ECCS-3631
Networks and Data Communications

Module 7-1
Internet Protocol version 6 (IPv6)

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IPv4

- IPv4 has only about 4.3 million addresses available
- Almost completely allocated.
- There are more than 7 billion internet devices
- There is no QoS parameter in IPv4

IPv6: Motivation

initial motivation: 32-bit address space almost completely allocated.

additional motivation:

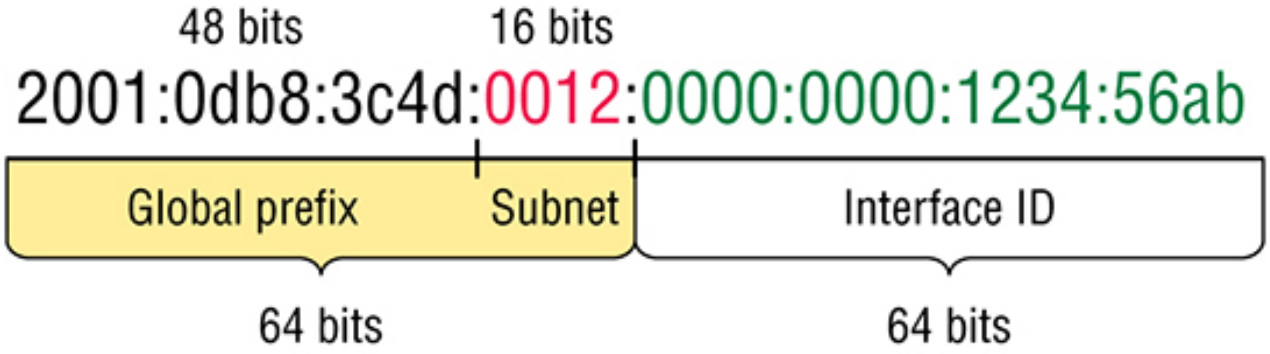
- header format helps speed processing/forwarding
- header changes to facilitate QoS

IPv6: Benefits

- Gives us lots of addresses; 3.4×10^{38}
- Address is 128 bits in length
- No broadcast, it uses multicast traffic

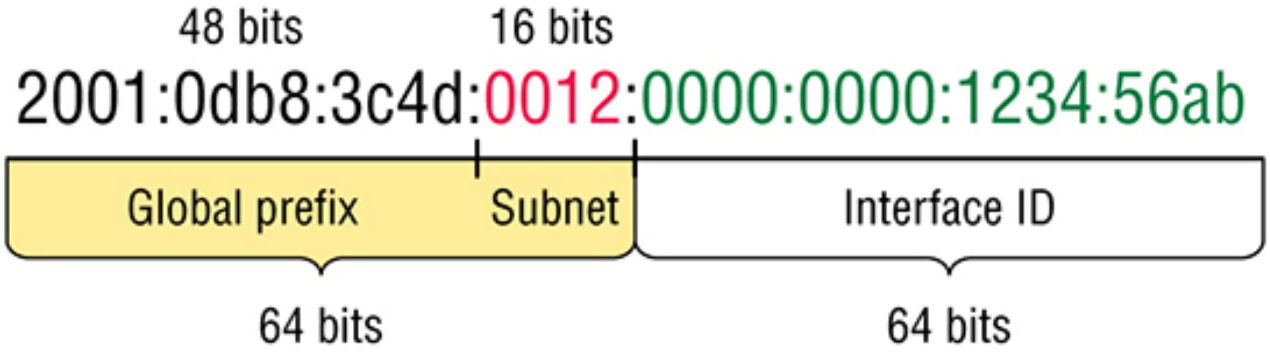
Using multicast, a source can send a single copy of data to a single multicast address, which is then distributed to an entire group of recipients.

IPv6 Addressing



- The address is expressed in hexadecimal just like a MAC address
- It has 8 group of numbers
- Separated by colons
- It has eight 16-bit hexadecimal colon-delimited blocks

IPv6: Shortened Expression



- Drop any leading zeros in each of the individual blocks
- After dropping leading zeros from the above:

```
2001:db8:3c4d:12:0:0:1234:56ab
```

- We can remove consecutive blocks of zeros by replacing them with a doubled colon

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

IPv6: Shortened Expression Example

- If address has four blocks of zeros and each of them were separated, I can replace only one contiguous block with a doubled colon

