

1 Project Overview

This project focuses on practicing IP addressing and subnetting in a simulated network environment. Subnetting is a crucial skill in networking as it allows a large network to be divided into smaller, manageable segments called subnets. This helps improve network performance, enhances security, and ensures efficient utilization of IP addresses.

Through this project, learners will understand how to calculate subnet ranges, assign IP addresses to devices, and verify connectivity within and between subnets.

2 Objectives

- **Calculate subnet ranges:** Learn to divide a given network (e.g., 192.168.10.0/28) into smaller subnets (e.g., /28) and determine the valid host ranges for each subnet.
- **Assign IP addresses:** Properly assign IP addresses to PCs and router interfaces according to the subnetting plan.
- **Test connectivity:** Use tools like ping to verify communication between devices in the same subnet and across different subnets.
- **Understand routing basics:** Learn when and how routing is necessary for inter-subnet communication.

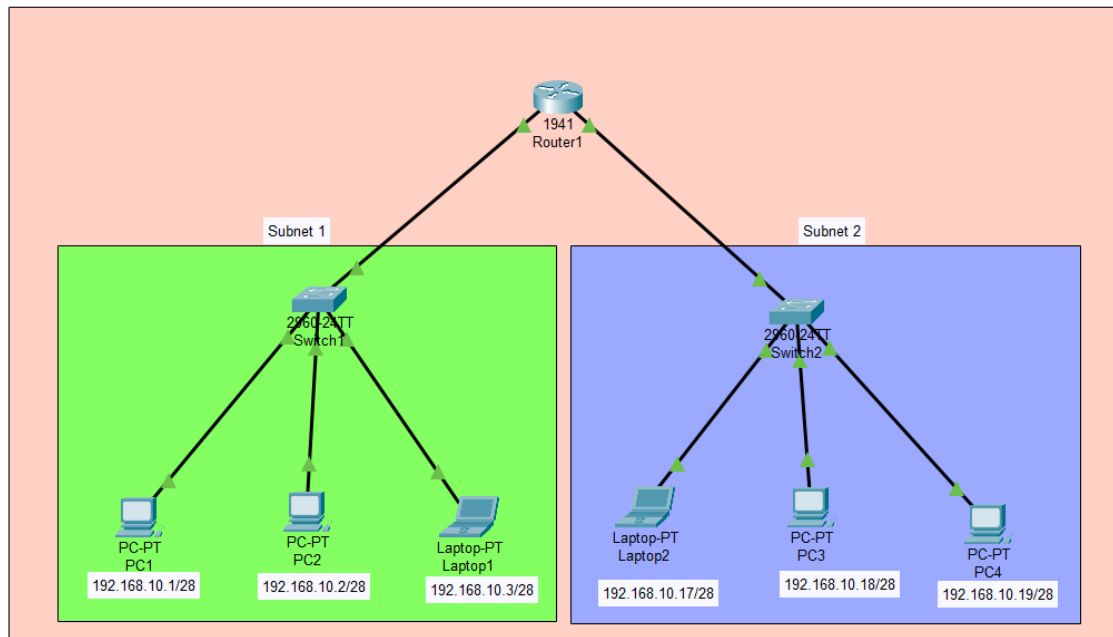
3 Network Topology

This project utilizes a simple network topology consisting of:

- **Devices:**
 - 2 Cisco switches
 - 1 Router
 - 2 PCs and 1 laptop connected to each switch
- **Network Addressing:**
 - Base network: 192.168.10.0/24
 - Subnet mask: /28
 - This results in 16 subnets with 14 usable hosts each.
- **Connections:**
 - PCs are connected to switches.
 - Switches are connected to router interfaces.
 - Router interfaces are configured for each subnet to enable inter-subnet communication if required.
- **Subnet Details Example:**

Subnet	Network Address	First Address	Last Address	Broadcast Address
Subnet 1	192.168.10.0/28	192.168.10.1	192.168.10.14	192.168.10.15
Subnet 2	192.168.10.16/28	192.168.10.17	192.168.10.30	192.168.10.31

3.1 Topology Diagram:



4 Step by Step Configuration

4.1 Subnet Planning:

- Determine the number of subnets required.
- Calculate subnet addresses, host ranges, and broadcast addresses.
- Document the IP plan to avoid conflicts.

