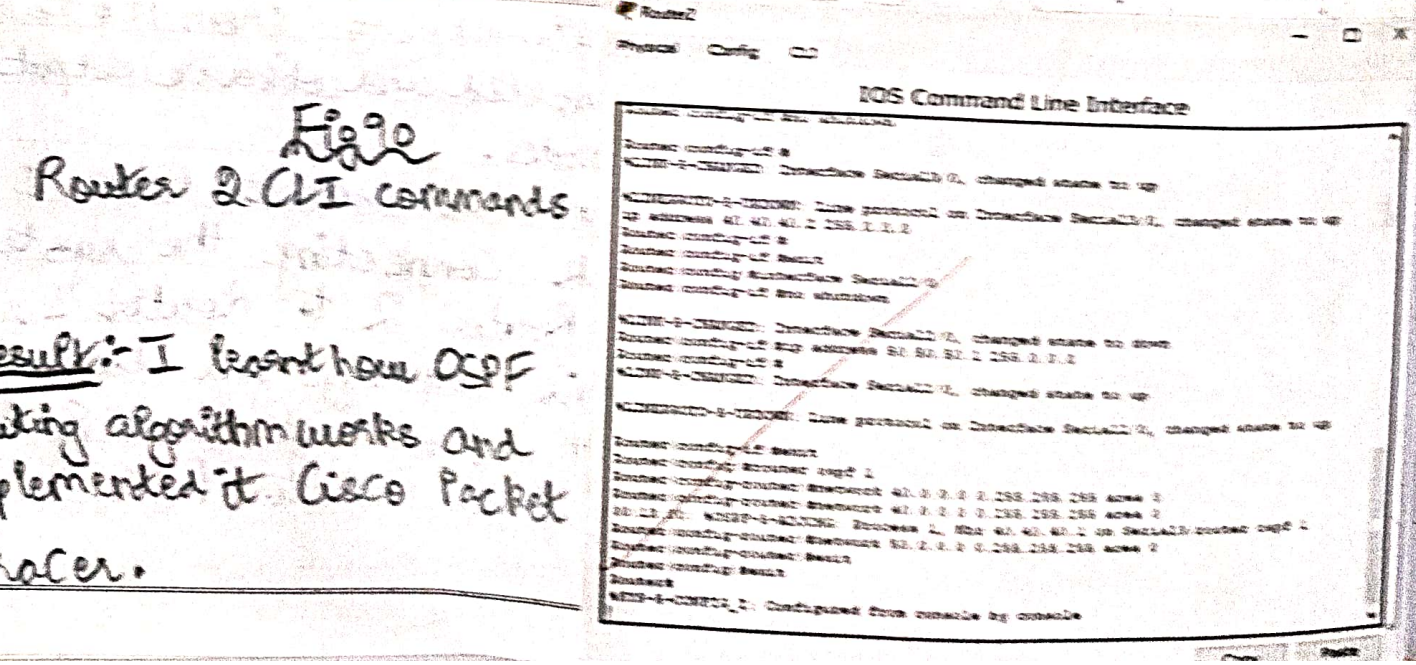

Fig. 90

Router 2 CLI commands

#Result:- I learnt how OSPF routing algorithm works and implemented it Cisco Packet Tracer.

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→ Conclusion :- Analysing the path taken by the message to reach the destination in the 3 cases, shows us that the shortest path (Router 0 to 1) is always preffered over the longer path (Router 2) in the OSPF routing. The network chose to send the message through Router 0 and 1 when they were connected as the path was shorter in that case. On breaking the connection between the two routers the network chose a longer path from Router 2 but reconnecting the Routers 0 and 1 again the same path was taken as in case 1 showing that it was the actual shortest path between 2 PC's

→ Result :- I learnt to implement OSPF routing algorithm using Cisco Packet Tracer and realized how OSPF algorithm always selects the shortest path between the source and the destination.

Teacher's Signature

Exp 8:- To implement subnetting b/w 2 PC groups in CPT.

Date:- 4/4

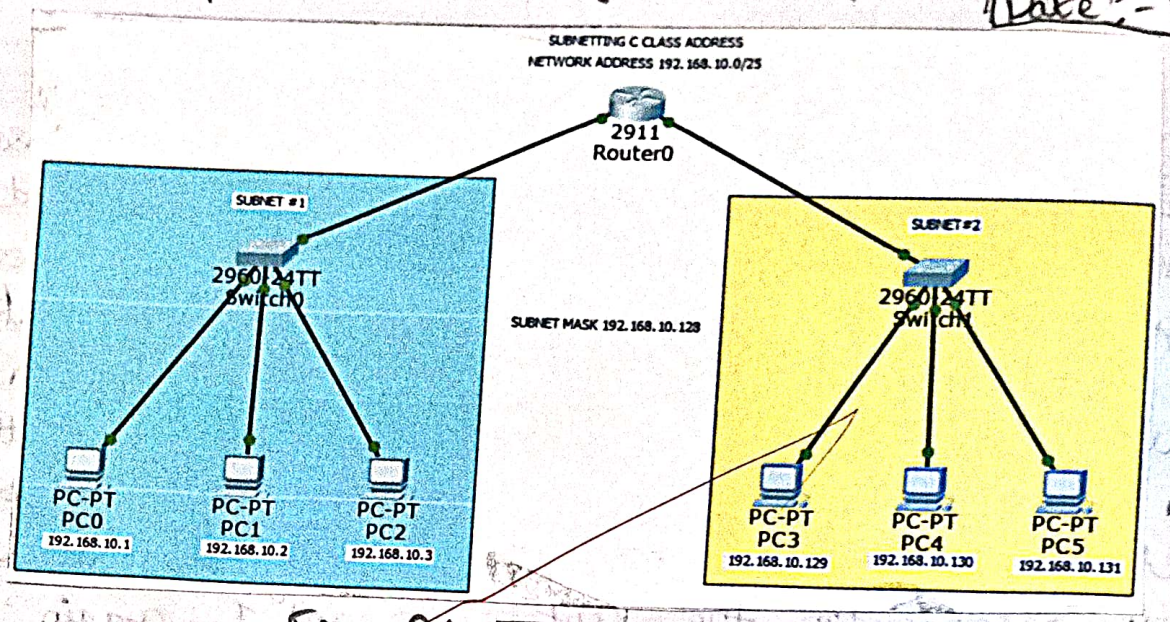

Fig. 91 Topology created with 2 groups.

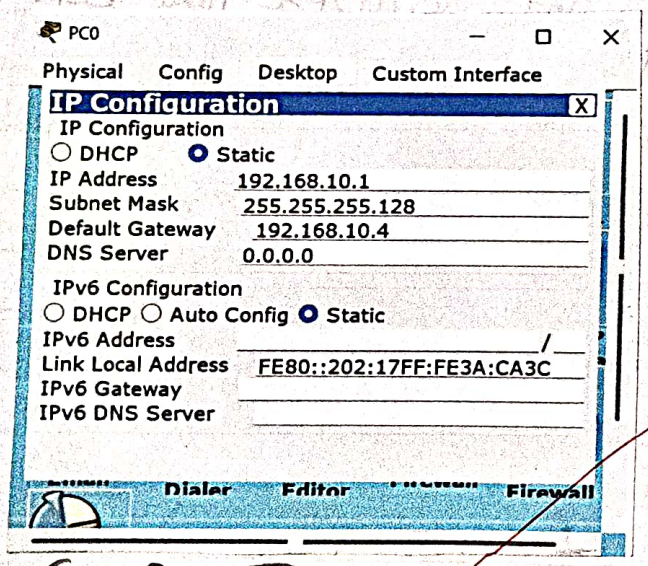

Fig. 92 IP Configuration of PC 0

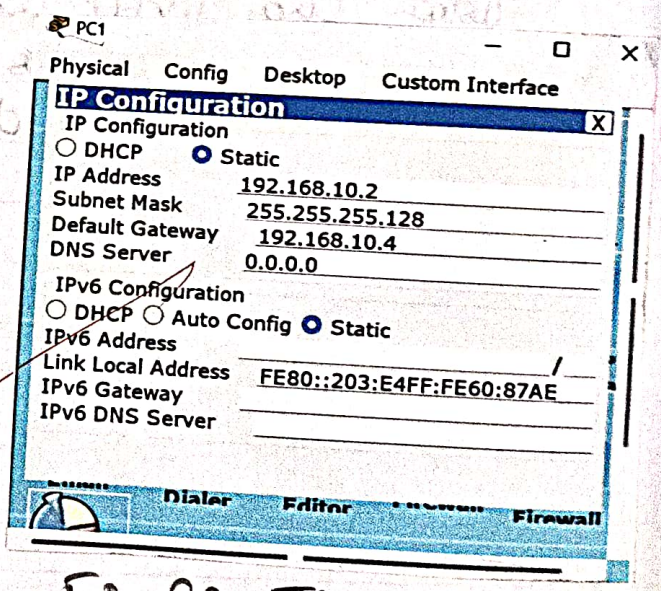

Fig. 93 IP configuration of PC 1

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Experiment-8

→ Aim :- To implement subnetting between 2 groups of PCs in Cisco Packet Tracer

→ Objective :- To show and understand how subnetting works among various PCs and within groups/ connecting multiple groups.

→ Theory :- Sub netting is the process of dividing a large IP network into smaller, manageable sub-networks called subnets. It enhances network performance, improves security and optimizes IP addresses allocation. By borrowing bits from the host portion of an IP address, subnetting creates multiple logical network within a single physical network. Each subnet has its own network and broadcast address, ensuring isolated communi-cation domains. Subnetting reduces network congestion by limiting brodcast traffic and allows for efficient routing by organizing IP addresses hierarchically. It is commonly used in organizations to separate departments, manage network traffic and make better use of available IP address space.

