Date: 20/07/2025

Lab Practical #01:

Study of basic networking commands and IP configuration.

Practical Assignment #01:

1. Perform and explain various networking commands listed below:
   i. ipconfig
   ii. ping
   iii. getmac
   iv. systeminfo
   v. traceroute / tracert
   vi. netstat
   vii. nslookup
   viii. hostname
   ix. pathping
   x. arp

1. ipconfig

Description:

No.	Option	Description
1	ipconfig	Displays basic IP configuration for all adapters.
2	ipconfig /all	Shows detailed IP settings, including MAC address and DHCP info.
3	ipconfig /release	Releases current IP address from DHCP server.
4	ipconfig /renew	Renews the IP address from DHCP server.
5	ipconfig /flushdns	Clears DNS cache on your system.

Implementation:

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1 ipconfig

```
C:\Users\Nikhil>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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   IPv4 Address. . . . . . . . . . . : 192.168.189.140
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63

C:\Users\Nikhil>
```

2 ipconfig /all

```
C:\Users\Nikhil>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-A45M567
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Mixed
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : F0-77-C3-F8-B3-B8
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : F2-77-C3-F8-B3-B7
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) Wireless-AC 9560
   Physical Address. . . . . . . . . : F0-77-C3-F8-B3-B7
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd(Preferred)
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0(Preferred)
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.189.140(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 23 July 2025 5.01.57 PM
   Lease Expires . . . . . . . . . . : 23 July 2025 6.01.56 PM
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63
   DHCP Server . . . . . . . . . . . : 192.168.189.63
   DHCPv6 IAID . . . . . . . . . . . : 116422595
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2C-26-48-35-F0-77-C3-F8-B3-B7
   DNS Servers . . . . . . . . . . . : 192.168.189.63
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

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3 ipconfig /releasell

```
C:\Users\Nikhil>ipconfig /release

Windows IP Configuration

No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7

C:\Users\Nikhil>
```

4 ipconfig /renew

```
C:\Users\Nikhil>ipconfig /renew

Windows IP Configuration

No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   IPv4 Address. . . . . . . . . . . : 192.168.189.140
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63

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```

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5. ipconfig /flushdns

```
C:\Users\Nikhil>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\Nikhil>
```

2. ping

Description:

No.	Option	Description
1	ping	Sends ICMP Echo Request to test connectivity.
2	ping [hostname]	Checks reachability of a host (e.g., ping google.com).
3	ping [IP]	Tests a specific IP (e.g., ping 8.8.8.8).
4	ping -n [count]	Sends a specific number of echo requests (e.g., ping -n 5 google.com)
5	ping -t [host]	Pings the target continuously until stopped.

Implementation:

1. ping google.com

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

Pinging google.com [2404:6800:4009:82b::200e] with 32 bytes of data:
Reply from 2404:6800:4009:82b::200e: time=96ms
Reply from 2404:6800:4009:82b::200e: time=108ms
Reply from 2404:6800:4009:82b::200e: time=125ms
Reply from 2404:6800:4009:82b::200e: time=93ms

Ping statistics for 2404:6800:4009:82b::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 93ms, Maximum = 125ms, Average = 105ms

C:\Users\Nikhil>
```

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2. ping 8.8.8.8

```
C:\Users\Nikhil>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=111ms TTL=113
Reply from 8.8.8.8: bytes=32 time=81ms TTL=113
Reply from 8.8.8.8: bytes=32 time=75ms TTL=113
Reply from 8.8.8.8: bytes=32 time=76ms TTL=113

Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 75ms, Maximum = 111ms, Average = 85ms

C:\Users\Nikhil>
```

3. ping -n 5 google.com

```
C:\Users\Nikhil>ping -n 5 google.com

Pinging google.com [2404:6800:4009:828::200e] with 32 bytes of data:
Reply from 2404:6800:4009:828::200e: time=62ms
Reply from 2404:6800:4009:828::200e: time=73ms
Reply from 2404:6800:4009:828::200e: time=81ms
Reply from 2404:6800:4009:828::200e: time=70ms
Reply from 2404:6800:4009:828::200e: time=62ms

Ping statistics for 2404:6800:4009:828::200e:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 62ms, Maximum = 81ms, Average = 69ms

C:\Users\Nikhil>
```

4. ping -t 8.8.8.8

```
C:\Users\Nikhil>ping -t 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=119ms TTL=113
Reply from 8.8.8.8: bytes=32 time=82ms TTL=113
Reply from 8.8.8.8: bytes=32 time=74ms TTL=113
Reply from 8.8.8.8: bytes=32 time=68ms TTL=113
Reply from 8.8.8.8: bytes=32 time=72ms TTL=113
Reply from 8.8.8.8: bytes=32 time=73ms TTL=113
Reply from 8.8.8.8: bytes=32 time=86ms TTL=113
Reply from 8.8.8.8: bytes=32 time=72ms TTL=113
```

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3. getmac

Description:

No.	Option	Description
1	getmac	Displays MAC address of the computer.
2	getmac /v	Shows detailed output with connection names.
3	getmac /fo list	Outputs MAC in list format.

Implementation:

1. getmac

```
C:\Users\Nikhil>getmac

Physical Address    Transport Name
=================== ============================================================
F0-77-C3-F8-B3-B7   \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

2. getmac /v

```
C:\Users\Nikhil>getmac /v

Connection Name Network Adapter Physical Address    Transport Name
=============== =============== =================== ============================================================
Wi-Fi           Intel(R) Wirele F0-77-C3-F8-B3-B7   \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

3. getmac /fo list

```
C:\Users\Nikhil>getmac /fo list

Physical Address: F0-77-C3-F8-B3-B7
Transport Name:   \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

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4. systeminfo

Description:

No.	Option	Description
1	Systeminfo	Displays detailed system configuration.
2	`systeminfo “Host“	findstr "Host"`
3	`systeminfo “OS“	findstr "OS"`

Implementation:

1. systeminfo

```
C:\Users\Nikhil>systeminfo

Host Name:                 DESKTOP-A45M567
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:                10.0.22631 N/A Build 22631
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          Nikhil
Registered Organization:
Product ID:                00327-36297-42854-AAOEM
Original Install Date:     22-06-2023, 11.40.33 PM
System Boot Time:          23-07-2025, 4.58.45 PM
System Manufacturer:       LENOVO
System Model:              81WB
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 142 Stepping 12 GenuineIntel ~2093 Mhz
BIOS Version:              LENOVO DXCN45WW, 13-06-2023
Windows Directory:         C:\Windows
System Directory:          C:\Windows\system32
Boot Device:               \Device\HarddiskVolume1
System Locale:             en-us;English (United States)
Input Locale:              00004009
Time Zone:                 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:     8,026 MB
Available Physical Memory: 2,691 MB
Virtual Memory: Max Size:  13,658 MB
Virtual Memory: Available: 6,925 MB
Virtual Memory: In Use:    6,733 MB
Page File Location(s):     D:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\DESKTOP-A45M567[redacted]
Hotfix(s):                 5 Hotfix(s) Installed.
                           [01]: KB5054980
                           [02]: KB5012170
                           [03]: KB5027397
                           [04]: KB5058405
                           [05]: KB5058528
Network Card(s):           1 NIC(s) Installed.
                           [01]: Intel(R) Wireless-AC 9560
                                 Connection Name: Wi-Fi
                                 DHCP Enabled:    Yes
                                 DHCP Server:     192.168.189.63
                                 IP address(es)
                                 [01]: 192.168.189.140
                                 [02]: fe80::38a8:deff:cc7a:4f46
                                 [03]: 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
                                 [04]: 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
Hyper-V Requirements:      A hypervisor has been detected. Features required for Hyper-V will not be displayed.
```

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2 /3 .

systeminfo | findstr "Host"

systeminfo | findstr "OS"

```
C:\Users\Nikhil>systeminfo | findstr "Host"
Host Name:                 DESKTOP-A45M567

C:\Users\Nikhil>systeminfo | findstr "OS"
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:                10.0.22631 N/A Build 22631
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
BIOS Version:              LENOVO DXCN45WW, 13-06-2023

C:\Users\Nikhil>
```

5. traceroute / tracert

Description:

No.	Option	Description
1	tracert google.com	Shows route taken to reach google.com.
2	tracert -d	Doesn't resolve hostnames (shows IPs only).
3	tracert -h 5	Limits max number of hops to 5.

Implementation:

Date: 20/07/2025

1. tracert google.com

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

Tracing route to google.com [2404:6800:4009:82b::200e]
over a maximum of 30 hops:

  1     3 ms     2 ms     3 ms  2409:40c1:3033:cdc9::b7
  2    41 ms    56 ms    39 ms  2405:200:5210:5:3924:110:3:206
  3    57 ms    49 ms    48 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6   987 ms   932 ms   508 ms  2405:200:801:2e00::84
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9   169 ms   143 ms   574 ms  2404:6800:81e1:2c0::1
 10   110 ms   122 ms   138 ms  2404:6800:81e1:2c0::1
 11   123 ms    90 ms   107 ms  2404:6800:81e1:2c0::1
 12   103 ms    99 ms    99 ms  2001:4860:0:1::5e60
 13   105 ms    97 ms   100 ms  2001:4860:0:1::77ae
 14   130 ms    98 ms   109 ms  2001:4860::c:4004:172c
 15   121 ms   123 ms   119 ms  2001:4860::9:4000:d773
 16    92 ms   110 ms    98 ms  2001:4860:0:1::3129
 17   110 ms   129 ms   107 ms  bom12s18-in-x0e.1e100.net [2404:6800:4009:82b::200e]

Trace complete.

C:\Users\Nikhil>
```

2. tracert -d google.com

```
C:\Users\Nikhil>tracert -d google.com

Tracing route to google.com [2404:6800:4009:82f::200e]
over a maximum of 30 hops:

  1     4 ms     2 ms     2 ms  2409:40c1:3033:cdc9::b7
  2    86 ms    53 ms    52 ms  2405:200:5210:5:3924:110:3:206
  3    58 ms    40 ms    48 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6   165 ms   100 ms   107 ms  2405:200:801:2e00::86
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9    75 ms    55 ms    77 ms  2404:6800:8281:c0::1
 10    86 ms    54 ms    78 ms  2404:6800:8281:c0::1
 11    87 ms    57 ms    58 ms  2001:4860:0:1::7ba6
 12   149 ms    68 ms    78 ms  2001:4860:0:1::87b2
 13    76 ms    78 ms   140 ms  2001:4860:0:1::8769
 14    75 ms    72 ms    81 ms  2001:4860:0:1::3ff
 15    80 ms    57 ms    59 ms  2404:6800:4009:82f::200e

Trace complete.

