Lab – Subnetting Network Topologies (Instructor Version)

Instructor Note: Red font color or Gray highlights indicate text that appears in the instructor copy only.

Objectives

Parts 1 to 5, for each network topology:

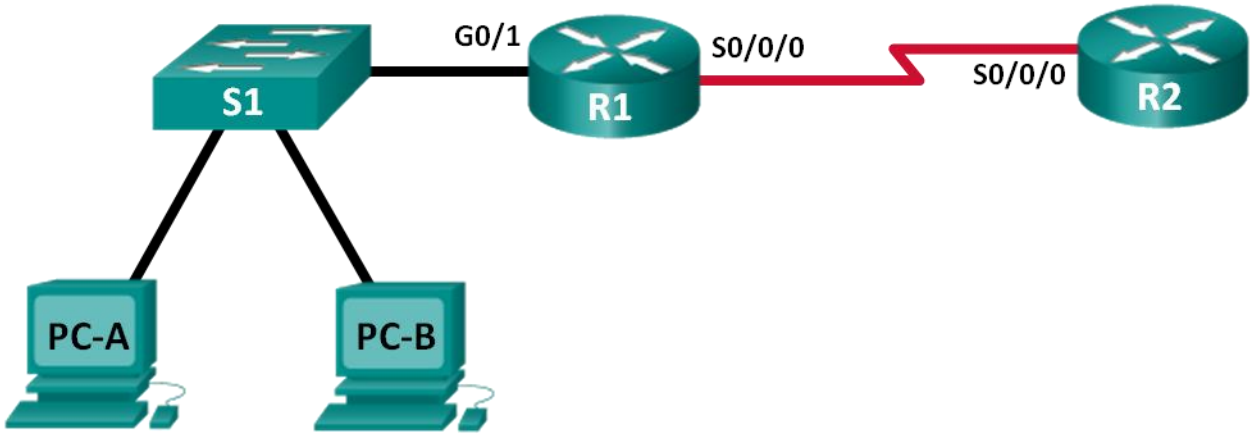
- Determine the number of subnets.
- Design an appropriate addressing scheme.
- Assign addresses and subnet mask pairs to device interfaces.
- Examine the use of the available network address space and future growth potential.

Background / Scenario

When given a network topology, it is important to be able to determine the number of subnets required. In this lab, several scenario topologies will be provided, along with a base network address and mask. You will subnet the network address and provide an IP addressing scheme that will accommodate the number of subnets displayed in the topology diagram. You must determine the number of bits to borrow, the number of hosts per subnet, and potential for growth as specified by the instructions.

Part 1: Network Topology A

In Part 1, you have been given the 192.168.10.0/24 network address to subnet, with the following topology. Determine the number of networks needed and then design an appropriate addressing scheme.



Step 1: Determine the number of subnets in Network Topology A.

a. How many subnets are there? _____ 2

b. How many bits should you borrow to create the required number of subnets? _____ 1

c. How many usable host addresses per subnet are in this addressing scheme? _____ 126

d. What is the new subnet mask in dotted decimal format? _____ 255.255.255.128

e. How many subnets are available for future use? _____ 0

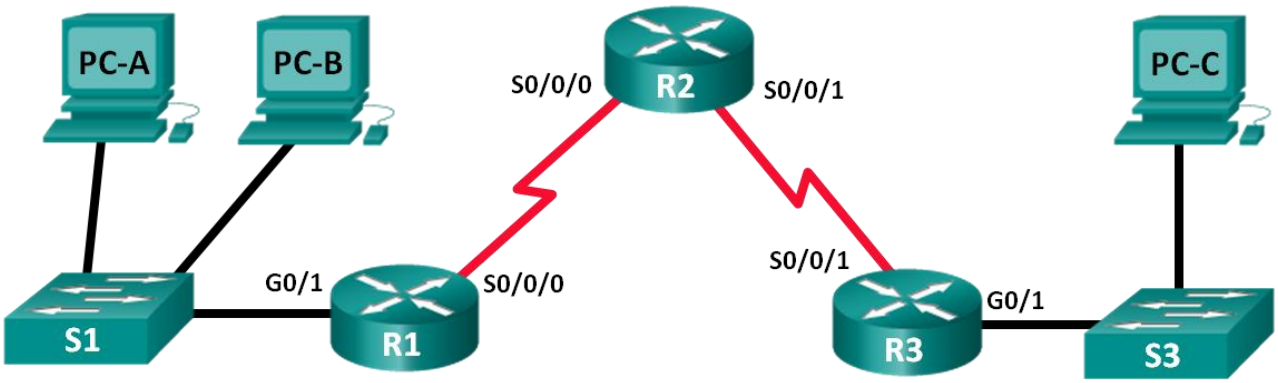
Step 2: Record the subnet information.

