IPv6 (IP version 6) Essentials
Ch3: IPv6 Addressing

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Address Types (1)

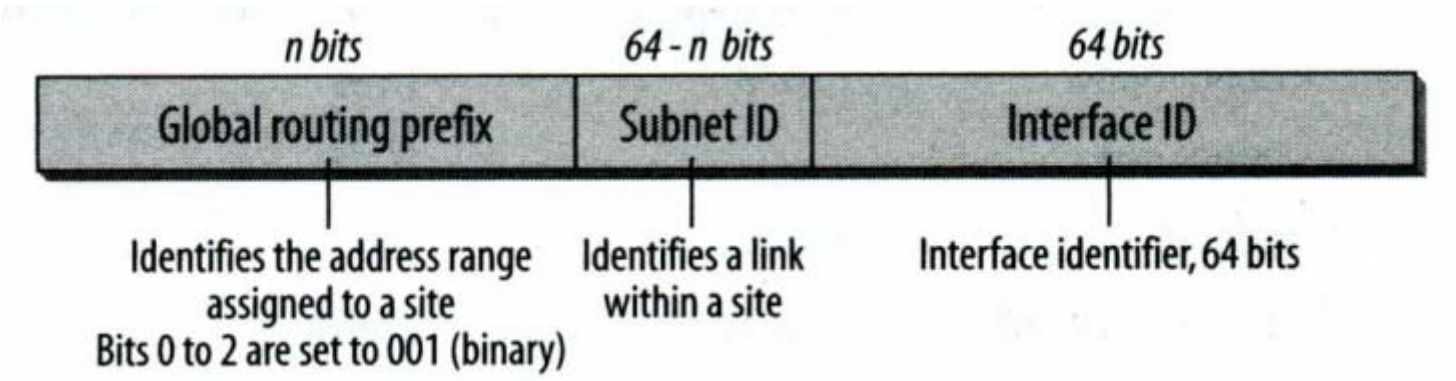
- An IPv4 address has 32 bits, & an IPv6 address has 128 bits.
- The IPv6 addressing architecture is defined in RFC 2373.
  - In IPv4: unicast, multicast, broadcast.
  - In IPv6: unicast, multicast, anycast (RFC 1546).
    - An anycast address is assigned to multiple interfaces (usually on multiple nodes / routers). A packet sent to an anycast address is delivered to only one of these interfaces, & is usually the nearest one (the shortest path).
- Some General Rules:
  - IPv4 / IPv6 addresses are assigned to interfaces, not to nodes.
    - Each interface of a node needs at least one unicast address.
    - A single interface can also be assigned multiple IPv6 addresses of any type (unicast, multicast, anycast).
    - It is also possible to assign one unicast address to multiple interfaces for load-sharing / load-balance.

Address Types (2)

- In IPv6, an address with all zeros (0) or all ones (1) is legal value.
  - (0000::0000), or (1111:1111: … :1111).
- A typical IPv6 address consists of three parts:
  - The global routing prefix (n-bit).
    - It is used to identify a special address: such as multicast, or an address range assigned to a site.
  - The subnet ID (64-n-bit).
    - It is used to identify a link within a site.
    - The subnet ID may also called as subnet prefix or subnet.
    - A subnet ID is associated with one link, or multiple subnet IDs may be assigned to one link.
  - The interface ID (64-bit).
    - It is used to identify an interface on a link.
    - It needs to be unique on that link.

Address Types (3)

- Format of the global unicast address.



Global IP prefix: 001X = 2 or 3 (2001, 2002, 3ffe, etc..)

Address Notation (1)

- An IPv6 address has 128 bits, or 16 bytes.
  - It is divided into eight (16-bit hexidecimal) blocks.
  - It is separated by colons.
    - Ex) FE80:0000:0000:0000:0202:B3FF:FE1E:8329
  - The leading zeros in each block can be skipped.
    - Ex) FE80:0:0:0:202:B3FF:FE1E:8329
  - A double colon can replace consecutive zeros, leading, or trailing zeros.
    - Ex) FE80::202:B3FF:FE1E:8329
  - The double colon can appear only once in an address.
    - Ex) CAFF:CA01:0000:0056:0000:ABCD:EF12:1234.
    - Ex) CAFF:CA01::56:0:ABCD:EF12:1234
    - Ex) CAFF:CA01:0:56::ABCD:EF12:1234

Address Notation (2)

- In IPv4 & IPv6 mixed environments, another convenient form of IPv6 address notation is used:
  - To put the values of an IPv4 address into the four low-order bytes of the IPv6 address.
    - Ex) An IPv4 address is 192.168.0.2, then the IPv6 address can be represented by x:x:x:x:x:x:192.168.0.2 (using dots).
    - Ex) An IPv6 address is 0:0:0:0:0:0:192.168.0.2, then it can be written as ::192.168.0.2
    - Ex) The IPv4 address can also be represented by hexadecimal ::C0A8:2 (using colons).

