ASIA PACIFIC UNIVERSITY OF TECHNOLOGY & INNOVATION

Introduction to Networking

CT043-3-1 VE1

Tutorial Activity 11: Introduction to IP Addressing

Instructions: 10-15 minutes

Answer these questions:

Classful Addressing - A, B, C

Network & Host Identification

Highlight The Network Portion Of These Addresses:	Highlight The Host Portion Of These Addresses:
177.100.18.4	10.15.123.50
119.18.45.0	171.2.199.31
209.240.80.78	198.125.87.177
199.155.77.56	223.250.200.222
117.89.56.45	17.45.222.45
126.8.156.0	195.0.21.98

Hint:

In classful addressing, IP addresses are divided into five classes (A, B, C, D, and E), but only classes A, B, and C are used for network and host identification. Here's how you determine the network and host portions of the IP addresses based on their class:

1. **Class A:**
    - **Range: 0.0.0.0 to 127.255.255.255**
    - **Network portion: First octet**
    - **Host portion: Last three octets**

2. **Class B:**
    - **Range: 128.0.0.0 to 191.255.255.255**
    - **Network portion: First two octets**
    - **Host portion: Last two octets**

3. **Class C:**
    - **Range: 192.0.0.0 to 223.255.255.255**
    - **Network portion: First three octets**
    - **Host portion: Last octet**

Example Explanation:

- **For the IP address 177.100.18.4, it falls into Class B (since 177 falls between 128 and 191).**
    - **Network portion: 177.100**
    - **Host portion: 18.4**

Default Subnet Masks

- Write the correct default subnet mask, network address and broadcast address for each of the following addresses:

IP Address	Subnet Mask	Network Address	Broadcast Address
177.100.18.4/16			
119.18.45.0/8			
191.249.234.191/16			
10.10.250.1/8			
192.12.35.105/24			
77.251.200.51/8			
189.210.50.1/18			
193.100.77.8/24			

Answer:

IP Address	Subnet Mask	Network Address	Broadcast Address
177.100.18.4/16	255.255.0.0	177.100.0.0	177.100.255.255
119.18.45.0/8	255.0.0.0	119.0.0.0	119.255.255.255
191.249.234.191/16	255.255.0.0	191.249.0.0	191.249.255.255
10.10.250.1/8	255.0.0.0	10.0.0.0	10.255.255.255
192.12.35.105/24	255.255.255.0	192.12.35.0	192.12.35.255
77.251.200.51/8	255.0.0.0	77.0.0.0	77.255.255.255
189.210.50.1/18	255.255.192.0	189.210.0.0	189.210.63.255
193.100.77.8//24	255.255.255.0	193.100.77.0	193.100.77.255

Solution

Question 1: 177.100.18.4/16

Powers	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Number	128	64	32	16	8	4	2	1

IP Address	177	100	18	14
Subnet Mask (/16)	255	255	0	0
IP Address Binary	1011 0001 (177-128-32-16-1)	0110 0100 (100-64-32-4)	0001 0010 (18-16-2)	0000 1110 (14-8-4-2)
Subnet Mask (/16) Binary	1111 1111	1111 1111	0000 0000	0000 0000
Network Address (ANDing)	1011 0001	0110 0100	0000 0000	0000 0000
Network Address Decimal	177	100	0	0
Broadcast Address (1/16) Binary	1011 0001	0110 0100	1111 1111	1111 1111
Broadcast Address (1/16) Decimal	177	100	255	255

Question 2: 119.18.45.0/8

IP Address	119	18	45	0
Subnet Mask (/8)	255	0	0	0
IP Address Binary	0111 0111	0001 0010	0010 1101	0000 0000
Subnet Mask (/8) Binary	1111 1111	0000 0000	0000 0000	0000 0000
Network Address (ANDing)	0111 0111	0000 0000	0000 0000	0000 0000
Network Address Decimal	119	0	0	0
Broadcast Address (1/8) Binary	0111 0111	1111 1111	1111 1111	1111 1111
Broadcast Address (1/8) Decimal	119	255	255	255

