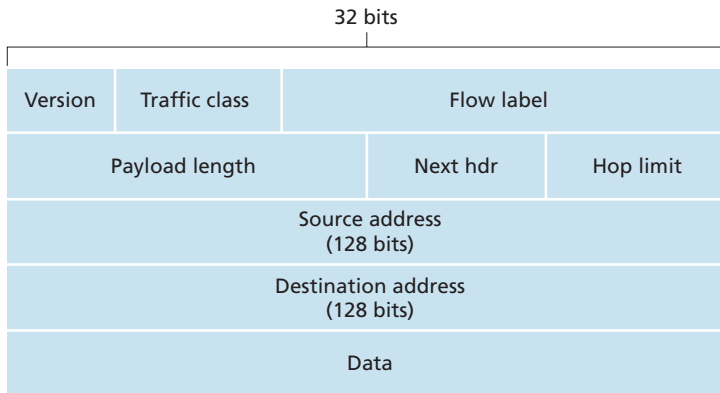


# IPv6

# IPv6 header



# IPv6 vs. IPv4 header

**IPv4 Header**

Version	IHL	Type of Service	Total Length	
Identification			Flags	Fragment Offset
Time to Live	Protocol	Header Checksum		
Source Address				
Destination Address				
Options				Padding

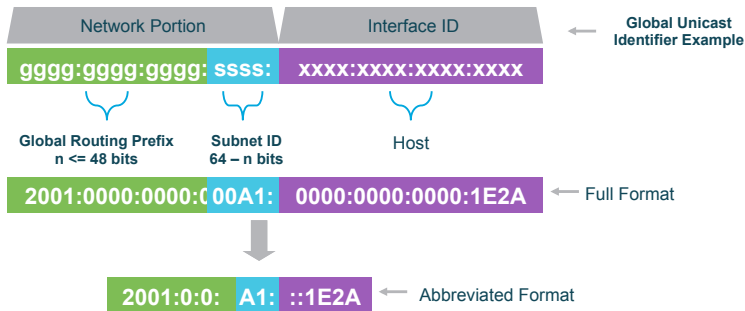
**Legend**

- Field name kept from IPv4 to IPv6
- Fields not kept in IPv6
- Name and position changed in IPv6
- New field in IPv6

**IPv6 Header**

Version	Traffic Class	Flow Label	
Payload Length		Next Header	Hop Limit
Source Address			
Destination Address			

# IPv6 Addresses – a closer look



IPv6 addresses are 128 bits long

- Segmented into 8 groups of four HEX characters
- Separated by a colon (:)
- 50% for network ID, 50% for interface ID
- Compact format

# IPv6 Adresses – Simplification

- Base format (16-byte)

2001:0660:3003:0001:0000:0000:6543:210F

- Compact Format:

2001:660:3003:1::6543:210F

- Heading zeros are remove, block of zeros can be removed
  - :0001: becomes :1:
  - :0000: becomes ::
  - :0000:0000: becomes ::

# IPv6 Addresses – Addresses Types

- Three types of unicast address scopes

- Link-Local – Non routable exists on single layer 2 domain (FE80::/64)

FE80:0000:0000:0000:

XXXX:XXXX:XXXX:XXXX

- Unique-Local (ULA) – Routable with an administrative domain (FC00::/7)

FC00:gggg:gggg:

ssss:

XXXX:XXXX:XXXX:XXXX

- Global – Routable across the Internet (2000::/3)

2000:GGGG:GGGG:

ssss:

XXXX:XXXX:XXXX:XXXX

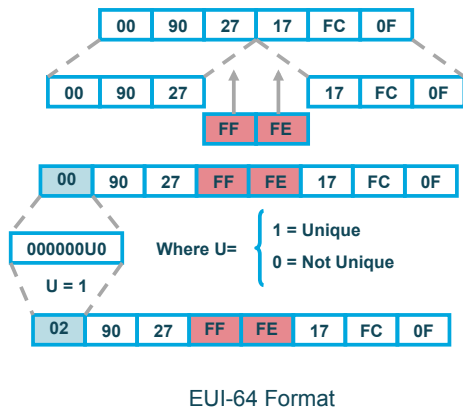
- Multicast addresses begin with FF00::/8

FFfs:

XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX

# IPv6 Interface Identifier

- **Introduction**
- Interface-ID can be manually configured
- stateless auto-configuration
  - This format expands the 48 bit MAC address to 64 bits by inserting FFFE into the middle 16 bits
  - local (“u” bit) is set to 1 for global scope and 0 for local scope