2001:0000:0000:0012:0000:0000:1234:56ab

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

2001::12::1234:56ab

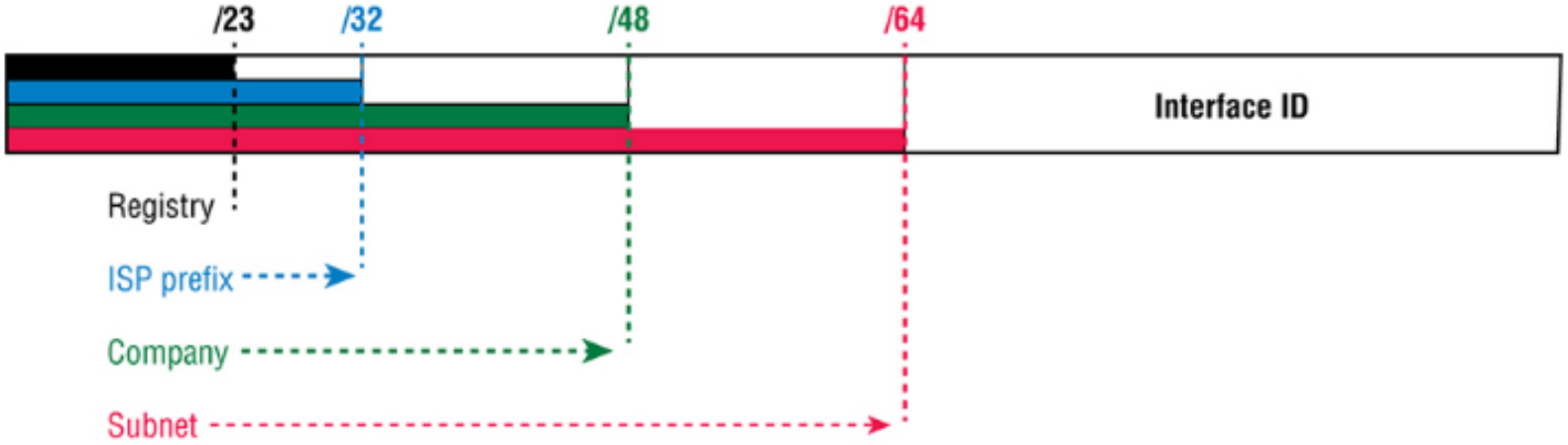
Instead, the best you can do is this:

2001::12:0:0:1234:56ab

- if we remove two sets of zeros, the device looking at the address will have no way of knowing where the zeros go back in. Basically, the router would look at the incorrect address and say, "Well, do I place two blocks into the first set of doubled colons and two into the second set, or do I place three blocks into the first set and one block into the second set?"

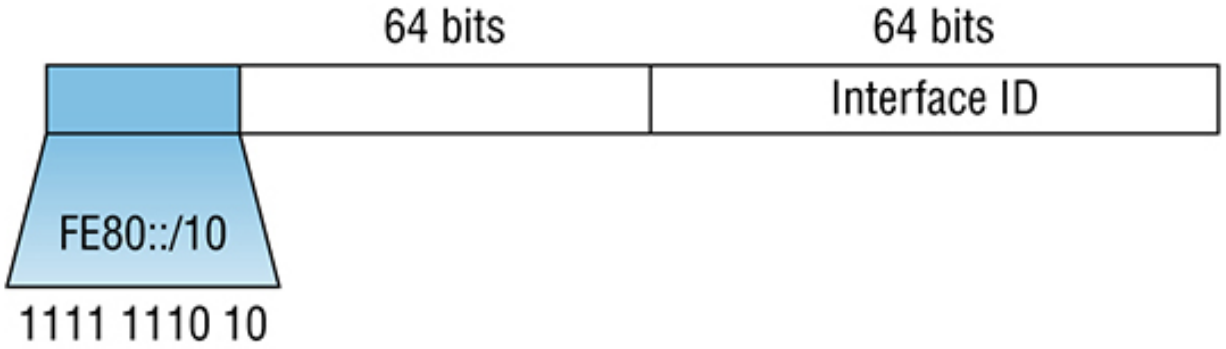
IPv6: Address Types

- No broadcast IP address in IPv6
- **Unicast** Packets addressed to a unicast address are delivered to a single interface.
- **Global unicast addresses (2000::/3)** These are your typical publicly routable addresses and they're the same as in IPv4. Global addresses start at 2000::/3.
- The Figure shows how a unicast address breaks down. The ISP can provide you with a minimum /48 network ID, which in turn provides you 16-bits to create a unique 64-bit router interface address. The last 64-bits are the unique host ID.



IPv6: Address Types

- **Link-local addresses (FE80::/10)** These are like the Automatic Private IP Address. In IPv6 they start with FE80::/10, as shown in Figure.
- The first 10 bits define the address type



- **Multicast (FF00::/8)** Again, as in IPv4, packets addressed to a multicast address are delivered to all interfaces tuned into the multicast address. Sometimes people call them "one-to-many" addresses. It's really easy to spot a multicast address in IPv6 because they always start with *FF*.

- **Let's look at your computer's ipconfig, what type of IPv6 do you have?**