Lab 1 – Review Calculating IPv4 Subnets, VLSM

Objectives

Part 1: Calculate IPv4 Address Subnetting

- Determine the number of subnets created.
- Determine number of hosts per subnet.
- Determine the subnet address.
- Determine the host range for the subnet.
- Determine the broadcast address for the subnet.

Part 2: Designing and Implementing a VLSM Addressing Scheme

Part 1: Calculate IPv4 Address Subnetting

When given an IPv4 address, the original subnet mask and the new subnet mask, you will be able to determine:

- Network address of this subnet
- Broadcast address of this subnet
- Range of host addresses of this subnet
- Number of subnets created
- Number of hosts per subnet

The following example shows a sample problem along with the solution for solving this problem:

Given:		AND = 172.16.64.0 (With new subnet)
Host IP Address:	172.16.77.120	10101100.00010000.01001101.01111000
Original Subnet Mask	255.255.0.0	11111111.11111111.00000000.00000000
New Subnet Mask:	255.255.240.0	11111111.11111111.11110000.00000000
Find:		
Number of Subnet Bits Toggled	4	
Number of Subnets Created Networks	16	
Number of Host Bits per Subnet	12	
Number of Hosts per Subnet 2^zeros=2^12	4,094	
Network Address of this Subnet	172.16.64.0	
IPv4 Address of First Host on this Subnet	172.16.64.1	
IPv4 Address of Last Host on this Subnet	172.16.79.254	
IPv4 Broadcast Address on this Subnet	172.16.79.255	

Let's analyze how this table was completed.

The original subnet mask was 255.255.0.0 or /16. The new subnet mask is 255.255.240.0 or /20. The resulting difference is 4 bits. Because 4 bits were borrowed, we can determine that 16 subnets were created because $2^4 = 16$.

The new mask of 255.255.240.0 or /20 leaves 12 bits for hosts. With 12 bits left for hosts, we use the following formula: $2^{12} = 4{,}096 – 2 = 4{,}094$ hosts per subnet.

Binary ANDing will help you determine the subnet for this problem, which results in the network 172.16.64.0.

Finally, you need to determine the first host, last host, and broadcast address for each subnet. One method to determine the host range is to use binary math for the host portion of the address. In our example, the last 12 bits of the address is the host portion. The first host would have all significant bits set to zero and the least significant bit set to 1. The last host would have all significant bits set to 1 and the least significant bit set to 0. In this example, the host portion of the address resides in the 3rd and 4th octets.

Description	1st Octet	2nd Octet	3rd Octet	4th Octet	Description
Network/Host	**nnnnnnnn**	**nnnnnnnn**	**nnnn**hhhh	hhhhhhhh	Subnet Mask
Binary	**10101100**	**00010000**	**0100**0000	00000001	First Host
Decimal	172	16	64	1	First Host
Binary	**10101100**	**00010000**	**0100**1111	11111110	Last Host
Decimal	172	16	79	254	Last Host
Binary	**10101100**	**00010000**	**0100**1111	11111111	Broadcast
Decimal	172	16	79	255	Broadcast

Step 1: Fill out the tables below with appropriate answers given the IPv4 address, original subnet mask, and new subnet mask.

a. **Problem 1**:

Given:	
Host IP Address:	192.168.200.139 192.168.200.10001011
Original Subnet Mask	255.255.255.0
New Subnet Mask:	255.255.255.224 11111111.11111111.11111111.11100000
Find:	
Number of Subnet Bits	3
Number of Subnets Created	8
Number of Host Bits per Subnet	5
Number of Hosts per Subnet	30
Network Address of this Subnet	192.168.200.128
IPv4 Address of First Host on this Subnet	192.168.200.129
IPv4 Address of Last Host on this Subnet	192.168.200.158
IPv4 Broadcast Address on this Subnet	192.168.200.159

b. **Problem 2**:

Given:	
Host IP Address:	10.101.99.228 10.01100101.01100011.11100100
Original Subnet Mask	255.0.0.0
New Subnet Mask:	255.255.128.0 11111111.11111111.10000000.00000000
Find:	
Number of Subnet Bits	9
Number of Subnets Created	512
Number of Host Bits per Subnet	15
Number of Hosts per Subnet	32766
Network Address of this Subnet	10.101.0.0
IPv4 Address of First Host on this Subnet	10.101.0.1
IPv4 Address of Last Host on this Subnet	10.101.127.254
IPv4 Broadcast Address on this Subnet	10.101.127.255

10.101.128.0

c. **Problem 3**:

