

CCNA (200-301) Cisco Certified Network Associate

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Lecture 8

جامعة الجميع الذكية

تسعى لتكون الكيان الأول الذي يتبنى مبدأ المجتمع التعليمي
التعاوني ويقدم العلم مقابل العمل لتنمية وبناء المجتمعات.

مزيد من التفاصيل

IPv6



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❑ What is IPv6?

- IPv6 is the most recent version of Internet Protocol (IP). It's designed to supply IP addressing and additional security to support the predicted growth of connected devices in IoT, manufacturing, and emerging areas.

❑ Why use IPv6 vs IPv4?

- The primary reason to make the change is due to IPv6 addressing. IPv4 is based on 32-bit addressing, limiting it to a total of 4.3 billion addresses.
- IPv6 is based on 128-bit addressing and can support 340 undecillion, which is 340 trillion³ addresses. Having more addresses has grown in importance with the expansion of smart devices and connectivity.

- IPv6 provides more than enough globally unique IP addresses for every networked device currently on the planet, helping ensure providers can keep pace with the expected proliferation of IP-based devices.
- In addition to addressing, IPv6 benefits include:
 - ☐ Stateless address auto configuration
 - ☐ Optional NAT (Network Address Translation)
 - ☐ Easier administration with DHCPv6
 - ☐ Improved quality of service with flow labeling
 - ☐ Header length of 20 bytes in ipv4 whereas header length of ipv6 is 40bytes.

IPv4 Header Format

- 20 Bytes + Options

bits:	4	8	16	20	32
Version	H. Length	TOS	Total Length		
Identification			Flags	Fragment Offset	
Time To Live	Protocol		Header Checksum		
32 bits Source Address					
32 bits Destination Address					
Options					

Modified Field

Deleted Field



IPv6 Header Format

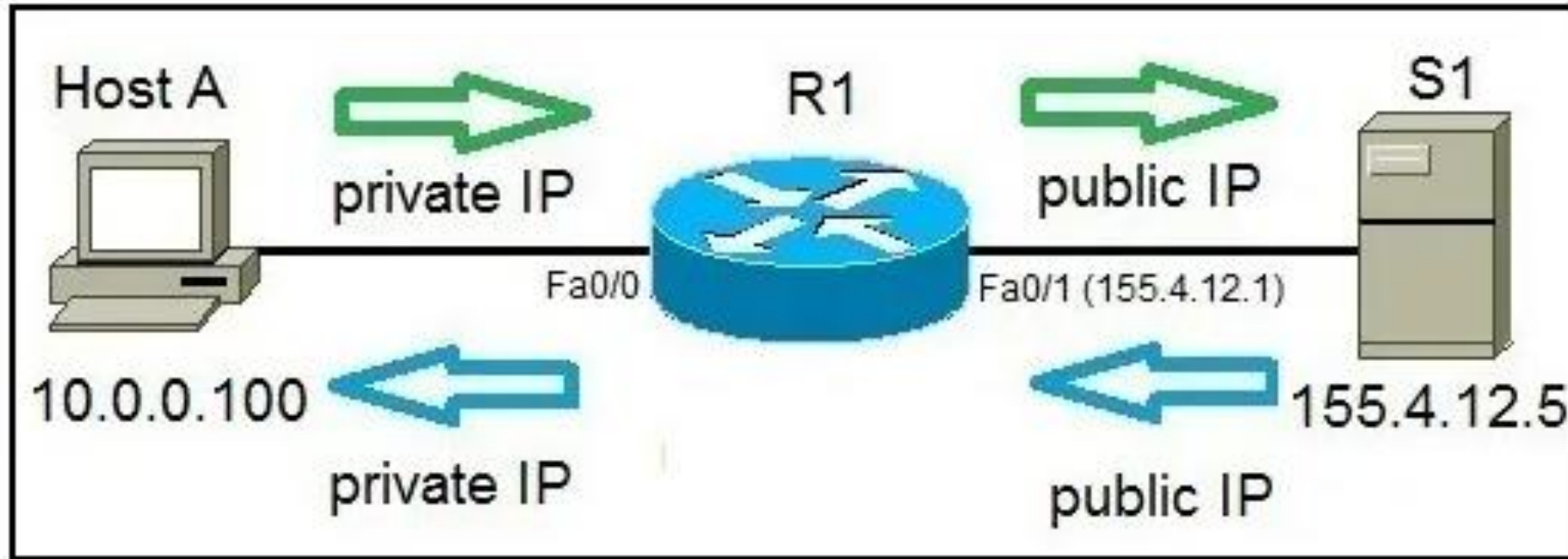
- From 12 to 8 Fields (40 bytes)

