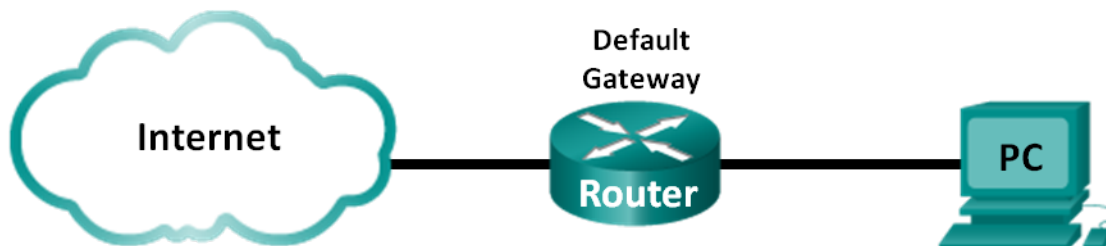# Activity 6.2 – Identifying IPv6 Addresses

Topology

Objectives

Part 1: Identify the Different Types of IPv6 Addresses

Part 2: Practice IPv6 Address Abbreviation

Background / Scenario

With the depletion of the Internet Protocol version 4 (IPv4) network address space and the adoption and transition to IPv6, networking professionals must understand how both IPv4 and IPv6 networks function. Many devices and applications already support IPv6. This includes extensive Cisco device Internetwork Operating System (IOS) support and workstation/server operating system support, such as that found in Windows and Linux.

This lab focuses on IPv6 addresses and the components of the address. In Part 1, you will identify the IPv6 address types, and in Part 2, you will view the IPv6 settings on a PC. In Part 3, you will practice IPv6 address abbreviation.

Part 1: Identify the Different Types of IPv6 Addresses

In Part 1, you will review the characteristics of IPv6 addresses to identify the different types of IPv6 addresses.

Step 1: Review the different types of IPv6 addresses.

An IPv6 address is 128 bits long. It is most often presented as 32 hexadecimal characters. Each hexadecimal character is the equivalent of 4 bits (4 x 32 = 128). A non-abbreviated IPv6 host address is shown here:

2001:0DB8:0001:0000:0000:0000:0000:0001

A hextet is the hexadecimal, IPv6 version of an IPv4 octet. An IPv4 address is 4 octets long, separated by dots. An IPv6 address is 8 hextets long, separated by colons.

An IPv4 address is 4 octets and is commonly written or displayed in decimal notation.

255.255.255.255

An IPv6 address is 8 hextets and is commonly written or displayed in hexadecimal notation.

FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF

In an IPv4 address, each individual octet is 8 binary digits (bits). Four octets equals one 32-bit IPv4 address.

11111111 = 255

11111111.11111111.11111111.11111111 = 255.255.255.255

In an IPv6 address, each individual hextet is 16 bits long. Eight hextets equals one 128-bit IPv6 address.

> **1111111111111111 = FFFF**
>
> **1111111111111111.1111111111111111.1111111111111111.1111111111111111.**
> **1111111111111111.1111111111111111.1111111111111111.1111111111111111 =**
> **FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF**

If we read an IPv6 address starting from the left, the first (or far left) hextet identifies the IPv6 address type. For example, if the IPv6 address has all zeros in the far left hextet, then the address is possibly a loopback address.

> **0000**:0000:0000:0000:0000:0000:0000:0001 = loopback address
>
> ::1 = loopback address abbreviated

As another example, if the IPv6 address has FE80 in the first hextet, then the address is a link-local address.

> **FE80**:0000:0000:0000:C5B7:CB51:3C00:D6CE = link-local address
>
> **FE80**::C5B7:CB51:3C00:D6CE = link-local address abbreviated

Study the chart below to help you identify the different types of IPv6 address based on the numbers in the first hextet.

