

SE TE 1

2nd Semester 2023 – 2024

LABORATORY NO. 7

Designing an IP Subnetting Scheme for Growth

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Submitted to:

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I. Objectives

- a. To be able to design an IP subnetting scheme that meets a specified network requirement.
- b. To efficiently allocate IP addresses to network segments.
- c. To design an IP subnetting scheme that can handle future possibility of growth.

II. Design

Step 1: Determining the number of subnets needed.

- Since there are **4 subnets** initially required in the problem and the 20% growth requirement, multiply 4 by 1.2.
- This will yield **4.8 subnets or ~5 subnets** in order to handle the possibility of future growth.

Step 2: Identify the number of hosts needed for each subnet.

- From the given network requirement based on the problem, the number of hosts for each subnet are as follows:
 - o Subnet 1: 20 hosts
 - o Subnet 2: 10 hosts
 - o Subnet 3: 25 hosts
 - o Subnet 4: 15 hosts

Step 3: Subnetting Proper

- **Subnet mask: $2^3 = 8$**
- The subnet mask will be 255.255.255.248, enough to cater the maximum of 25 hosts per subnet

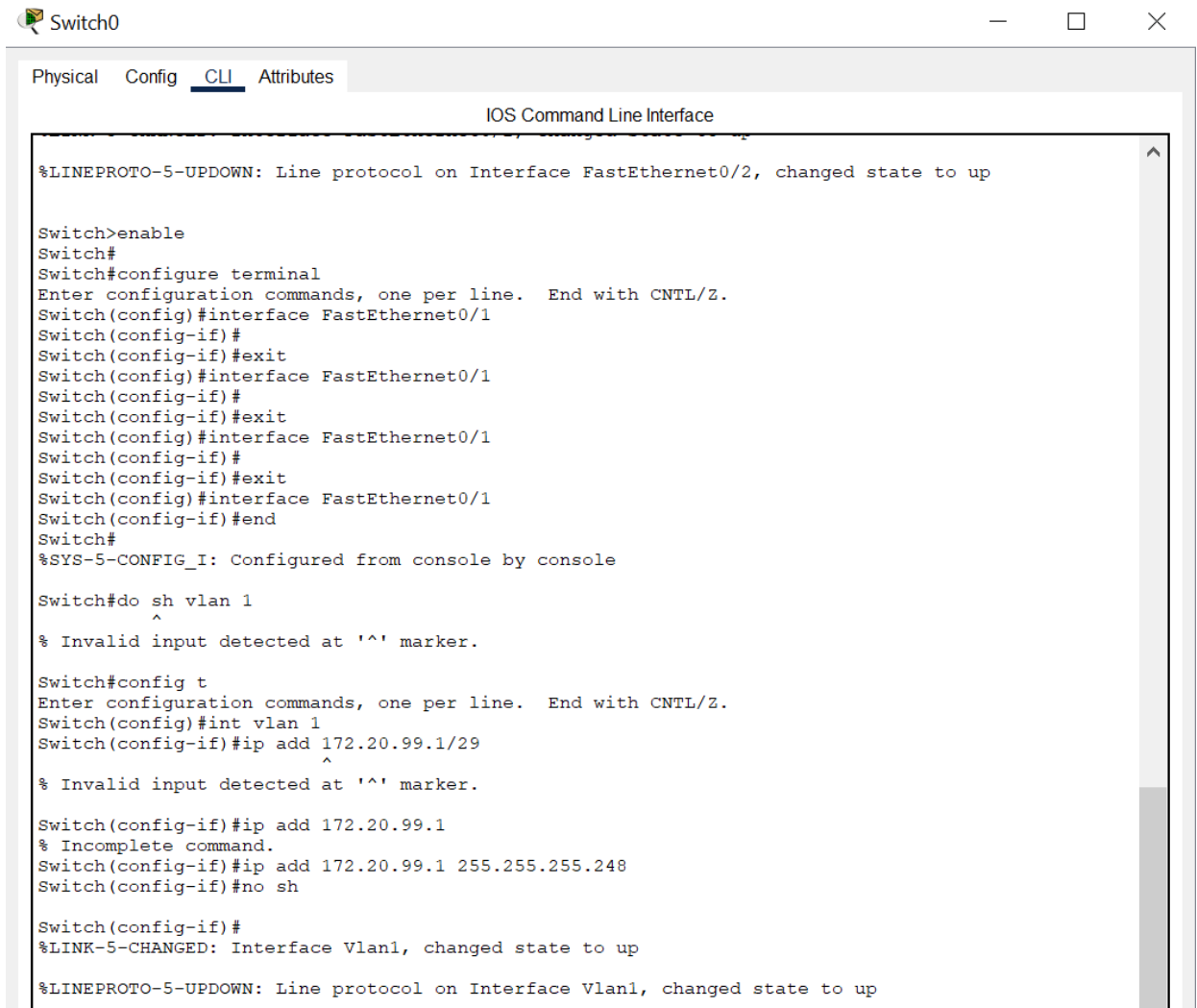
Step 4: Allocation of IP Addresses for the Router