bits:	4	12	16	24	32
Version	Class of Traffic	Flow Label			
Payload Length			Next Header	Hop Limit	
128 bits Source Address					
128 bits Destination Address					

- Avoid checksum redundancy
- Fragmentation end to end

Solution for IPv4 Reduction before using ipv6:

- Use sub netting : companies and ISP does not use class A , B or C but use subnet from them.
- Using NAT (Network Address Translation) :
 - ❖ Hosts inside network use only single registered IP called public IP to communicate with each other network.
 - ❖ While using a block of ip address called private ip for internal communication.



❑ IPv6 writing

- ❖ IPv6 consists of 128 bits
- ❖ Written in hexadecimal in 32 digits
- ❖ 48(binary) = 1 digit (hexadecimal)

Network	Interface ID
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❖ For example:

❖ FD00 : 1311 : AAAA : 0001 : 3413: 2222: 7713 : 1131

first quartet

eighth quartet

- ❖ Every quartet consists of 16 bits or 4 hexadecimal digit
- ❖ IPv6 consists of 8 quartets

Compacting IPv6

1. Neglect all leading zero in any quartet:

❑ EX: 2300 : 0001 : 3200 : 4111 : 0013 : 1112 : 3111
 2300 : 1 : 3200 : 4111 : 13 : 1112 : 3111

2. Replace any number of continuous quartets contain all digit zero by[::] (only one time).

2300 :0000 :0000:1141 :0000: 0000: 0000:1111

2300 :: 1141 :: 1111 **X**

2300 :: 1141 :0:0:0: 1111 **✓**

2300:0:0: 1141 :: 1111 **✓**



IPv6 Sub netting

❑ IPv6 → 2300 : AAAA : 1111 : 8913 : 1111 : 2222 : 3333 : 4444 /64

❑ 2300 : AAAA : 1111 : 8913 :: /64 →→ Network id

❑ IPv6 → 2300 : AAAA : 1111 : 8913 : 1111 : 2222 : 3333 : 4444 /55

IPv6 Sub netting

❑ IPv6 → 2300 : AAAA : 1111 : 8913 : 1111 : 2222 : 3333 : 4444 /55

❑ 2300 : AAAA : 1111 : 8800 :: /55 →→ Network id

IPv6Types

- ❑ This information shows the categories of different IPv6 address types, and explains the uses for each of them.

IPv6 addresses are categorized into these basic types:

1.Unicast address

The unicast address specifies a single interface. A packet sent to a unicast address destination travels from one host to the destination host.

- The two **regular types of unicast addresses include:**

A- Local unicast address (Private IP)

FD00:: /8



B-Global unicast addresses(Public IP) are designed for use on any network.

The prefix used for a global address begins with binary 001

2000:: /3

0010 → 2xxx

0011 → 3xxx

C-There are two special unicast addresses defined:

1.Unspecified address

The unspecified address is 0:0:0:0:0:0:0:0. You can abbreviate the address with two colons (::). The unspecified address indicates the absence of an address, and it can never be assigned to a host. It can be used by an IPv6 host that does not yet have an address assigned to it. For example, when the host sends a packet to discover if an address is used by another node, the host uses the unspecified address as its source address.

2.Loopback address

The loopback address is 0:0:0:0:0:0:0:1. You can abbreviate the address as ::1. The loopback address is used by a node to send a packet to itself.

