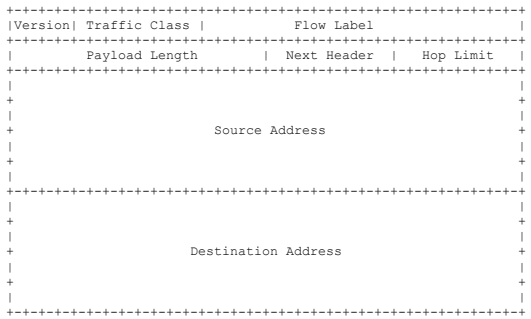
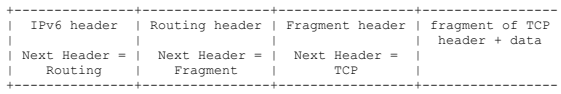
IPv6 Cheatsheet

IPv6 Protocol header (RFC2460)



Version(4-bit) Always set to 6
Traffic Class(8-bit) A DSCP value for QoS
Flow Label(20-bit) Identifies unique flows
Payload Length(16-bit) Length of the payload in bytes
Next Header(8-bit) Header or protocol which follows
Hop Limit (8-bits) Similar to IPv4's time to live field
Source Address (128-bit) Source IP address
Destination Address(128-bit)Dest. IP addresses

Extension Headers (RFC2460)



Hop-by-Hop Options (0)
Routing (43)
Fragment (44)
Destination Options (60)
Authentication (51)
Encapsulating Security Payload (50)

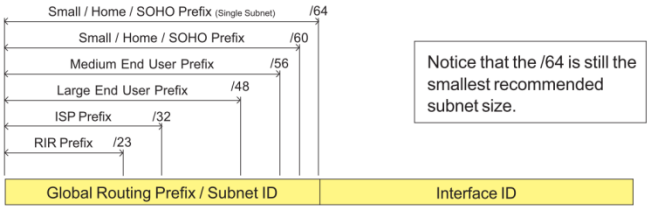
Text Representation of Addresses (RFC5952)

XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX
X Hexadecimal Digit, 4 Bits (0-9, a-f)
: separates “Hextets” (4 Hex Digits)
Notation Rules

- Eliminate leading zeros in all Hextets
- Longest sequence of 2 or more Hextets of zeros is replaced by **::** (used only once)
- Hex characters are represented in lowercase ("a", "b", "c", "d", "e", and "f")

Examples
fe80::1
ff02::1:ff52:b0eb
2001:620:100:10a0:c87e:39ff:fe4b:8645

Address Assignment (RFC6177)



Address Types (RFC4291)

2000::/3	Global unicast
::/128	Unspecified
::1/128	Loopback
ff00::/8	Multicast
fe80::/10	Link-Local unicast
fc00::/7	Unique Local (RFC4193)

Reserved Ranges

::/0	Default Route
::ffff:0:0/96	IPv4-mapped Addresses (RFC4291)
2001::/32	Teredo Tunneling (RFC4380)
2001:db8::/32	Documentation (RFC3849)
2002::/16	6to4 (RFC3056)

Multicast Ranges (RFC4291)

ff01::/16	Interface-Local scope
ff02::/16	Link-Local scope
ff04::/16	Admin-Local scope
ff05::/16	Site-Local scope
ff08::/16	Organisation-Local scope
ff0e::/16	global scope

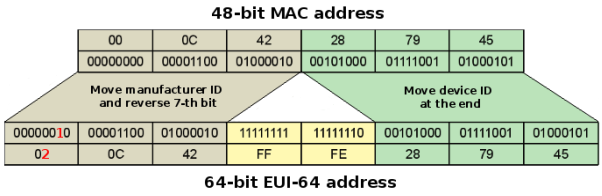
Link-Local Multicast Addresses

ff02::1	All Nodes (RFC4291)
ff02::2	All Routers (RFC4291)
ff02::5	OSPF (RFC5340)
ff02::6	OSPF DR (RFC5340)
ff02::c	SSDP (no RFC)
ff02::16	MLDv2 (RFC3810)
ff02::1:2	All DHCP Agents and Servers
ff02::1:3	LLMNR (RFC4795)

ff02::1:ffxx:xxxx Solicited-Node Address (RFC4291)

Interface ID

Used to identify Interfaces on a link
Always 64 Bits long (RFC4291)
48-Bit Ethernet MAC-Address to EUI-64 Mapping

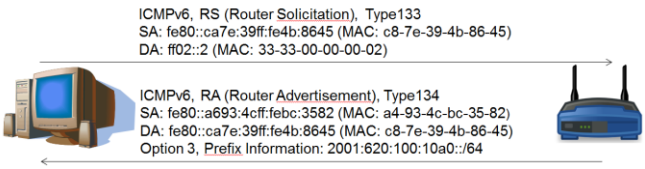


Privacy Extensions (RFC4941)
Genereate additional random Interface ID (Temporary Address) which is renewed frequently.
Address is used for Internet connections to hide the MAC Address

A Node’s required Addresses (RFC4291)

