Aim ↬ Study basic network commands and Cisco IOS show commands.

Objectives ↬

i. Implementation of network troubleshooting command.
ii. Utilization of show command for network analysis.

Software Required ↬ Cisco Packet Tracer

Theory ↬

Some basic commands are critical for network diagnostics, connectivity checks, and understanding network configurations, especially in simulation environments like Cisco Packet Tracer.

a) **ping** ↪ This command tests connectivity between your computer and another device on a network. It sends ICMP Echo Request messages and waits for Echo Reply messages, helping to determine if the other device is reachable and how long the round trip takes.
b) **ipconfig** ↪ Displays the IP address, subnet mask, and default gateway for all network adapters in the computer. ipconfig/all provides a more detailed view, including MAC address, DHCP status, and DNS information, which help resolve human-readable domain names to IP addresses.
c) **nslookup** ↪ Used to query DNS servers and retrieve domain name or IP address mapping information. It's useful for diagnosing DNS issues.
d) **hostname** ↪ Returns the hostname of your computer, which is the name identified on the network.
e) **tracert** ↪ Traces the route that packets take from your computer to a destination host. It shows each hop along the way and the time it takes for each hop, helping diagnose where delays or issues occur.
f) **pathping** ↪ Combines the functionality of ping and tracert to provide detailed information about the route and packet loss at each hop between the source and destination. pathping google.com would give a detailed report of the route to Google's servers.
g) **netstat** ↪ Displays network statistics, including active connections, ports on which the computer is listening, and routing table information. It's useful for monitoring network activity and troubleshooting.
h) **getmac** ↪ Shows the MAC addresses of network adapters on the computer. MAC addresses are unique identifiers for network devices.
i) **arp** ↪ Displays and modifies the ARP (Address Resolution Protocol) cache, which stores mappings between IP addresses and MAC addresses. It's essential for local network communications.

Procedure ↬

i. Drag and drop 3 PCs and 1 switch onto the workspace.
ii. Use Copper Straight-Through cables to connect each PC to the switch.
iii. Go to each PC's desktop, open "IP Configuration," and assign unique IP addresses within the same subnet (e.g., 8.8.8.0, 8.8.8.1, 8.8.8.2). Set the subnet mask to 255.0.0.0.
iv. Open the command prompt on each PC and use ping to test connectivity between PCs (e.g., ping 8.8.8.1 from 8.8.8.0).
v. Run ipconfig / ipconfig/all to check IP configurations, nslookup to test DNS lookup, hostname to verify the hostname, and tracert to trace the route between PCs or to an external address if Internet access is configured.

Simulation ↬

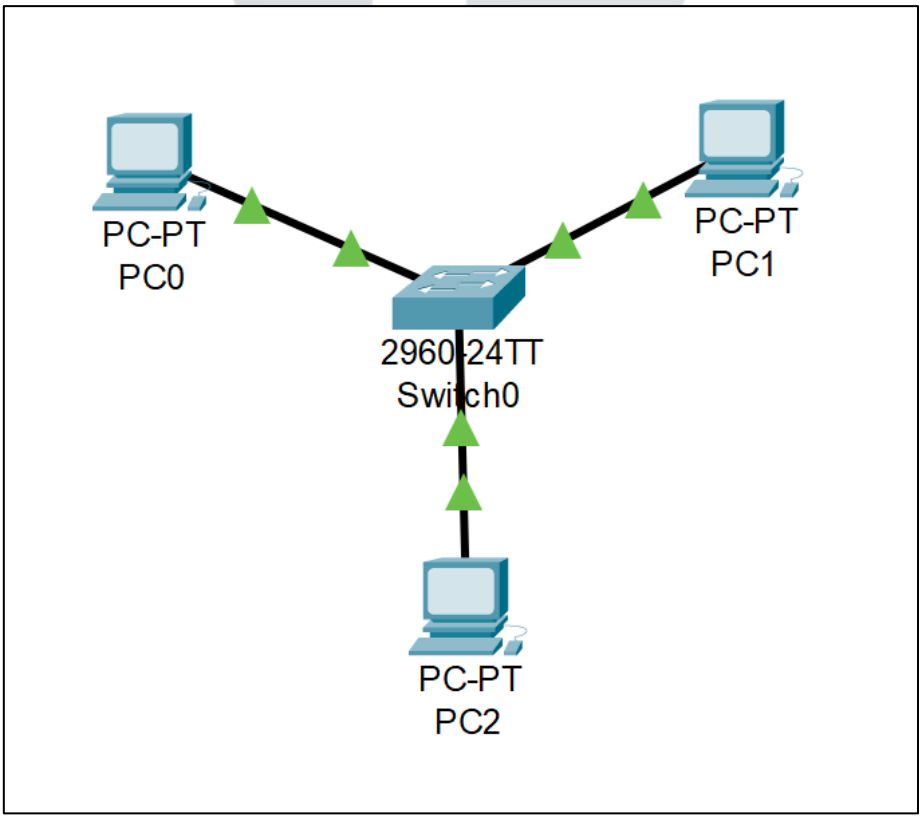
```
C:\Users\nitin>ping google.com

Pinging google.com [142.250.194.174] with 32 bytes of data:
Reply from 142.250.194.174: bytes=32 time=6ms TTL=60
Reply from 142.250.194.174: bytes=32 time=9ms TTL=60
Reply from 142.250.194.174: bytes=32 time=7ms TTL=60
Reply from 142.250.194.174: bytes=32 time=7ms TTL=60

Ping statistics for 142.250.194.174:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 9ms, Average = 7ms

C:\Users\nitin>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::b74f:7fa5:623:2fbb%7
   IPv4 Address. . . . . . . . . . . : 10.10.51.15
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Default Gateway . . . . . . . . . : 10.10.48.1
```