Prefix Notation (1)

- The notation for prefixes has been specified in RFC 2373.
- It is also called the global routing prefix.
- A prefix is the high-order bits in an IP address.
  - Ex) 3FFE:501::/32
- It is used to identify the subnet or a specific type of address.
- It is very similar to the way of IPv4 addresses written in Classless Interdomain Routing (CIDR) notation.
  - Ex) 140.21.1.3/16
  - The notation appends the prefix length:
    - Ex) IPv6 address / prefix length.
- The prefix also represents a subnet mask.
  - In IPv4, a subnet mask specifies the bits of the IPv4 address that belong to the network ID.
  - The IPv6 prefix is used to identify the subnet that an interface belongs to.
    - Ex) 2E78:DA53:12::/40

Prefix Notation (2)

- Understanding prefix notation (Ex: 2E78:DA53:12::/40).

Hex notation	Binary notation	Number of bits
2E 78	0010 1110 0111 1000	16
DA 53	1101 1010 0101 0011	16
12	0001 0010	8
		Total: 40

- A double colon can be also used in prefix, but it should be careful!!
  - Ex) The address is CAFF:CA01:0000:0056:0000:ABCD:EF12:1234/64, can we compress it as follows?
    - CAFF:CA01::56/64 (when we only focus on the prefix) (ok???)
      - Answer is wrong.
      - CAFF:CA01:0:56::/64 is correct.

Format Prefixes (1)

- Prefixes can be also used to identify special addresses, such as link-local addresses or multicast addresses.
  - The major part of the address space (over 80%) is unassigned.
- The address space of prefix $(00)_{16}$ is reserved for speciality.
  - Some special addresses use the address space, such as:
    - The unspecified address (::).
    - The loopback address (::1).
      - IPv4: lookback address 127.0.0.1
    - The IPv6 addresses with embedded IPv4 addresses.
- Unicast addresses can be distinguished from multicast addresses by their prefix.
  - Globally unique unicast addresses have a high-order byte of $(001)_2$.
  - An IPv6 multicast address has a high-order byte of 1111 1111 (FF in hex).
  - Anycast addresses are a part of the unicast address space.

Format Prefixes (2)

- List of assigned prefixes.

Allocation	Prefix binary	Prefix hex	Fraction of address space
Unassigned	0000 0000	::0/8	1/256
Reserved	0000 001		1/128
Global unicast	001	2000::/3	1/8
Link-local unicast	1111 1110 10	FE80::/10	1/1024
Reserved (formely Site-local unicast)	1111 1110 11	FEC0::/10* * deprecated	1/1024
Local IPv6 address	1111 110	FC00::/7	(Unique Local Unicast, RFC 4139, replace site-local address)
Private administration	1111 1101	FD00::/8	
Multicast	1111 1111	FF00::/8	1/256

Format Prefixes (3)

- Addresses in the prefix range $(001)_2$ to $(111)_2$ should use a 64-bit interface identifier.
  - Except for multicast addresses with the prefix 1111 1111.
- The 64-bit interface identifier follows the EUI-64 (Extended Unique Identifier) format.
  - The EUI-64 is a unique identifier defined by the IEEE (Institute of Electrical and Electronics Engineers).
  - Ex) When a user's Windows XP host auto-configures a link-local address on an Ethernet interface (MAC): 00-02-b3-1e-83-29.
    - Using the 48-bit (6-Byte) Ethernet MAC address to create the 64-bit interface identifier.
      - 1st: the hex digits (ff-fe) are inserted between the third & fourth bytes of the MAC address.
        - 00-02-b3-ff-fe-1e-83-29.

Format Prefixes (4)

- 2nd: the second low-order bit (in the first byte of the MAC address) is complemented (0 ←→ 1). That is 0x00 ←→ 0x02.
  - Binary: 0x00 = 0000 0000 → 0000 0010 = 0x02.
- 3rd: the IPv6 interface identifier corresponding to the Ethernet MAC address (00-02-b3-1e-83-29) is 0202:b3ff:fe1e:8329.

- The IPv6 link-local address is the combination of:
  - The prefix fe80::/64
  - A 64-bit interface identifier (e.g. EUI-64).
  - That is: fe80::202:b3ff:fe1e:8329 (RFC 2464).

Address Privacy (1)

- Like IPv4 (static IP → manually configured, dynamic IP → dynamically assigned by a DHCP server), a device can have an IPv6 address via stateless configuration or stateful configuration.
  - Stateless configuration: does not use DHCPv6 server assignment.
  - Stateful configuration: use DHCPv6 server assignment.
- In early 2001, RFC 3041, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6“, introduced a new kind of IPv6 address:
  - Using a random number in place of the factory-assigned serial number (EUI-64).
  - The above address can also change over time.
- Hence, in the IPv6 address architecture, we can choose between two types of addresses:
  - Unique stable IP addresses: assigned through manual configuration, a DHCP server, or autoconfiguration using the EUI-64.
  - Temporary transient IP addresses: assigned using a random number in place of the EUI-64.