→ Procedure :- 1) Create the shown topology by connecting

Teacher's Signature

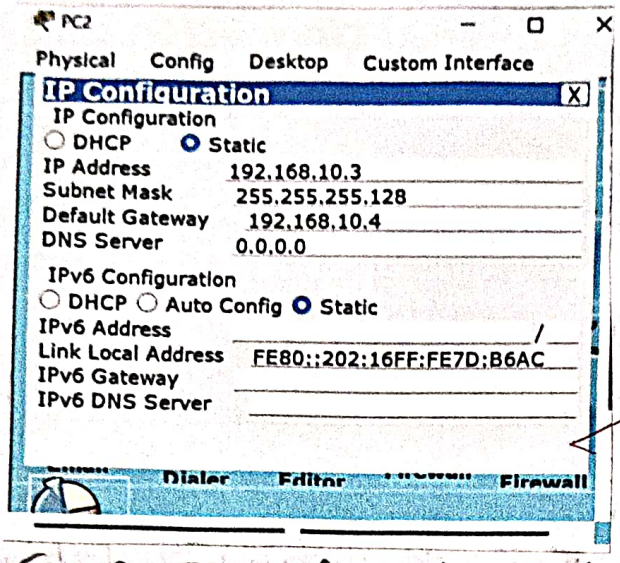

Fig. 94 IP configuration of PC2

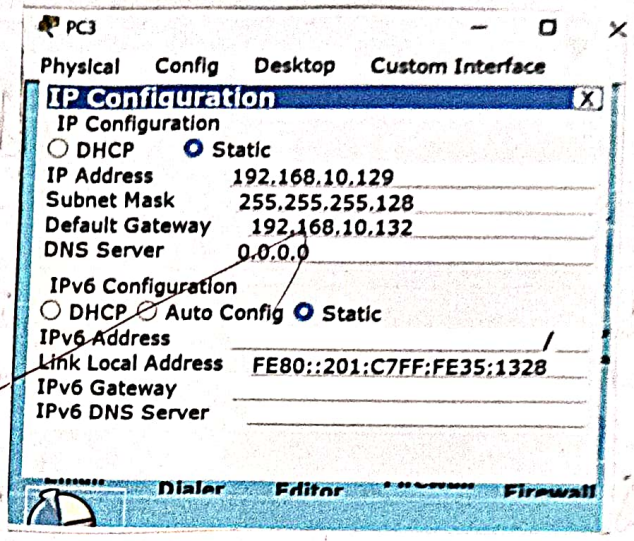

Fig. 95 Ip configuration of PC3

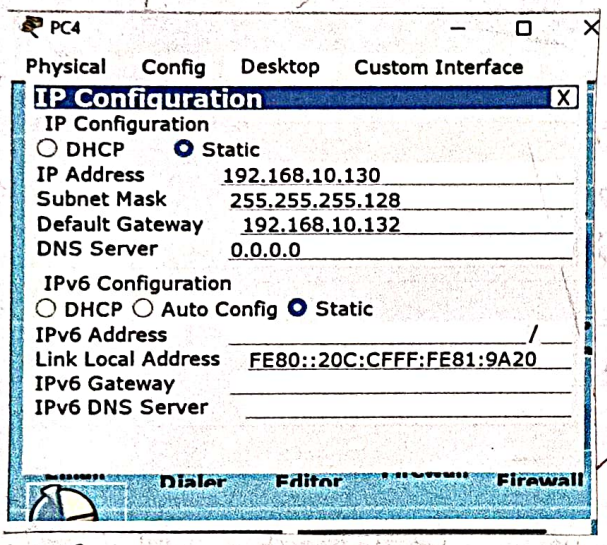

Fig. 96 IP configuration of PC4

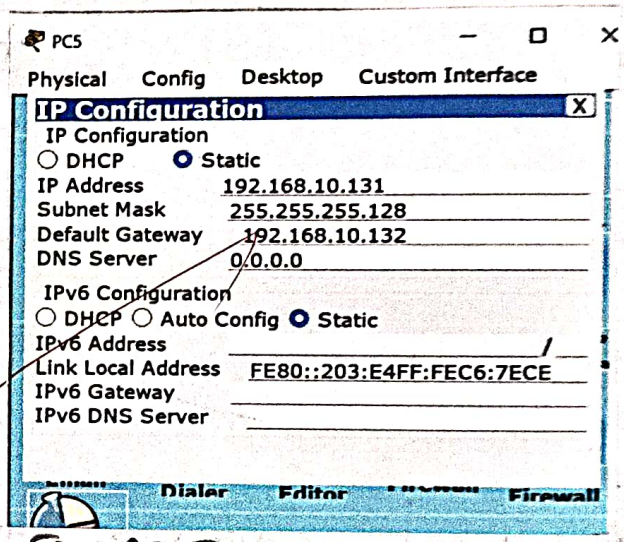

Fig. 97 Ip configuration of PC5

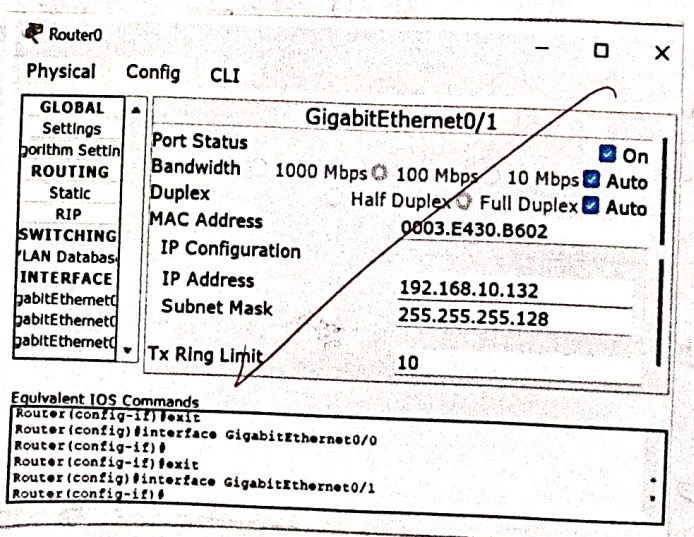

Fig. 98
Router 0
GigabitEthernet 0/1
Configuration

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1 Router, 2 switches and 3 PC's with each switch to create 2 separate subnets.

2) Consider the Network ID as 192.168.10.0/25 and subnet Mask as 192.168.10.128

3) We have 192.168.10.0/25 which in binary is 192.168.10.0/25 = 11111111.11111111.11111111.10000000 so $2^n \Rightarrow 2^1 = 2$ is the no. of subnets and no. of hosts $= 2^7 = 128$. This gives us valid hosts as 1, 126 (subnet 0) and 129, 254 (subnet 128)

4) Assign IP Addresses to all PC's as shown below:-

(a) PC0 → IP = 192.168.10.1
Subnet Mask = 255.255.255.128
Default Gateway = 192.168.10.4

(b) PC1 → IP = 192.168.10.2
Subnet Mask = 255.255.255.128
Default Gateway = 192.168.10.4

(c) PC2 → IP = 192.168.10.3
Subnet Mask = 255.255.255.128
Default Gateway = 192.16.10.4

(d) PC3 → IP = 192.168.10.129
Subnet Mask = 255.255.255.128
Default Gateway = 192.168.10.132

(e) PC4 → IP = 192.168.10.130
Subnet Mask = 255.255.255.128
Default Gateway = 192.168.10.132

Teacher's Signature

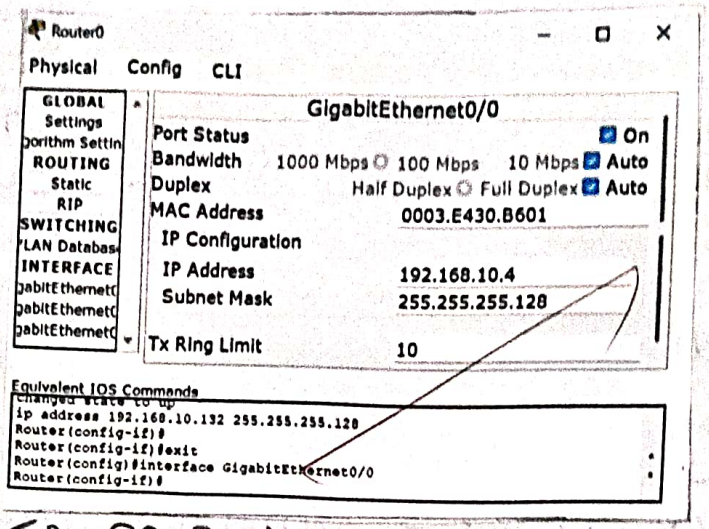

Fig.99 Router 0 → Gigabit Ethernet 0/0 configuration

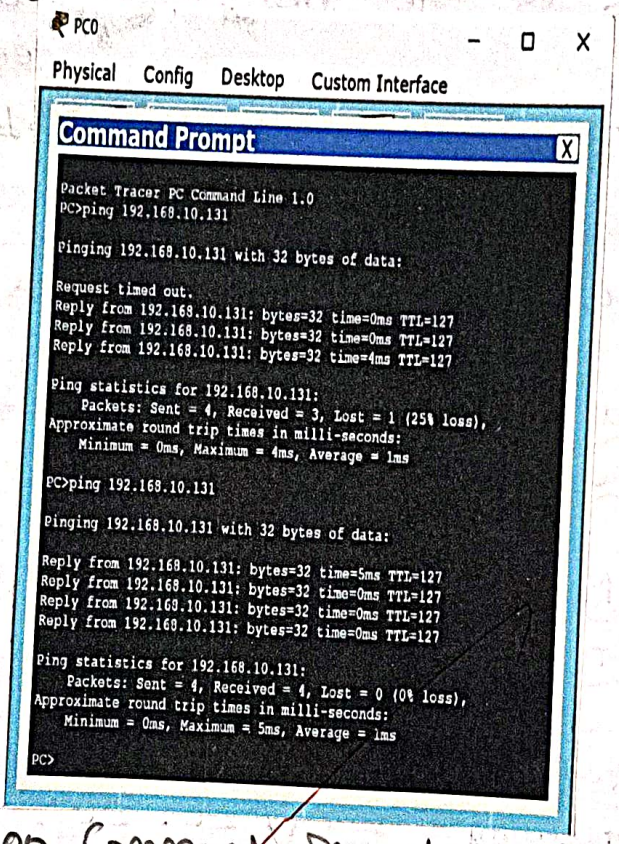

Fig.100 Command Prompt verification using PC0

→ **Result** :- I was able to learn the fundamentals behind subnetting and how it works on Cisco Packet Tracer to make successful connections of devices.

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(b) PC5 → IP = 192.168.10.131
Subnet Mask = 255.255.255.128
Default Gateway = 192.168.10.132

5) Now in the router:- 1) go to config
2) Go to gigabitEthernet 0/0, turn it on and enter IP as 192.168.10.4 and subnet mask as 255.255.255.128
3) Go to gigabitEthernet 0/1, turn it on and enter IP as 192.168.10.132 and subnet mask as 255.255.255.128

6) We can confirm if all the connections are correct by pinging one device of a subnet from another device of the other subnet. (For Ex:- In PC0, go to command prompt and run - ping 192.168.10.131).

→ Conclusion:- We observed that we are successfully able to ping one device from another across subnets, proving that the subnetting was done for the network.

→ Result:- I was able to learn the fundamentals behind subnetting and how it works on Cisco Packet Tracer to make successful connections of devices.

Teacher's Signature

Exp9 :- Introduction to basic networking tools → Wireshark, Network Miner, Datadog to show their installation and perform one exercise in each tool.