4.2 Device Configuration:

- Assign IP addresses to router interfaces based on subnet plan:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip address 192.168.10.14 255.255.255.240
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface gigabitEthernet 0/1
Router(config-if)#ip address 192.168.10.30
Router(config-if)#no shutdown
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

☐ Top

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- Assign IP addresses to PCs, laptop according to their subnet

Physical Config Desktop Programming Attributes

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig /all

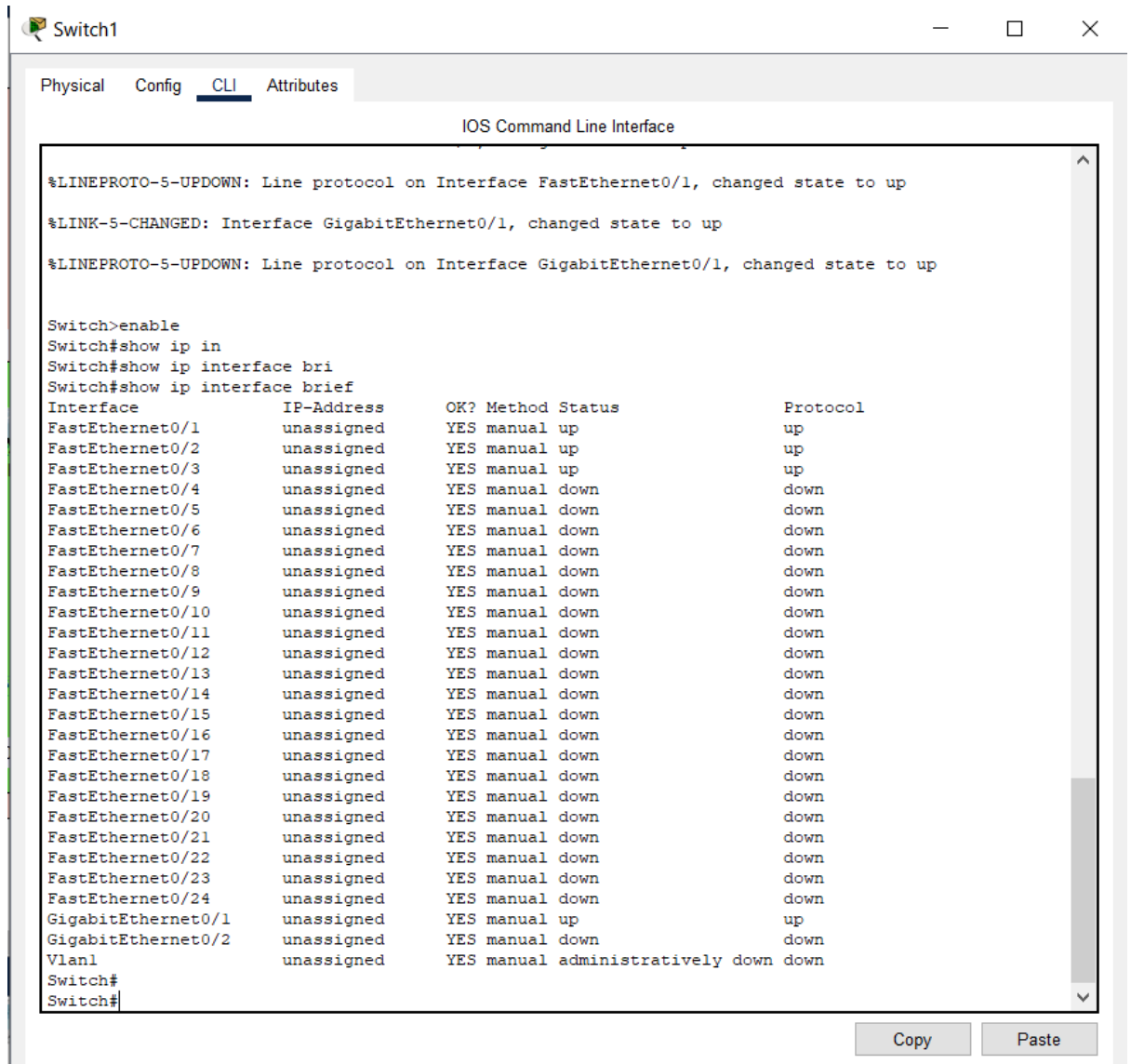
FastEthernet0 Connection: (default port)

Connection-specific DNS Suffix...:
Physical Address.....: 0003.E410.848D
Link-local IPv6 Address.....: FE80::203:E4FF:FE10:848D
IPv6 Address.....: ::
IPv4 Address.....: 192.168.10.1
Subnet Mask.....: 255.255.255.240
Default Gateway.....: ::
                        192.168.10.14
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-67-80-11-51-00-03-E4-10-84-8D
DNS Servers.....: ::
                        0.0.0.0