Address Privacy (2)

- Link- & Site-local Addresses:
  - In IPv4, there are private IP addresses (such as 192.168.x.x) defined in RFC 1918. These addresses reserved for private use should never be forwarded over the Internet routers.
  - IPv6 allocates two separate address spaces for link- & site-local use, both identified by their prefix.
    - Link-local address prefix: 1111 1110 10/10 → FE80 (hex).
    - Site-local address prefix: 1111 1110 11/10 → FEC0 (hex).
  - Link-local address (FE80::/10, RFC 3513):
    - A link-local address is for use on a single link & should never be routed (no routers).
    - It can be used for auto-configuration mechanisms, for neighbor discovery, & is useful for creating temporary networks.
    - In a conference room, to share files on your computers:

Address Privacy (3)

- Computers using a wireless network (layer2 device) or a cross-cable between Ethernet interfaces, without any special configuration by using the link-local address.

- Site-local address (FEC0::/10, reserved by IETF, RFC 3879):
  - Site-local addresses contain subnet information within the address.
  - They can be routed within a site, but routers should not forward them outside the site (such as a enterprise).
  - Unique local unicast address (FC00::/7, RFC 4139).
    - Like IPv4 private address in a site.
    - L (bit): identifies the assignment policy. Currently, only L=1 (FD00::/8) is defined for local assignment.
    - Global ID (40-bit): a identifier that ensures the global uniqueness of the address.

Address Privacy (4)

- Address formats for link- & site-local use.

Link-local address

1111 1110 10	0	Interface ID
10 bits	*54 bits*	*64 bits*

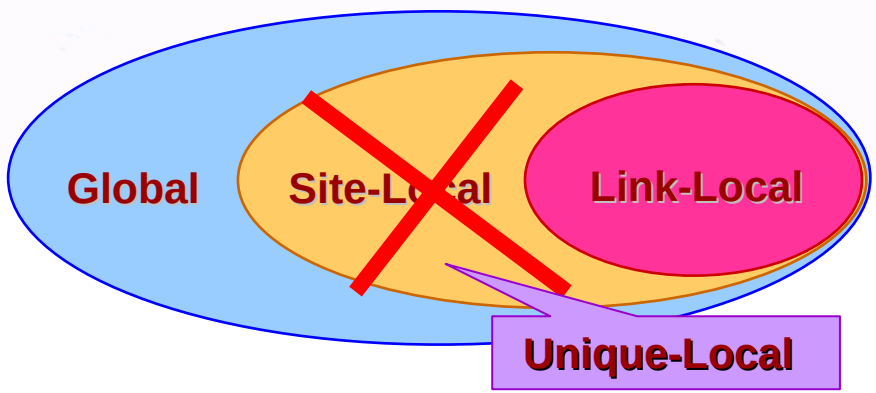
Local IPv6 address

1111 110L (7-bit + L 1-bit)

1111 1110	L	Global ID	Subnet ID	Interface ID
Prefix 7 bits	*1 bit*	*40 bits*	*16 bits*	*64 bits*

Prefix: FC00::/7 identifies local IPv6 Unicode address

L: Set to 1 if the prefix is assigned locally
If set to 0, may be defined in the future



Aggregatable Global Unicast Address (1)

- Aggregatable global unicast addresses are identified by the prefix 001.
- The prefix (3-bit) is followed by 5 components:
  - 1st is the TLA (Top-Level Aggregation Identifier: 13-bit):
    - TLA contains the highest level of routing information about the address.
    - In the earlier specification, the TLA was assigned to the:
      - American Registry for Internet Numbers (ARIN) in North America.
      - Reseau IP Europeens (RIPE) Network Coordination Center in Europe.
      - Asia Pacific Network Information Center (APNIC) in Asia.
    - After this change in the specification, the TLA focuses on routing optimization, but does not focus on a provider (ISP).