Fill in the following table with the subnet information:

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	192.168.10.0	192.168.10.1	192.168.10.126	192.168.10.127
1	192.168.10.128	192.168.10.129	192.168.10.254	192.168.10.255
2				
3				
4				
5				

Part 2: Network Topology B

The network topology from Part 1 has expanded to accommodate the addition of router R3 and its accompanying network, as illustrated in the following topology. Use the 192.168.10.0/24 network address to provide addresses to the network devices, and then design a new addressing scheme to support the additional network requirement.



Step 1: Determine the number of subnets in Network Topology B.

a. How many subnets are there? _____ 4

b. How many bits should you borrow to create the required number of subnets? _____ 2

c. How many usable host addresses per subnet are in this addressing scheme? _____ 62

d. What is the new subnet mask in dotted decimal format? _____ 255.255.255.192

e. How many subnets are available for future use? _____ 0

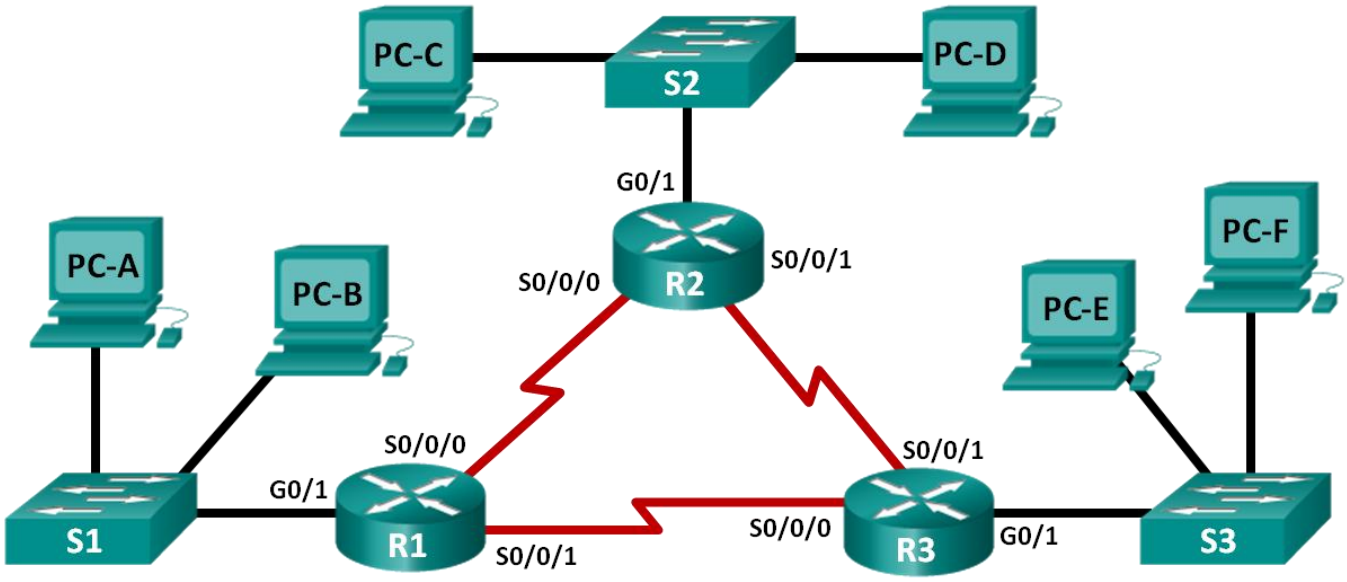
Step 2: Record the subnet information.