C:\Users\Nikhil>
```

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3. tracert -d google.com

```
C:\Users\Nikhil>tracert -h 5 google.com

Tracing route to google.com [2404:6800:4009:810::200e]
over a maximum of 5 hops:

  1     5 ms     4 ms     2 ms  2409:40c1:3033:cdc9::b7
  2    65 ms    74 ms    98 ms  2405:200:5210:5:3924:110:3:206
  3    83 ms    67 ms    82 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.

Trace complete.

C:\Users\Nikhil>
```

6. netstat

Description:

No.	Option	Description
1	netstat	Shows route taken to reach google.com.
2	netstat -a	Doesn't resolve hostnames (shows IPs only).
3	netstat -n	Limits max number of hops to 5.

Implementation:

1. netstat

```
C:\Users\Nikhil>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:61100        DESKTOP-A45M567:49350  SYN_SENT
  TCP    192.168.189.140:61037  whatsapp-cdn-shv-01-pnq1:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  relay-800db3bd:https   ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  sf-in-f188:5228        ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  g2600-140f-7200-003c-0000-0000-17d4-00c5:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60970  bom12s13-in-x03:https  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61093  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61094  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:https  ESTABLISHED

C:\Users\Nikhil>
```

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2. netstat -a

```
C:\Users\Nikhil>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:80             DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:135            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:443            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:445            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:3306           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:5040           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:7070           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49664          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49665          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49666          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49667          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49668          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49670          DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:1001         DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:27017        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:28385        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:28390        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:49351        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:49677        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:61129        DESKTOP-A45M567:49350  SYN_SENT
  TCP    192.168.189.140:139    DESKTOP-A45M567:0      LISTENING
  TCP    192.168.189.140:61109  whatsapp-cdn-shv-04-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61110  whatsapp-cdn-shv-02-bom1:https  ESTABLISHED
  TCP    192.168.189.140:61111  whatsapp-cdn-shv-01-pnq1:https  ESTABLISHED
  TCP    192.168.189.140:61112  whatsapp-cdn-shv-01-bom1:https  ESTABLISHED
  TCP    192.168.189.140:61113  whatsapp-cdn-shv-02-pnq1:https  ESTABLISHED
  TCP    192.168.189.140:61114  whatsapp-cdn-shv-02-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61115  whatsapp-cdn-shv-01-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61116  whatsapp-cdn-shv-01-hyd1:https  ESTABLISHED
  TCP    192.168.189.140:61117  whatsapp-cdn-shv-03-bom2:https  ESTABLISHED
  TCP    [::]:80                DESKTOP-A45M567:0      LISTENING
  TCP    [::]:135               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:443               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:445               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:3306              DESKTOP-A45M567:0      LISTENING
  TCP    [::]:7070              DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49664             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49665             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49666             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49667             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49668             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49670             DESKTOP-A45M567:0      LISTENING
  TCP    [::1]:49669            DESKTOP-A45M567:0      LISTENING
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  relay-800db3bd:https   ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  sf-in-f188:5228        ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  g2600-140f-7200-003c-0000-0000-17d4-00c5:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61093  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61094  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61103  pnbomb-bk-in-x04:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61108  whatsapp-chatd-edge6-shv-01-hyd1:http  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61122  [2603:1046:1406::5]:https  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61123  [2603:1046:1406::5]:https  TIME_WAIT
  UDP    0.0.0.0:5050           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5355           *:*
  UDP    0.0.0.0:50001          *:*
  UDP    0.0.0.0:52753          *:*
  UDP    127.0.0.1:1900         *:*
  UDP    127.0.0.1:49664        127.0.0.1:49664
  UDP    127.0.0.1:61591        *:*
  UDP    192.168.189.140:137    *:*
  UDP    192.168.189.140:138    *:*
  UDP    192.168.189.140:1900   *:*
  UDP    192.168.189.140:61590  *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5355              *:*
```

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3. netstat -n

```
C:\Users\Nikhil>netstat -n

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:61145        127.0.0.1:49350        SYN_SENT
  TCP    192.168.189.140:61111  157.240.242.60:443     ESTABLISHED
  TCP    192.168.189.140:61115  163.70.143.60:443      TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  [64:ff9b::9471:146d]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  [2404:6800:4003:c03::bc]:5228  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  [2600:140f:7200:3c::17d4:c5]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61108  [2a03:2880:f285:c8:face:b00c:0:7260]:80  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61122  [2603:1046:1406::5]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61123  [2603:1046:1406::5]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61132  [2a03:2880:f285:c8:face:b00c:0:7260]:80  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61141  [2404:6800:4009:80d::2004]:443  ESTABLISHED

C:\Users\Nikhil>
```

7. nslookup

Description:

No.	Option	Description
1	nslookup	Starts interactive mode for DNS queries..
2	nslookup google.com	Queries DNS for IP of google.com.
3	nslookup -type=MX gmail.com	Queries mail servers of gmail.com.

Implementation:

1. nslookup

```
C:\Users\Nikhil>nslookup
DNS request timed out.
    timeout was 2 seconds.
Default Server:  UnKnown
Address:  192.168.189.63
```

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2. nslookup

```
C:\Users\Nikhil>nslookup google.com
Server:  UnKnown
Address:  192.168.189.63

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4009:810::200e
          142.250.70.46


C:\Users\Nikhil>
```

3. nslookup -type=MX gmail.com

```
C:\Users\Nikhil>nslookup -type=MX gmail.com
Server:  UnKnown
Address:  192.168.189.63

Non-authoritative answer:
gmail.com       MX preference = 5, mail exchanger = gmail-smtp-in.l.google.com
gmail.com       MX preference = 10, mail exchanger = alt1.gmail-smtp-in.l.google.com
gmail.com       MX preference = 20, mail exchanger = alt2.gmail-smtp-in.l.google.com
gmail.com       MX preference = 40, mail exchanger = alt4.gmail-smtp-in.l.google.com
gmail.com       MX preference = 30, mail exchanger = alt3.gmail-smtp-in.l.google.com

C:\Users\Nikhil>
```

8. hostname

Description:

No.	Option	Description
1	hostname	Combines ping and tracert with packet loss statistics.

Implementation:

1. hostname

```
C:\Users\Nikhil>hostname
DESKTOP-A45M567

C:\Users\Nikhil>
```

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9. pathping

Description:

No.	Option	Description
1	pathping google.com	Combines ping and tracert with packet loss statistics.

Implementation:

1. pathping google.com

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

Tracing route to google.com [2404:6800:4009:82f::200e]
over a maximum of 30 hops:
  0  DESKTOP-A45M567 [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]
  1  2409:40c1:3033:cdc9::b7
  2  2405:200:5210:5:3924:110:3:206
  3  2405:200:5210:5:3925::1
  4     *        *        *
Computing statistics for 75 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                          DESKTOP-A45M567 [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]
                                   0/ 100 =  0%   |
  1    2ms     0/ 100 =  0%     0/ 100 =  0%  2409:40c1:3033:cdc9::b7
                                   7/ 100 =  7%   |
  2  292ms     7/ 100 =  7%     0/ 100 =  0%  2405:200:5210:5:3924:110:3:206
                                  93/ 100 = 93%   |
  3  ---     100/ 100 =100%     0/ 100 =  0%  2405:200:5210:5:3925::1

Trace complete.

C:\Users\Nikhil>
```

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10. arp

Description:

No.	Option	Description
1	arp -a	Combines ping and tracert with packet loss statistics.
2	arp -d *	Deletes all ARP entries.
3	arp -s <IP> <MAC>	Adds a static entry (requires Admin privileges).

Implementation:

1. arp -a

```
C:\Users\Nikhil>arp -a

Interface: 192.168.189.140 --- 0x7
  Internet Address      Physical Address      Type
  192.168.189.63        de-38-fd-48-0a-a6     dynamic
  192.168.189.133       50-c2-e8-5d-d1-5d     dynamic
  192.168.189.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

C:\Users\Nikhil>
```

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Lab Practical #02:

Study of different network devices in detail.

Practical Assignment #02:

1. Give difference between below network devices.
   - Hub and Switch
   - Switch and Router
2. Working of below network devices:
   - Repeater
   - Modem((DSL and ADSL)
   - Hub
   - Bridge
   - Switch
   - Router
   - Gateway

Hub and Switch

No.	Hub	Switch
1	Operates at Layer 1 (Physical)	Operates at Layer 2 (Data Link)
2	Broadcasts data to all ports	Forwards data to specific ports
3	No MAC address learning	Learns and stores MAC addresses
4	Less efficient, causes collisions	More efficient, no collisions
5	Half-duplex communication	Full-duplex communication

Switch and Router

No.	Switch	Router
1	Operates at Layer 2 (Data Link)	Operates at Layer 3 (Network)
2	Uses MAC addresses for routing	Uses IP addresses for routing
3	Connects devices in a LAN	Connects multiple networks
4	Does not provide NAT or DHCP	Provides NAT, DHCP, and firewall
5	Faster for local traffic	Slower due to complex routing

Router and Gateway

No.	Router	Gateway
1	Routes data between networks	Connects different protocols
2	Uses IP addresses	Translates between protocols

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3	Operates at Layer 3	Can operate at multiple layers
4	Typically, hardware-based	Can be hardware or software
5	Focuses on packet forwarding	Focuses on protocol conversion

Working of below network devices:

1. **Repeater**
   - A repeater regenerates and amplifies weak signals to extend the range of a network. It operates at the Physical Layer (Layer 1) and does not filter or interpret data.
2. **Modem (DSL and ADSL)**
   - A modem modulates digital data into analog signals for transmission over telephone lines (DSL) and demodulates incoming analog signals back into digital data. ADSL (Asymmetric DSL) provides faster download speeds than upload speeds.
3. **Hub**
   - A hub is a basic networking device that connects multiple devices in a LAN. It broadcasts incoming data to all connected devices, operating at the Physical Layer (Layer 1).
4. **Bridge**
   - A bridge connects two LAN segments and filters traffic based on MAC addresses. It operates at the Data Link Layer (Layer 2) to reduce collisions by dividing collision domains.
5. **Switch**
   - A switch connects devices in a LAN and forwards data to specific ports based on MAC addresses. It operates at the Data Link Layer (Layer 2) and improves network efficiency by reducing collisions.
6. **Router**
   - A router connects multiple networks and routes data packets based on IP addresses. It operates at the Network Layer (Layer 3) and provides features like NAT, DHCP, and firewall.
7. **Gateway**
   - A gateway connects networks with different protocols or architectures. It translates data between incompatible systems and can operate at multiple layers of the OSI model.

