Todd Lammle's CompTIA Network+
Chapter 7: IP Addressing
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Chapter 7 Objectives

The Following CompTIA Network+ Exam Objectives Are Covered in This Chapter:

- **1.3 Identify the following address formats**
  - **IPv6**
  - **IPv4**
- **1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes**
  - **Addressing Technologies**
  - **Public vs. private**
  - **DHCP (static, dynamic APIPA)**
  - **Addressing schemes**
  - **Unicast**
  - **Multicast**
  - **Broadcast**

Terminology

- **Bit:** A *bit* is one digit, either a 1 or a 0.
- **Byte:** A *byte* is 7 or 8 bits, depending on whether parity is used. For the rest of this chapter, always assume a byte is 8 bits.
- **Octet:** An octet, made up of 8 bits, is just an ordinary 8-bit binary number. In this chapter, the terms *byte* and *octet* are completely interchangeable.
- **Network address:** This is the designation used in routing to send packets to a remote network—for example, 10.0.0.0, 172.16.0.0, and 192.168.10.0.
- **Broadcast address:** The *broadcast address* is used by applications and hosts to send information to all hosts on a network.

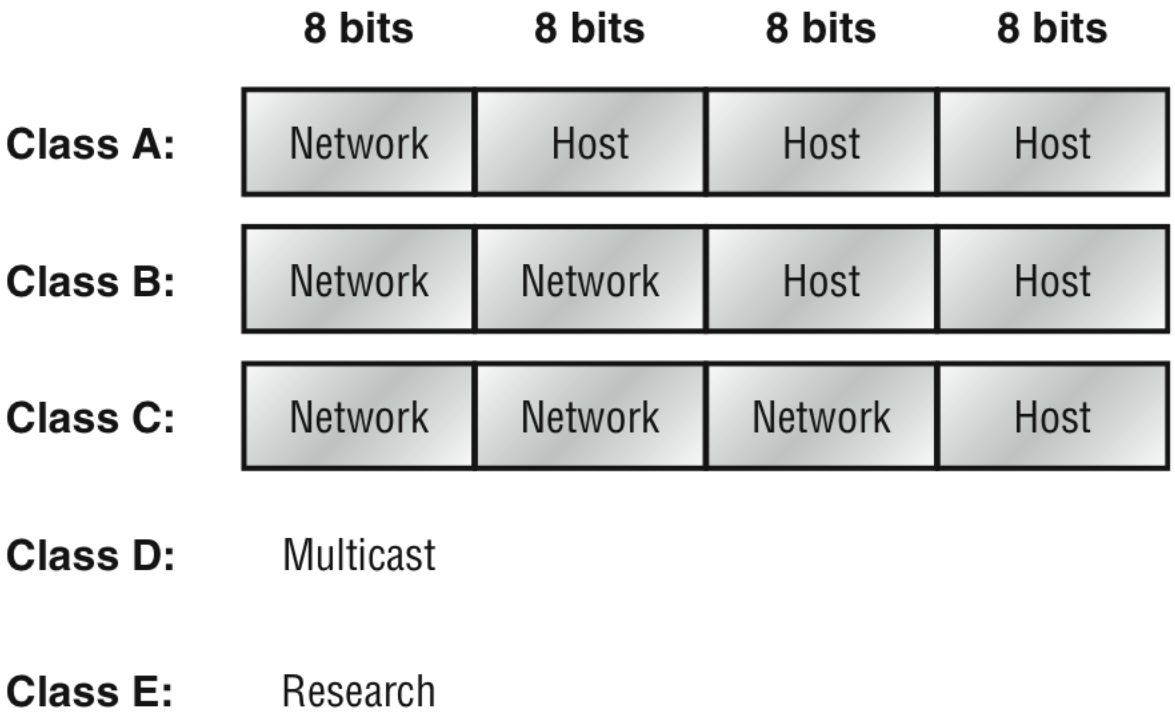
The Hierarchical IP Addressing Scheme

- An IP address consists of 32 bits of information. These bits are divided into four sections, referred to as *octets* or bytes, and four octets sum up to 32 bits (8×4=32).
- You can depict an IP address using one of three methods:
  - Dotted-decimal, as in 172.16.30.56
  - Binary, as in 10101100.00010000.00011110.00111000
  - Hexadecimal, as in AC.10.1E.38

Addressing

- The *network address*—also called the network number—uniquely identifies each network. Every machine on the same network shares that network address as part of its IP address. In the IP address 172.16.30.56, for example, 172.16 is the network address.
- The *host address* is assigned to, and uniquely identifies, each machine on a network. This part of the address must be unique because it identifies a particular machine—an individual—as opposed to a network, which is a group. This number can also be referred to as a *host address*. So in the sample IP address 172.16.30.56, the 30.56 is the host address.

