LAB 7 - Exercise:
Addressing the Networks

Learning Objectives

Upon completion of this lab, you will be able to:

- Determine the number of subnets needed.
- Determine the number of hosts needed.
- Design an appropriate classless addressing scheme using basic subnetting
- Design an appropriate classless addressing scheme using VLSM technique

Scenario

Figure 1 shows the topology diagram with classfull IP addressing schemes. Implement a scalable network to provide the IP addressing by using address block **193.128.56.0/24**. The subnetwork has the following addressing requirements:

- The LAN 1 – 32 workstations.
- The LAN 2 – 16 workstations.
- The LAN 3 – 5 workstations.

Note:

Remember that the interfaces of network devices are also need IP addresses and must be included in the addressing requirements.

e.g.: requirement no of addresses for LAN 1 = 35 addresses

32 + 2 + 1 (Workstation add.s + Network add. + Broadcast add. + Gateway add.)

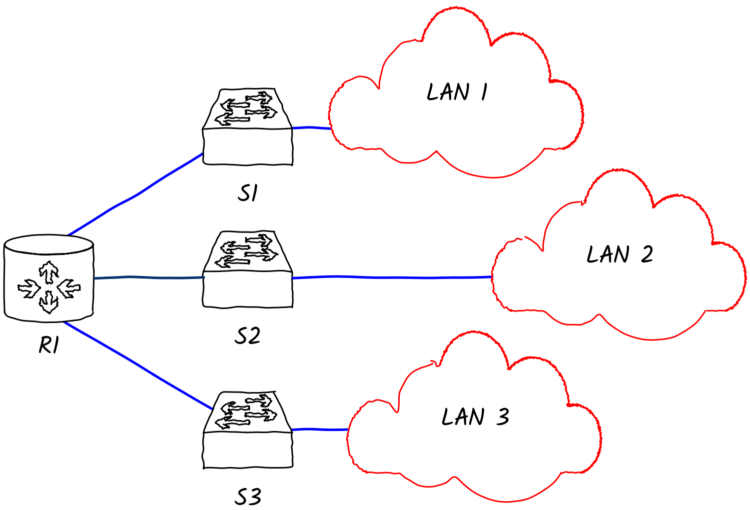


Figure 1 Topology Diagram

Design an IP Addressing Scheme.

Based on scenario above, determine all available IP addresses using basic subnetting technique in Table1 while Variable Length Subnet Masking (VLSM) technique in Table 2.

TIPS: *Basic subnetting has the same number of addresses for every subnetwork created.*

Basic Subnetting

Addressing requirements

Highest number of hosts →

LAN A = **32** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway) = **35** → **64**

Given

Address range **193.128.56.0 – 193.128.56.255**

SM = **/24** = **255.255.255.0**

Lets m = bit required for host

No. of addresses = 2^m = 64 , m= 6

11000001	**10000000**	**00111000**	**00000000**	1st block1 for **LAN A**
11000001	**10000000**	**00111000**	**00111111**	0 → 63 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**01000000**	2nd block1 for **LAN B**
11000001	**10000000**	**00111000**	**01111111**	64 → 127 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**10000000**	3rd block1 for **LAN C**
11000001	**10000000**	**00111000**	**10111111**	128 → 191 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**11000000**	4th block1 - FREE
11000001	**10000000**	**00111000**	**11111111**	192 → 255 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26

Fill in the following table with the subnet information.