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Lab Practical #03:

Study of different types of network cables & connectors and crimping a LAN.

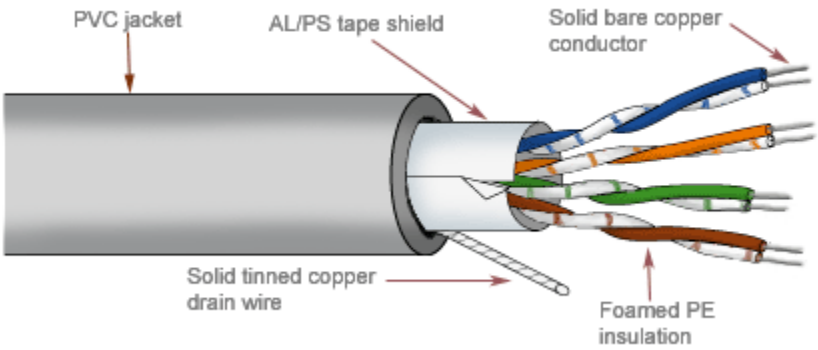
Practical Assignment #03:

1. List various networks cable. Also, write short description.
2. Difference between guided and unguided media.
3. Give cross-wired cable and straight through cable diagram (Color Code wise).

1. List various networks cable and connectors. Also, write short description.

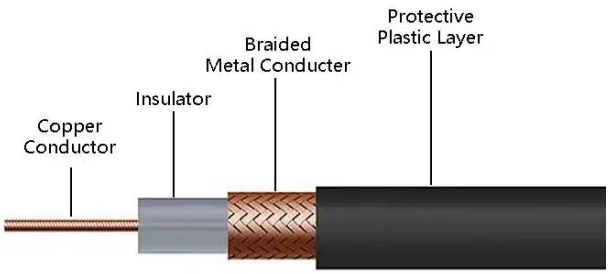
a) **Twisted Pair Cable**

- **Description**: Twisted pair cables consist of pairs of insulated copper wires twisted together to reduce electromagnetic interference. They are commonly used in Ethernet networks. There are two types:
  - Unshielded Twisted Pair (UTP): Lacks shielding, cheaper, and widely used in home and office networks.
  - Shielded Twisted Pair (STP): Includes shielding to reduce interference, used in environments with high interference.
- **Diagram**:



b) **Coaxial Cable**

- **Description**: Coaxial cables have a central conductor surrounded by insulation, a metallic shield, and an outer cover. They are used for cable TV, internet (DOCSIS), and older Ethernet networks.
- **Diagram**:



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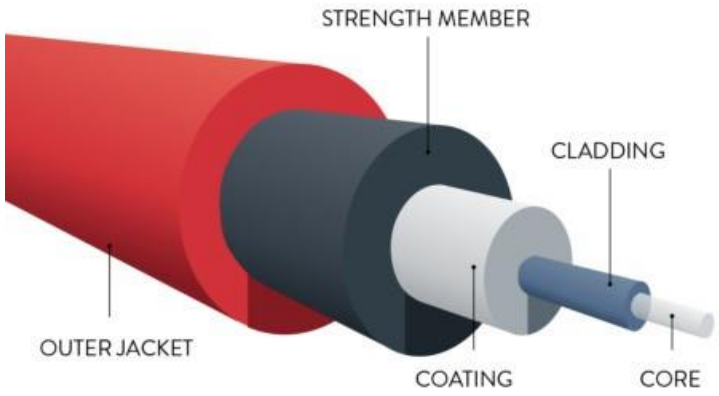
c) **Fiber Optic Cable**

- **Description**: Fiber optic cables use glass or plastic fibres to transmit data as light pulses. They offer high bandwidth, low attenuation, and immunity to electromagnetic interference. Used in high-speed internet and long-distance communication.
- **Diagram**:

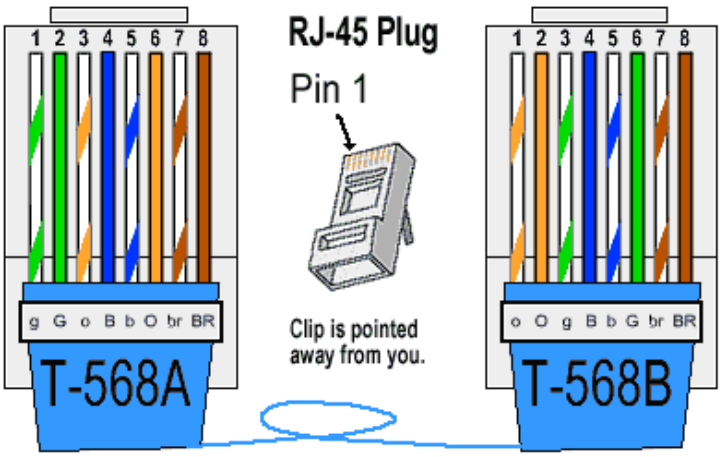


2. Difference between guided and unguided media.

No.	Guided Media	Unguided Media
1	Uses physical cables to transmit data	Uses wireless signals (e.g., radio waves).
2	Examples: Twisted pair, coaxial, fiber	Examples: Wi-Fi, Bluetooth, satellite's
3	Secure and reliable.	Prone to interference and less secure.
4	Limited by cable length.	No physical limitations, but range varies.

3. Give cross-wired cable and straight through cable diagram (Color Code wise).

a) Cross-wired Cable Diagram (Color Code) PC to PC



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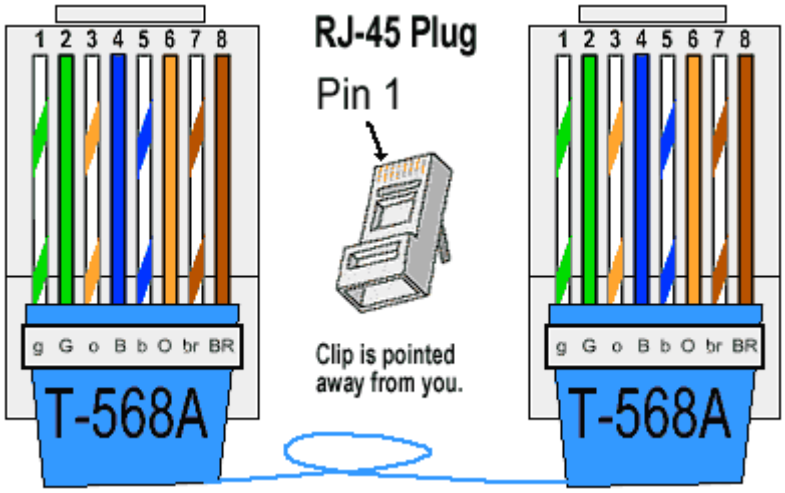
b) Straight Through Cable Diagram (Color Code) PC to Switch



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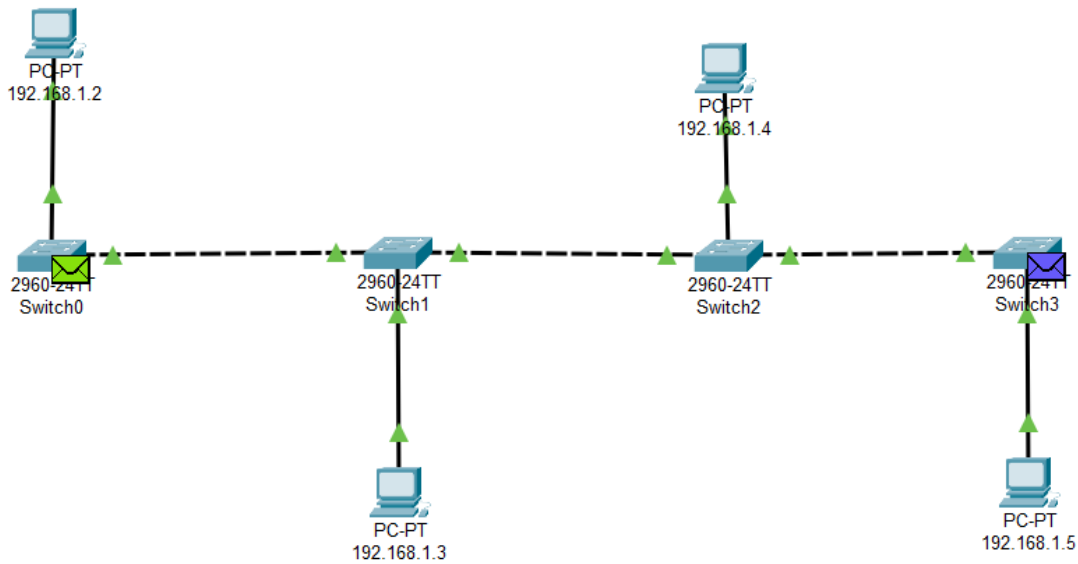
Lab Practical #04:

Installation of Network Simulator (Packet Tracer) and Implement different LAN topologies.