Question 3: 191.249.234.191/16

IP Address	191	249	234	191
Subnet Mask (/16)	255	255	0	0
IP Address Binary	1011 1111	1111 1001	1110 1010	1011 1111
Subnet Mask (/16) Binary	1111 1111	1111 1111	0000 0000	0000 0000
Network Address (ANDing)	1011 1111	1111 1001	0000 0000	0000 0000
Network Address Decimal	191	249	0	0
Broadcast Address (1/16) Binary	1011 1111	1111 1001	1111 1111	1111 1111
Broadcast Address (1/16) Decimal	191	249	255	255

Question 4: 10.10.250.1/8

IP Address	10	10	250	1
Subnet Mask (/8)	255	0	0	0
IP Address Binary	0000 1010	0000 1010	1111 1010	0000 0001
Subnet Mask (/8) Binary	1111 1111	0000 0000	0000 0000	0000 0000
Network Address (ANDing)	0000 1010	0000 0000	0000 0000	0000 0000
Network Address Decimal	10	0	0	0
Broadcast Address (1/8) Binary	0000 1010	1111 1111	1111 1111	1111 1111
Broadcast Address (1/8) Decimal	10	255	255	255

Question 5: 192.12.35.105/24

IP Address	192	12	35	105
Subnet Mask (/24)	255	255	255	0
IP Address Binary	1100 0000	0000 1100	0010 0011	0110 1001
Subnet Mask (/24) Binary	1111 1111	1111 1111	1111 1111	0000 0000
Network Address (ANDing)	1100 0000	0000 1100	0010 0011	0000 0000
Network Address Decimal	192	12	35	0
Broadcast Address (1/24) Binary	1100 0000	0000 1100	0010 0011	1111 1111
Broadcast Address (1/24) Decimal	192	12	35	255

Question 6: 77.251.200.51/8

IP Address	77	251	200	51
Subnet Mask (/8)	255	0	0	0
IP Address Binary	0100 1101	1111 1011	1100 1000	0011 0011
Subnet Mask (/8) Binary	1111 1111	0000 0000	0000 0000	0000 0000
Network Address (ANDing)	0100 1101	0000 0000	0000 0000	0000 0000
Network Address Decimal	77	0	0	0
Broadcast Address (1/8) Binary	0100 1101	1111 1111	1111 1111	1111 1111
Broadcast Address (1/8) Decimal	77	255	255	255

Question 7: 189.210.50.1/18

IP Address	189	210	50	1
Subnet Mask (/18)	255	255	192	0
IP Address Binary	1011 1101	1101 0010	0011 0010	0000 0001
Subnet Mask (/18) Binary	1111 1111	1111 1111	1100 0000	0000 0000
Network Address (ANDing)	1011 1101	1101 0010	0000 0000	0000 0000
Network Address Decimal	189	210	0	0
Broadcast Address (1/18) Binary	1011 1101	1101 0010	0011 1111	1111 1111
Broadcast Address (1/18) Decimal	189	210	63	255

Question 8: 193.100.77.8/24

IP Address	193	100	77	8
Subnet Mask (/24)	255	255	255	0
IP Address Binary	1100 0001	0110 0100	0100 1101	0000 1000
Subnet Mask (/24) Binary	1111 1111	1111 1111	1111 1111	0000 0000
Network Address (ANDing)	1100 0001	0110 0100	0100 1101	0000 0000
Network Address Decimal	193	100	77	0
Broadcast Address (1/24) Binary	1100 0001	0110 0100	0100 1101	1111 1111
Broadcast Address (1/24) Decimal	193	100	77	255

IPv4 Addressing

Question 1: What is an "octet"?

Answer:

An octet is a unit of digital information that consists of 8 bits. In networking and computing, the term "octet" is often used instead of "byte" because it clearly indicates that there are 8 bits, whereas the size of a byte can vary in different systems.

Question 2: How many bits there are in 1 octet?

Answer:

1 octet = 8 bits

Question 3: Name and state the function of these addresses?

- 127.0.0.1/8 –
- 169.254.0.1/16 -

Answer:

127.0.0.1/8:

- **Function**: This is the **loopback address**. It is used to test network software without physically sending any packets over a network. It refers to the local computer or device you're using. The /8 indicates that the first 8 bits (or the first octet) represent the network portion of the IP address.