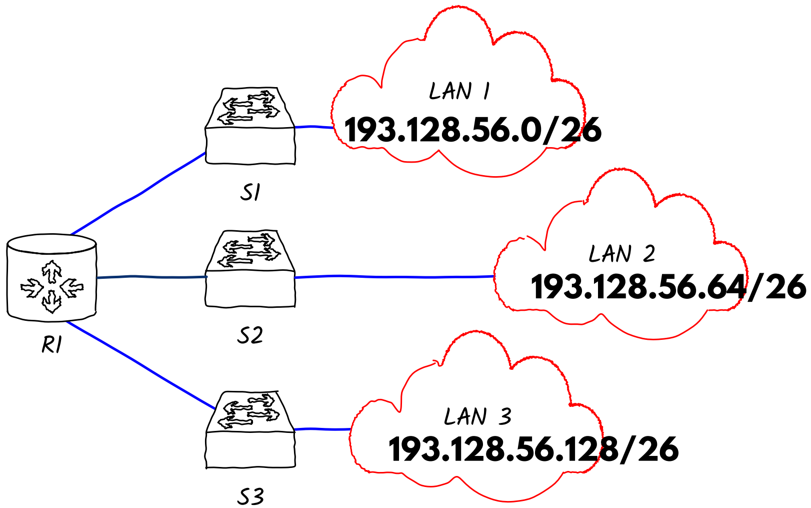
Table 1: IP Addressing scheme by basic subnetting technique

Subnetwork Number	Network Address	First Usable Host Address	Last Usable Host Address	Broadcast Address	SubnetMask
LAN A	**193.128.56.0**	**193.128.56.1**	**193.128.56.62**	**193.128.56.63**	**/26**
LAN B	**193.128.56.64**	**193.128.56.65**	**193.128.56.126**	**193.128.56.127**	**/26**
LAN C	**193.128.56.128**	**193.128.56.129**	**193.128.56.190**	**193.128.56.191**	**/26**

Examine the Network Requirements.

Examine the network requirements and answer the questions below. Keep in mind that IP addresses will be needed for each of the LAN interfaces.

1. How many subnetworks are required? **3**
2. Which subnet own the highest number of IP addresses? **All same, 64**
3. What is the total number of IP addresses allocated for all LANs? **64+64+64=192**
4. How many IP addresses successfully saved for future needs? **256-192 = 62**



VLSM

Addressing requirements

LAN A = **32** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway) = **35 → 64**

LAN B = **16** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway) = **19 → 32**

LAN C = **5** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway) = **8 → 8**

Given

Address range **193.128.56.0 – 193.128.56.255**

SM = **/24** = **255.255.255.0**

LAN A

Lets m = bit required for host

No. of addresses = 2^m = 64 , m= 6

11000001	**10000000**	**00111000**	**00000000**	1st block1 for **LAN A**
11000001	**10000000**	**00111000**	**00111111**	0 → 63 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**01000000**	2nd block1 - FREE
11000001	**10000000**	**00111000**	**01111111**	64 → 127 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**10000000**	3rd block1 - FREE
11000001	**10000000**	**00111000**	**10111111**	128 → 191 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26
11000001	**10000000**	**00111000**	**11000000**	4th block1 - FREE
11000001	**10000000**	**00111000**	**11111111**	192 → 255 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26

LAN B

Use 2nd block1

11000001	**10000000**	**00111000**	**01000000**	2nd block1 - FREE
11000001	**10000000**	**00111000**	**01111111**	64 → 127 (64 addresses)
11111111	**11111111**	**11111111**	**11000000**	SM=255.255.255.192 =/26

No. of addresses = 2^m = 32 , m= 5

11000001	**10000000**	**00111000**	**01000000**	1st block2 – **LAN B**
11000001	**10000000**	**00111000**	**01011111**	64 → 95 (32 addresses)
11111111	**11111111**	**11111111**	**11100000**	SM=255.255.255.224 =/27

11000001	**10000000**	**00111000**	**01100000**	2nd block2 - FREE
11000001	**10000000**	**00111000**	**01111111**	96 → 127 (32 addresses)
11111111	**11111111**	**11111111**	**11100000**	SM=255.255.255.224 =/27

LAN C

Use 2nd block2

11000001	**10000000**	**00111000**	**01100000**	2nd block2 - FREE
11000001	**10000000**	**00111000**	**01111111**	96 → 127 (32 addresses)
11111111	**11111111**	**11111111**	**11100000**	SM=255.255.255.224 =/27

