



Sybex CCNA 640-803

Chapter 4: Easy Subnetting

Instructor & Todd Lammle

Chapter 4 Objectives

The CCNA Topics Covered in this chapter include:

- Interpret network diagrams
- Describe the operation and benefits of using private and public IP addressing
- Implement static and dynamic addressing services for hosts in a LAN environment.

Subnetting Basics

- Benefits of subnetting include:
 - Reduced network traffic
 - Optimized network performance
 - Simplified management
 - Facilitated spanning of large geographical distances.

How To Create Subnets

Take bits from the host portion of the IP address and reserve them to define the subnet address.

To create a subnet, follow these steps:

1. Determine the number of required network IDs:

- One for each LAN subnet
- One for each wide area network connection

2. Determine the number of required host IDs per subnet:

- One for each TCP/IP host
- One for each router interface

3. Based on the above requirements, create the following:

- One subnet mask for your entire network
- A unique subnet ID for each physical segment
- A range of host IDs for each subnet

Subnet Masks

- Used to define which part of the host address will be used as the subnet address.
- A 32-bit value that allows the recipient of IP packets to distinguish the network ID portion of the IP address from the host ID portion.

Understanding the Powers of 2

Understanding the Powers of 2

Powers of 2 are important to understand and memorize for use with IP subnetting. To review powers of 2, remember that when you see a number with another number to its upper right (called an exponent), this means you should multiply the number by itself as many times as the upper number specifies. For example, 2^3 is $2 \times 2 \times 2$, which equals 8. Here's a list of powers of 2 you should commit to memory:

$$2^1 = 2$$

$$2^3 = 8$$

$$2^5 = 32$$

$$2^7 = 128$$

$$2^2 = 4$$

$$2^4 = 16$$

$$2^6 = 64$$

$$2^8 = 256$$

Default Subnet Masks

Class	Format	Default Subnet Mask
A	<i>network.node.node.node</i>	255.0.0.0
B	<i>network.network.node.node</i>	255.255.0.0
C	<i>network.network.network.node</i>	255.255.255.0

Classless Inter-Domain Routing (CIDR)

Used to allocate an amount of IP address space to a given entity (company, home, customer, etc).

Example: 192.168.10.32/28

The slash notation (/) means how many bits are turned on (1s) and tells you what your subnet mask is.

CIDR Values

Subnet Mask	CIDR Value	Subnet Mask	CIDR Value
255.0.0.0	/8	255.255.252.0	/22
255.128.0.0	/9	255.255.254.0	/23
255.192.0.0	/10	255.255.255.0	/24
255.224.0.0	/11	255.255.255.128	/25
255.240.0.0	/12	255.255.255.192	/26
255.248.0.0	/13	255.255.255.224	/27
255.252.0.0	/14	255.255.255.240	/28
255.254.0.0	/15	255.255.255.248	/29
255.255.0.0	/16	255.255.255.252	/30
255.255.128.0	/17		
255.255.192.0	/18		
255.255.224.0	/19		
255.255.240.0	/20		
255.255.248.0	/21		

Subnetting Class C Addresses

In a Class C address, only 8 bits are available for defining the hosts. Remember that subnet bits start at the left and go to the right, without skipping bits. This means that the only Class C subnet masks can be the following:

Binary	Decimal	CIDR
10000000 = 128		/25
11000000 = 192		/26
11100000 = 224		/27
11110000 = 240		/28
11111000 = 248		/29
11111100 = 252		/30

Class C 192 mask examples

Subnet	Host	Meaning
00	000000 = 0	The network (do this first)
00	000001 = 1	The first valid host
00	111110 = 62	The last valid host
00	111111 = 63	The broadcast address (do this second)

Subnet	Host	Meaning
01	000000 = 64	The network
01	000001 = 65	The first valid host
01	111110 = 126	The last valid host
01	111111 = 127	The broadcast address

Class C 192 mask examples

Subnet	Host	Meaning
10	000000 = 128	The subnet address
10	000001 = 129	The first valid host
10	111110 = 190	The last valid host
10	111111 = 191	The broadcast address

Subnet	Host	Meaning
11	000000 = 192	The subnet address
11	000001 = 193	The first valid host
11	111110 = 254	The last valid host
11	111111 = 255	The broadcast address

Subnetting Class C Addresses – Fast Method

Answer Five Simple Questions:

- How many subnets does the chosen subnet mask produce?
- How many valid hosts per subnet are available?
- What are the valid subnets?
- What's the broadcast address of each subnet?
- What are the valid hosts in each subnet?

How Many Subnets?

2^2 = number of subnets.

- X is the number of masked bits, or the 1s.
- For example, in 11000000, the number of ones gives us 2^2 subnets. In this example there are 4 subnets.

How Many Hosts Per Subnet?

$2^y - 2 =$ number of hosts per subnet.

- Y is the number of unmasked bits, or the 0s.
- For example, in 11000000, the number of zeros gives us $2^6 - 2$ hosts. In this example, there are 62 hosts per subnet.

What Are The Valid Subnets?

- 256-subnet mask = block size, or base number.
- For example $256-192=64$. 64 is the first subnet. The next subnet would be the base number plus itself or $64+64=128$, (the second subnet).

What's The Broadcast Address For Each Subnet?

- The broadcast address is all host bits turned on, which is the number immediately preceding the next subnet.

What Are The Valid Hosts?

- Valid hosts are the number between the subnets, omitting all 0s and all 1s.

Summary

- Go through all written and review questions
- Review answers in class