169.254.0.1/16:

- **Function**: This address falls within the range of **APIPA (Automatic Private IP Addressing)**. When a device cannot obtain an IP address from a DHCP server, it automatically assigns itself an address in the range 169.254.0.0 to 169.254.255.255. The /16 indicates that the first 16 bits (or the first two octets) represent the network portion of the IP address.

Question 4: What is a Classful addressing scheme?

Answer:

Classful addressing is a method of allocating IP addresses based on predefined classes (A, B, C, D, E) in the IPv4 system. Each class has a fixed range of IP addresses and a fixed number of bits for the network and host portions.

- **Class A**: 0.0.0.0 - 127.255.255.255 (large networks)
- **Class B**: 128.0.0.0 - 191.255.255.255 (medium-sized networks)
- **Class C**: 192.0.0.0 - 223.255.255.255 (small networks)
- **Class D**: 224.0.0.0 - 239.255.255.255 (multicast)
- **Class E**: 240.0.0.0 - 255.255.255.255 (reserved for future use)

Question 5: Briefly explain why classful addressing wasted many IPv4 addresses?

Answer:

Classful addressing led to waste because it allocated fixed block sizes for each class, regardless of the actual need. For example, a company might receive a Class B address block, which provides 65,536 IP addresses, even if they only needed a few hundred. The remaining addresses would be unused, leading to inefficiency and a rapid depletion of available IPv4 addresses.

Question 6: What is a Classless addressing scheme?

Answer:

Classless addressing (also known as **CIDR - Classless Inter-Domain Routing**) is a method that replaces the rigid class-based system by allowing a more flexible allocation of IP addresses. It uses a variable-length subnet mask (VLSM), which enables more efficient use of IP address space by allowing the division of an IP address space into subnets of varying sizes.

Question 7: Give 2 examples of classless addressing.

Answer:

192.168.1.0/24:

- A common subnet in private networks, where /24 indicates that the first 24 bits are the network portion, leaving 8 bits for host addresses.

10.0.0.0/8:

- A large subnet is often used in private networks, where /8 indicates that the first 8 bits are the network portion, leaving 24 bits for host addresses.

Lab – Calculating IPv4 Subnets

Objectives

- Part 1: Determine IPv4 Address Subnetting
- Part 2: Calculate IPv4 Address Subnetting

Background / Scenario

The ability to work with IPv4 subnets and determine network and host information based on a given IP address and subnet mask is critical to understanding how IPv4 networks operate. The first part is designed to reinforce how to compute network IP address information from a given IP address and subnet mask. When given an IP address and subnet mask, you will be able to determine other information about the subnet.

Required Resources

- 1 PC (Windows 7 or 8 with Internet access)
- **Optional**: IPv4 address calculator

Part 1: Determine IPv4 Address Subnetting

In Part 1, you will determine the network and broadcast addresses, as well as the number of hosts, given an IPv4 address and subnet mask.

REVIEW: To determine the network address, perform binary ANDing on the IPv4 address using the subnet mask provided. The result will be the network address. Hint: If the subnet mask has a decimal value of 255 in an octet, the result will ALWAYS be the original value of that octet. If the subnet mask has a decimal value of 0 in an octet, the result will ALWAYS be 0 for that octet.

Example:
IP Address 192.168.10.10, Subnet Mask 255.255.255.0, Result (Network) 192.168.10.0

Knowing this, you may only have to perform binary ANDing on an octet that does not have 255 or 0 in its subnet mask portion. Example: IP Address 172.30.239.145, Subnet Mask 255.255.192.0

Analyzing this example, you can see that you only have to perform binary ANDing on the third octet. The first two octets will result in 172.30 due to the subnet mask. The fourth octet will result in 0 due to the subnet mask. IP Address 172.30.239.145, Subnet Mask 255.255.192.0, Result (Network) 172.30.?.0

Perform binary ANDing on the third octet.