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

Windows IP Configuration

   Host Name . . . . . . . . . . . . : Steve
   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. . . . . . . . . : 52-5A-65-F5-C9-2F
   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. . . . . . . . . : 52-5A-65-F5-C9-3F
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
   Physical Address. . . . . . . . . : 50-5A-65-F5-C9-6F
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::b74f:7fa5:623:2fbb%7(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.10.51.15(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Lease Obtained. . . . . . . . . . : 15 August 2024 01:14:49
   Lease Expires . . . . . . . . . . : 15 August 2024 10:14:50
   Default Gateway . . . . . . . . . : 10.10.48.1
   DHCP Server . . . . . . . . . . . : 1.1.1.1
   DHCPv6 IAID . . . . . . . . . . . : 105929317
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2B-F8-67-7D-00-DE-AB-CA-60-4F
   DNS Servers . . . . . . . . . . . : 8.8.8.8
                                       8.8.4.4
                                       4.2.2.2
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

```
C:\Users\nitin>nslookup
Default Server:  dns.google
Address:  8.8.8.8

> exit

C:\Users\nitin>hostname
Steve

C:\Users\nitin>tracert

Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
               [-R] [-S srcaddr] [-4] [-6] target_name

Options:
    -d                 Do not resolve addresses to hostnames.
    -h maximum_hops    Maximum number of hops to search for target.
    -j host-list       Loose source route along host-list (IPv4-only).
    -w timeout         Wait timeout milliseconds for each reply.
    -R                 Trace round-trip path (IPv6-only).
    -S srcaddr         Source address to use (IPv6-only).
    -4                 Force using IPv4.
    -6                 Force using IPv6.

C:\Users\nitin>pathping

Usage: pathping [-g host-list] [-h maximum_hops] [-i address] [-n]
                [-p period] [-q num_queries] [-w timeout]
                [-4] [-6] target_name

Options:
    -g host-list     Loose source route along host-list.
    -h maximum_hops  Maximum number of hops to search for target.
    -i address       Use the specified source address.
    -n               Do not resolve addresses to hostnames.
    -p period        Wait period milliseconds between pings.
    -q num_queries   Number of queries per hop.
    -w timeout       Wait timeout milliseconds for each reply.
    -4               Force using IPv4.
    -6               Force using IPv6.
```

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

Tracing route to google.com [142.250.194.174]
over a maximum of 30 hops:
  0  Steve [10.10.51.15]
  1  10.10.48.1
  2     *        *        *
Computing statistics for 25 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Steve [10.10.51.15]
                                    1/ 100 =  1%   |
  1   32ms     1/ 100 =  1%     0/ 100 =  0%  10.10.48.1

Trace complete.