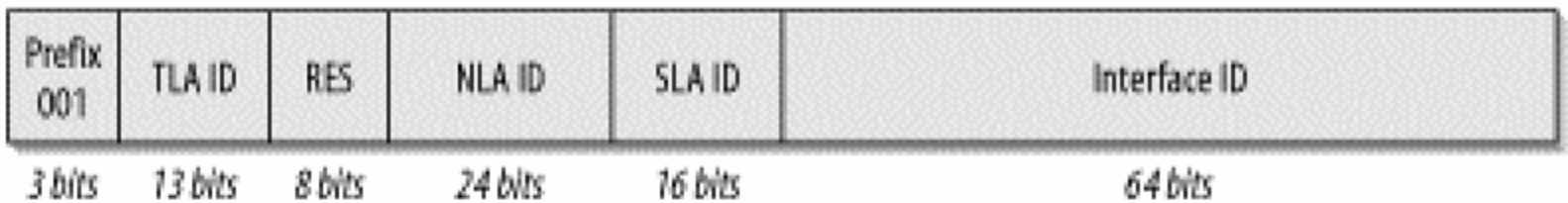
Aggregatable Global Unicast Address (2)

- 2nd is the RES (Reserved: 8-bit):
- 3rd is the NLA (Next-Level Aggregation Identifier: 24-bit):
  - Service providers (ISPs) usually use the NLA.
  - These providers are usually public.
    - These ISPs will further structure the address space assigned by the TLA.
- 4th is the SLA (Site-Level Aggregation Identifier: 16-bit):
  - The SLA is the address space assigned to organizations (enterprises, schools, etc.).
  - It can be also subnetted further within the organization.
- 5th is the interface identifier (64-bit).

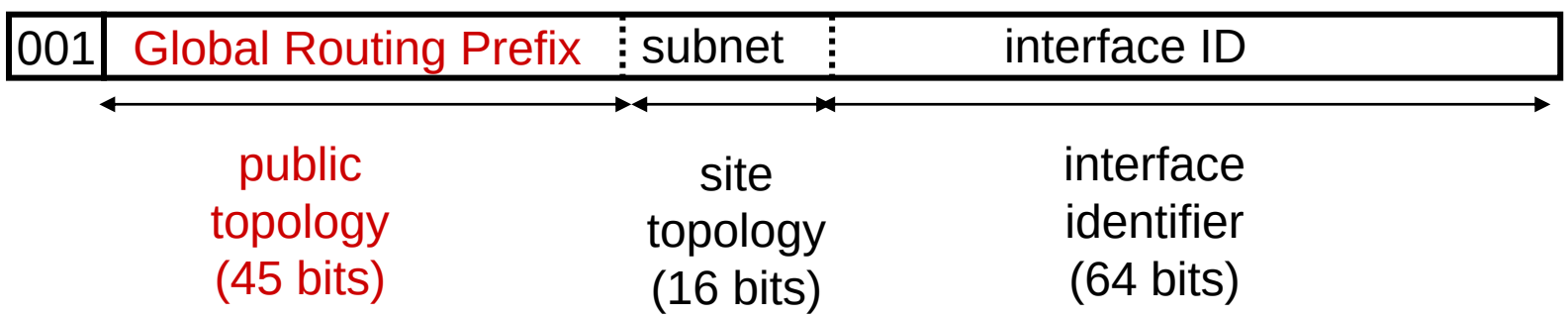
- International Registry Services & Current Address Allocations:
  - http://www.iana.org/ipaddress/ip-addresses.htm is a great entry point for global IP address services, current address allocations for both IPv4 & IPv6, and information about how to request IPv6 address services.

Aggregatable Global Unicast Address (3)

- Format of the aggregatable global unicast address.



Prefix	001, prefix for aggregatable global unicast address.
TLA ID	Top–level aggregation identifier.
RES	Reserved for future use.
NLA ID	Next–level aggregation identifier.
SLA ID	Site–level aggregation identifier.
Interface ID	Interface identifier.



Aggregatable Global Unicast Address (4)

- Internet Assigned Numbers Authority (IANA) assigns the 2001::/16 (prefix length 16) address space to its registered ISPs.
  - At present, under IANA, each registered ISP can get the address space (prefix length 23) in 2001::/16, such as:
    - Assigns 2001:0200::/23 & 2001:0C00::/23 to (APNIC, for Asia).
    - Assigns 2001:0400::/23 to (ARIN, for America).
    - Assigns 2001:0600::/23 & 2001:0800::/23 to (RIPE NCC, for Eurpos & the Middle East).
- These registered ISPs can assign their address space (prefix length 32) to their registered ISPs.
  - Ex) Taiwan ISP gets 2001:0288::/32 address space (prefix length 32).
    - Under these registered ISPs, they can also assign their address spaces to their registered ISP (prefix length 48).

Aggregatable Global Unicast Address (5)

- Current TLA allocations.