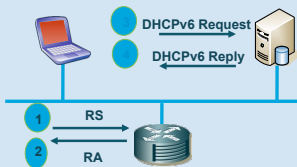
# IPv6 – Address Assignment

## Similar to IPv4

Manually configured

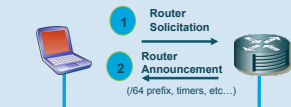


Assigned via DHCP



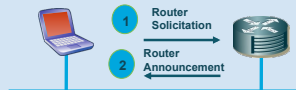
## New in IPv6

Stateless configuration



IPv6 Address = /64 prefix + EUI64 (e.g. MAC address)

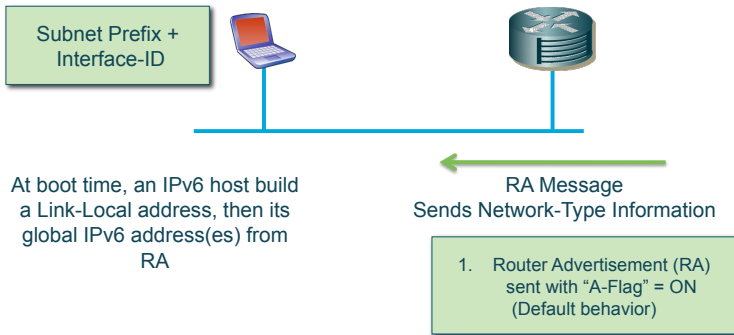
Auto-generated pseudo-random number (rfc3041)



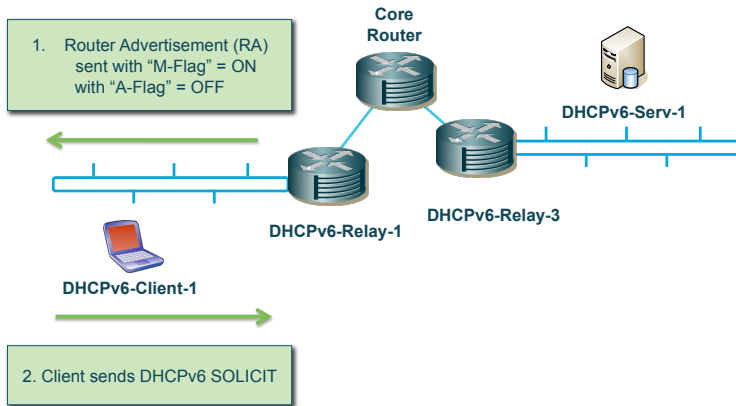
IPv6 Address = /64 prefix + Random 64 bits (rfc3041)



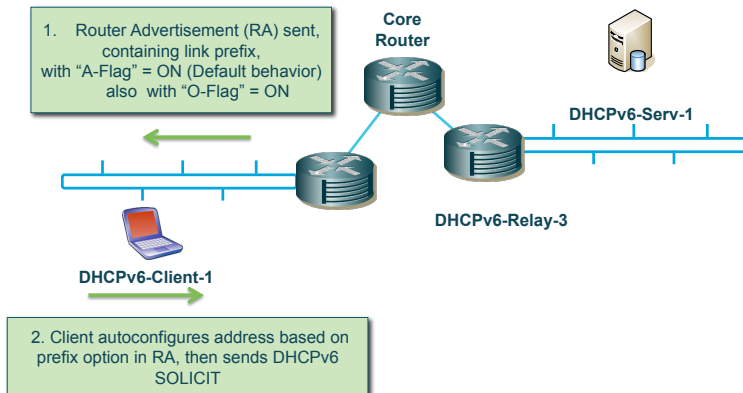
# IPv6 – Address Autoconfiguration (SLAAC)



# IPv6 – Stateful DHCP



# IPv6 – Stateless DHCP



# IPv6 – Router Discovery



Router advertisement packet definitions:

ICMPv6 Type = 134

Src = router link-local address

Dst = all-nodes multicast address

Data = options, prefix, lifetime, autoconfig flag

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- Routers join the “all routers” multicast group FF02::2
- Clients send a “Router Solicitation” query (RS)
- Routers send out “Router Advertisement” messages (RA)
  - periodically to “all nodes multicast” address FF02::1
  - in response to the RS query