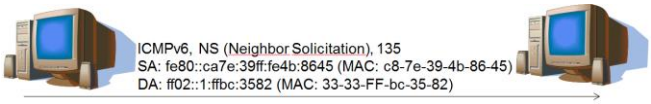
- Link-local address per interface
- All configured unicast addresses
- Loopback address
- All nodes multicast address
- Solicited node multicast address per unicast address
- Multicast address for all member groups

Stateless Address Autoconfiguration – SLAAC (RFC4862)



1. Client creates own link-local unicast address with link-local prefix and EUI-64 Interface ID
2. Clients sends ICMPv6 Router-Solicitation to All-Routers link-local multicast Address
3. Router replies with ICMPv6 Router-Advertisement, containing the links global routing prefix
4. Client create own global unicast address with global routing prefix and EUI-64 Interface ID
5. Client performs duplicate address detection against the newly created address

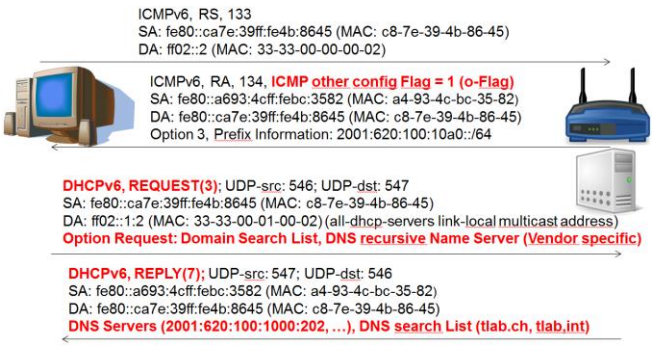
Duplicate Address Detection – DAD (RFC4862)



1. Client sends ICMPv6 Neighbor Discovery to his own solicited Node link-local multicast address, expecting no response
2. If a host responds, the client need to create another unicast address

Stateless DHCPv6 Service (RFC3736)

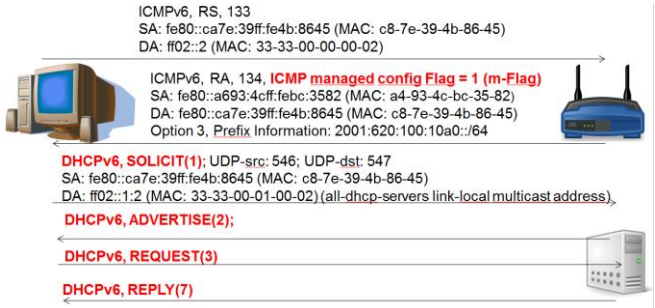
- Used to provide DNS Servers to clients
- No client addresses are manged
- Routers must set “o-Flag” in ICMPv6 RA messages



1. Client sends ICMPv6 RS to all-routers address
2. Upon detecting the o-flag, the client sends a DHCPv6 REQUEST to the all-dhcpv6-servers link-local multicast address
3. DHCPv6 Server relies with a DHCPv6 REPLY message containing DNS servers and names

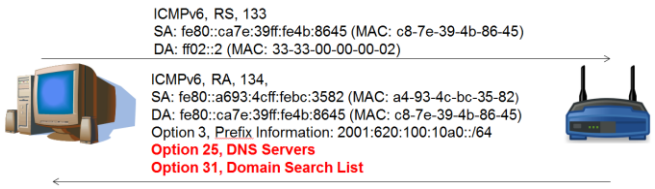
Stateful DHCPv6 Service (RFC3315)

- Used to provide DHCP Service to IPv6 nodes
- DHCPv6 Server manages client addresses
- Routers must set “m-Flag” in ICMPv6 RA messages



1. Client sends ICMPv6 RS to all-routers address
2. Upon detecting the m-flag, the client sends a DHCPv6 SOLICIT to the all-dhcpv6-servers link-local multicast address
3. DHCPv6 Server relies with a DHCPv6 ADVERTISE message offering a global unicast address
4. Client requests the offered address sending a DHCPv6 REQUEST message
5. Server acknowledges address assignment with DHCPv6 REPLY message

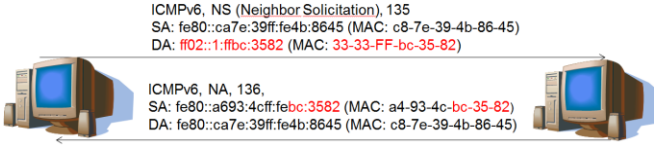
DNS Server as an RA Option – RDNSS (RFC6106)



1. Client sends ICMPv6 RS to all-routers address
2. Router replies with ICMPv6 RA message containing global routing prefix and DNS information using an option field

Neighbor Discovery Protocol – NDP (RFC4861)

- Used to map IPv6 addresses and Ethernet MAC addresses
- Replaces Addess Resolution Protocol (ARP)



1. Host 1 sends ICMPv6 Neighbor Solicitation to solicited node multicast address
2. Host 2 replies with ICMPv6 Neighbor Advertisement containing his Ethernet MAC address