2. Multicast address

The multicast address specifies a set of interfaces, possibly at multiple locations. The prefix used for a multicast address is ff. If a packet is sent to a multicast address, one copy of the packet is delivered to each member of the group.

FF00:: /8

1111 1111

3. Link-local address

Link-local addresses are designed for use on a single local link (local network). Link-local addresses are automatically configured on all interfaces. The prefix used for a link-local address is **FE80::/10**. Routers do not forward packets with a destination or source address containing a link-local address.



3. Link-local address

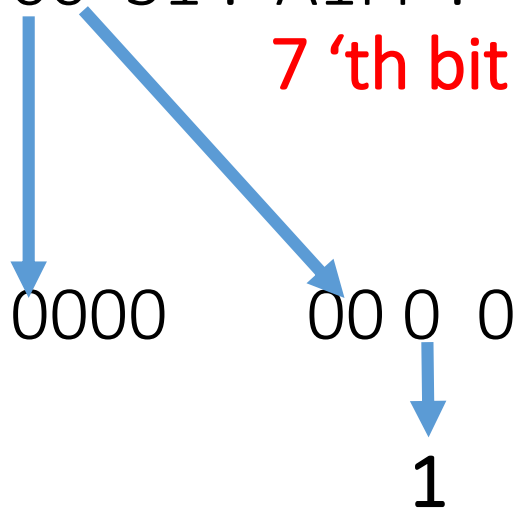
- ❑ Like APIPA assign ip address to any IPv6 enabled host.
- ❑ Any coat used IPv6 have address on the following subnet:
 - FE80:: /64 → interface id → 64 bits
 - Using **Mac address (48 bits)** and **(FFFE) hexadecimal digits**.
- **For example:**
- **If we enable ip v6 in host with interface have the following Mac :**
00-13-A1-31-4D-AF Network part → Fe80 /64

Part of Interface ID :

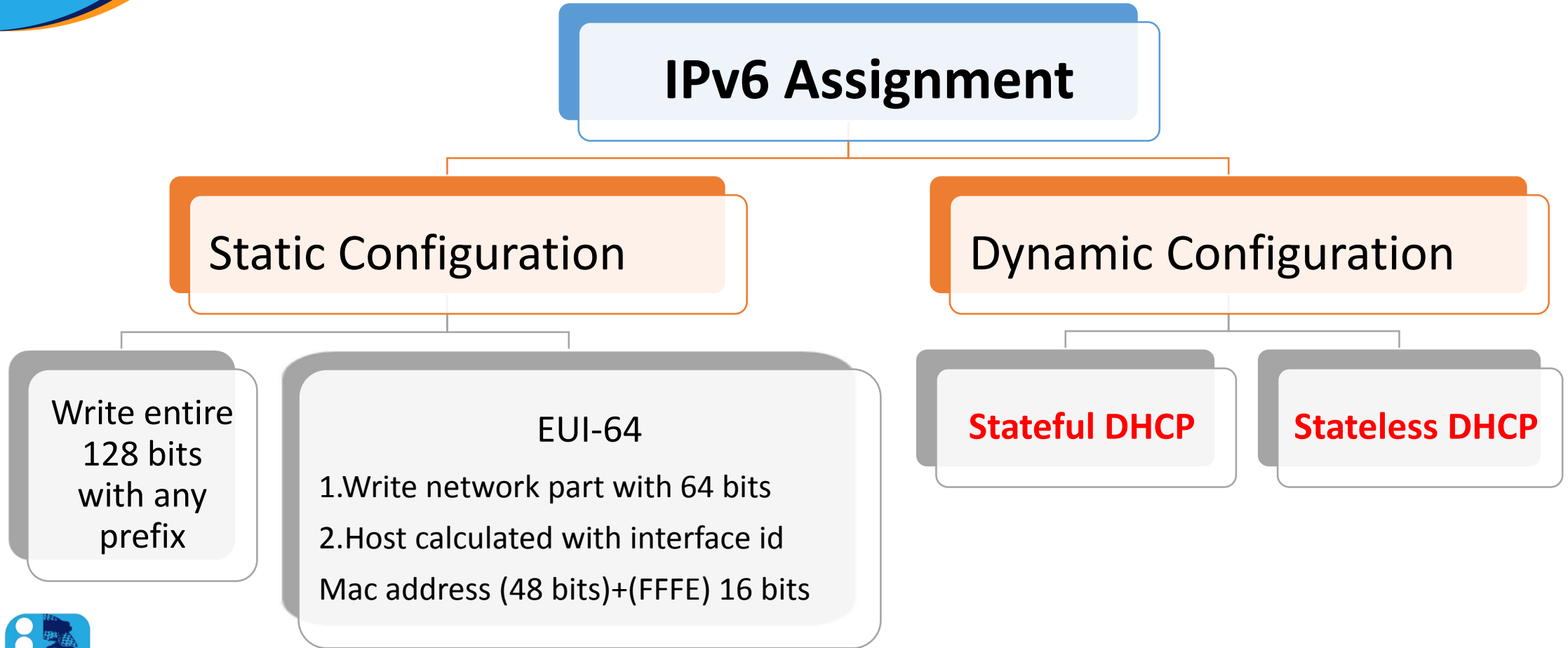
[00 - 31 - A1 -] [31 - 4D - AF]