	Decimal	Binary
	239	1110 1111
	192	1100 0000
Result	**192**	1100 0000

Analyzing this example again produces the following result:

IP Address	172.30.239.145
Subnet Mask	255.255.192.0
Result (Network)	172.30.192.0

Continuing with this example, determining the number of hosts per network can be calculated by analyzing the subnet mask. The subnet mask will be represented in dotted decimal format, such as 255.255.192.0, or network prefix format, such as /18. An IPv4 address always has 32 bits. Subtracting the number of bits used for the network portion (as represented by the subnet mask) gives you the number of bits used for hosts.

Using our example above, the subnet mask 255.255.192.0 is equivalent to /18 in prefix notation. Subtracting 18 network bits from 32 bits results in 14 bits left for the host portion. From there, it is a simple calculation:

- $2^{number\ of\ host\ bits}$ - 2 = Number of hosts
- 2^{14} = 16,384 – 2 = 16,382 hosts

Determine the network and broadcast addresses and number of host bits and hosts for the given IPv4 addresses and prefixes in the following table.

IPv4 Address/Prefix	Network Address	Broadcast Address	Total Number of Host Bits	Total Number of Hosts
192.168.100.25/8				
172.30.10.130/30				
10.1.113.75/19				
198.133.219.250/24				
128.107.14.191/22				
172.16.104.99/27				

Answer:

IPv4 Address/Prefix Subnet Mask	Network Address	Broadcast Address	Total Number of Host Bits	Total Number of Hosts
192.168.100.25/8 255.0.0.0	**192.0.0.0**	**192.255.255.255**	**32 - 8 = 24**	$2^{(32-8)}$ **- 2 = 16, 777 214**
172.30.10.130/30 255.255.255.252	**172.30.10.128**	**172.30.10.131**	**32 - 30 = 2**	$2^{(32-30)}$ **- 2 = 2**
10.1.113.75/19 255.255.224.0	**10.1.96.0**	**10.1.127.255**	**32 - 19 = 13**	$2^{(32-19)}$ **- 2 = 8, 190**
198.133.219.250/24 255.255.255.0	**198.133.219.0**	**198.133.219.255**	**32 - 24 = 8**	$2^{(32-24)}$ **- 2 = 254**
128.107.14.191/22 255.255.252.0	**128.107.12.0**	**128.107.15.255**	**32 - 22 = 10**	$2^{(32-22)}$ **- 2 = 1, 022**
172.16.104.99/27 255.255.255.224	**172.16.104.96**	**172.16.104.127**	**32 - 27 = 5**	$2^{(32-27)}$ **- 2 = 30**

Part 2: 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:	
Host IP Address	172.16.77.120
Original Subnet Mask	255.255.0.0
New Subnet Mask	255.255.240.0
Find:	
Number of Subnet Bits	4
Number of Subnets Created	16
Number of Host Bits per Subnet	12
Number of Hosts per Subnet	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 are 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	**nnnn nnnn**	**nnnn nnnn**	**nnnn** hhhh	hhhh hhhh	Subnet Mask
Binary	**1010 1100**	**0001 0000**	**0100** 0000	0000 0001	First Host
Decimal	172	16	64	1	First Host
Binary	**1010 1100**	**0001 0000**	**0100** 1111	1111 1110	Last Host
Decimal	172	16	79	254	Last Host
Binary	**1010 1100**	**0001 0000**	**0100** 1111	1111 1111	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
Original Subnet Mask (/24)	255.255.255.0
New Subnet Mask (/27)	255.255.255.224
Find:	
Number of Subnet Bits (*Bits Borrowed*)	**3**
Number of Subnets Created	$2^n = 2^3 = 8$
Number of Host Bits per Subnet	**32 - Prefix Length = 32 - 27 = 5 (Host Bit Left)**
Number of Hosts per Subnet	**Total IP addresses in The Subnet include Network & Broadcast - The Number of Value IP addresses for the Host In the Subnet** $2^{(32-27)} - 2 = 2^5 - 2 = 30$
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**