Fill in the following table with the subnet information:

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	192.168.10.0	192.168.10.1	192.168.10.62	192.168.10.63
1	192.168.10.64	192.168.10.65	192.168.10.126	192.168.10.127
2	192.168.10.128	192.168.10.129	192.168.10.190	192.168.10.191
3	192.168.10.192	192.168.10.193	192.168.10.254	192.168.10.255
4				
5				
6				
7				

Part 3: Network Topology C

The topology has changed again with a new LAN added to R2 and a redundant link between R1 and R3. Use the 192.168.10.0/24 network address to provide addresses to the network devices. Also provide an IP address scheme that will accommodate these additional devices. For this topology, assign a subnet to each network.



Step 1: Determine the number of subnets in Network Topology C.

a. How many subnets are there? _____ 6

b. How many bits should you borrow to create the required number of subnets? _____ 3

c. How many usable host addresses per subnet are in this addressing scheme? _____ 30

d. What is the new subnet mask in dotted decimal format? _____ 255.255.255.224

e. How many subnets are available for future use? _____ 2

Step 2: Record the subnet information.

Fill in the following table with the subnet information:

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	192.168.10.0	192.168.10.1	192.168.10.30	192.168.10.31
1	192.168.10.32	192.168.10.33	192.168.10.62	192.168.10.63
2	192.168.10.64	192.168.10.65	192.168.10.94	192.168.10.95
3	192.168.10.96	192.168.10.97	192.168.10.126	192.168.10.127
4	192.168.10.128	192.168.10.129	192.168.10.158	192.168.10.159
5	192.168.10.160	192.168.10.161	192.168.10.190	192.168.10.191
6	192.168.10.192	192.168.10.193	192.168.10.222	192.168.10.223
7	192.168.10.224	192.168.10.225	192.168.10.254	192.168.10.255
8				
9				
10				

Step 3: Assign addresses to network devices in the subnets.

a. Fill in the following table with IP addresses and subnet masks for the router interfaces:

Instructor Note: These are suggested IP addresses based on using the first 6 subnets from the table above as assigned to each segment.

Device	Interface	IP Address	Subnet Mask
R1	GigabitEthernet 0/1	192.168.10.1	255.255.255.224
	Serial 0/0/0	192.168.10.33	255.255.255.224
	Serial 0/0/1	192.168.10.65	255.255.255.224
R2	GigabitEthernet 0/1	192.168.10.97	255.255.255.224
	Serial 0/0/0	192.168.10.34	255.255.255.224
	Serial 0/0/1	192.168.10.129	255.255.255.224
R3	GigabitEthernet 0/1	192.168.10.161	255.255.255.224
	Serial 0/0/0	192.168.10.66	255.255.255.224
	Serial 0/0/1	192.168.10.130	255.255.255.224