Date → 11/4/

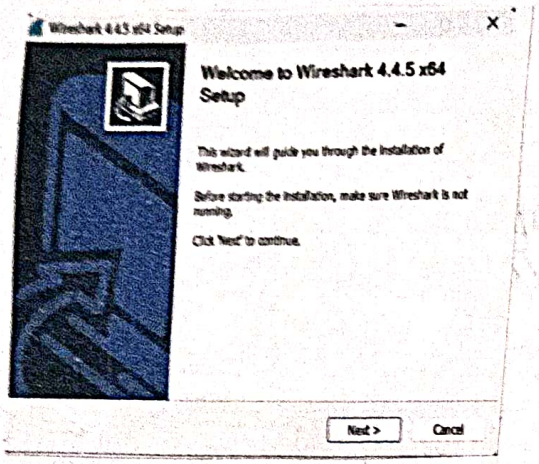

Fig. 10.1 Install setup of Wireshark

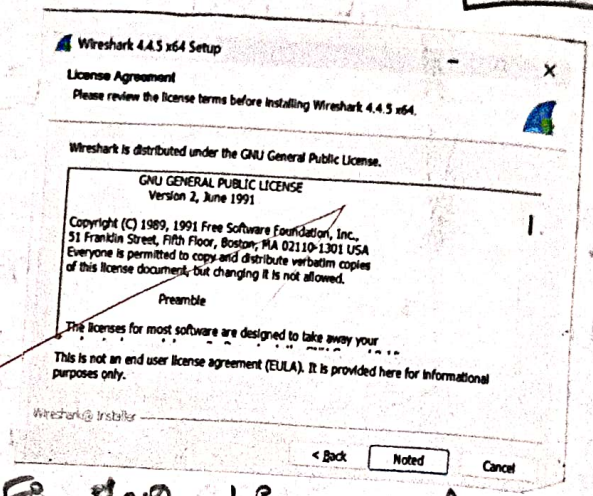

Fig. 10.2 License Agreement

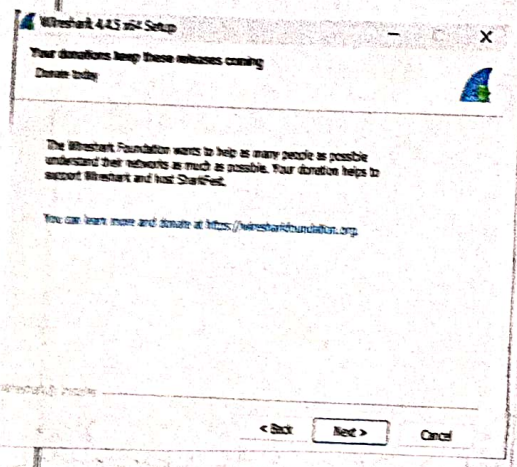

Fig. 10.3 donations for Wireshark

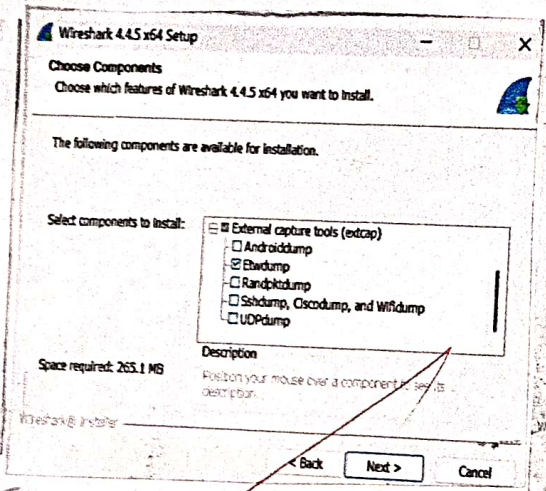

Fig. 10.4 selecting components needed

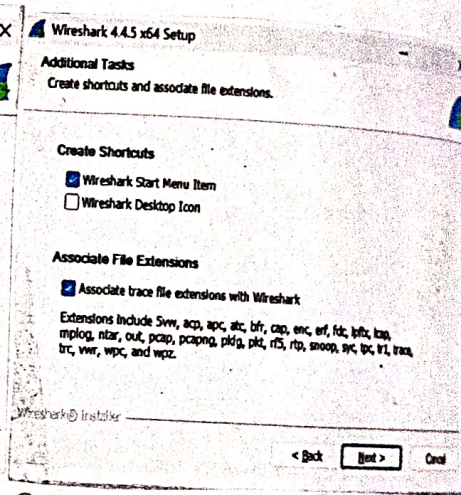

Fig. 10.5 selecting icons to be created

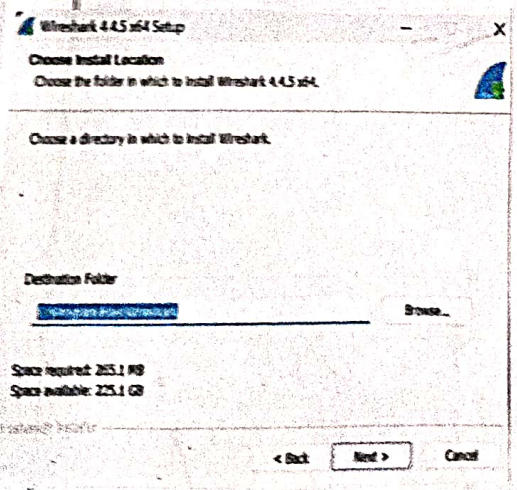

Fig. 10.6 Give path to Wireshark

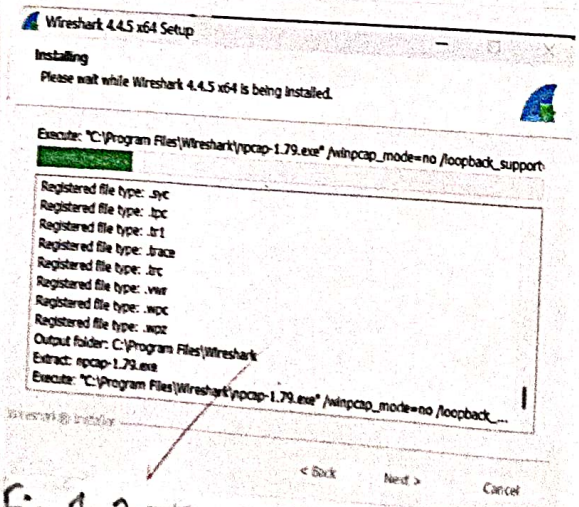

Fig. 10.7 Installation

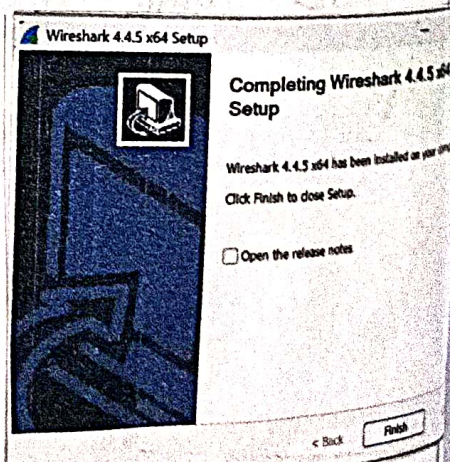

Fig. 10.8 Finished installation

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Experiment - 9

→ Aim :- Introduction to basic networking tools - Wireshark, Network Miner, Datadog to show their installation and perform one exercise in each tool.

→ Objective :- Learning to use and getting familiar with basic networking tools stated above and performing one exercise in each of them to understand how to install them and how they function.

→ Theory :- (a) Wireshark :- It has a very rich history ranging to mid - 2006. Wireshark is a network packet analyzer which prevents captured packet data in detail. It is a measuring device for examining what's happening inside a network cable. Wireshark is available for free and its open source also.

(b) Network Miner :- Open source network forensics tool that extracts files, images, emails and passwords, from captured network traffic in PCAP files. Can be used to capture live network traffic by sniffing a network interface. Primarily designed to run in Windows, but can be also used in Linux.

