IPv6

IPv6 is the next generation of IPaddressing. Used on the Internet and on some LANs and WANs, it is designed to meet the inadequacies of IPv4. IPv6 is slowly gaining popularity in today's networks, but is still the underdog compared to IPv4. The main reason that IPv6 was developed was to address the addressing shortcomings of IPv4. Where IPv4 (a 32-bit) system can have approximately 4 billion total theoretical addresses, IPv6 (128-bit) can have a total of 340 undecillion theoretical addresses; a far greater total. Various limitations of the system will drastically reduce that number, but the remaining result is still aeons above and beyond the IPv4 system. However, IPv6 is also known for security. IPsec is a fundamental piece of the IPv6 puzzle, and if used properly can offer much more secure communications than IPv4. IPv6 also supports larger packet sizes known as jumbograms. Table 14.4 summarizes some of the differences between IPv4 and IPv6.

TABLE 14.4 IPv4 Versus IPv6

IPv4	IPv6
32-bit	128-bit
4 billion addresses	340 undecillion addresses
Less secure	More secure, IPsec is mandatory
65,536 byte packet size max.	4 billion bytes max

IPv6 addresses are 128-bit hexadecimal numbers that are divided into eight groups of four numbers each. The most commonly used type is the unicast address which defines a single IP address on a single interface (such as a network adapter). Windows auto-configures a unicast address when IPv6 is installed. The address will either start with FE80, FE90, FEA0, or FEB0 (collectively, this range is shown as FE80:/10). Every Windows computer with IPv6 installed also receives a loopback address that is ::1. The IPv6 address ::1 is the equivalent to IPv4's loopback address of 127.0.0.1.

There are three types of IPv6 addresses as shown in Table 14.5

TABLE 14.5 IPv6 Address Types

IPv6 Type	Address Range	Description
Unicast	Global Unicast, begins at 2000 Link-Local, begins at FE80::/10 Loopback is ::1	Address assigned to one interface
Anycast	Uses the Unicast structure	Address assigned to a group of interfaces. Packets are delivered to the first interface only.
Multicast	FF00::/8	Address assigned to a group of interfaces./ Packets are delivered to all interfaces.

Here's an example of an IPv6 address:

```
2001:7120:0000:8001:0000:0000:0000:1F10
```

IPv6 addresses are broken down into three sections: the global routing prefix, in this case 2001:7120:0000, a subnet which is 8001 and the individual interface ID, shown as 0000:0000:0000:1F10.

This is the full address, but you will more commonly see truncated addresses. There are two ways to truncate, or shorten, an IPv6 address. First is to remove leading zeroes. Any group of 4 zeroes can be truncated down to a single zero; basically zero is always zero, so the additional zeroes are not necessary. Also, one consecutive group of zeroes can be truncated as a double colon ::. In the example we have 12 consecutive zeroes that can be truncated all the way down to a double colon. The end result of both of these abbreviations would be:

```
2001:7120:0:8001::1F10
```

IPv6 addresses can be assigned statically as well; this can be done within the Internet Protocol Version 6 Properties window, which can be accessed from Local Area Connection Properties; it is listed right next to IPv4.

The CompTIA A+ objectives only cover the basics about IPv6 address lengths and conventions, and how they compare to IPv4. However, IPv6 is definitely the way of the future, and as such I would recommend that you take some time to investigate it further. My CompTIA Network+ Video Mentor and the CompTIA Network+ Cert Guide go into more depth about IPv6. Those titles are listed at the end of the chapter.