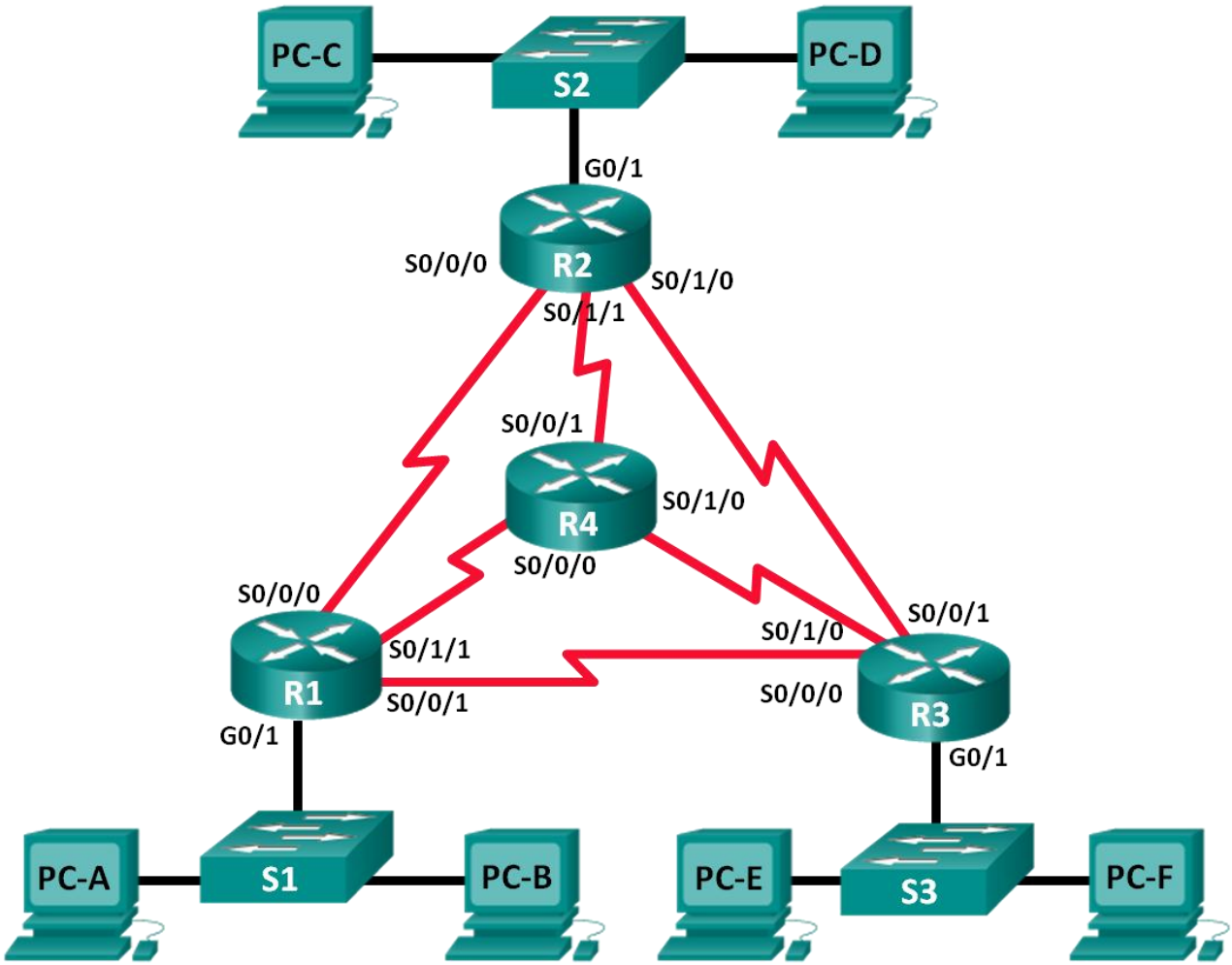
b. Fill in the following table with the IP addresses and subnet masks for devices in the LAN as displayed in topology.

Instructor Note: These are suggested IP addresses based on using the first 6 subnets from the table above as assigned to each segment.

Device	Interface	IP Address	Subnet Mask	Default Gateway
PC-A	NIC	192.168.10.30	255.255.255.224	192.168.10.1
PC-B	NIC	192.168.10.29	255.255.255.224	192.168.10.1
S1	VLAN 1	192.168.10.2	255.255.255.224	192.168.10.1
PC-C	NIC	192.168.10.126	255.255.255.224	192.168.10.97
PC-D	NIC	192.168.10.125	255.255.255.224	192.168.10.97
S2	VLAN 1	192.168.10.98	255.255.255.224	192.168.10.97
PC-E	NIC	192.168.10.190	255.255.255.224	192.168.10.161
PC-F	NIC	192.168.10.189	255.255.255.224	192.168.10.161
S3	VLAN 1	192.168.10.162	255.255.255.224	192.168.10.161

Part 4: Network Topology D

The network was modified to accommodate changes in the organization. The 192.168.10.0/24 network address is used to provide the addresses in the network.