IPv4 (Dec)	192	168	200	139
IPv4 (Bin)	1100 0000	1010 1000	1100 1000	1000 1011
Ori Sub (Dec) /24	255	255	255	0
New Sub (Dec) /27	255	255	255	224
New Sub (Bin) /27	1111 1111	1111 1111	1111 1111	111 1 0000
NA (Bin)	1100 0000	1010 1000	1100 1000	1000 0000
NA (Dec)	192	168	200	128
BC (Bin) /27	1100 0000	1010 1000	1100 1000	100 1 1111
BC (Dec) /27	192	168	200	159
First Usable Host Address (Bin)	1100 0000	1010 1000	1100 1000	100 0 0001
First Usable Host Address (Dec)	192	168	200	129
Last Usable Host Address (Bin)	1100 0000	1010 1000	1100 1000	100 1 1110
Last Usable Host Address (Dec)	192	168	200	159

b. Problem 2:

Given:	
Host IP Address	10.101.99.228
Original Subnet Mask	255.0.0.0
New Subnet Mask (/17)	255.255.128.0
Find:	
Number of Subnet Bits	**9**
Number of Subnets Created	2^9 **= 512**
Number of Host Bits per Subnet	**32 - 17 = 15**
Number of Hosts per Subnet	2^{15} **- 2 = 32,766**
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**

IPv4 (Dec)	10	101	99	228
IPv4 (Bin)	0000 1010	0110 0101	0110 0011	1110 0100
Ori Sub (Dec) /8	255	0	0	0
New Sub (Dec) /17	255	255	128	0
New Sub (Bin) /17	1111 1111	1111 1111	1 000 0000	0000 0000
NA (Bin)	0000 1010	0110 0101	0000 0000	0000 0000
NA (Dec)	10	101	0	0
BC (Bin) /17	1111 1111	1111 1111	0 111 1111	1111 1111
BC (Dec) /17	10	101	127	255
First Usable Host Address (Bin)	1111 1111	1111 1111	0 000 0000	0000 0001
First Usable Host Address (Dec)	10	101	0	1
Last Usable Host Address (Bin)	1111 1111	1111 1111	0 111 1111	1111 1110
Last Usable Host Address (Dec)	10	101	127	254

c. Problem 3:

Given:	
Host IP Address	172.22.32.12
Original Subnet Mask	255.255.0.0
New Subnet Mask	255.255.224.0
Find:	
Number of Subnet Bits	**3**
Number of Subnets Created	2^3 **= 8**
Number of Host Bits per Subnet	**32 - 19 = 13**
Number of Hosts per Subnet	2^{13} **- 2 = 8,190**
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**

IPv4 (Dec)	172	22	32	12
IPv4 (Bin)	1010 1100	0001 0110	0010 0000	0000 1100
Ori Sub (Dec) /16	255	255	0	0
New Sub (Dec) /19	255	255	224	0
New Sub (Bin) /19	1111 1111	1111 1111	111 0 0000	0000 0000
NA (Bin)	1010 1100	0001 0110	001 0 0000	0000 0000
NA (Dec)	172	22	32	0
BC (Bin) /19	1010 1100	0001 0110	001 1 1111	1111 1111
BC (Dec) /19	172	22	63	255
First Usable Host Address (Bin)	1010 1100	0001 0110	001 0 0000	0000 0001
First Usable Host Address (Dec)	172	22	32	1
Last Usable Host Address (Bin)	1010 1100	0001 0110	001 1 1111	1111 1110
Last Usable Host Address (Dec)	172	22	63	254

d. Problem 4:

Given:	
Host IP Address	192.168.1.245
Original Subnet Mask	255.255.255.0
New Subnet Mask	255.255.255.252
Find:	
Number of Subnet Bits	**6**
Number of Subnets Created	2^6 **= 64**
Number of Host Bits per Subnet	**32 - 30 = 2**
Number of Hosts per Subnet	2^2 **- 2 = 2**
Network Address of this Subnet	**192.168.1.244**
IPv4 Address of First Host on this Subnet	**192.168.1.245**
IPv4 Address of Last Host on this Subnet	**192.168.1.246**
IPv4 Broadcast Address on this Subnet	**195.168.1.247**