No. of addresses = 2^m = 8 , m=3

11000001	**10000000**	**00111000**	**01100000**	1st block3 – **LAN C**
11000001	**10000000**	**00111000**	**01100111**	96 → 103 (8 addresses)
11111111	**11111111**	**11111111**	**11111000**	SM=255.255.255.248 =/29

11000001	**10000000**	**00111000**	**01101000**	2nd block3 – FREE
11000001	**10000000**	**00111000**	**01101111**	104 → 111 (8 addresses)
11111111	**11111111**	**11111111**	**11111000**	SM=255.255.255.248 =/29

11000001	**10000000**	**00111000**	**01110000**	3rd block3 – FREE
11000001	**10000000**	**00111000**	**01110111**	112 → 119 (8 addresses)
11111111	**11111111**	**11111111**	**11111000**	SM=255.255.255.248 =/29

11000001	**10000000**	**00111000**	**01111000**	4th block3 – FREE
11000001	**10000000**	**00111000**	**01111111**	120 → 127 (8 addresses)
11111111	**11111111**	**11111111**	**11111000**	SM=255.255.255.248 =/29

Fill in the following table with the subnet information.

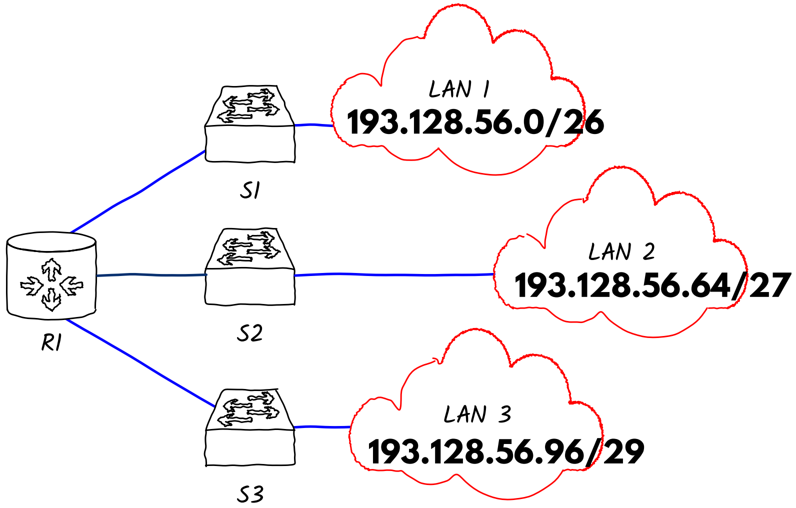
Table 2: IP Addressing scheme by VLSM technique

Subnetwork Number	Network Address	First Usable Host Address	Last Usable Host Address	Broadcast Address	SubnetMask
LAN A	**193.128.56.0**	**193.128.56.1**	**193.128.56.62**	**193.128.56.63**	**/26**
LAN B	**193.128.56.64**	**193.128.56.65**	**193.128.56.94**	**193.128.56.95**	**/27**
LAN C	**193.128.56.96**	**193.128.56.97**	**193.128.56.102**	**193.128.56.103**	**/29**

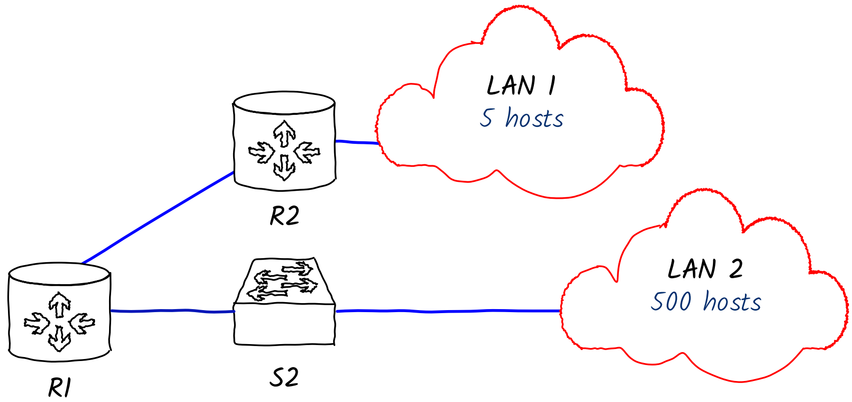
Examine the Network Requirements.