Step 1: Determine the number of subnets in Network Topology D.

a. How many subnets are there? _____ 9

b. How many bits should you borrow to create the required number of subnets? _____ 4

c. How many usable host addresses per subnet are in this addressing scheme? _____ 14

d. What is the new subnet mask in dotted decimal format? _____ 255.255.255.240

e. How many subnets are available for future use? _____ 7

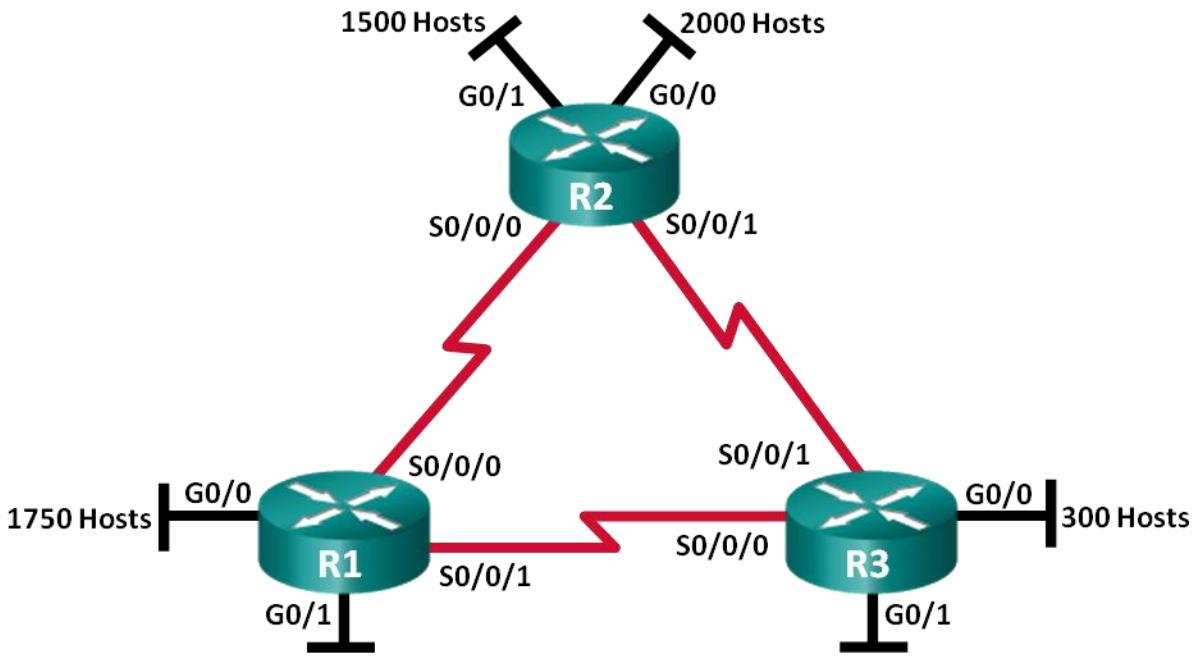
Step 2: Record the subnet information.

Fill in the following table with the subnet information.

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	192.168.10.0	192.168.10.1	192.168.10.14	192.168.10.15
1	192.168.10.16	192.168.10.17	192.168.10.30	192.168.10.31
2	192.168.10.32	192.168.10.33	192.168.10.46	192.168.10.47
3	192.168.10.48	192.168.10.49	192.168.10.62	192.168.10.63
4	192.168.10.64	192.168.10.65	192.168.10.78	192.168.10.79
5	192.168.10.80	192.168.10.81	192.168.10.94	192.168.10.95
6	192.168.10.96	192.168.10.97	192.168.10.110	192.168.10.111
7	192.168.10.112	192.168.10.111	192.168.10.126	192.168.10.127
8	192.168.10.128	192.168.10.129	192.168.10.142	192.168.10.143
9	192.168.10.144	192.168.10.145	192.168.10.158	192.168.10.159
10	192.168.10.160	192.168.10.161	192.168.10.174	192.168.10.175
11	192.168.10.176	192.168.10.177	192.168.10.190	192.168.10.191
12	192.168.10.192	192.168.10.193	192.168.10.206	192.168.10.207
13	192.168.10.208	192.168.10.209	192.168.10.222	192.168.10.223
14	192.168.10.224	192.168.10.225	192.168.10.238	192.168.10.239
15	192.168.10.240	192.168.10.241	192.168.10.254	192.168.10.255
16				
17				