- Router 1: 172.20.99.1/29
- Router 2: 172.20.99.9/29
- Router 3: 172.20.99.17/29
- Router 4: 172.20.99.25/29
- Router 5: 172.20.99.33/29

Step 5: Allocation of IP Addresses for the Hosts

- Subnet 1: 172.20.99.2 to 172.20.99.6 (5 hosts)
- Subnet 2: 172.20.99.10 to 172.20.99.14 (5 hosts)
- Subnet 3: 172.20.99.18 to 172.20.99.22 (5 hosts)
- Subnet 4: 172.20.99.26 to 172.20.99.30 (5 hosts)
- Subnet 5: 172.20.99.34 to 172.20.99.38 (5 hosts)

III. Schematics



The screenshot shows a network switch named 'Switch0' with a window titled 'Switch0'. The window has tabs for 'Physical', 'Config', 'CLI' (selected), and 'Attributes'. The main area displays the 'IOS Command Line Interface' with the following text:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>enable
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface FastEthernet0/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/1
Switch(config-if)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console

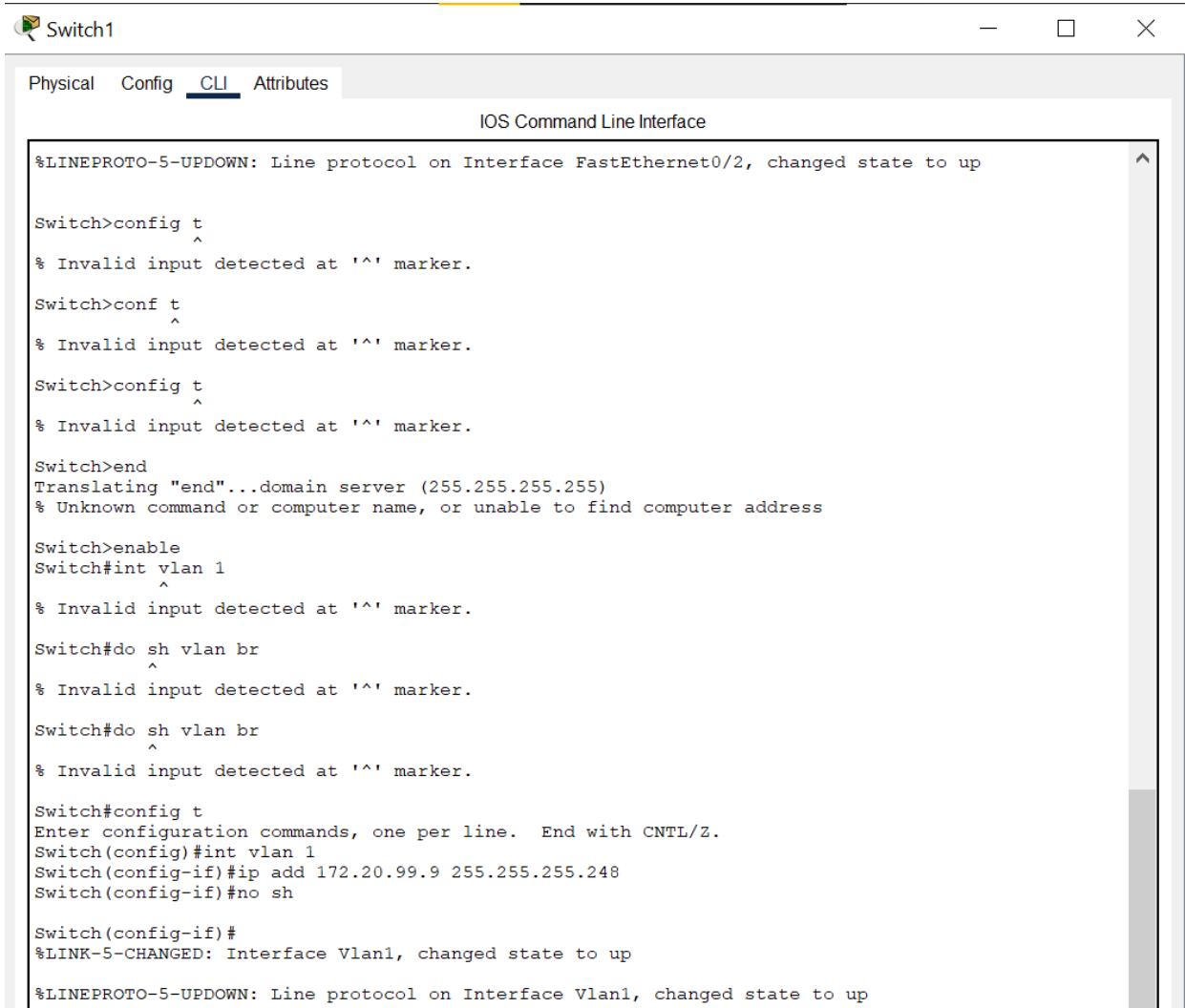
Switch#do sh vlan 1
^
% Invalid input detected at '^' marker.

Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int vlan 1
Switch(config-if)#ip add 172.20.99.1/29
^
% Invalid input detected at '^' marker.

Switch(config-if)#ip add 172.20.99.1
% Incomplete command.
Switch(config-if)#ip add 172.20.99.1 255.255.255.248
Switch(config-if)#no sh

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

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



The screenshot shows a network switch named 'Switch1' with a window titled 'Switch1'. The window has four tabs: 'Physical', 'Config', 'CLI', and 'Attributes'. The 'CLI' tab is selected, showing the 'IOS Command Line Interface'. The interface displays a series of commands and their outputs:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>config t
      ^
% Invalid input detected at '^' marker.

Switch>conf t
      ^
% Invalid input detected at '^' marker.

Switch>config t
      ^
% Invalid input detected at '^' marker.

Switch>end
Translating "end"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Switch>enable
Switch#int vlan 1
      ^
% Invalid input detected at '^' marker.

Switch#do sh vlan br
      ^
% Invalid input detected at '^' marker.

Switch#do sh vlan br
      ^
% Invalid input detected at '^' marker.

Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int vlan 1
Switch(config-if)#ip add 172.20.99.9 255.255.255.248
Switch(config-if)#no sh

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

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

IOS Command Line Interface

```
Model number          : WS-C2960-24TT-L
System serial number  : FOC1010X104
Top Assembly Part Number : 800-27221-02
Top Assembly Revision Number : A0
Version ID            : V02
CLEI Code Number      : COM3L00BRA
Hardware Board Revision Number : 0x01

Switch Ports Model          SW Version        SW Image
-----
*    1 26      WS-C2960-24TT-L    15.0(2)SE4      C2960-LANBASEK9-M

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE SOFTWARE (fcl)
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Press RETURN to get started!

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>enable
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int vlan 1
Switch(config-if)#ip add 172.20.99.17 255.255.255.248
Switch(config-if)#no sh

Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
```

Switch3

Physical Config CLI Attributes

IOS Command Line Interface

```
Top Assembly Part Number      : 000-27221-02
Top Assembly Revision Number  : A0
Version ID                   : V02
CLEI Code Number             : COM3L00BRA
Hardware Board Revision Number : 0x01

Switch Ports Model          SW Version        SW Image
-----
*    1 26      WS-C2960-24TT-L  15.0(2)SE4      C2960-LANBASEK9-M

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE SOFTWARE (fc1)
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Press RETURN to get started!

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>enable
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int vlan 1
Switch(config-if)#int vlan 3
Switch(config-if)#int vlan 1
Switch(config-if)#ip add 172.20.99.25 255.255.255.248
Switch(config-if)#no sh

Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
```

PC0

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

Bluetooth

FastEthernet0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 0060.5CAC.4C9C

IP Configuration

☐ DHCP

☒ Static

IPv4 Address 172.20.99.2

Subnet Mask

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address: FE80::260:5CFF:FEAC:4C9C

PC1

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

Bluetooth

FastEthernet0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 000D.BD8B.1D13

IP Configuration

☐ DHCP

☒ Static

IPv4 Address 172.20.99.10

Subnet Mask

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address: FE80::20D:BDFF:FE8B:1D13

PC2

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

Bluetooth

FastEthernet0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 0050.0F0A.9EA2

IP Configuration

☐ DHCP

☒ Static

IPv4 Address 172.20.99.18

Subnet Mask

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address: FE80::250:FFF:FE0A:9EA2

PC3

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

Bluetooth

FastEthernet0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 0002.4AA4.B0A5

IP Configuration

☐ DHCP

☒ Static

IPv4 Address 172.20.99.26

Subnet Mask

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address: FE80::202:4AFF:FEA4:B0A5

IV. Questions

- a. How many Ethernet networks currently exist? There are **4 Ethernet networks**.
- b. How many WAN links currently exist? There is **1 WAN link**.
- c. How many total networks? There are **5 networks in total**
- d. How many subnets? **There are 4 subnets**.
- e. How many subnets with 20% growth? **There are 5 subnets with 20% growth**

Reflection:

1. With the initial block of addresses assigned by the ISP, and the requirements for future growth, is there any other subnetting scheme that could have worked?

Yes, given the initial IP block from the ISP and future growth needs, an alternative subnetting scheme like **Variable Length Subnet Mask (VLSM) could have been more efficient**. VLSM allows for dividing an IP address space into subnets of varying sizes, optimizing the use of IP addresses by allocating smaller subnets to networks with fewer hosts and larger subnets to those with more hosts.

2. If the maximum number of hosts per network segment was only 14, could you have used another scheme? Why?

Yes, if the maximum number of hosts per network segment was 14, **a /28 subnet mask could have been used**. This mask supports up to 14 usable host addresses per subnet, making it suitable for the scenario described. The choice of a /28 subnet mask is practical for networks that require a maximum of 14 hosts, ensuring efficient use of IP addresses without wasting them.

3. Although it works for the scenario in item b above, would it be a good idea to use 4 bits for subnets and 4 bits for hosts?

No, **using 4 bits for subnets and 4 bits for hosts might not be practical**. With 4 bits for subnets, you would have 16 subnets, and with 4 bits for hosts, you would have 16 hosts per subnet. **This setup would not meet the network's requirements for a maximum of 14 hosts per network segment**, as it would allow for **16 hosts**, not 14. Therefore, this approach would not be efficient for the given scenario.