Prefix	Allocation	RFC
2000::/3	Assignable Global Unicast Address space Allocations made out of the 2000::/3 space can be viewed at *http://www.iana.org/assignments/ipv6-unicast-address-assignments*	RFC 3513
2001:0000::/32	Teredo	RFC 4380
2001:DB8::/32	For documentation purposes only, nonroutable	RFC 3849
2002::/16	6to4	RFC 3056
3FFE::/16	6Bone Testing (to be phased out by June 2006)	RFC 2471

Aggregatable Global Unicast Address (6)

- In worldwide, ISPs can use the following sites to access their regional registry information about IPv6 address registration.
  - ARIN (America) Registration Services:
    http://www.arin.net/library/guidelines/ipv6_initial.html
  - RIPE-NCC (Eurpos & the Middle East) Registration Services:
    http://www.ripe.net/ripencc/mem-services/registration/ipv6.html
  - APNIC (Asia) Registration Services:
    http://www.apnic.net/faq/IPv6-FAQ.html
  - LACNIC (Latin American & Caribbean) Registration Services:
    http://www.lacnic.net/en/index.html
- For end users, IPv6 address allocation is managed by their ISPs.

Aggregatable Global Unicast Address (7)

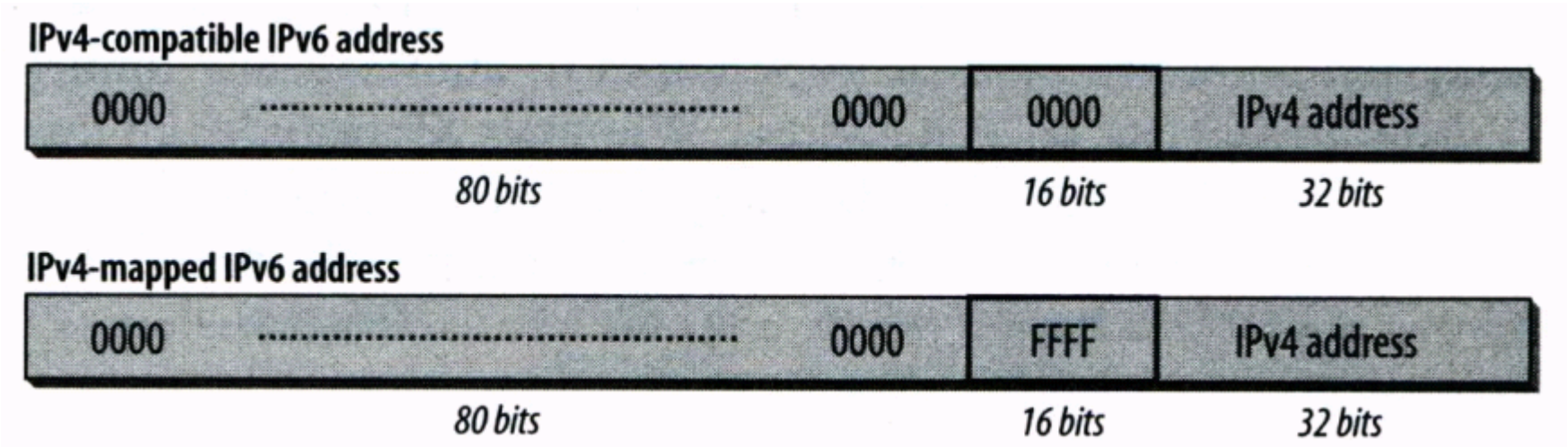
- Special Addresses:
  - The unspecified address.
    - The address is 0:0:0:0:0:0:0:0, & is also called the all-zeros address.
    - It can also be abbreviated as :: (all zero).
    - Like IPv4 address: 0.0.0.0, it indicates the absence of a valid address, or it can be used as a source address when a host is in the boot period. The host uses it to send out a address request for address configuration.
  - The loopback address.
    - In IPv6, the loopback address is 0:0:0:0:0:0:0:1, & its abbreviation is ::1
    - The IPv4 loopback address is 127.0.0.1
    - It is helpful in troubleshooting & testing the IP stack.
      - Because it can be used to send a packet to itself protocol stack, without sending it into the actual network.

Aggregatable Global Unicast Address (8)

- There are 4 different types of addresses for IPv6 & IPv4 transition mechanisms.
  - IPv6 addresses with embedded IPv4 addresses:
    - Because the transition from IPv4 to IPv6 will be gradual, 2 special types of addresses have been defined for backward compatibility with IPv4 (RFC 2373).
    - IPv4-compatible IPv6 address (for dual stack machines, 6over4 tunnel):
      - This type of address is used to tunnel IPv6 packets dynamically over an IPv4 network (backbone).
      - IPv6 nodes are assigned a special IPv6 unicast address, which carries an IPv4 address in the low-order 32 bits.
      - It is ::IPv4 (128-bit).
    - IPv4-mapped IPv6 address (IPv6 machine ←→ IPv4 only mechanism):
      - This type of address is used to represent the address of IPv4-only node.

Aggregatable Global Unicast Address (9)

- Format of IPv6 addresses with an embedded IPv4 address.