00 31 : A1FF : FE 31 : 4D AF

7 'th bit from the left must be 1



0 2 1 3 :A1FF : FE 31 : 4D AF



1. Stateful DHCP

- ❑ Configured like DHCPv4

- ❑ Configuration include

 - ip address pool

 - Prefix /subnet mask

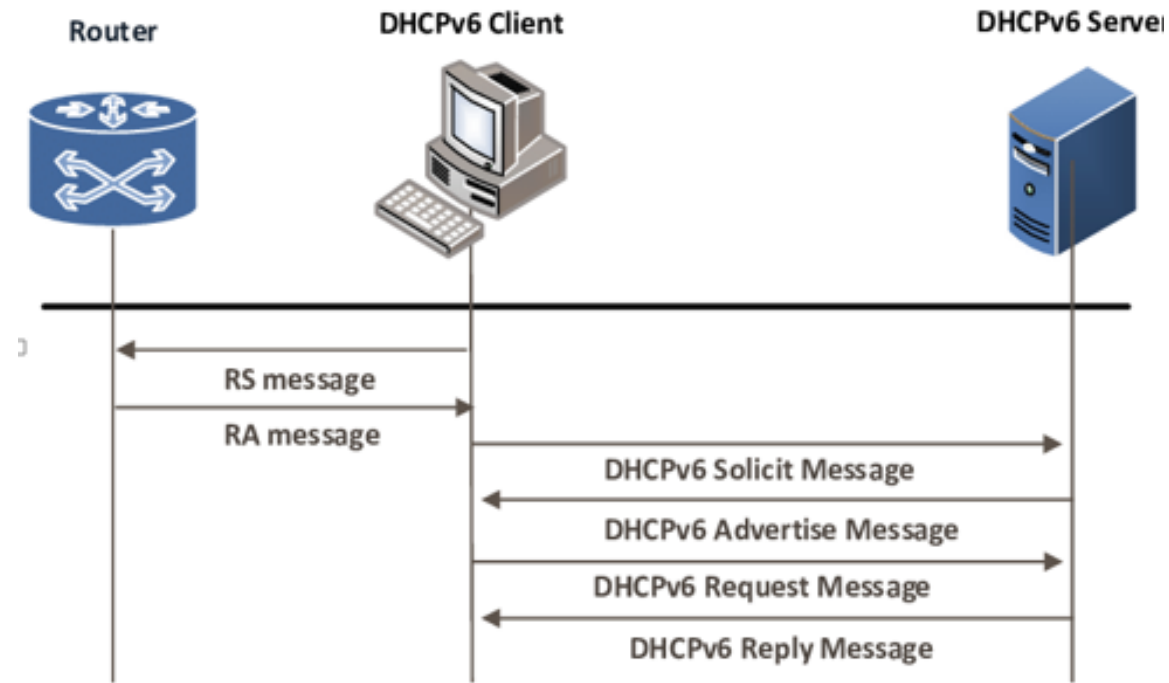
 - Default gateway ip

 - Preferred and alternative DNS

- ❑ What is the difference between DHCPV4 and DHCP v6

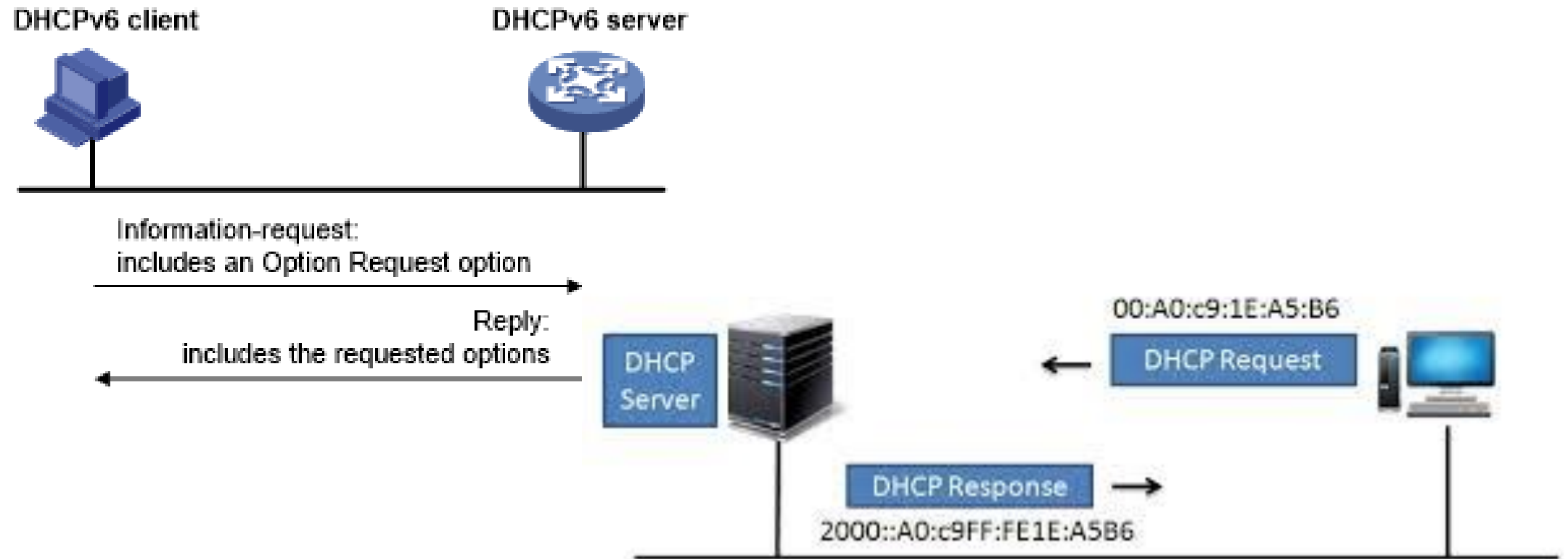


- ❖ In **DHCPv4** Discover packet use destination ip address 255.255.255.255 , so all hosts process this packet data but, only DHCP server replies .
- ❖ In **DHCPv6** Discover packet use FF02::2:1 which resend to **DHCP server (Multi cast)** so , all hosts know from the header if they complete the process of data if they are DHCP server
Or discard which reduce the processing on host .



2. Stateless DHCP server

- ❑ use EUI-64 to assign interface ID to host automatically
- ❑ But the host used protocol called NDP (neighbor discovery protocol) to get the network address and default gateway ip.
- ❑ NDP used two types of message :
 - 1.RS: router solicitation
 - 2.RA :router advertisement





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