Practical Assignment #04:

1. **Create a simple network with switch and two or more pc. Also check connectivity between them using ping command or PDU utility.**
2. **Implement different topologies in packet tracer.**
    a. **Bus**
    b. **Ring**
    c. **Star**
    d. **Mesh**
    e. **Tree**

1. Bus



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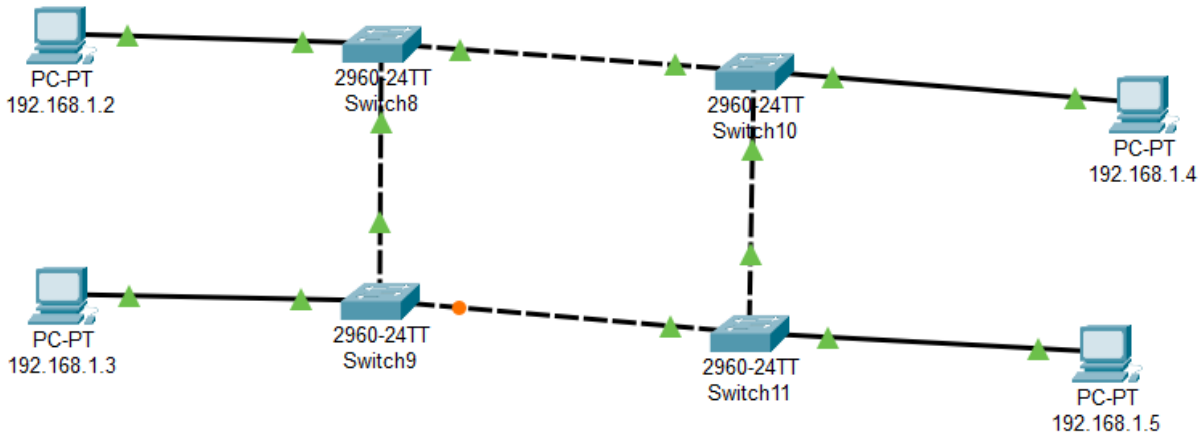
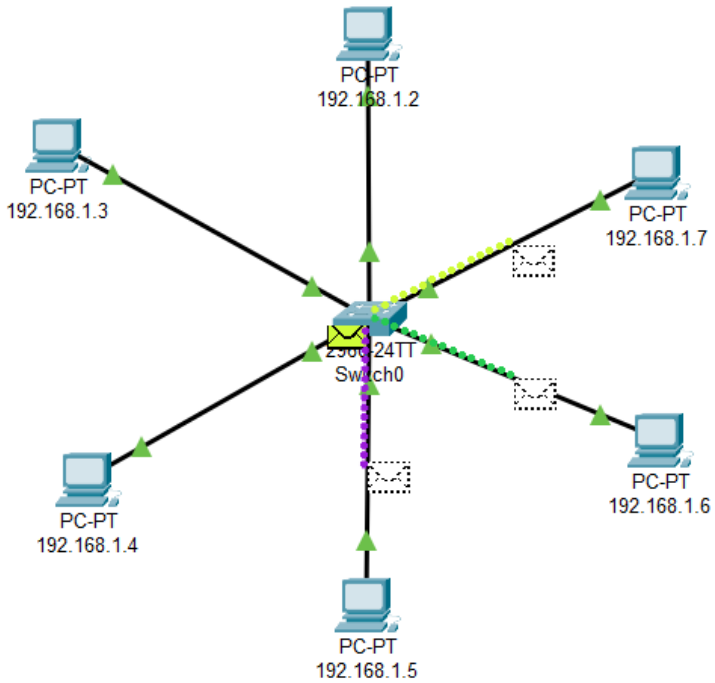
2. Ring



3. Star



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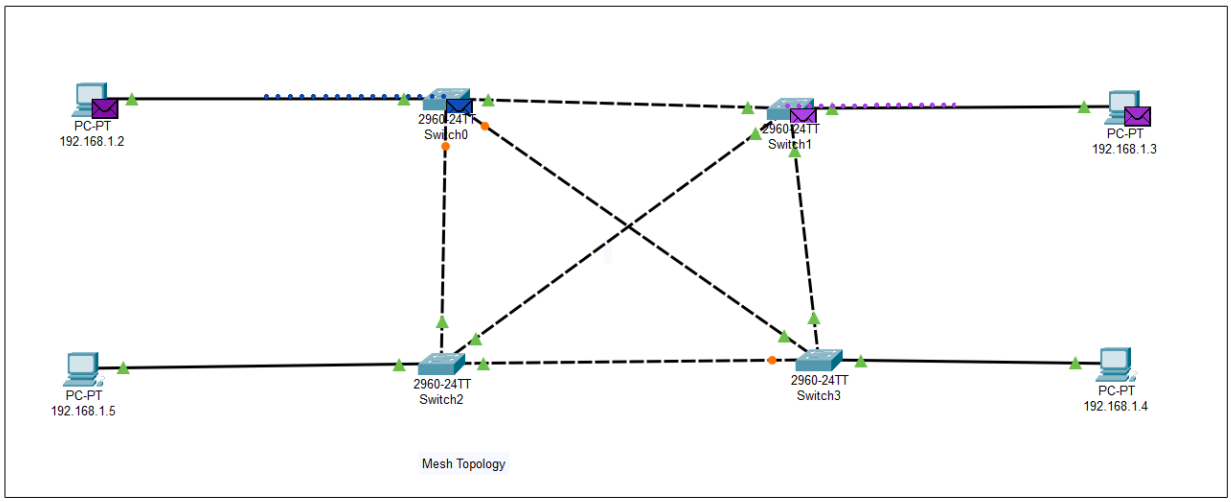
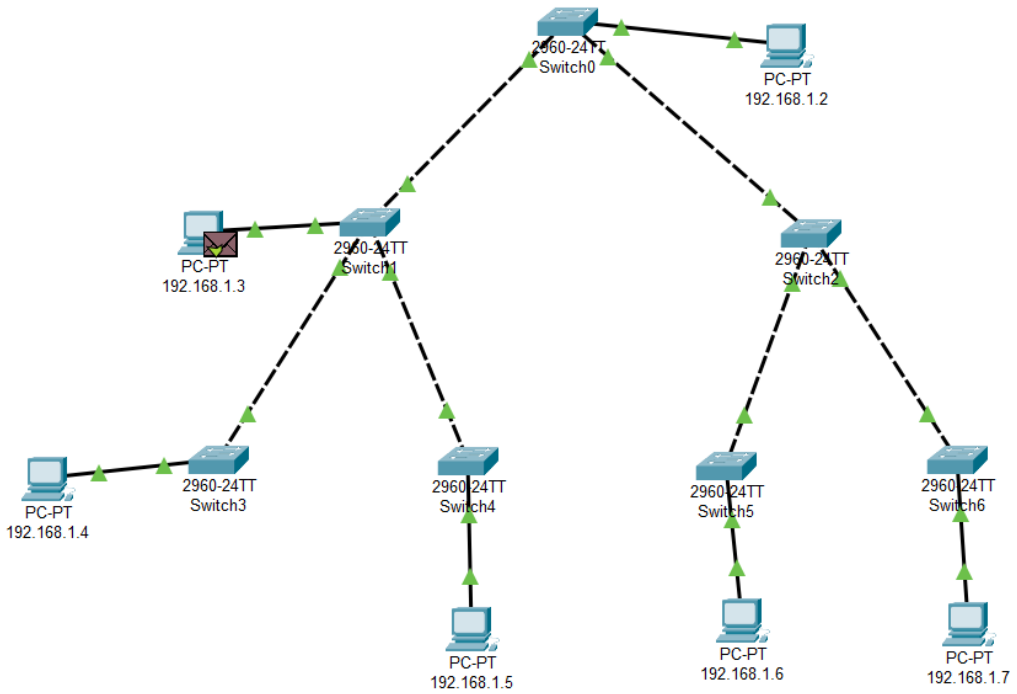
4. Mesh



5. Tree



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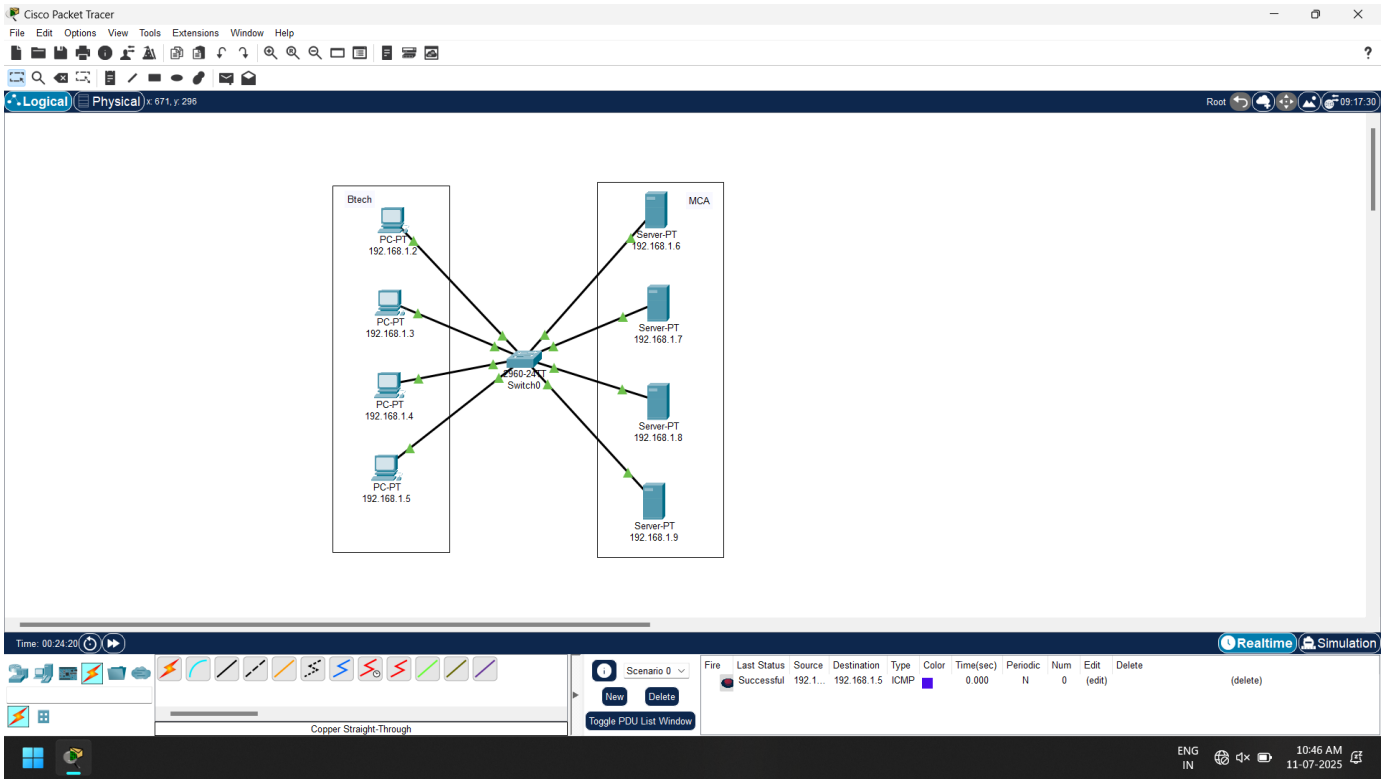
Lab Practical #05:

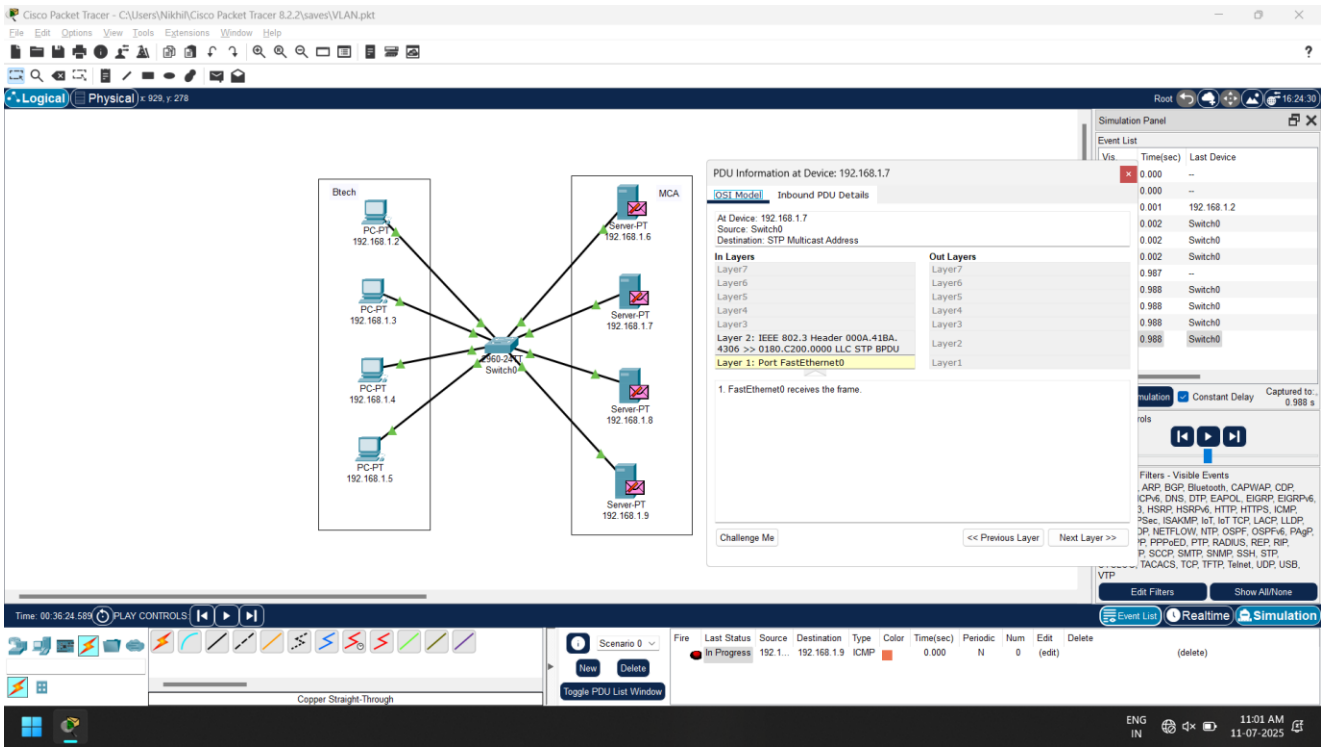
Study the concept of VLAN using packet tracer.

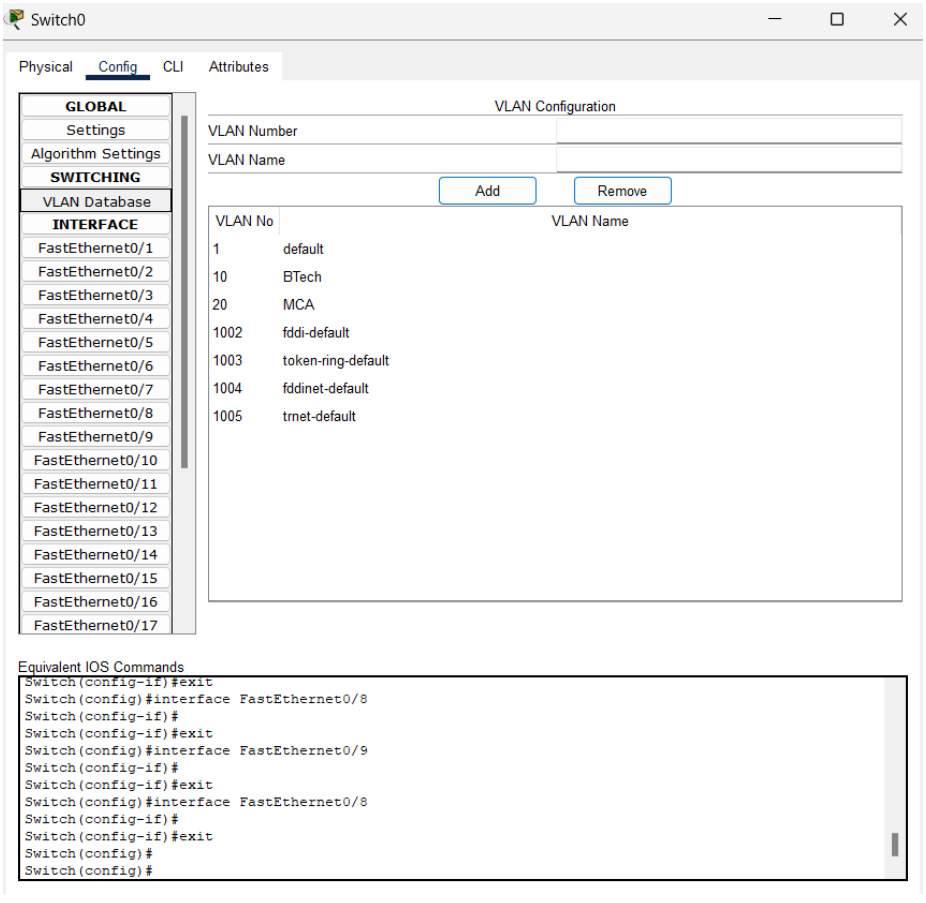
Practical Assignment #05:

1. **Implement the different network structures in VLAN and VLAN trunking. Also check connectivity between them using ping command or PDU utility.**