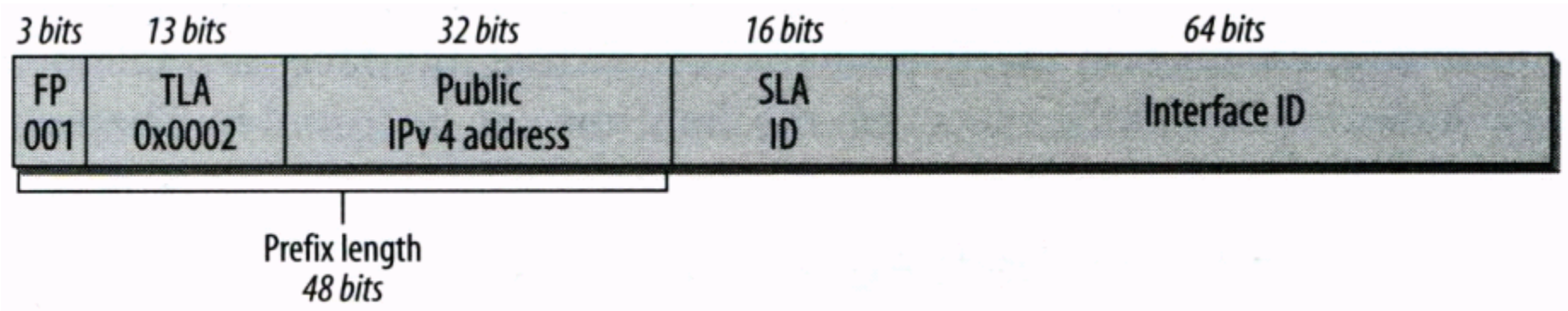
Aggregatable Global Unicast Address (10)

- This address can be used by an IPv6 node to send a packet to an IPv4-only node.
- The IPv6 address carries an IPv4 address in its low-order 32 bits of the address.
- It is ::FFFF:IPv4 (128-bit).

- 6to4 addresses (6to4 tunnel):
  - 6to4 is one of the mechanisms to let IPv6 hosts can communicate with each other via an IPv4-only network (RFC 3056).
  - 6to4 address is global IPv6 address:
    - 2002:IPv4:SLA:Interface ID
    - 2002 = Prefix 001 + TLA0x0002
  - IPv4 address must be global / public address.
  - Ex) An interface for 6to4 has an IPv4 address 62.2.84.115, then the 6to4 address is 2002:3e02:5473::/48 (hexadecimal).

Aggregatable Global Unicast Address (11)

- Format of the 6to4 address.

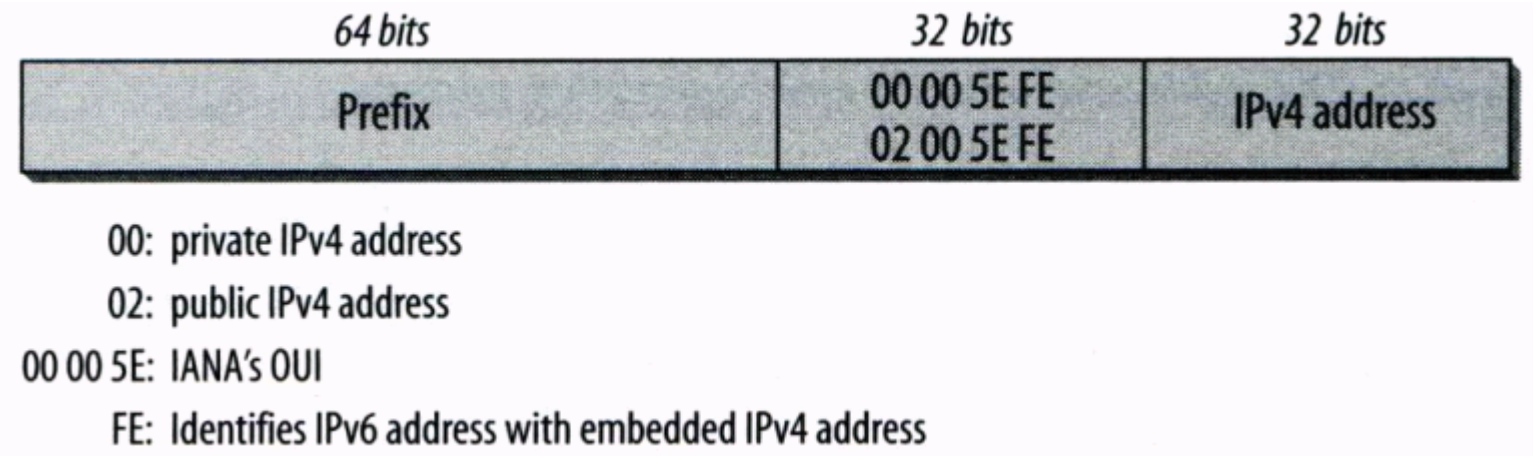


Aggregatable Global Unicast Address (12)

- ISATAP addresses:
  - A automatic tunneling mechanism: Intra-Site Automatic Tunnel Addressing Protocol (ISATAP).
  - Windows XP/Vista already includes an implementation of ISATAP.
  - It uses a type identifier of 0xFE to specify that it is an IPv6 address with an embedded IPv4 address.
  - The first 64-bit: follow the format of the aggregatable global unicast address.
  - The following 32-bit: IANA owns the IEEE Organizationally Unique Identifier (OUI) 00 00 5E / 02 00 5E.
    - The next 8-bit: are used for a type identifier (0xFE) to indicate that this is an IPv6 address with an embedded IPv4 address.
  - The last 32-bit: contain the embedded IPv4 address, which can be written in dotted decimal or hexadecimal representation.