Teacher's Signature

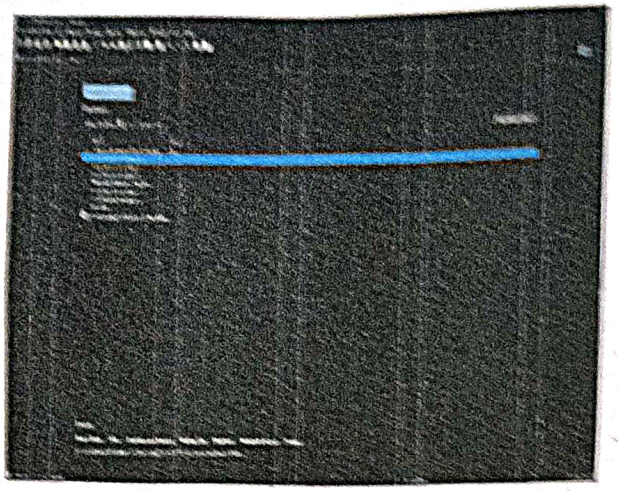

Fig. 109 Wireshark Interface

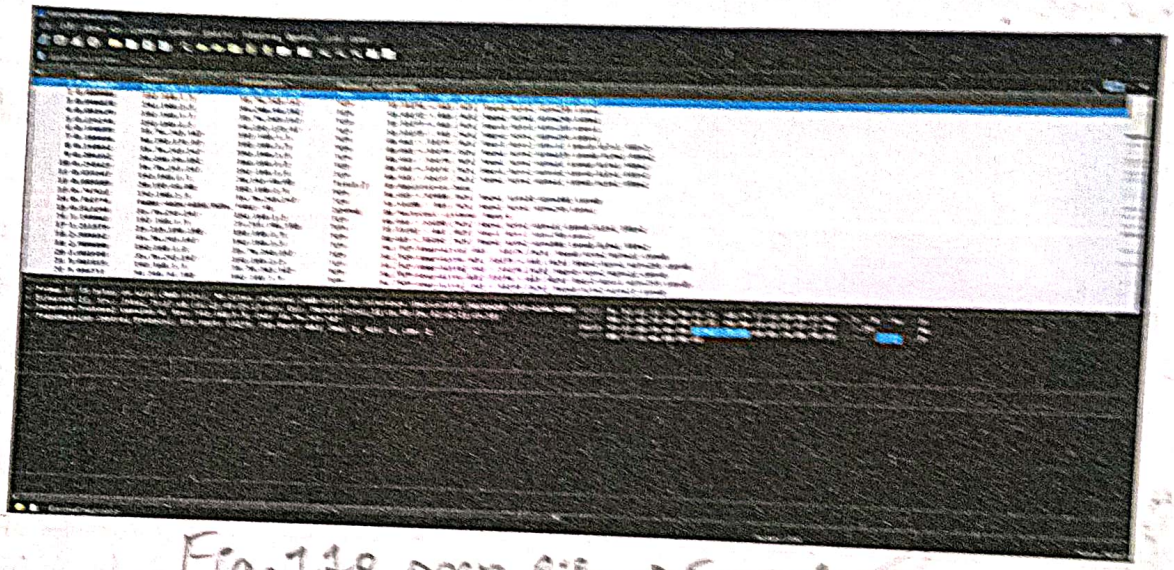

Fig. 110 open file → ExerciseOne.pcap

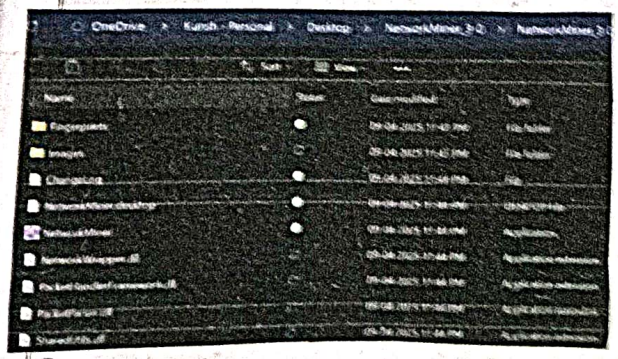

Fig. 111 Downloaded NetworkMiner

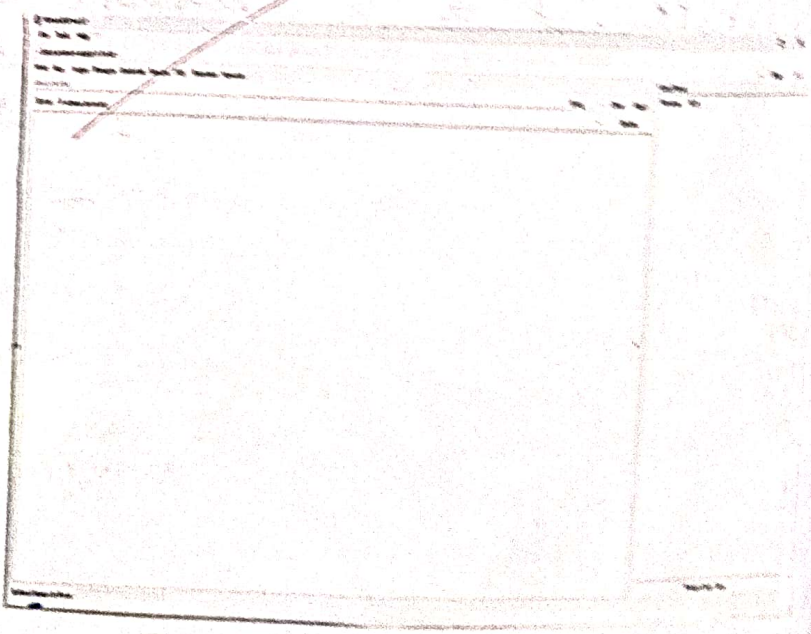

Fig. 112 NetworkMiner Interface

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(c) Datadog:- Datadog is a monitoring service for cloud scale applications, providing monitoring of servers databases tool and services through a SaaS-based data analytics platform. Its used for log-management, infrastructure monitoring and can collect data from servers, databases, containers and cloud services. With it users can monitor their network in real time and get alerts when anomalies occur. Datadog makes it easy to integrate services and was built for a cloud infrastructure monitoring service, with a dashboard, alerting and visualization of metrics.

Benefits of Wireshark:- 1) Supported protocols
2) User-friendliness 3) Low Cost/Free
4) Program support on multiple devices.
5) Operating system support on OS's like Linux and Mac.

Benefits of Network Miner:- 1) Easy to use, less processing time.
2) Can extract user credential (usernames and passwords) for supported protocols and display under "Credentials" tab.
3) User can search sniffed or stored data for keywords.
4) Allows users to insert arbitrary string or byte-patterns that shall be searched for with keyword search functionality.
5) Portable application that doesn't require any installation which means that USB version, can run directly from

Teacher's Signature

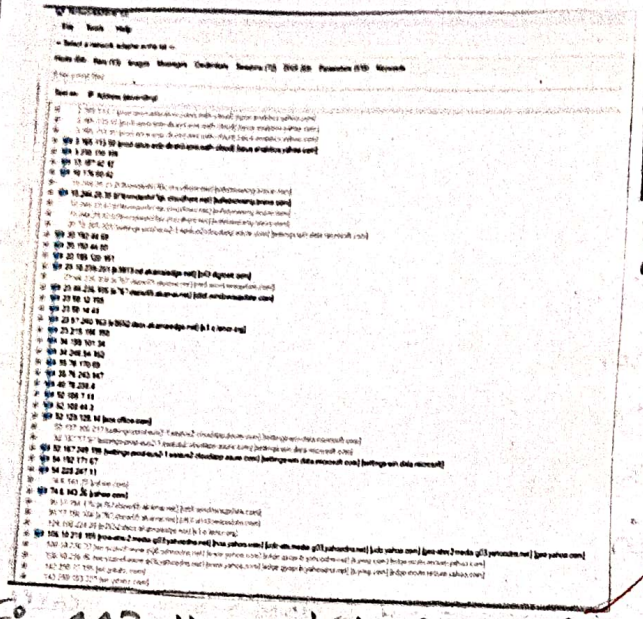

Fig. 113 Hosts tab for file exercise One .pcap

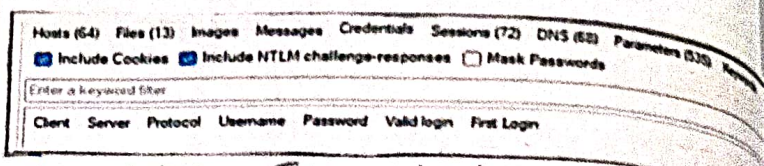

Fig. 114 Files tab

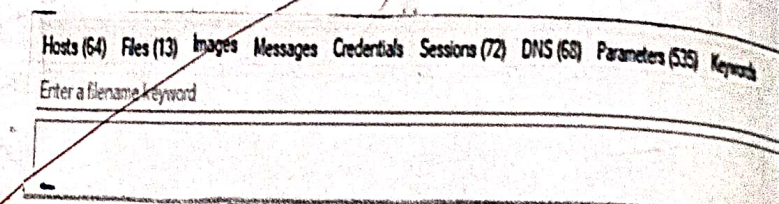

Fig. 115 Images Tab

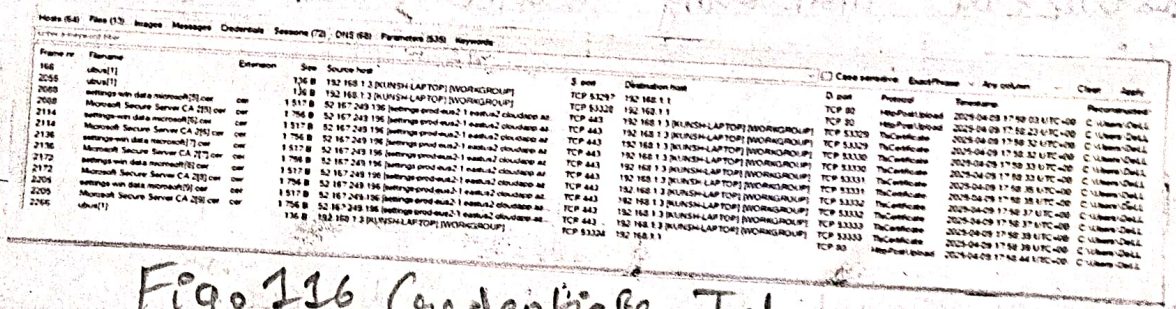

Fig. 116 Credentials Tab

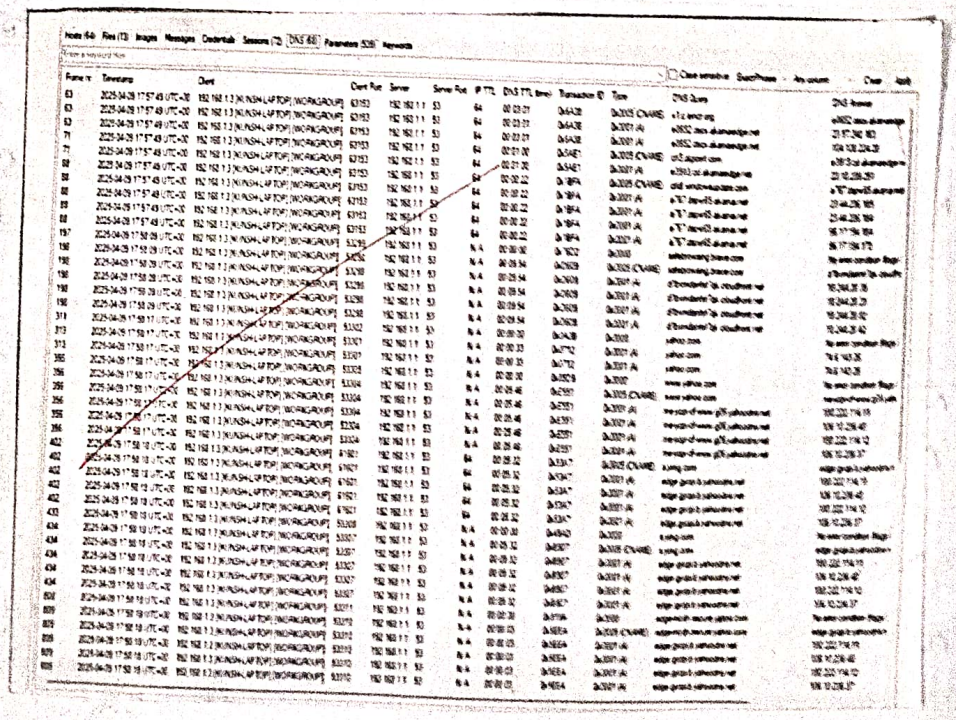

Fig. 117

DNS Tab

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USB flash drive.

→ Procedure :- (a) Installation of Wireshark :-

1) Double-click on the .exe file to begin installation and click next in the introductory window.
2) Install software. Read licensing agreement and then click, I Agree.
3) Select the components of Wireshark as shown
4) Click Next in Additional task window
5) Select location where you wish to install Wireshark and then click Next.

☆ Exercise in Wireshark :-

1) Open Wireshark and use File menu to open the file "Exercise One.pcap". If absent create the file
2) The packets of the file show an automatic conversation between the server and the user. Use the information and the packet details to answer the below questions:-

(a) IP Address of the client initiating the conversation is :-

(b) Identify the server about the packet that is about to be contacted :- User contacted www.mail.yahoo.com which is a protected/secure website, hence no common name as there is no SSL Certificate.
The destination IP's are :- 35.76.243.147, 35.72.4.84, 35.76.243.144. (These are AWS IP's being used by