First Hextet (Far Left)	Type of IPv6 Address
0000 to 00FF	Loopback address, any address, unspecified address, or IPv4-compatible
2000 to 3FFF	Global unicast address (a routable address in a range of addresses that is currently being handed out by the Internet Assigned Numbers Authority [IANA])
FE80 to FEBF	Link-local (a unicast address which identifies the host computer on the local network)
FC00 to FCFF	Unique-local (a unicast address which can be assigned to a host to identify it as being part of a specific subnet on the local network)
FF00 to FFFF	Multicast address

There are other IPv6 address types that are either not yet widely implemented, or have already become deprecated, and are no longer supported. For instance, an **anycast address** is new to IPv6 and can be used by routers to facilitate load sharing and provide alternate path flexibility if a router becomes unavailable. Only routers should respond to an anycast address. Alternatively, **site-local addresses** have been deprecated and replaced by unique-local addresses. Site-local addresses were identified by the numbers FEC0 in the initial hextet.

In IPv6 networks, there are no network (wire) addresses or broadcast addresses as there are in IPv4 networks.

Step 2: Match the IPv6 address to its type.

Match the IPv6 addresses to their corresponding address type. Notice that the addresses have been compressed to their abbreviated notation and that the slash network prefix number is not shown. Some answer choices must be used more than once.

IPv6 Address	Answer
2001:0DB8:1:ACAD::FE55:6789:B210	1. _____
::1	2. _____
FC00:22:A:2::CD4:23E4:76FA	3. _____
2033:DB8:1:1:22:A33D:259A:21FE	4. _____
FE80::3201:CC01:65B1	5. _____
FF00::	6. _____
FF00::DB7:4322:A231:67C	7. _____
FF02::2	8. _____

Answer Choices

a. Loopback address

b. Global unicast address

c. Link-local address

d. Unique-local address

e. Multicast address

Part 2: Practice IPv6 Address Abbreviation

In Part 2, you will study and review rules for IPv6 address abbreviation to correctly compress and decompress IPv6 addresses.

Step 1: Study and review the rules for IPv6 address abbreviation.

Rule 1: In an IPv6 address, a string of four zeros (0s) in a hextet can be abbreviated as a single zero.

2001:0404:0001:1000:**0000:0000**:0EF0:BC00

2001:0404:0001:1000:**0:0**:0EF0:BC00 (abbreviated with single zeros)

Rule 2: In an IPv6 address, the leading zeros in each hextet can be omitted, trailing zeros cannot be omitted.

2001:**0**404:**000**1:1000:0000:0000:**0**EF0:BC00

2001:404:1:1000:0:0:EF0:BC00 (abbreviated with leading zeros omitted)

Rule 3: In an IPv6 address, a single continuous string of four or more zeros can be abbreviated as a double colon (::). The double colon abbreviation can only be used one time in an IP address.

2001:0404:0001:1000:**0000:0000:**0EF0:BC00

2001:404:1:1000**::**EF0:BC00 (abbreviated with leading zeroes omitted and continuous zeros replaced with a double colon)

The image below illustrates these rules of IPv6 address abbreviation:

```
   FF01:0000:0000:0000:0000:0000:0000:1
=  FF01:0:0:0:0:0:0:1
=  FF01::1
```

```
   E3D7:0000:0000:0000:51F4:00C8:C0A8:6420
=  E3D7::51F4:C8:C0A8:6420
```

```
   3FFE:0501:0008:0000:0260:97FF:FE40:EFAB
=  3FFE:501:8:0:260:97FF:FE40:EFAB
=  3FFE:501:8::260:97FF:FE40:EFAB
```

Step 2: Practice compressing and decompressing IPv6 addresses.

Using the rules of IPv6 address abbreviation, either compress or decompress the following addresses:

1) 2002:0EC0:0200:0001:0000:04EB:44CE:08A2

   _____

2) FE80:0000:0000:0001:0000:60BB:008E:7402

   _____

3) FE80::7042:B3D7:3DEC:84B8

   _____

4) FF00::

   _____

5) 2001:0030:0001:ACAD:0000:330E:10C2:32BF

   _____