Aggregatable Global Unicast Address (13)

- Format of the ISATAP address.

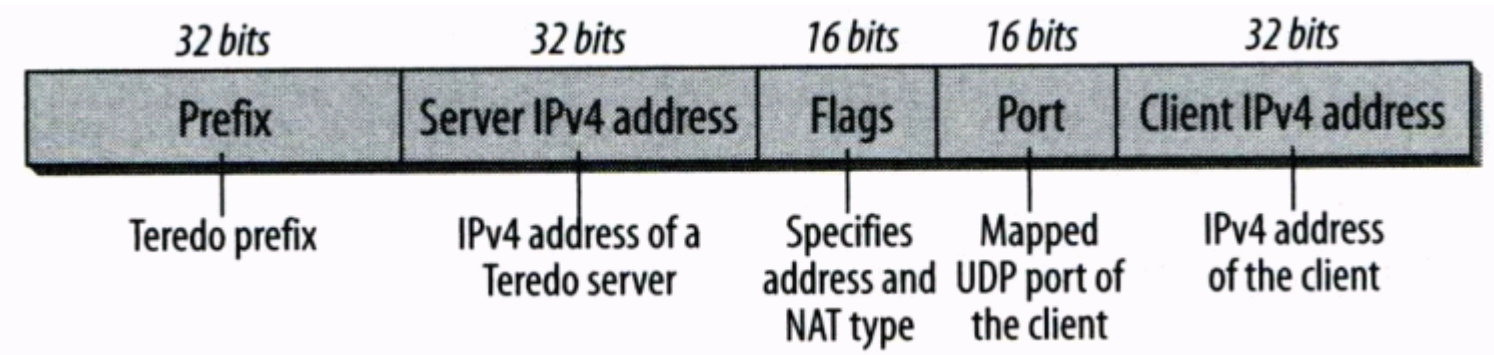


Aggregatable Global Unicast Address (14)

- Ex) A host with an IPv4 address 192.168.0.1 (private IP), & the host is assigned a 64-bit prefix 3FFE:1a05:510:200::/64 (SLA is 200).
  - The ISATAP (global) address for this host is:
    - 3FFE:1a05:510:200:0000:5EFE:192.168.0.1 (decimal representation).
    - Or 3FFE:1a05:510:200:0000:5EFE:C0A8:1 (hexadecimal representation).
  - The link-local address for this host is:
    - FE80::0000:5EFE:192.168.0.1
  - The site-local address for this host is:
    - FEC0::200:0000:5EFE:192.168.0.1 (SLA is 200).

Aggregatable Global Unicast Address (15)

- Teredo addresses (Tunnel mechanism):
  - IPv4 or IPv6 host behind one or more IPv4 routers with NAT mechanism.
    - This host wants to communicate with remote IPv6 host via the IPv4 network (e.g. Internet / backbone).
    - The IPv6 packet is encapsulated into IPv4 UDP packet.
    - Teredo prefix: 3FFE:831F::/32 (old), 2001:0000::/32 (new).
  - Windows XP/Vista already includes an implementation of Teredo.
  - Format of the Teredo address.

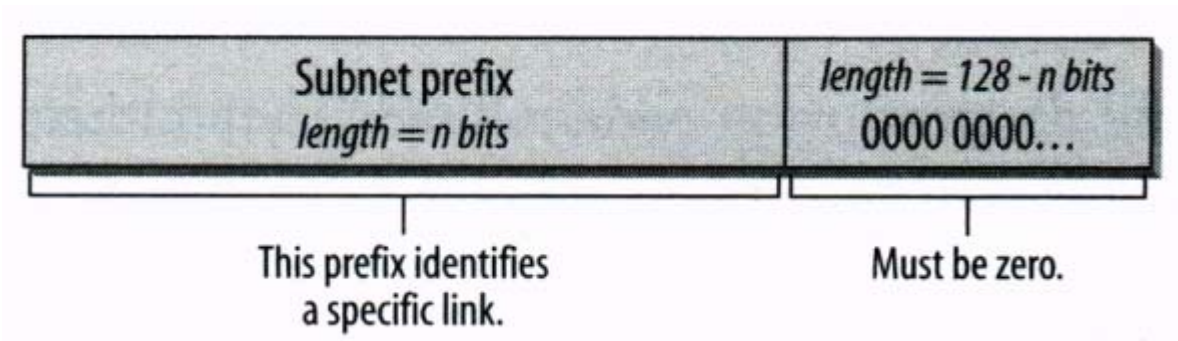


Anycast Address (1)