Teacher's Signature

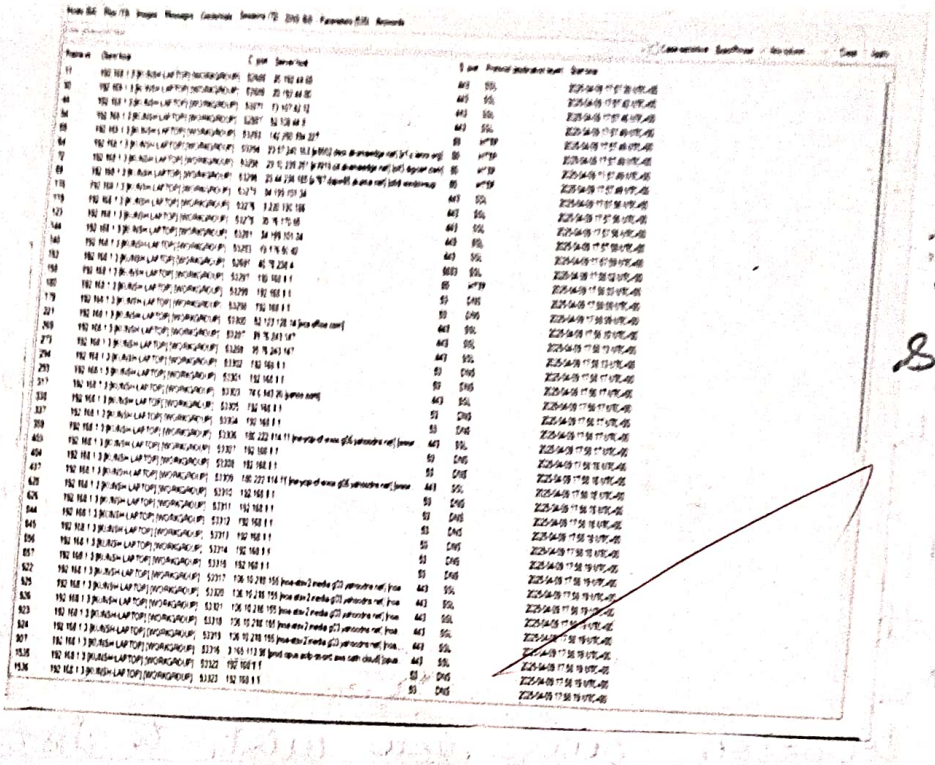

Fig. 118 Sessions Tab

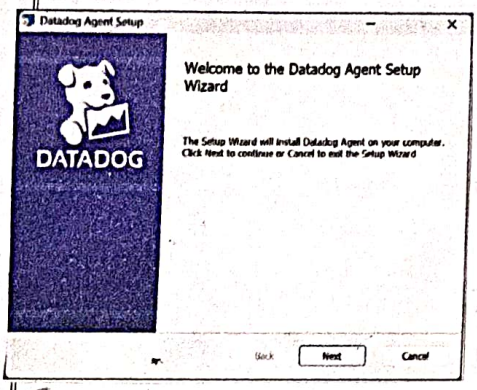

Fig. 119 Datadog installation

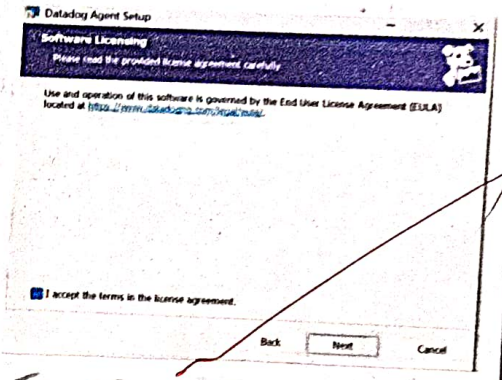

Fig. 120 License Aggreement

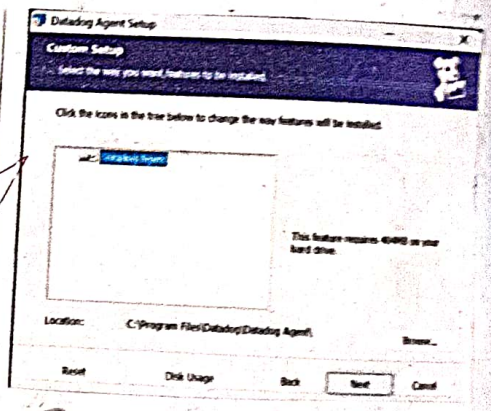

Fig. 121 Setup for Datadog Agent

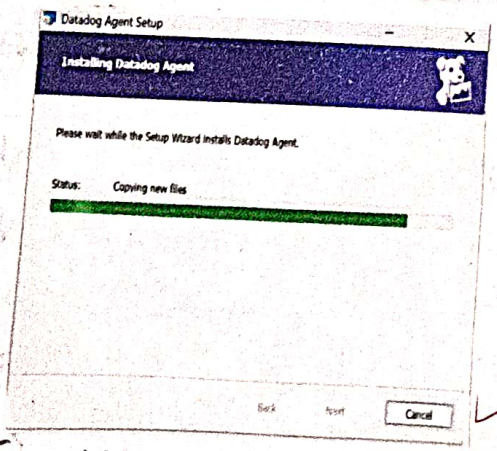

Fig. 122 Installing Datadog Agent

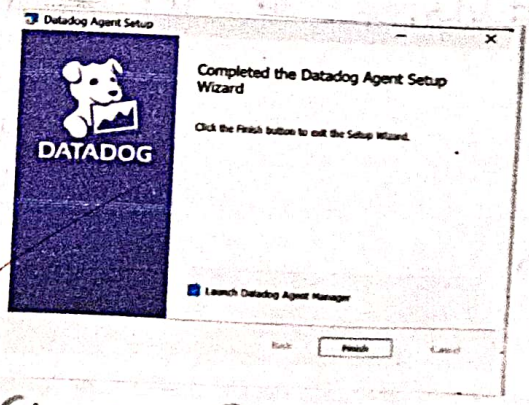

Fig. 123 Finished Datadog Agent installation.

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yahoo's servers (port 443)).

(c) Whats happening in frame 3, 4 and 5:-
Frame 3 → Client - Server → TCP/ACK
Frame 4 → Client sends first bit of TLS handshake
Frame 5 → Server ACKs the handshake message

(d) Whats happening in frame 6 and 7:-
Frame 6 → Server sends 'Server Hello' as part of TLS
Frame 7 → Client ACK's the server's Hello.

(e) Whats happening in Frame 8:- Used for flow control

(f) Whats happening in Frames 9 & 10? How is it related:-
Frame 9:- Server sends more TLS certificate data
Frame 10:- Client ACK's it.
#This is part of the continued TLS exchange. These are sequenced as 10 acknowledges 9's data.

(g) What happens in Packet 11:
Frame and Packet 11 is when the TLS handshake completes (server finishes sending data).

(h) Why the client sends a new request in Packet 12 automatically:- This is typical protocol behaviour to automatic rekey TLS session or automatic rekeying.

(i) Whats happening in Packets 13 to 22:-
In these packets the new TLS handshake completes and client sends its ACK with key exchange for parties to start secure encrypted communication.

(j) What happens in Packets 23 to 26:-
In these packets the sends a HTTPS request over the TLS handshake and server starts loading the sites data (Eg:- text, favicon).

Teacher's Signature

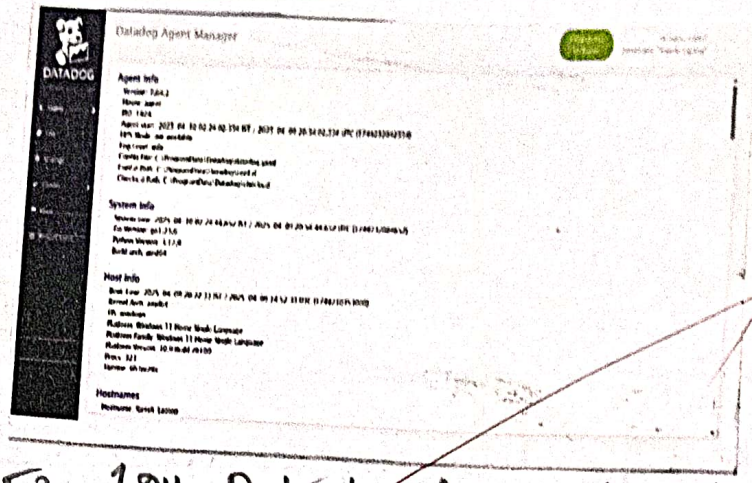

Fig. 124 Datadog Agent interface

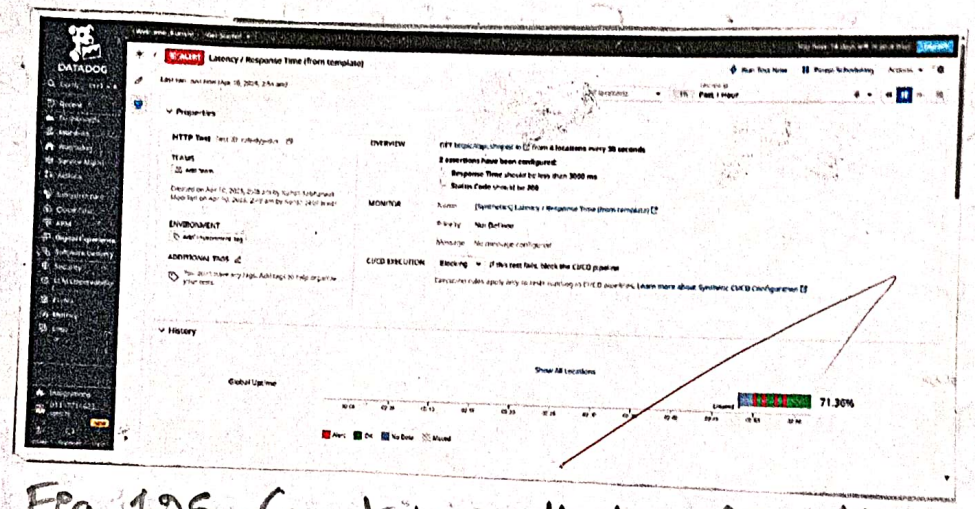

Fig. 125 Created synthetic Ping / latency Test

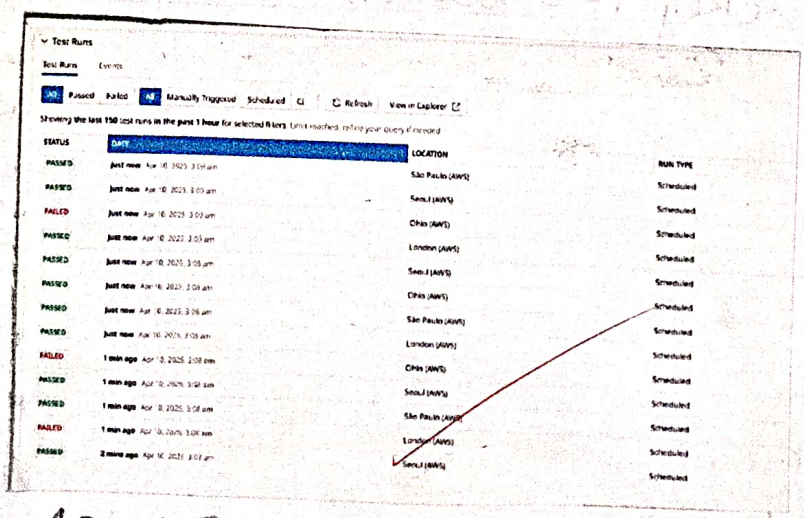

Fig. 126 Test Cases of the synthetic Test

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In one sentence, what was the user doing:-
The user was accessing a secure (HTTPS) website on the browser (www.yahoo.com).

(b) Installation of Network Miner:-

1) Download the network miner .zip file
2) Extract all its files by unzipping the folder
3) open the folder and click on the Network Miner application.

☆ Exercise on Network Miner:-

1) Launch Network Miner
2) Go to Hosts Tab after opening a file (.pcap) for analysis. (Use Exercise One - pcap → same that we used in Wireshark).
3) Extract Credentials by going to Credentials tab
4) Check the "Files" tab to see if any files were transmitted. Same in "Images" tab.
5) Use the "DNS" tab to see domain names resolved by clients and see the TCP sessions to track individual connections between hosts.
6) Identify suspicious Activities by looking for unencrypted credentials in HTTP or FTP traffic. (none found in this case).