Class A, B, C


8 bits
8 bits
8 bits
8 bits
Class A:
Network
Host
Host
Host
Class B:
Network
Network
Host
Host
Class C:
Network
Network
Network
Host
Class D:
Multicast
Class E:
Research

Class A Addresses

- In a Class A network address, the first byte is assigned to the network address and the three remaining bytes are used for the host addresses. The Class A format is as follows:

  network.host.host.host

Class B Addresses

- In a Class B network address, the first 2 bytes are assigned to the network address and the remaining 2 bytes are used for host addresses. The format is as follows:

  network.network.host.host

Class C Addresses

- The first 3 bytes of a Class C network address are dedicated to the network portion of the address, with only 1 measly byte remaining for the host address. Here's the format:

  network.network.network.host

Reserved Address Space

Table 7.1: Reserved IP Addresses

ADDRESS	FUNCTION
Network address of all 0s	Interpreted to mean “this network or segment.”
Network address of all 1s	Interpreted to mean “all networks.”
Network 127.0.0.1	Reserved for loopback tests. Designates the local host and allows that host to send a test packet to itself without generating network traffic.
Host address of all 0s	Interpreted to mean “network address” or any host on specified network.
Host address of all 1s	Interpreted to mean “all hosts” on the specified network; for example, 128.2.255.255 means “all hosts” on network 128.2 (Class B address).
Entire IP address set to all 0s	Used by Cisco routers to designate the default route. Could also mean “any network.”
Entire IP address set to all 1s (same as 255.255.255.255)	Broadcast to all hosts on the current network; sometimes called an “all 1s broadcast” or limited broadcast.

Private Address Space

Table 7.2: Reserved IP Address Space

ADDRESS CLASS	RESERVED ADDRESS SPACE
Class A	10.0.0.0 through 10.255.255.255
Class B	172.16.0.0 through 172.31.255.255
Class C	192.168.0.0 through 192.168.255.255

APIPA

- Windows provides what is called Automatic Private IP Addressing (APIPA).
- With APIPA, clients can automatically self-configure an IP address and subnet mask, which is the minimum information needed for hosts to communicate when a DHCP server isn't available.
- The IP address range for APIPA is 169.254.0.1 through 169.254.255.254. The client also configures itself with a default class B subnet mask of 255.255.0.0.

Address Terms

- **Layer 2 broadcasts:** These are sent to all hosts on a LAN.
- **Broadcasts (Layer 3):** These are sent to all hosts on the network.
- **Unicast:** These are sent to a single destination host.
- **Multicast:** These are packets sent from a single source and transmitted to many devices on different networks.

IPv6

•People refer to IPv6 as “the next-generation Internet protocol,” and it was originally created as the answer to IPv4’s inevitable, looming address-exhaustion crisis.

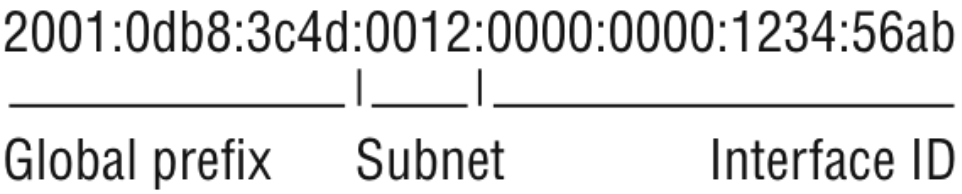
•Though you’ve probably heard a thing or two about IPv6 already, it has been improved even further in the quest to bring us the flexibility, efficiency, capability, and optimized functionality that can truly meet our ever-increasing needs.

• The capacity of its predecessor, IPv4, pales in comparison—and that’s the reason it will eventually fade into history completely.

•The IPv6 header and address structure has been completely overhauled, and many of the features that were basically just afterthoughts and addendums in IPv4 are now included as full-blown standards in IPv6.

IPv6

You probably already read about the fact that at 128 bits an IPv6 address is much larger than an IPv4 address. Let's take a look at an example:



Here's an example of how this looks if you were not able to resolve names and had to use an IPv6 address in your browser: http://[2001:0db8:3c4d:0012:0000:0000:1234:56ab]/default.html

When you use a web browser to make an HTTP connection to an IPv6 device, you have to type the address into the browser with brackets around the literal address. Because a colon is already being used by the browser for specifying a port number. So if you don't enclose the address in brackets, the browser will have no way to identify the information.

IPv6 Shortened Expression

Again referring to our sample address on the page before, you can remove the two blocks of zeros by replacing them with double colons, like this:

2001:db8:3c4d:12::1234:56ab

Cool—you replaced the blocks of all zeros with double colons. The rule you have to follow to get away with this is that you can only replace one contiguous block of zeros in an address. So if my address has four blocks of zeros and each of them is separated, I don't get to replace them all.

Check out this example:
2001:0000:0000:0012:0000:0000:1234:56ab

And just know that you *can't* do this:
2001::12::1234:56ab

Instead, this is the best that you can do:
2001::12:0:0:1234:56ab

Summary

- Summary
- Exam Essentials Section
- Written Labs
- Review Questions