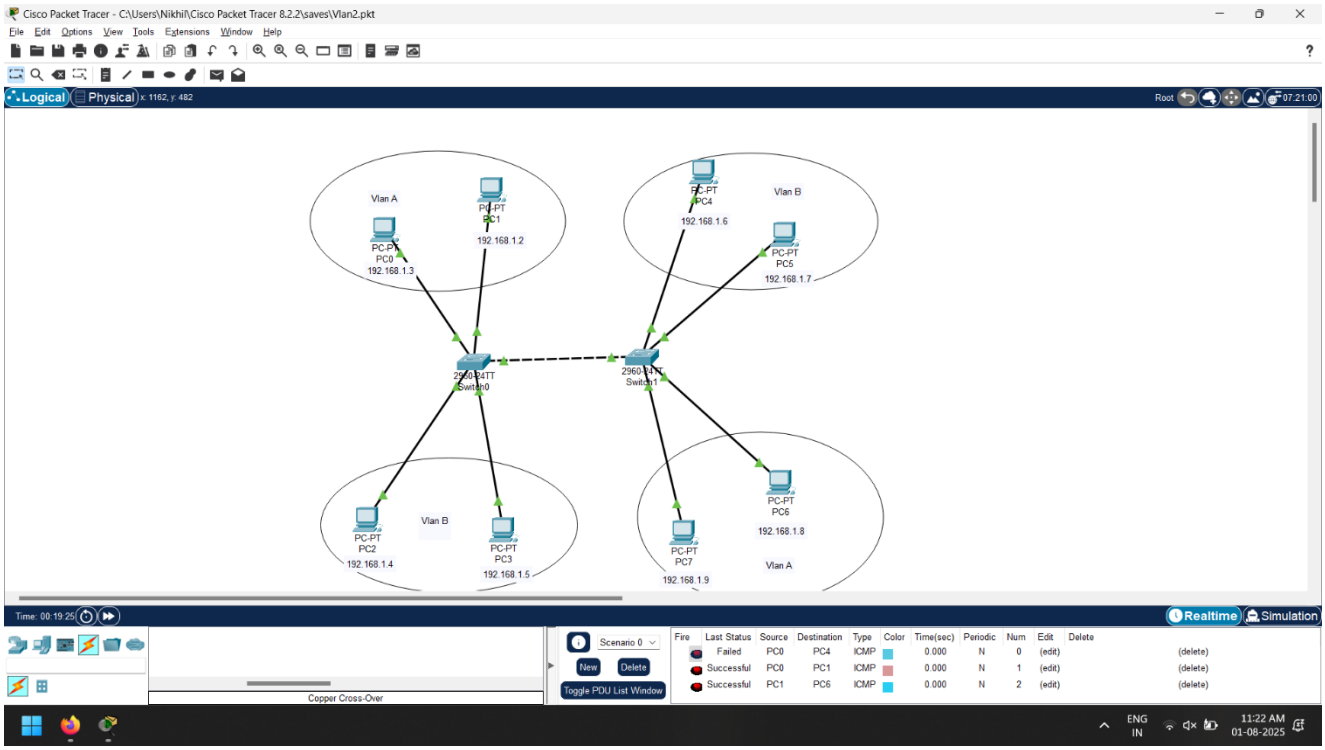


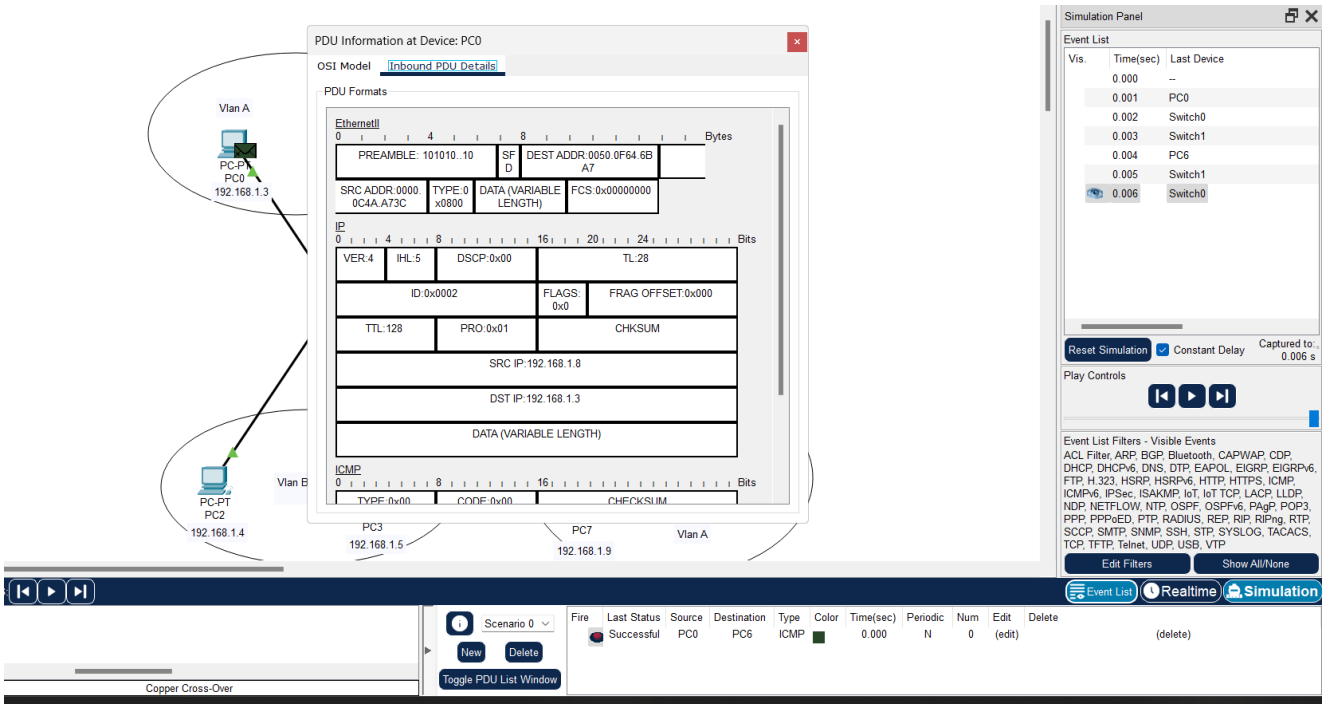
Date: 21/08/2025



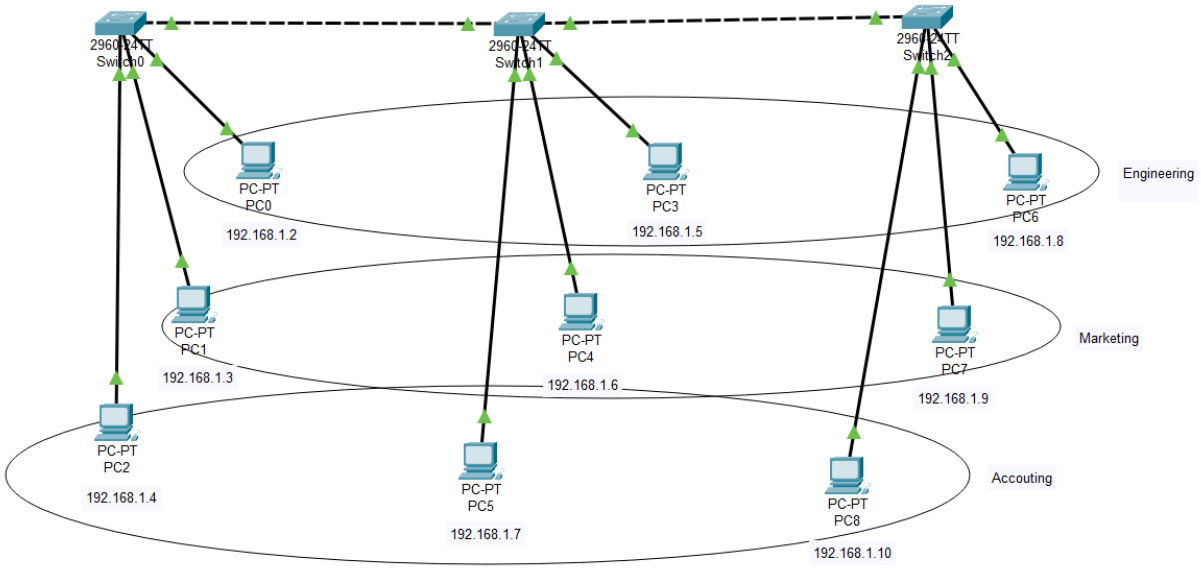


Date: 21/08/2025





Date: 21/08/2025



Date: 27/08/2025

Lab Practical #06:

Study Client-Server Socket programming - TCP & UDP

Practical Assignment #06:

1. **Write a C/Java code for TCP Server-Client Socket Programming.**
2. **Write a C/Java code for UDP Server-Client Socket Programming.**

1. For TCP Server-Client:

TCP Server Program:

```
import java.io.*;
import java.net.*;

public class TCPServer {
public static void main(String[] args) throws IOException {
ServerSocket serverSocket = new ServerSocket(6789);
System.out.println("TCP Server started. Waiting for client...");

Socket clientSocket = serverSocket.accept();
System.out.println("Client connected: " + clientSocket.getInetAddress());

BufferedReader in = new BufferedReader(new InputStreamReader(clientSocket.getInputStream()));
PrintWriter out = new PrintWriter(clientSocket.getOutputStream(), true);

String inputLine;
while ((inputLine = in.readLine()) != null) {
System.out.println("Received from client: " + inputLine);
out.println("Server echoes: " + inputLine);
}
in.close();
out.close();
clientSocket.close();
serverSocket.close();
}}
```

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TCP Client Program:

```
import java.io.*;
import java.net.*;

public class TCPClient {
public static void main(String[] args) throws IOException {
Socket clientSocket = new Socket("localhost", 6789);

BufferedReader in = new BufferedReader(new InputStreamReader(clientSocket.getInputStream()));
PrintWriter out = new PrintWriter(clientSocket.getOutputStream(), true);
BufferedReader stdIn = new BufferedReader(new InputStreamReader(System.in));

String userInput;
while ((userInput = stdIn.readLine()) != null) {
out.println(userInput);
System.out.println("Server response: " + in.readLine());
}

out.close();
in.close();
stdIn.close();
clientSocket.close();
}
}
```

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2. For UDP Server-Client:

UDP Server Program:

```
import java.io.*;
import java.net.*;

public class UDPServer {
   public static void main(String[] args) throws IOException {
      DatagramSocket serverSocket = new DatagramSocket(9876);
      byte[] receiveData = new byte[1024];

      System.out.println("UDP Server started. Waiting for datagrams...");

      while (true) {
         DatagramPacket receivePacket = new DatagramPacket(receiveData, receiveData.length);
         serverSocket.receive(receivePacket);

         String sentence = new String(receivePacket.getData(), 0, receivePacket.getLength());
         System.out.println("Received from client: " + sentence);

         InetAddress IPAddress = receivePacket.getAddress();
         int port = receivePacket.getPort();

         String capitalizedSentence = sentence.toUpperCase();
         byte[] sendData = capitalizedSentence.getBytes();

         DatagramPacket sendPacket = new DatagramPacket(sendData, sendData.length, IPAddress,
port);
         serverSocket.send(sendPacket);
      }
   }
}
```

Date: 27/08/2025

UDP Client Program:

```
import java.io.*;
import java.net.*;
public class UDPClient {
public static void main(String[] args) throws IOException {
BufferedReader inFromUser = new BufferedReader(new InputStreamReader(System.in));
DatagramSocket clientSocket = new DatagramSocket();
InetAddress IPAddress = InetAddress.getByName("localhost");
 byte[] sendData;
byte[] receiveData = new byte[1024];
System.out.print("Enter message: ");
String sentence = inFromUser.readLine();
sendData = sentence.getBytes();
DatagramPacket sendPacket = new DatagramPacket(sendData, sendData.length, IPAddress, 9876);
clientSocket.send(sendPacket);
DatagramPacket receivePacket = new DatagramPacket(receiveData, receiveData.length);
clientSocket.receive(receivePacket);
String modifiedSentence = new String(receivePacket.getData(), 0, receivePacket.getLength());
System.out.println("FROM SERVER: " + modifiedSentence);
clientSocket.close();
  }
}
```

Date: 29/08/2025

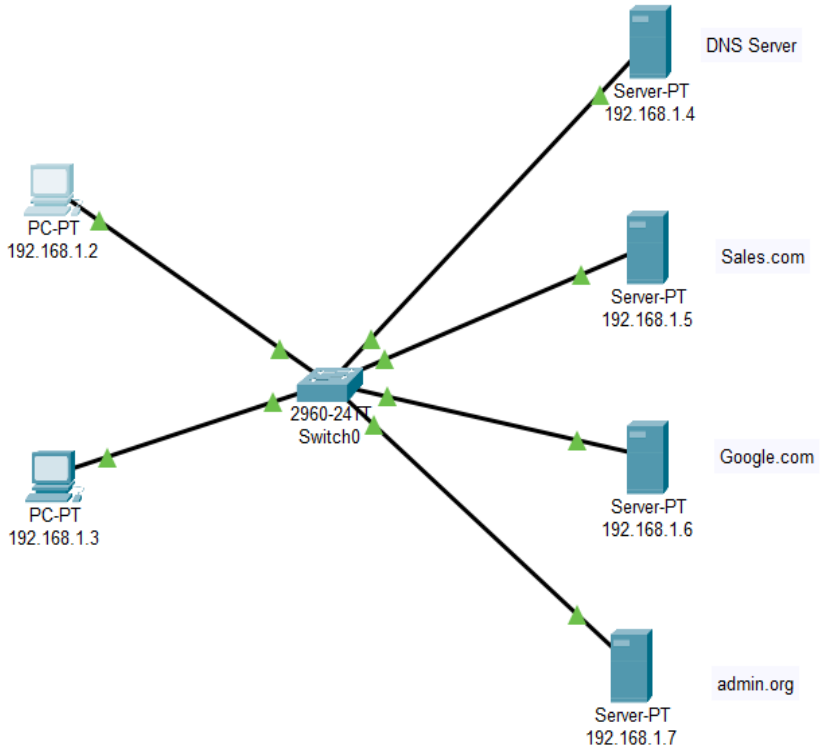
Lab Practical #07:

Study the application layer protocol DNS, DHCP, FTP.