Part 5: Network Topology E

The organization has a network address of 172.16.128.0/17 to be divided as illustrated in the following topology. You must choose an addressing scheme that can accommodate the number of networks and hosts in the topology.



Step 1: Determine the number of subnets in Network Topology E.

a. How many subnets are there? _____ 9

b. How many bits should you borrow to create the required number of subnets? _____ 4

c. How many usable host addresses per subnet are in this addressing scheme? _____ 2046

d. What is the new subnet mask in dotted decimal format? _____ 255.255.248.0

e. How many subnets are available for future use? _____ 7

Step 2: Record the subnet information.

Fill in the following table with the subnet information:

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	172.16.128.0	172.16.128.1	172.16.135.254	172.16.135.255
1	172.16.136.0	172.16.136.1	172.16.143.254	172.16.143.255
2	172.16.144.0	172.16.144.1	172.16.151.254	172.16.151.255
3	172.16.152.0	172.16.152.1	172.16.159.254	172.16.159.255
4	172.16.160.0	172.16.160.1	172.16.167.254	172.16.167.255
5	172.16.168.0	172.16.168.1	172.16.175.254	172.16.175.255
6	172.16.176.0	172.16.176.1	172.16.183.254	172.16.183.255
7	172.16.184.0	172.16.184.1	172.16.191.254	172.16.191.255
8	172.16.192.0	172.16.192.1	172.16.199.254	172.16.199.255
9	172.16.200.0	172.16.200.1	172.16.207.254	172.16.207.255
10	172.16.208.0	172.16.208.1	172.16.215.254	172.16.215.255
11	172.16.216.0	172.16.216.1	172.16.223.254	172.16.223.255
12	172.16.224.0	172.16.224.1	172.16.231.254	172.16.231.255
13	172.16.232.0	172.16.232.1	172.16.239.254	172.16.239.255
14	172.16.240.0	172.16.240.1	172.16.247.254	172.16.247.255
15	172.16.248.0	172.16.248.1	172.16.255.254	172.16.255.255
16				
17				

Step 3: Assign addresses to network devices in the subnets.

a. Fill in the following table with IP addresses and subnet masks for the router interfaces:

Instructor Note: These are suggested IP addresses based on using the first 9 subnets from the table above as assigned to each segment.

Device	Interface	IP Address	Subnet Mask
R1	GigabitEthernet 0/0	172.16.128.1	255.255.248.0
	GigabitEthernet 0/1	172.16.136.1	255.255.248.0
	Serial 0/0/0	172.16.144.1	255.255.248.0
	Serial 0/0/1	172.16.152.1	255.255.248.0
R2	GigabitEthernet 0/0	172.16.160.1	255.255.248.0
	GigabitEthernet 0/1	172.16.168.1	255.255.248.0
	Serial 0/0/0	172.16.144.2	255.255.248.0
	Serial 0/0/1	172.16.176.1	255.255.248.0
R3	GigabitEthernet 0/0	172.16.184.1	255.255.248.0
	GigabitEthernet 0/1	172.16.192.1	255.255.248.0
	Serial 0/0/0	172.16.152.2	255.255.248.0
	Serial 0/0/1	172.16.176.2	255.255.248.0

Reflection

1. What information is needed when determining an appropriate addressing scheme for a network?

   _____

   _____

   Number of networks and hosts are needed when determining an appropriate addressing scheme for a network.

2. After the subnets are assigned, will all the host addresses be utilized in each subnet?

   _____

   _____

   No. For the WAN serial links, only two addresses will be utilized. For the subnets with host PCs, all the addresses can be used in each subnet.