IPv4 (Dec)	192	168	1	245
IPv4 (Bin)	1100 0000	1010 1000	0000 0001	1111 0101
Ori Sub (Dec) /24	255	255	255	0
New Sub (Dec) /30	255	255	255	252
New Sub (Bin) /30	1111 1111	1111 1111	1111 1111	1111 11 00
NA (Bin)	1100 0000	1010 1000	0000 0001	1111 01 00
NA (Dec)	192	168	1	244
BC (Bin) /30	1100 0000	1010 1000	0000 0001	1111 01 11
BC (Dec) /30	192	168	1	247
First Usable Host Address (Bin)	1100 0000	1010 1000	0000 0001	1111 01 01
First Usable Host Address (Dec)	192	168	1	245
Last Usable Host Address (Bin)	1100 0000	1010 1000	0000 0001	1111 01 10
Last Usable Host Address (Dec)	192	168	1	246

e. Problem 5:

Given:	
Host IP Address	128.107.0.55
Original Subnet Mask	255.255.0.0
New Subnet Mask	255.255.255.0
Find:	
Number of Subnet Bits	**8**
Number of Subnets Created	2^8 **= 256**
Number of Host Bits per Subnet	**32 - 24 = 8**
Number of Hosts per Subnet	2^8 **- 2 = 254**
Network Address of this Subnet	**128.107.0.0**
IPv4 Address of First Host on this Subnet	**127.107.0.1**
IPv4 Address of Last Host on this Subnet	**127.107.0.254**
IPv4 Broadcast Address on this Subnet	**128.107.0.255**

IPv4 (Dec)	128	107	0	55
IPv4 (Bin)	1000 0000	0110 1011	0000 0000	0011 0111
Ori Sub (Dec) /16	255	255	0	0
New Sub (Dec) /24	255	255	255	0
New Sub (Bin) /24	1111 1111	1111 1111	1111 1111	0000 0000
NA (Bin)	1000 0000	0110 1011	0000 0000	0000 0000
NA (Dec)	128	107	0	0
BC (Bin) /24	1000 0000	0110 1011	0000 0000	1111 1111
BC (Dec) /24	128	107	0	255
First Usable Host Address (Bin)	1000 0000	0110 1011	0000 0000	0000 0001
First Usable Host Address (Dec)	128	107	0	1
Last Usable Host Address (Bin)	1000 0000	0110 1011	0000 0000	1111 1110
Last Usable Host Address (Dec)	128	107	0	254

f. Problem 6:

Given:	
Host IP Address	192.135.250.180
Original Subnet Mask	255.255.255.0
New Subnet Mask	255.255.255.248
Find:	
Number of Subnet Bits	**5**
Number of Subnets Created	2^5 **= 32**
Number of Host Bits per Subnet	**32 - 29 = 3**
Number of Hosts per Subnet	2^3 **- 2 = 6**
Network Address of this Subnet	**192.135.250.176**
IPv4 Address of First Host on this Subnet	**192.135.250.177**
IPv4 Address of Last Host on this Subnet	**192.135.250.182**
IPv4 Broadcast Address on this Subnet	**192.135.250.183**

IPv4 (Dec)	192	135	250	180
IPv4 (Bin)	1100 0000	1000 0111	1111 1010	1011 0100
Ori Sub (Dec) /24	255	255	255	0
New Sub (Dec) /29	255	255	255	248
New Sub (Bin) /29	1111 1111	1111 1111	1111 1111	1111 1 000
NA (Bin)	1100 0000	1000 0111	1111 1010	1011 0 000
NA (Dec)	192	135	250	176
BC (Bin) /29	1100 0000	1000 0111	1111 1010	1011 0 111
BC (Dec) /29	192	135	250	183
First Usable Host Address (Bin)	1100 0000	1000 0111	1111 1010	1011 0 001
First Usable Host Address (Dec)	192	135	250	177
Last Usable Host Address (Bin)	1100 0000	1000 0111	1111 1010	1011 0 110
Last Usable Host Address (Dec)	192	135	250	182

g. Reflection Question:

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

Answer: The subnet mask determines everything about the address: the network, number of host bits, number of hosts and the broadcast address. Merely looking at an IPv4 address tells you nothing. You need the subnet mask to fill in all the important pieces of information.