4.2.4 IPv6 Facts

Because of the rapid grown of the Internet, available IPv4 addresses have been nearly depleted. Many organizations use Network Address Translators (NATs) to map multiple private address spaces to a single public IP address. However, using NATs to overcome the problem introduces security-related issues as well as other problems when connecting two organizations that use the same private address space. The IPv6 address standard seeks to address the issues of the IPv4 address standard.

IPv6 follows the same basic rules as IPv4:

- Each host must have a unique IPv6 address.
- Each host on the same logical network must have the same network address.
- Hosts can communicate directly only with other hosts on the same logical network. Communications between hosts on different networks require a router to route packets between networks.

The following table describes the structure of an IPv6 address:

Component	Description
Format	IPv6 uses a 128-bit address made up of 32 hexadecimal numbers organized into 8 quartets. ▪ The quartets are separated by colons. ▪ Each quartet is represented as a hexadecimal number between 0 and FFFF. Each quartet represents 16 bits of data (FFFF = 1111 1111 1111 1111).

Leading Zeros	Leading zeros can be omitted in each section. For example, the quartet 0284 could also be represented by 284.
	▪ Addresses with consecutive zeros can be expressed more concisely by substituting a double colon for the group of zeros. For example:
	  ▪ Long form: FEC0:0:0:0:78CD:1283:F398:23AB
	  ▪ Concise form: FEC0::78CD:1283:F398:23AB
	▪ If an address has more than one consecutive location where one or more quartets are all zeros, only one location can be abbreviated. For example, FEC2:0:0:0:78CA:0:0:23AB could be abbreviated as either one of the following:
	  ▪ FEC2::78CA:0:0:23AB
	  ▪ FEC2:0:0:0:78CA::23AB
	FEC2::78CA::23AB is not a valid IPv6 address.

Prefix and Interface ID	The 128-bit address contains two parts:
	▪ The *prefix* is equivalent to the IPv4 network ID.
	  ▪ The prefix is typically 64 bits.
	  ▪ IPv6 addresses are allocated based on physical location, with the prefix also including the global routing information.
	  ▪ The 64-bit prefix is often referred to as the *global routing* prefix.
	  ▪ Routers can be configured to announce the prefix.
	  ▪ Subnetting can be done using the same formulas as IPv4.
	▪ The last 64 bits make up the *interface ID*.
	  ▪ This is the unique address assigned to an interface.
	  ▪ Clients can use a randomly generated host address or the Extended Unique Identifier 64 (EUI-64).
	Addresses are assigned to interfaces (network connections), not to the host. Technically, the interface ID is *not* a host address.

When using IPv6, be aware that:

- The IPv6 loopback address is ::1
- IPv6 eliminates the need for DHCP to issue IP addresses. DHCP is needed only to provide additional information, such as the DNS server information.
- IPv6 makes it possible for each device to have a publicly registered address. Having a unique address for each device removes the need for NAT and PAT.

The following table compares IPv6 address types with IPv4 address types:

IPv4 Address	IPv6 Address	IPv6 Starts With
Public Addresses	Global-Unicast	2 or 3
Private IP Addresses	Unique-Local	FC or FD
APIPA	Link-Local	FE8
Multicast	Multicast	FF

Keep in mind the following about addressing:

- A global-unicast address is an address on the Internet.
- Unique-local, previously referred to as site-local, indicates a private IP Address.
- Link-local indicates that the IP address was configured by default.
- Multicast indicates that the packet is addressed to a number of hosts on the network, but not all hosts.