Bluetooth Connection:

Connection-specific DNS Suffix...:
Physical Address.....: 0002.1751.893B
Link-local IPv6 Address.....: ::
--More--
```

- Enable Interfaces:



The screenshot shows a network switch window titled "Switch1" with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the "IOS Command Line Interface". The terminal output shows several status messages and commands:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Switch>enable
Switch#show ip in
Switch#show ip interface bri
Switch#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/1	unassigned	YES	manual	up	up
FastEthernet0/2	unassigned	YES	manual	up	up
FastEthernet0/3	unassigned	YES	manual	up	up
FastEthernet0/4	unassigned	YES	manual	down	down
FastEthernet0/5	unassigned	YES	manual	down	down
FastEthernet0/6	unassigned	YES	manual	down	down
FastEthernet0/7	unassigned	YES	manual	down	down
FastEthernet0/8	unassigned	YES	manual	down	down
FastEthernet0/9	unassigned	YES	manual	down	down
FastEthernet0/10	unassigned	YES	manual	down	down
FastEthernet0/11	unassigned	YES	manual	down	down
FastEthernet0/12	unassigned	YES	manual	down	down
FastEthernet0/13	unassigned	YES	manual	down	down
FastEthernet0/14	unassigned	YES	manual	down	down
FastEthernet0/15	unassigned	YES	manual	down	down
FastEthernet0/16	unassigned	YES	manual	down	down
FastEthernet0/17	unassigned	YES	manual	down	down
FastEthernet0/18	unassigned	YES	manual	down	down
FastEthernet0/19	unassigned	YES	manual	down	down
FastEthernet0/20	unassigned	YES	manual	down	down
FastEthernet0/21	unassigned	YES	manual	down	down
FastEthernet0/22	unassigned	YES	manual	down	down
FastEthernet0/23	unassigned	YES	manual	down	down
FastEthernet0/24	unassigned	YES	manual	down	down
GigabitEthernet0/1	unassigned	YES	manual	up	up
GigabitEthernet0/2	unassigned	YES	manual	down	down
Vlan1	unassigned	YES	manual	administratively down	down

The terminal ends with the prompt "Switch#". Below the terminal window are "Copy" and "Paste" buttons.

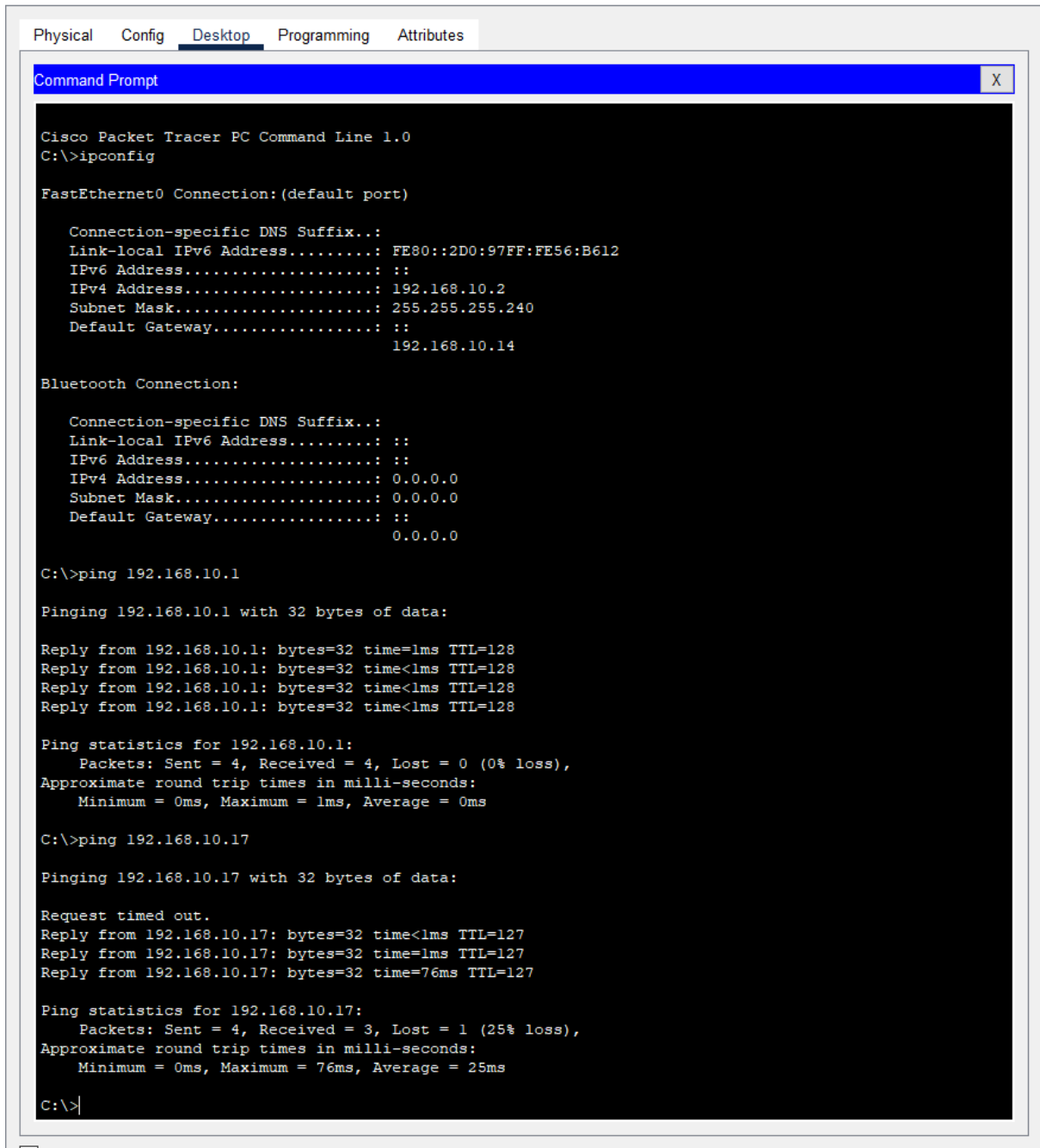
Explanation:

- Make sure router and switch interfaces are activated using no shutdown.
- Verify interface status with show ip interface brief.

5 Testing

5.1 Connectivity Testing:

- Use `ping` to test communication between devices within the same subnet and across different subnets.
- Examples:



```
Physical  Config  Desktop  Programming  Attributes

Command Prompt

Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: FE80::2D0:97FF:FE56:B612
    IPv6 Address . . . . .: ::
    IPv4 Address . . . . .: 192.168.10.2
    Subnet Mask . . . . .: 255.255.255.240
    Default Gateway . . . . .:
                                   192.168.10.14

Bluetooth Connection:

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

C:\>ping 192.168.10.1

Pinging 192.168.10.1 with 32 bytes of data:

Reply from 192.168.10.1: bytes=32 time=1ms TTL=128
Reply from 192.168.10.1: bytes=32 time<1ms TTL=128
Reply from 192.168.10.1: bytes=32 time<1ms TTL=128
Reply from 192.168.10.1: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.10.17

Pinging 192.168.10.17 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.17: bytes=32 time<1ms TTL=127
Reply from 192.168.10.17: bytes=32 time=1ms TTL=127
Reply from 192.168.10.17: bytes=32 time=76ms TTL=127

Ping statistics for 192.168.10.17:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 76ms, Average = 25ms

C:\>|
```

5.2 IP Verification:

- On PCs: ipconfig /all
- On Router: show ip interface brief

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig /all

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Physical Address.....: 0001.432D.7053
    Link-local IPv6 Address.....: FE80::201:43FF:FE2D:7053
    IPv6 Address.....: ::
    IPv4 Address.....: 192.168.10.17
    Subnet Mask.....: 255.255.255.240
    Default Gateway.....: ::
                                192.168.10.30
    DHCP Servers.....: 0.0.0.0
    DHCPv6 IAID.....:
    DHCPv6 Client DUID.....: 00-01-00-01-AD-45-10-A8-00-01-43-2D-70-53
    DNS Servers.....: ::
                                0.0.0.0
```

```
Router>enable
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0       192.168.10.14   YES manual up          up
GigabitEthernet0/1       192.168.10.30   YES manual up          up
Vlan1                    unassigned      YES unset  administratively down down
Router#
```

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6 Conclusion

Subnetting is a fundamental networking technique that improves network management, reduces broadcast traffic and ensures efficient IP usage. By completing this project, learners gain hands-on experience in planning subnets, assigning IP addresses, and verifying network connectivity, laying a solid foundation for designing scalable and efficient networks.