(c) Installation of Datadog:-

Teacher's Signature

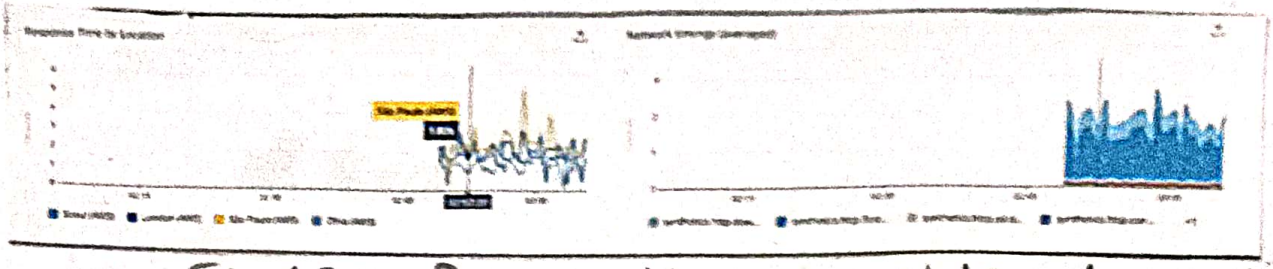


Fig. 127 Response time and Network timings g

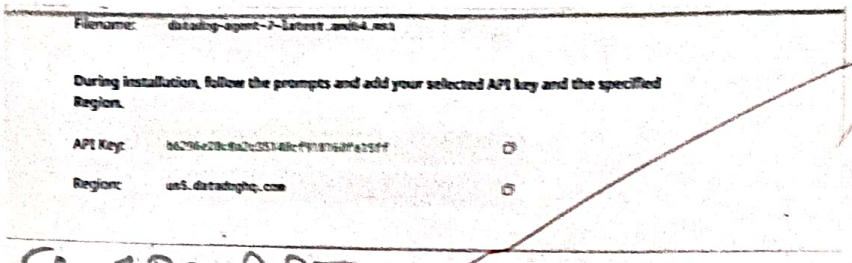
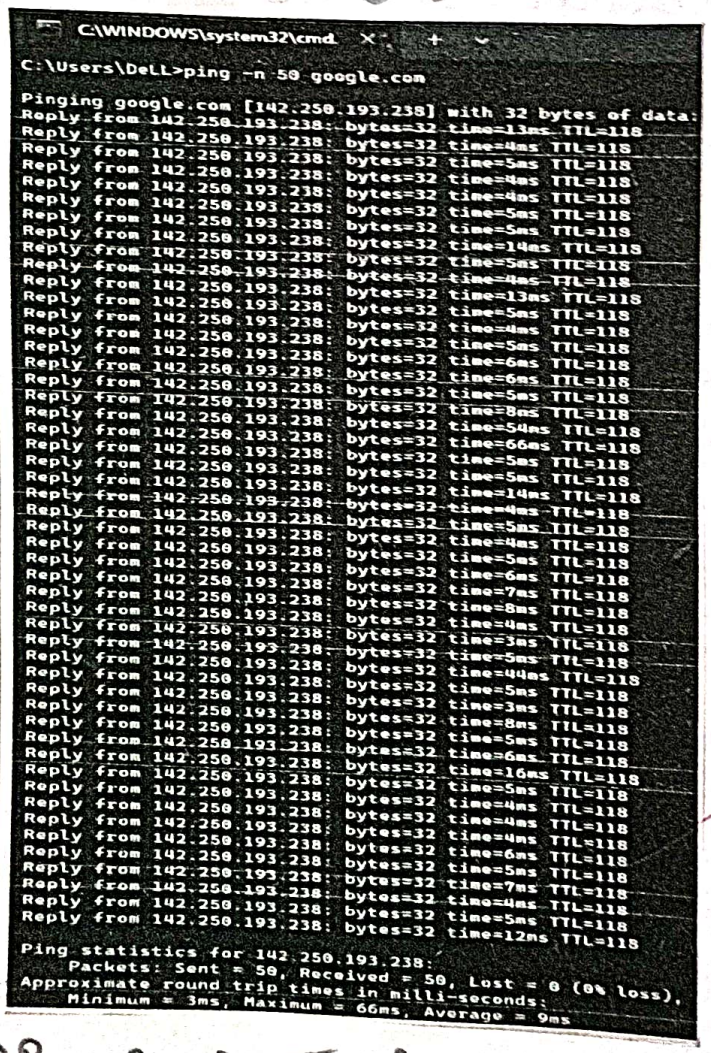


Fig. 128 API - Key for Datadog installation



```
C:\WINDOWS\system32\cmd
C:\Users\DeLL>ping -n 50 google.com

Pinging google.com [142.250.193.238] with 32 bytes of data:
Reply from 142.250.193.238: bytes=32 time=13ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=14ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=13ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=6ms TTL=118
Reply from 142.250.193.238: bytes=32 time=6ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=8ms TTL=118
Reply from 142.250.193.238: bytes=32 time=54ms TTL=118
Reply from 142.250.193.238: bytes=32 time=66ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=14ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
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Reply from 142.250.193.238: bytes=32 time=3ms TTL=118
Reply from 142.250.193.238: bytes=32 time=8ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
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Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=6ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=7ms TTL=118
Reply from 142.250.193.238: bytes=32 time=4ms TTL=118
Reply from 142.250.193.238: bytes=32 time=5ms TTL=118
Reply from 142.250.193.238: bytes=32 time=12ms TTL=118

Ping statistics for 142.250.193.238:
    Packets: Sent = 50, Received = 50, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 66ms, Average = 9ms
```

Fig. 129 Command prompt Latency and Ping Test Command

→ Result → I learnt how to install popular network tools like Wireshark, Netmask Miner and Datadog and do an exercise on each of them.

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1) Register for Datadog-Monitoring by going on their website and signing up for the 14 day free-trial by creating an account.

2) Install the Datadog Agent by downloading the Datadog Agent Installer and running the installer and entering your own generated API key and setting region as:- datadoghq.com

3) Finish the installation and launch the Datadog Agent.

4) Once the agent loads go to the website's home page to login and access all features.

☆ Exercise in Datadog:-

1) We will try to run ping test and latency test and compare to actual values from the command prompt.

2) Navigate to Monitoring tab and then Synthetic Monitoring to create a new Ping Test that pings 4 different servers at different locations every 30 secs for 1-2 mins.

3) Check for Packet Loss and latency graph under the tests tab by enabling the created test.

4) Run ping commands in CMD to compare results and check if values match.

→ Result:- I learnt how install popular networking tools like Wireshark, Network Miner and Datadog and do an exercise on each of them.

Teacher's Signature 18/4/25

Exp10:- Small office / Home office / SOHO Network Design and Implementation

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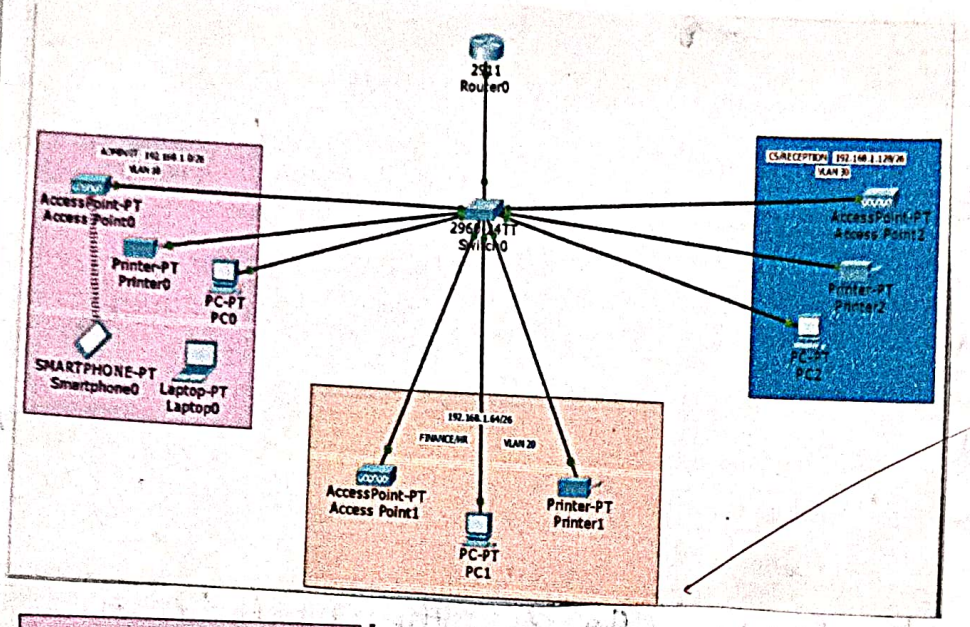

Fig. 130 Network Topology Created

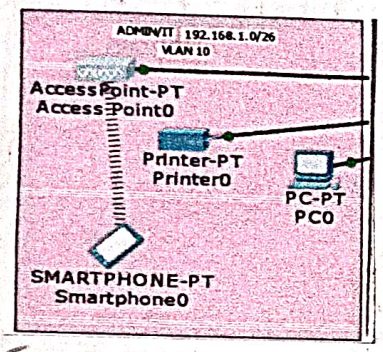

Fig. 131 VLAN 10

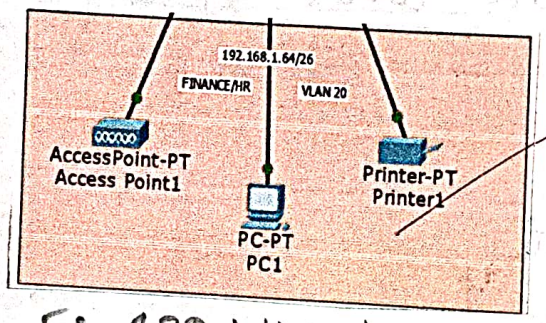

Fig. 132 VLAN 20

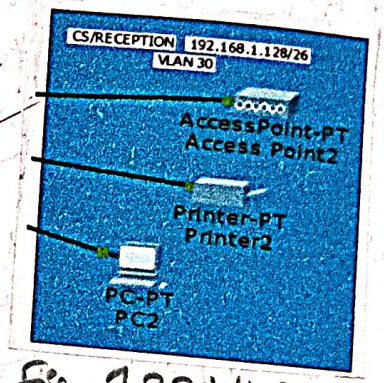

Fig. 133 VLAN 30

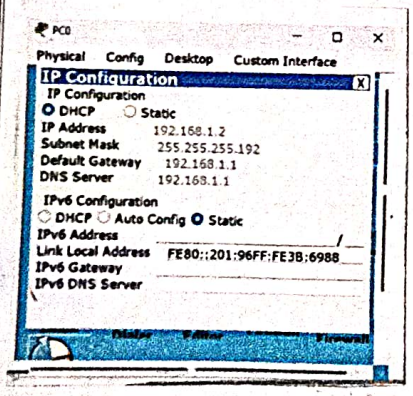

Fig. 134 PC0 IP configuration

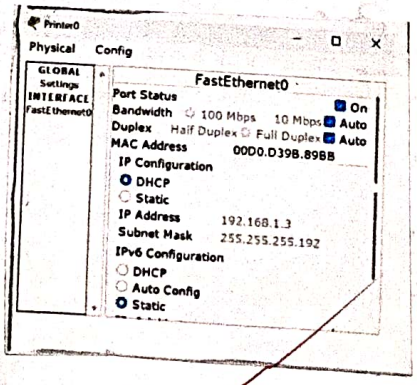

Fig. 135 Printer0 FastEthernet0 Configuration

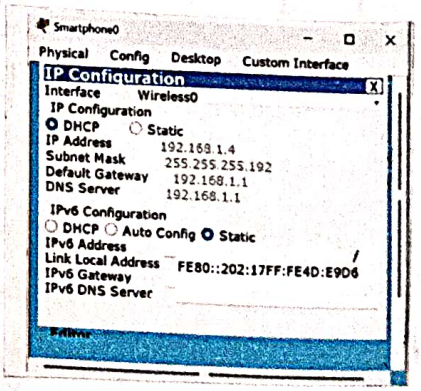

Fig. 136 Smartphone0 IP configuration

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Experiment-10

→ Aim:- Small office/Home office/SOHO Network Design and Implementation.