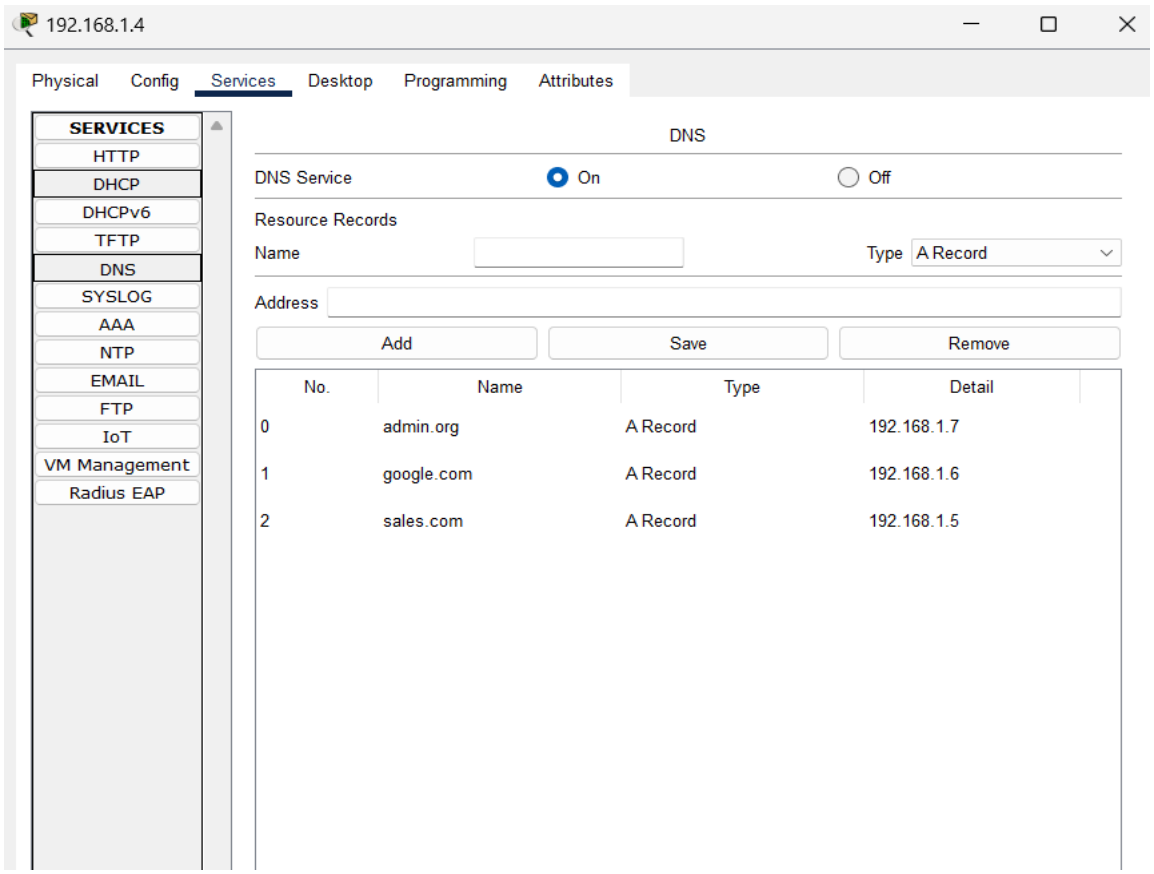
Practical Assignment #07:

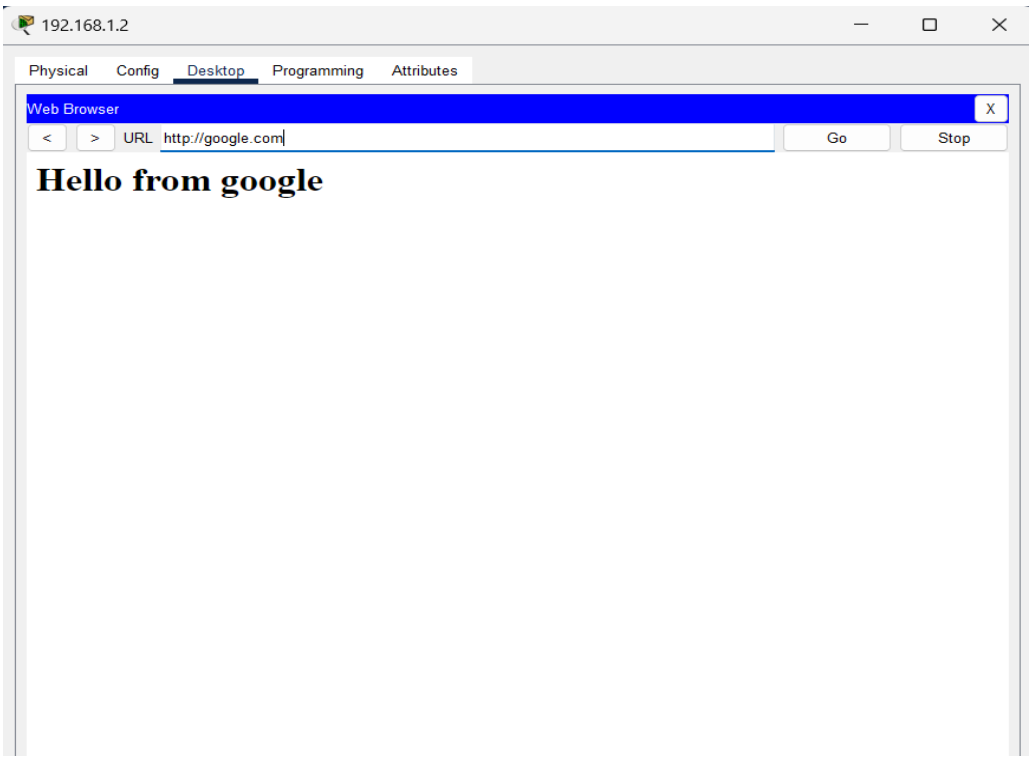
1. **Implement the application layer protocol DNS, DHCP, and FTP. Also check connectivity between them using ping command or PDU utility.**