Examine the network requirements and answer the questions below. Keep in mind that IP addresses will be needed for each of the LAN interfaces.

1. How many subnets are required? **3**
2. Which subnet own the highest number of IP addresses? **LAN A**
3. What is the total number of IP addresses allocated for all LANs? **64+32+8= 104**
4. How many IP addresses successfully saved for future needs? **256-104 = 152**



Scenario 2



Implement a scalable network to provide the IP addressing by using address block **190.1.0.0/22**. Based on the scenario above, determine all available IP addresses using the Variable Length Subnet Masking (VLSM) technique.

VLSM

Addressing requirements

LAN 2 = **500** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway → Interface R1) = **503** → **512**

LAN 1 = **5** (PC) + **1** (Net Add) + **1** (Broadcast Add) + **1** (Gateway → Interface R2) = **8** → **8**

R1R2 = **1** (Net Add) + **1** (Broadcast Add) + **2** (Gateway → Interface R1 & R2) = **4** → **4**

Given

Address range **193.0.1.0 – 193.0.3.255**

SM = **/22** = **255.255.252.0**

LAN 2

Lets m = bit required for host

No. of addresses = 2^m = 512 , m= 9

11000001	**00000001**	**00000000**	**00000000**	1st & 2ND block1 for **LAN 2**
11000001	**00000001**	**00000001**	**11111111**	192.1.0.0 → 192.1.1.255 (512 addresses)
11111111	**11111111**	**11111110**	**00000000**	SM=255.255.254.0 =/23
11000001	**00000001**	**00000010**	**00000000**	3RD & 4TH block1 - FREE
11000001	**00000001**	**00000011**	**11111111**	192.1.2.0 → 192.1.3.255 (512 addresses)
11111111	**11111111**	**11111110**	**00000000**	SM= 255.255.254.0 = /23

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LAN 1

Use **192.1.2.0 /23**

Lets m = bit required for host

No. of addresses = 2^m = 8 , m= 3

11000001	**00000001**	**00000010**	**00000000**	192.1.2.0 → 192.1.2.7 (8 addresses) **LAN1**
11000001	**00000001**	**00000010**	**00000111**	
11111111	**11111111**	**11111111**	**11111000**	SM= 255.255.255.248 = /29

R1R2

Use **192.1.2.0 /23**

Lets m = bit required for host

No. of addresses = 2^m = 4 , m= 2

11000001	**00000001**	**00000010**	**00001000**	192.1.2.8 → 192.1.2.11 (4 addresses) **R1R2**
11000001	**00000001**	**00000010**	**00001011**	
11111111	**11111111**	**11111111**	**11111000**	SM= 255.255.255.252 = /30

Subnet Number	Network Address	First Usable Host Address	Last Usable Host Address	Broadcast Address	SubnetMask
LAN 2	**193.1.0.0**	**193.1.0.1**	**193.1.1.254**	**193.1.1.255**	**/23**
LAN 1	**193.1.2.0**	**193.1.2.1**	**193.1.2.6**	**193.1.2.7**	**/29**
R1R2	**193.1.2.8**	**193.1.2.9**	**193.1.2.10**	**193.1.2.11**	**/30**

Examine Network Requirements.

Examine the network requirements and answer the questions below. Keep in mind that IP addresses will be needed for each of the LAN interfaces.

1. How many subnetworks are needed? **3**
2. Which subnetwork owns the lowest number of IP addresses? **Subnetwork R1R2**
3. What is the total number of allocated IP addresses for LANs? **512+8+4 =524**
4. How many IP addresses successfully saved for future needs?

   /22 → 1024 - 524 = 500 addresses