C:\Users\nitin>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    10.10.51.15:49408      20.198.119.143:https   ESTABLISHED
  TCP    10.10.51.15:49868      20.198.118.190:https   ESTABLISHED
  TCP    10.10.51.15:49916      20.167.82.225:https    ESTABLISHED
  TCP    10.10.51.15:49980      ec2-44-218-192-198:https  ESTABLISHED
  TCP    10.10.51.15:49996      40.99.31.162:https     TIME_WAIT
  TCP    10.10.51.15:50118      dns:https              TIME_WAIT
  TCP    10.10.51.15:50119      server-18-239-142-21:https  TIME_WAIT
  TCP    10.10.51.15:50120      server-54-182-0-51:https  TIME_WAIT
  TCP    10.10.51.15:50121      server-18-239-142-21:https  TIME_WAIT
  TCP    10.10.51.15:50123      sc-in-f84:https        TIME_WAIT
  TCP    10.10.51.15:50124      server-18-172-64-31:https  TIME_WAIT
  TCP    10.10.51.15:50126      47:https               TIME_WAIT
  TCP    10.10.51.15:50127      server-18-239-142-44:https  TIME_WAIT
  TCP    10.10.51.15:50128      server-18-239-142-44:https  TIME_WAIT
  TCP    10.10.51.15:50129      server-108-159-80-47:https  TIME_WAIT
  TCP    10.10.51.15:50133      del11s22-in-f14:https  TIME_WAIT
  TCP    10.10.51.15:50134      sin26s10-in-f6:https   TIME_WAIT
  TCP    10.10.51.15:50136      ec2-52-5-62-219:https  ESTABLISHED
  TCP    10.10.51.15:50140      104.18.43.79:https     TIME_WAIT
  TCP    10.10.51.15:50142      104.18.40.222:https    TIME_WAIT
  TCP    10.10.51.15:50147      kul01s10-in-f42:https  TIME_WAIT
  TCP    10.10.51.15:50148      172.64.146.223:https   TIME_WAIT
  TCP    10.10.51.15:50154      104.18.86.42:https     TIME_WAIT
  TCP    10.10.51.15:50155      104.18.86.42:https     TIME_WAIT
  TCP    10.10.51.15:50156      sc-in-f84:https        TIME_WAIT
  TCP    10.10.51.15:50157      104.18.28.127:https    TIME_WAIT
  TCP    10.10.51.15:50158      104.18.35.23:https     TIME_WAIT
  TCP    10.10.51.15:50159      ec2-52-11-247-82:https  ESTABLISHED
  TCP    10.10.51.15:50160      a23-54-81-209:https    ESTABLISHED
  TCP    10.10.51.15:50161      52.109.124.28:https    TIME_WAIT
  TCP    10.10.51.15:50162      52.168.112.66:https    TIME_WAIT
  TCP    10.10.51.15:50164      a23-57-205-123:http    ESTABLISHED
  TCP    10.10.51.15:50165      a23-57-205-123:https   ESTABLISHED
  TCP    10.10.51.15:50166      a23-57-205-123:http    ESTABLISHED
  TCP    10.10.51.15:50167      a23-212-160-85:http    TIME_WAIT
  TCP    10.10.51.15:50169      a23-212-160-85:https   ESTABLISHED
  TCP    10.10.51.15:50170      a23-57-205-123:https   ESTABLISHED
  TCP    10.10.51.15:50171      server-18-239-142-117:https  ESTABLISHED
  TCP    10.10.51.15:50172      a23-57-207-82:https    ESTABLISHED
  TCP    10.10.51.15:50175      40.99.31.162:https     ESTABLISHED
  TCP    10.10.51.15:50176      a23-54-83-203:https    ESTABLISHED
  TCP    10.10.51.15:50179      20.42.73.24:https      ESTABLISHED
  TCP    10.10.51.15:50180      a104-90-6-226:http     TIME_WAIT
  TCP    10.10.51.15:50181      150.171.28.254:https   ESTABLISHED
  TCP    10.10.51.15:50182      13.107.4.254:https     ESTABLISHED
```

```
C:\Users\nitin>getmac

Physical Address    Transport Name
=================== ==========================================================
50-5A-65-F5-C9-6F   \Device\Tcpip_{551A0738-AB90-4FDC-B72C-774F8D298BFC}

C:\Users\nitin>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.
```



Result ↬

In this experiment, we successfully created a network with three PCs connected through a switch in Cisco Packet Tracer. Each PC was assigned a unique IP address within the same subnet. Connectivity was verified using commands like ping, ipconfig, tracert, and pathping, all of which confirmed successful communication and proper configuration.

Conclusion ↬

This experiment demonstrated basic network setup and verification using essential commands in Cisco Packet Tracer. Effective communication between PCs was established, providing a foundation for further network studies.

Precautions ↬

- Assign unique IP addresses within the same subnet to each PC.
- Use the correct Copper Straight-Through cables for connections.
- Ensure all PCs have the correct subnet mask.
- Carefully execute each command and monitor the results for accuracy.