1) DNS :-



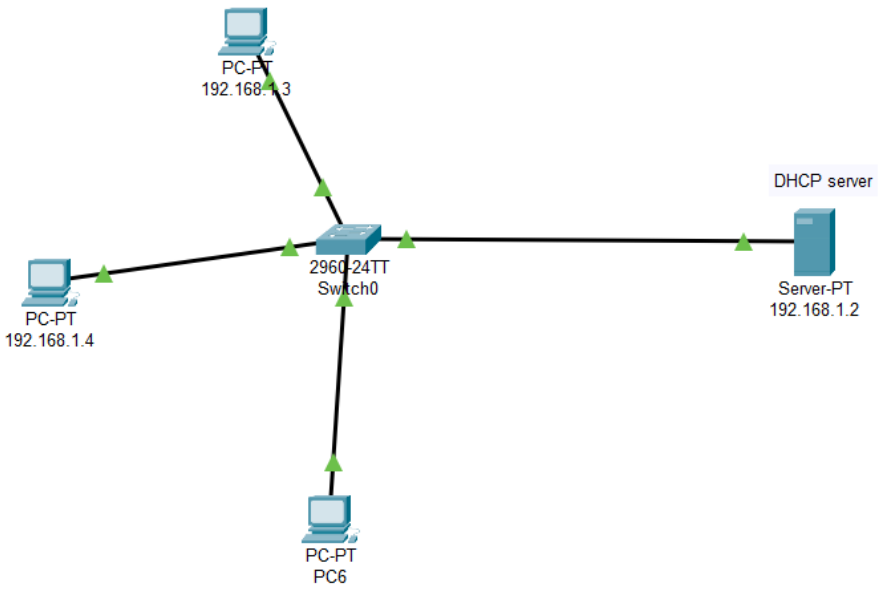
Date: 29/08/2025

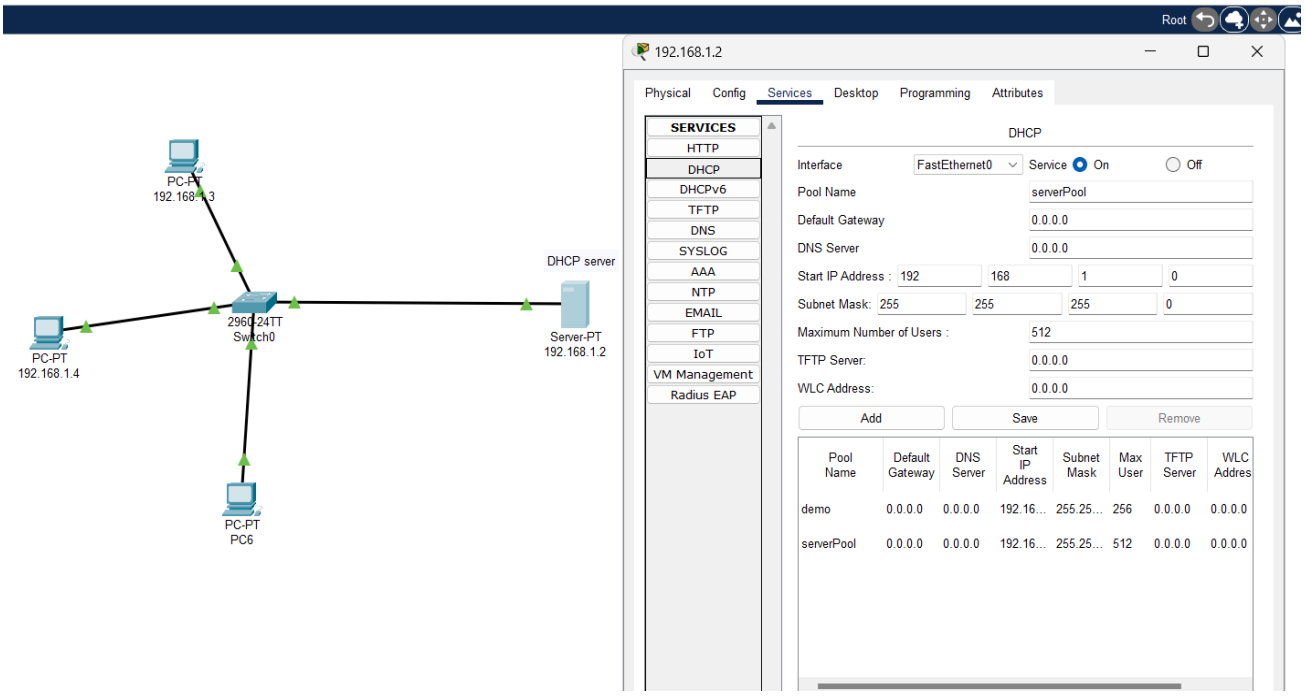




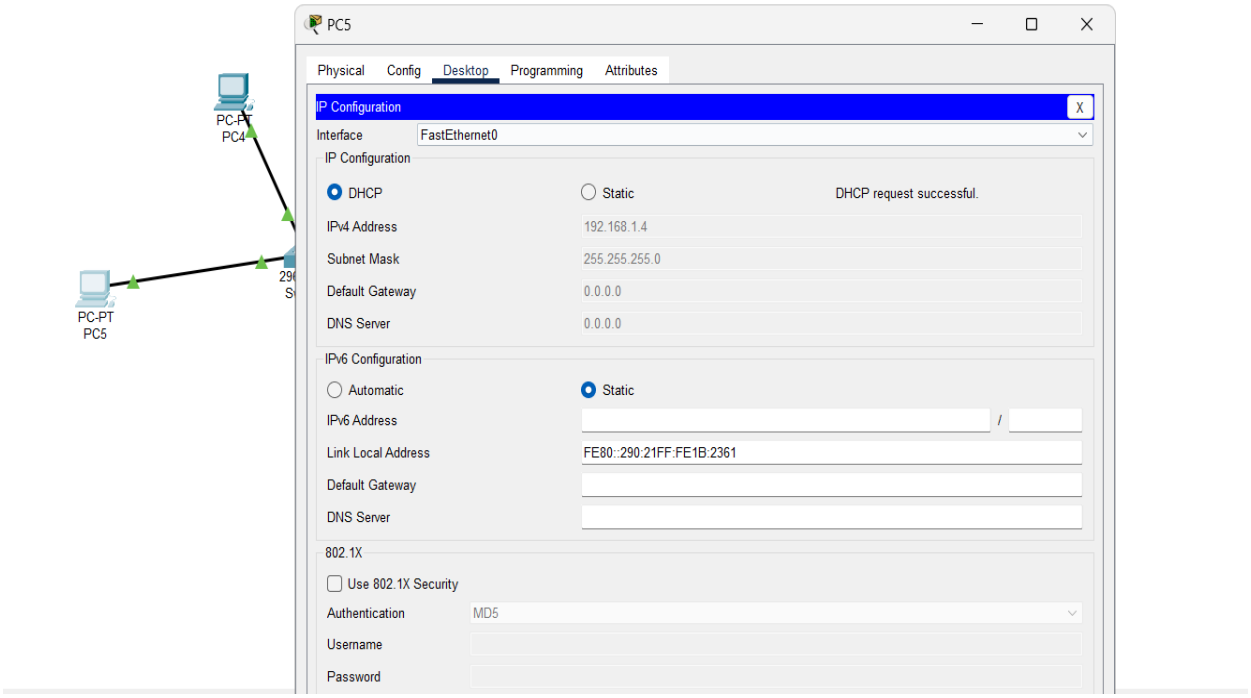
Date: 29/08/2025

2) DHCP :-

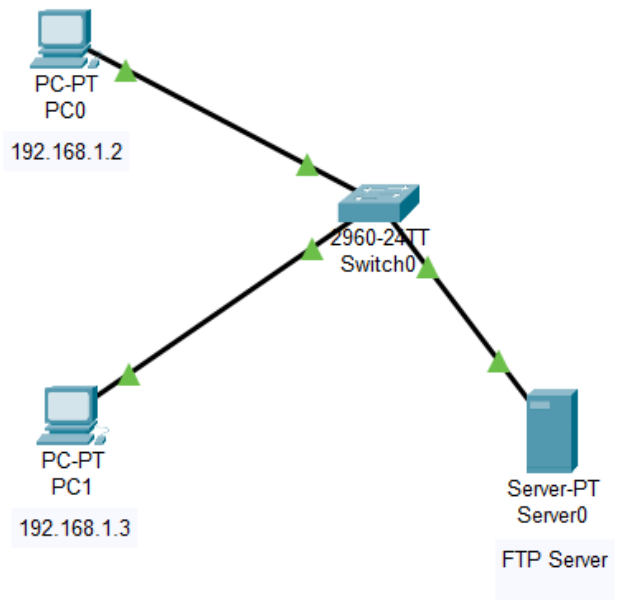




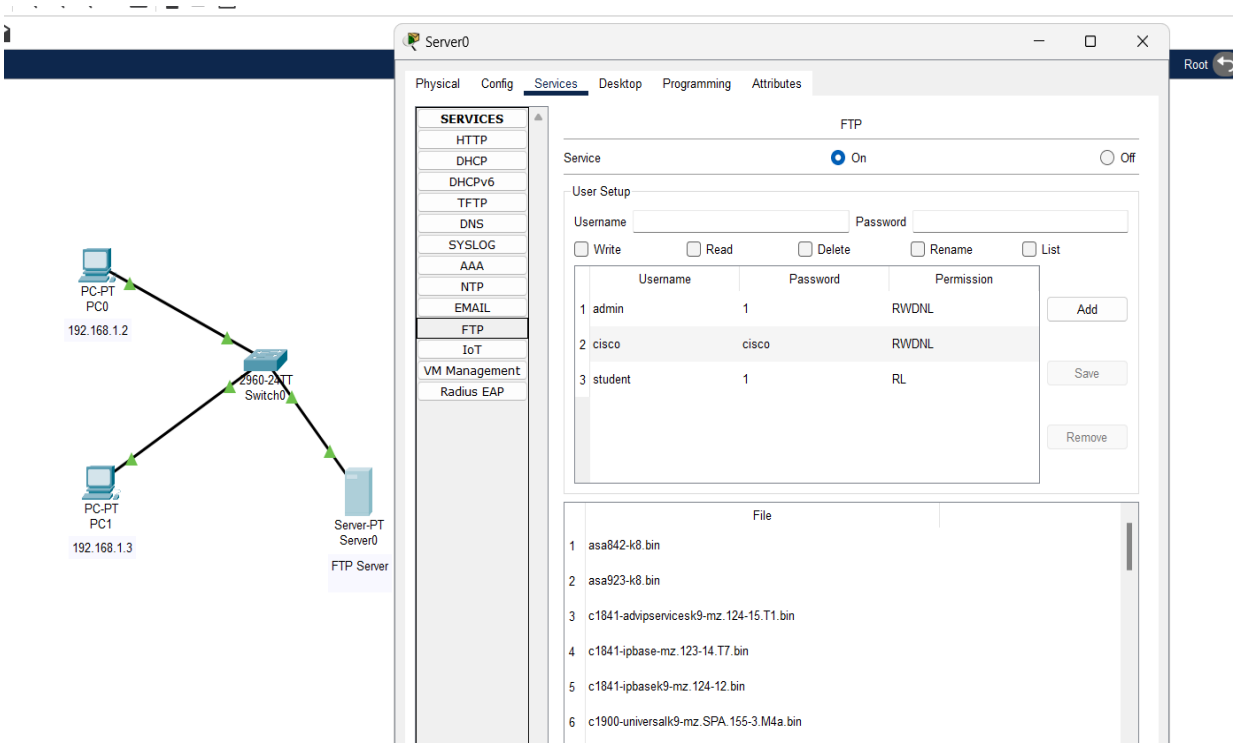
Date: 29/08/2025



3) FTP :-



Date: 29/08/2025




```
ftp>dir

Listing /ftp directory from 192.168.1.8:
0    : asa842-k8.bin                                    5571584
1    : asa923-k8.bin                                    30468096
2    : c1841-advipservicesk9-mz.124-15.T1.bin           33591768
3    : c1841-ipbase-mz.123-14.T7.bin                    13832032
4    : c1841-ipbasek9-mz.124-12.bin                     16599160
5    : c1900-universalk9-mz.SPA.155-3.M4a.bin           33591768
6    : c2600-advipservicesk9-mz.124-15.T1.bin           33591768
7    : c2600-i-mz.122-28.bin                            5571584
8    : c2600-ipbasek9-mz.124-8.bin                      13169700
9    : c2800nm-advipservicesk9-mz.124-15.T1.bin         50938004
10   : c2800nm-advipservicesk9-mz.151-4.M4.bin          33591768
11   : c2800nm-ipbase-mz.123-14.T7.bin                  5571584
12   : c2800nm-ipbasek9-mz.124-8.bin                    15522644
13   : c2900-universalk9-mz.SPA.155-3.M4a.bin           33591768
14   : c2950-i6q412-mz.121-22.EA4.bin                   3058048
15   : c2950-i6q412-mz.121-22.EA8.bin                   3117390
16   : c2960-lanbase-mz.122-25.FX.bin                   4414921
17   : c2960-lanbase-mz.122-25.SEE1.bin                 4670455
18   : c2960-lanbasek9-mz.150-2.SE4.bin                 4670455
19   : c3560-advipservicesk9-mz.122-37.SE1.bin          8662192
20   : c3560-advipservicesk9-mz.122-46.SE.bin           10713279
21   : c800-universalk9-mz.SPA.152-4.M4.bin             33591768
22   : c800-universalk9-mz.SPA.154-3.M6a.bin            83029236
23   : cat3k_caa-universalk9.16.03.02.SPA.bin           505532849
24   : cgr1000-universalk9-mz.SPA.154-2.CG              159487552
25   : cgr1000-universalk9-mz.SPA.156-3.CG              184530138
26   : ir800-universalk9-bundle.SPA.156-3.M.bin         160968869
27   : ir800-universalk9-mz.SPA.155-3.M                 61750062
28   : ir800-universalk9-mz.SPA.156-3.M                 63753767
29   : ir800_yocto-1.7.2.tar                            2877440
30   : ir800_yocto-1.7.2_python-2.7.3.tar               6912000
31   : pt1000-i-mz.122-28.bin                           5571584
32   : pt3000-i6q412-mz.121-22.EA4.bin                  3117390
ftp>put demo.txt

Writing file demo.txt to 192.168.1.8:
File transfer in progress...

[Transfer complete - 9 bytes]

9 bytes copied in 0.047 secs (191 bytes/sec)
ftp>
```

Date: 29/08/2025