Given:	
Host IP Address:	172.22.32.12 172.22.00100000.00001100
Original Subnet Mask	255.255.0.0
New Subnet Mask:	255.255.224.0 255.255.11100000.00000000
Find:	
Number of Subnet Bits	3
Number of Subnets Created	8
Number of Host Bits per Subnet	13
Number of Hosts per Subnet	8190
Network Address of this Subnet	172.22.32.0
IPv4 Address of First Host on this Subnet	172.22.32.1
IPv4 Address of Last Host on this Subnet	172.22.63.254
IPv4 Broadcast Address on this Subnet	172.22.63.255

172.22.64.0

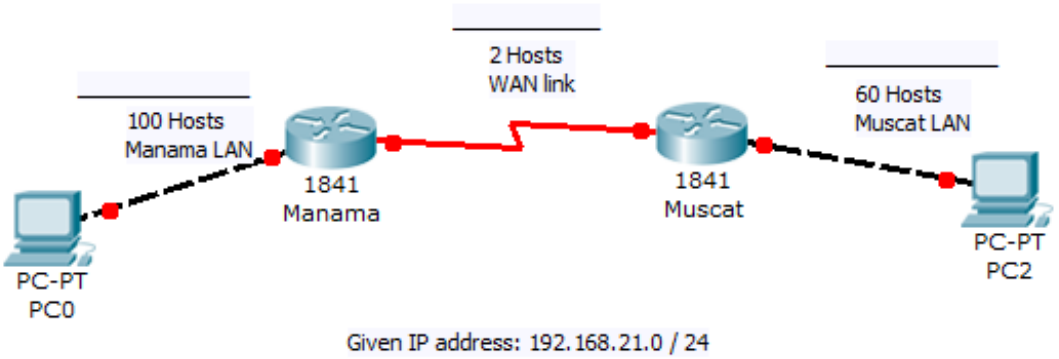
Reflection

Why is the subnet mask so important when analyzing an IPv4 address?

Part 2: VLSM - Subnetting a Subnet

Part 2: Designing and Implementing a VLSM Addressing Scheme

Topology



Given IP address: 192.168.21.0 / 24

Objectives

Part 1: Examine Network Requirements

Part 2: Design the VLSM Address Scheme

Background / Scenario

Variable Length Subnet Mask (VLSM) was designed to avoid wasting IP addresses. With VLSM, a network is subnetted and then re-subnetted. This process can be repeated multiple times to create subnets of various sizes based on the number of hosts required in each subnet. Effective use of VLSM requires address planning.

In this lab, use the 192.168.21.0/24 network address to develop an address scheme for the network displayed in the topology diagram. VLSM is used to meet the IPv4 addressing requirements.

Part 2: Examine Network Requirements

In Part 1, you will examine the network requirements to develop a VLSM address scheme for the network displayed in the topology diagram using the 192.168.21.0/24 network address.

Step 1: Determine how many host addresses and subnets are available.

How many host addresses are available in a /24 network? _____

What is the total number of host addresses needed in the topology diagram? _____

How many subnets are needed in the network topology? _____

Step 2: Determine the largest subnet.

How many IP addresses are required in the largest subnet? _____

What subnet mask can support that many host addresses? _____

How many total host addresses can that subnet mask support? _____

Can you subnet the 192.168.21.0/24 network address to support this subnet? _____

What are the two network addresses that would result from this subnetting?

_____

_____

Use the first network address for this subnet.

Step 3: Determine the second largest subnet.

What is the subnet description? _____

How many IP addresses are required for the second largest subnet? _____

What subnet mask can support that many host addresses? _____

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

_____

_____

Use the first network address for this subnet.

Step 4: Determine the subnets needed to support the serial links.

How many host addresses are required for the serial subnet link? _____

What subnet mask can support that many host addresses? _____

a. Continue subnetting the first subnet of each new subnet until you have four /30 subnets. Write the first two network addresses of these /30 subnets below.

_____

_____

Part 2B: Design the VLSM Address Scheme

Step 5: Calculate the subnet information.

Use the information that you obtained in Part 1 to fill in the following table.

Subnet Description	Number of Hosts Needed	Network Address /CIDR	First Host Address	Broadcast Address
Manama LAN G0/0	100			
Muscat LAN G0/0	60			
Manama S0/0/0 – Muscat S0/0/1	2			

Step 6: Complete the device interface address table.

Assign the first host address in the subnet to the Ethernet interfaces. HQ should be given the first host address on the Serial links to BR1 and BR2. BR1 should be given the first host address for the serial link to BR2.

Device	Interface	IP Address	Subnet Mask	Device Interface
Manama	G0/0			100 Host LAN
	S0/0/0			Muscat S0/0/1
Muscat	G0/1			60 Host LAN
	S0/0/1			Manama S0/0/0

Reflection

Can you think of a shortcut for calculating the network addresses of consecutive /30 subnets?

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