→ Objective:- To create small office/home office (SOHO) network design with VLAN connectivity and devices like Router, Switch, PC's, Printers and Access points in Cisco Pocket Tracer

→ Theory:- A small office home office (SOHO) network is a compact, cost-effective setup designed for limited users and devices. In this experiment, CPT is used to stimulate a SOHO networks with PC's, printers and access points. VLANs (Virtual Local Area Networks) allow you to divide one physical network (like a switch) into multiple isolated networks. Devices in different VLANs cannot communicate directly, even if they're connected to the same switch - unless allowed via a Router or Layer 3 switch giving VLANs advantages like:- Improved Security, Better Performance, Flexibility and simplified Management. In this experiment, VLANs are configured to logically separate departments of functions, enhancing security and traffic management. This setup enables

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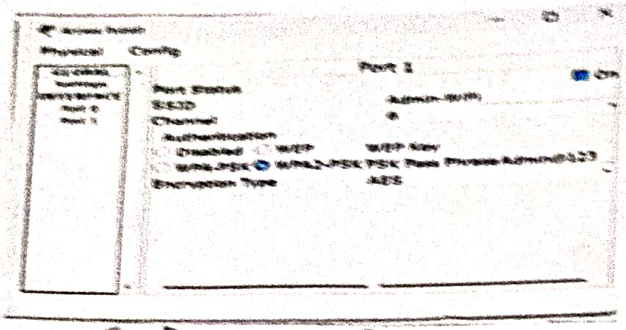

Fig. 137 Port 1 Access point configuration

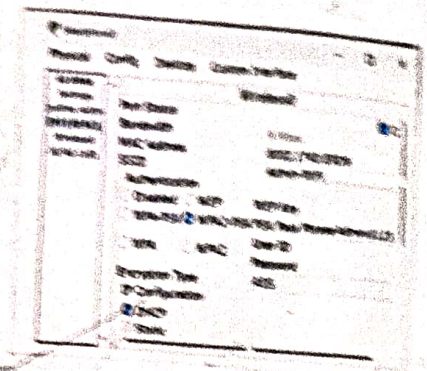

Fig. 138 Smartphone Wireless

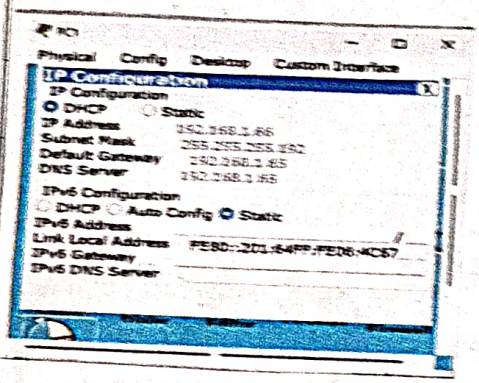

Fig. 139 PC 1 IP configuration

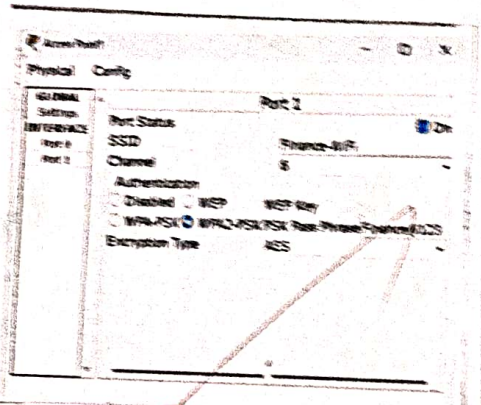

Fig. 140 Port 1 Access point Configuration

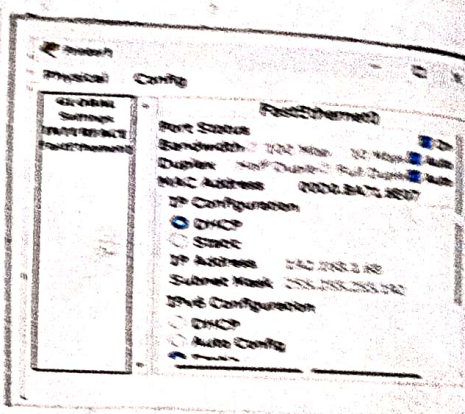

Fig. 141 Printer 1 Fast Ethernet Configuration

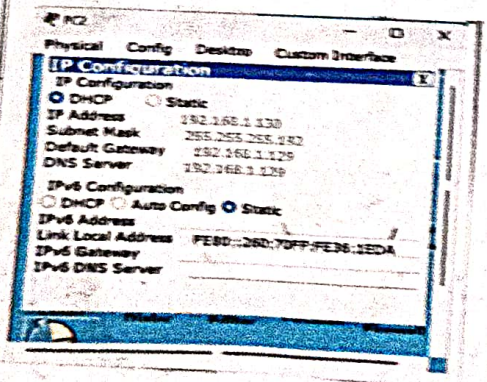

Fig. 142 PC2 IP Configuration

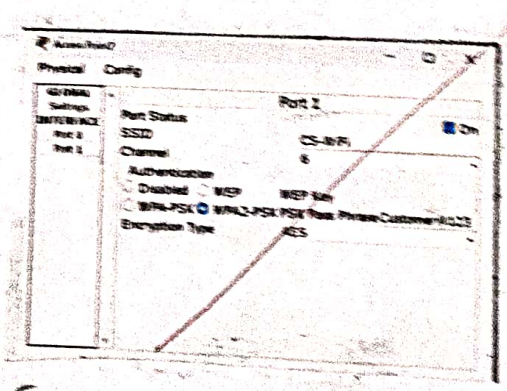

Fig. 143 Access point 2 Port 1 Configuration

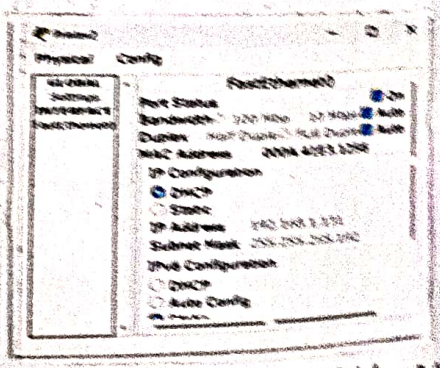

Fig. 144 Fast Ether Printer 2 Configuration

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efficient Communication of both devices (wired or wireless), device sharing and internet access all across the network.

Procedure:-

1) Start by creating 3 main sectors in which we will be implementing VLANs. Name them as ADMIN/IT, FINANCE/HR and CS (Customer service)/Reception.

2) Arrange the PC's, Printers and Access Points of each sector as shown in the topology below and connet them to a switch and router.

3) Once the above topology is created, we start by assigning names to VLANs of each sector VLAN10, VLAN20, VLAN30.

4) Now since we have 3 subnets:-
along with base network being 192.168.1.0 and therefore, we have:- Class C generic Subnet Mask
= 255.255.255.0
= 11111111.11111111.11111111.00000000
Hence on borrowing 2 bits (as no. of subnets = 2^n = 3
making n = 2 (approx.)).
New subnet mask = 11111111.11111111.11111111.11000000
= 255.255.255.192

Also block = 64

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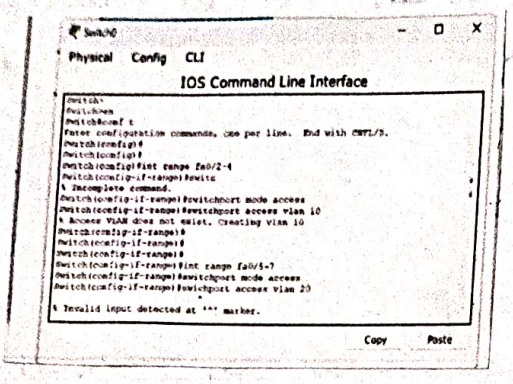
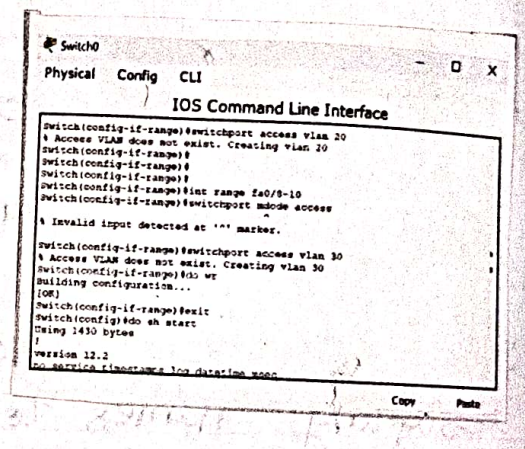


Fig. 145 Switch0 CLI commands

Fig. 146 Switch0 CLI commands



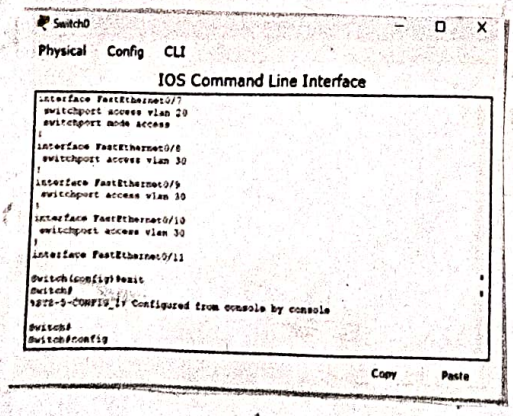


Fig. 147 Switch0 CLI commands

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Hence, we get:-

(a) 1st Subnet →

Network ID :- 192.168.1.0

Broad Cast ID :- 192.168.1.63

Host Range :- 192.168.1.1 to 192.168.1.62

(b) 2nd Subnet →

Network ID :- 192.168.1.64

Broadcast ID :- 192.168.1.127

Host Range :- 192.168.1.65 to 192.168.1.126

(c) 3rd Subnet :-

Network ID :- 192.168.1.128

Broadcast ID :- 192.168.1.191

Host Range :- 192.168.1.129 to 192.168.1.190

Now we assign 192.168.1.0/26 to VLAN 10, 192.168.1.64/26 to VLAN20 and 192.168.1.128/26 to VLAN30.

