Activity 6.1 – Calculating IPv4 Network Addresses

Objectives

Determine IPv4 Network Addresses

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

- none

Part 1: Determine IPv4 Address Subnetting

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 decimal value 255 in an octet, the result will ALWAYS be the original value of that octet. If the subnet mask has decimal value 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	11101111
	192	11000000
		=======
Result	**192**	11000000

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 in 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.

This 14 bits represent the total possible number of hosts, but remember that we must subtract one host for the network address, and another host for the broadcast address.

The calculation to determine the actual number of hosts is therefore:

$2^{(\text{number of host bits})} - 2 = \text{Number of hosts}$

$2^{14} = 16{,}384 - 2 = 16{,}382$ hosts

Given that the network address is 172.30.192.0, and there are 16382 hosts, the broadcast address will be the last possible host address on the network 127.30.255.255.

Network address: 10101100 . 00011110 . 11000000 . 00000000

First address on network: 10101100 . 00011110 . 11000000 . 00000001

Last address on network: 10101100 . 00011110 . 11111111 . 11111110

Broadcast address on network: 10101100 . 00011110 . 11111111 . 11111111

Determine the network and broadcast addresses and number of host bits and hosts for the given IPv4 addresses and prefixes in the following table. The first row has already been filled out as an example.

IPv4 Address/Prefix	Network Address	Broadcast Address	Total Number of Host Bits	Total Number of Hosts
173.30.239.145/18	**172.30.192.0**	**172.30.255.255**	**14**	**16382**
192.168.100.25/28				
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				