5) Now in the switch, in CLI, run the below commands:-

(a) en

(b) conf t

(c) int range fa0/2-4

(d) switchport mode access

(e) switch port access VLAN10

Repeat the steps for VLAN20 and 30 with fa0/5-7 and fa0/8-10 respectively.

6) Now we configure access points of each sector one by one by going to the config tab in the access point device and in port 1, assign respective port status and

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Hence, we get:-

(a) 1st Subnet →

Network ID :- 192.168.1.0

Broad Cast ID :- 192.168.1.63

Host Range :- 192.168.1.1 to 192.168.1.62

(b) 2nd Subnet →

Network ID :- 192.168.1.64

Broadcast ID :- 192.168.1.127

Host Range :- 192.168.1.65 to 192.168.1.126

(c) 3rd Subnet :-

Network ID :- 192.168.1.128

Broadcast ID :- 192.168.1.191

Host Range :- 192.168.1.129 to 192.168.1.190

Now we assign 192.168.1.0/26 to VLAN 10, 192.168.1.64/26 to VLAN20 and 192.168.1.128/26 to VLAN30.

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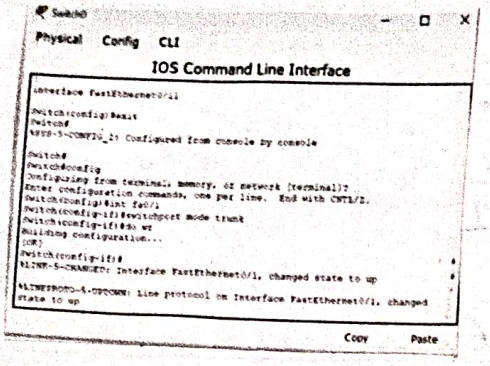

Fig. 148 Switch 0 CLI commands

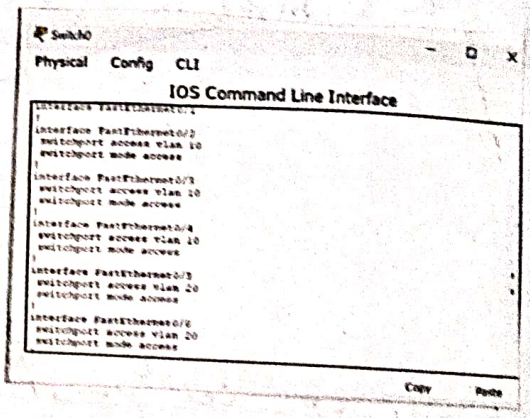

Fig. 149 Switch 0 CLI commands

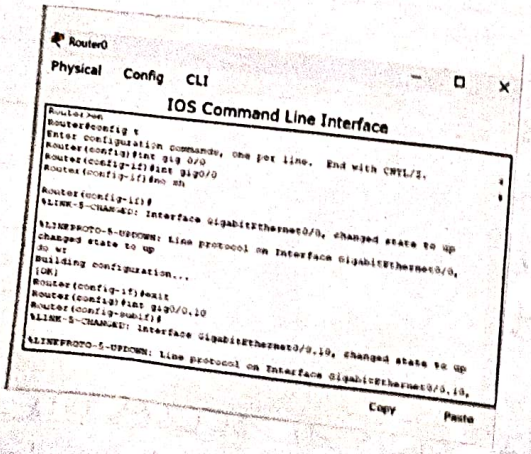

Fig. 150 Router 0 CLI comman

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Switch authentication to WPA2-PSK and set up appropriate password.

7) Again, in the switch run the below commands:-
(a) int fa0/1
(b) switchport mode trunk
(c) do wr

8) Now we move to the routers commands under the CLI tab. Execute:-
(a) en
(b) config
(c) Int gig 0/0
(d) No sh
(e) do wr
(f) exit
(g) int gig 0/0.10
(h) encapsulation dot1Q 10
(i) IP addresses 192.168.1.1 255.255.255.192
(j) exit

Run the commands from (g) to (j) each time changing the VLAN number (int gig0/0.20 and int gig0/0.30 with encapsulation dot1Q 20 and encapsulation dot1Q 30) and their respective ip addresses (beginning host range) as discussed in step 4.

9) Also enable DHCP by executing below commands in routers CLI:-
(a) service dhcp

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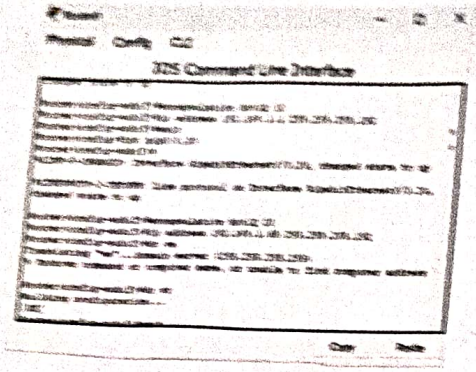

Fig. 151 Router 0 CLI commands

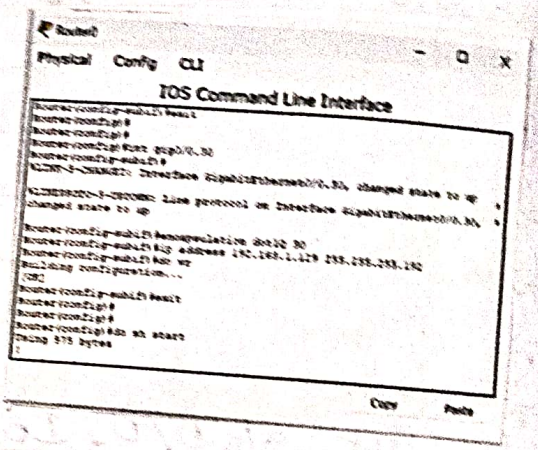

Fig. 152 Router 0 CLI Commands

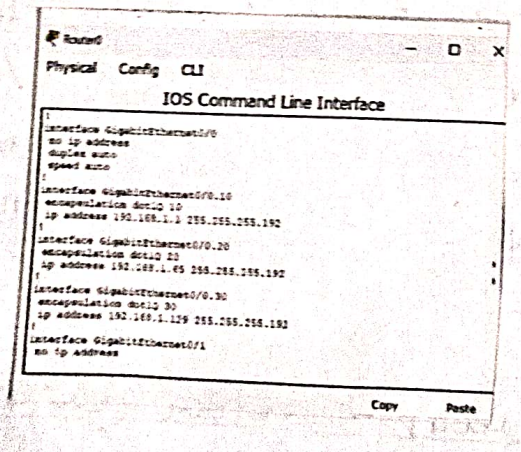

Fig. 153 Router 0 CLI commands

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(b) Ip dhcp pool Admin-Pool
(c) Network 192.168.1.0 255.255.255.192
(d) default router 192.168.1.1
(e) dns-server 192.168.1.1
(f) domain name admin.com
(g) exit

This command automatically assigns IP addresses to each device of VLAN 10 (ADMIN/IT).
Reapeating the steps, create FINANCE-POOL and CS-POOL with respective VLANs and default router, dns-server (beginning host range) from step 4.

10) Now if visit every device of each sector and switch them to DHCP in desktop → IP configuration (for PC's) and FastEthernet 0/0 (for printers) we can see they automatically get assigned the IPs.

11) In sector 1/VLAN 10, we have also connected a wireless device (smartphone) to demonstrate wireless connection. To connect we execute:-
(a) Go to Config → Wireless 0
(b) Enter SSID as Admin-WiFi and change authentication to WPA2-PSK and enter password Admin@123.
We may also see the IP address given to the smartphone in IP configuration.

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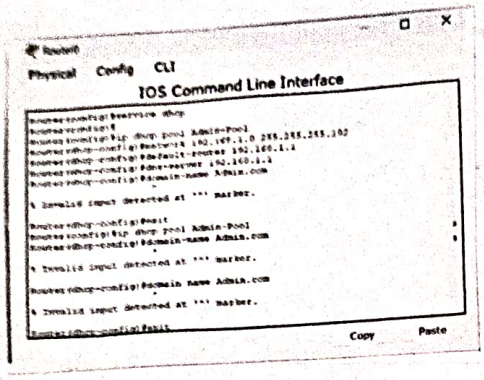

Fig. 154 Router 0 CLI commands

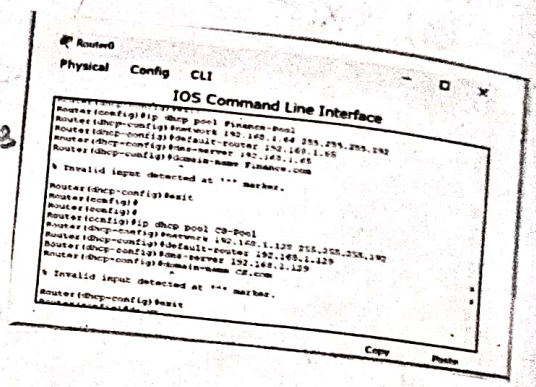

Fig. 155 Router 0 CLI commands

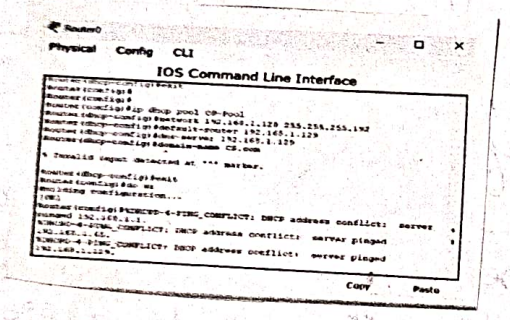

Fig. 156 Router 0 CLI commands

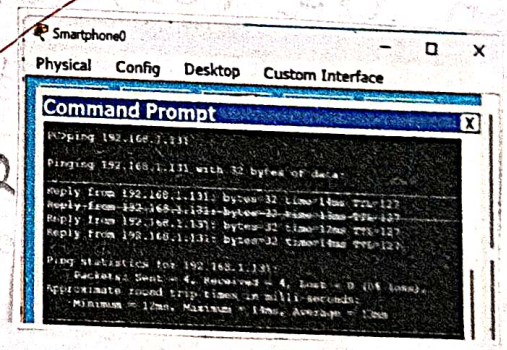

Fig. 157 Smartphone 0 to printer 2 ping test.

→ Result → I learnt how to implement VLAN in CPT to make multiple VLAN's communicate with each other both wired and wirelessly in a small office / home office (SOHO) network design.

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12) In order to check all connections are working we may ping one device from the other. (Lets say smartphone in sector 1 to printer in sector 3.)

→ Conclusion:- Through this experiment we understood how VLAN's work and communicate with each other and how IP addresses are assigned using DHCP service along with the topology that can be created in order to implement the SOHO Network design.

→ Result:- I learnt how to implement VLAN in CPT to make multiple VLANs communicate with each other both wired and wirelessly in a small office / home office (SOHO) network design.

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