- It is defined in RFC 2373.
- Anycast addresses are parts of the aggregatable global unicast addresses.
  - An anycast address may be assigned only to an IPv6 router.
    - It must not be assigned to an IPv6 host.
  - Each interface in this region must be configured the same anycast address.
  - An anycast address must not be used as the source address of an IPv6 packet.
- An example of anycast addresses is to identify a set of routers, which can access to a particular routing domain.
  - Ex) In a company, all the routers, which can provide access to Internet & within a region, are configured a specific anycast address.
    - Whenever a packet is sent to Internet, it will be delivered to the closest router that has the anycast address.

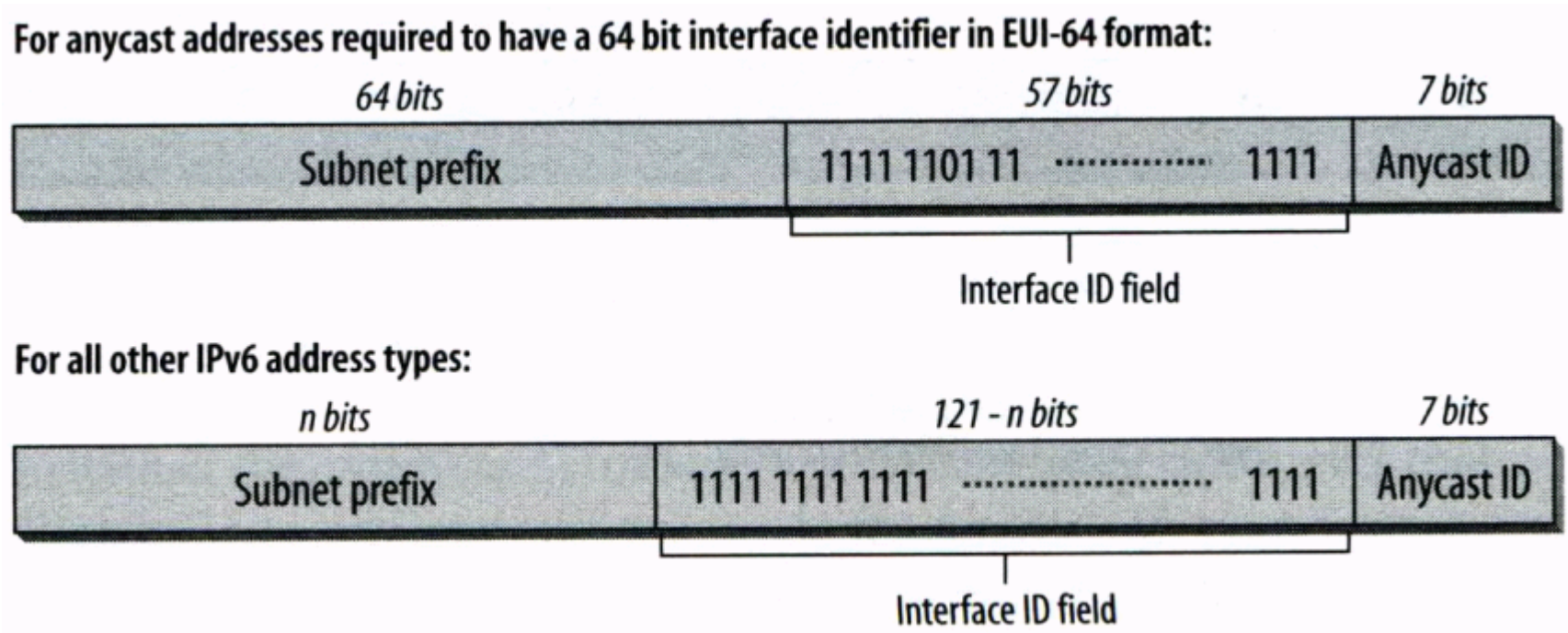
Anycast Address (2)

- In RFC 2373, it defined a required anycast address:
  - The subnet-router anycast address.
  - It is a regular unicast addresses, and includes:
    - A prefix specifying the subnet.
    - An identifier, which is set to all zeros.
      - A packet sent to this address will be delivered to one router on that subnet.
- Format of the subnet-router anycast address.



Anycast Address (3)

- General format of anycast addresses.
  - RFC 2526 provides more information about anycast address formats.
    - Anycast IDs (7-bit).



Anycast Address (4)

- Reserved anycast IDs.

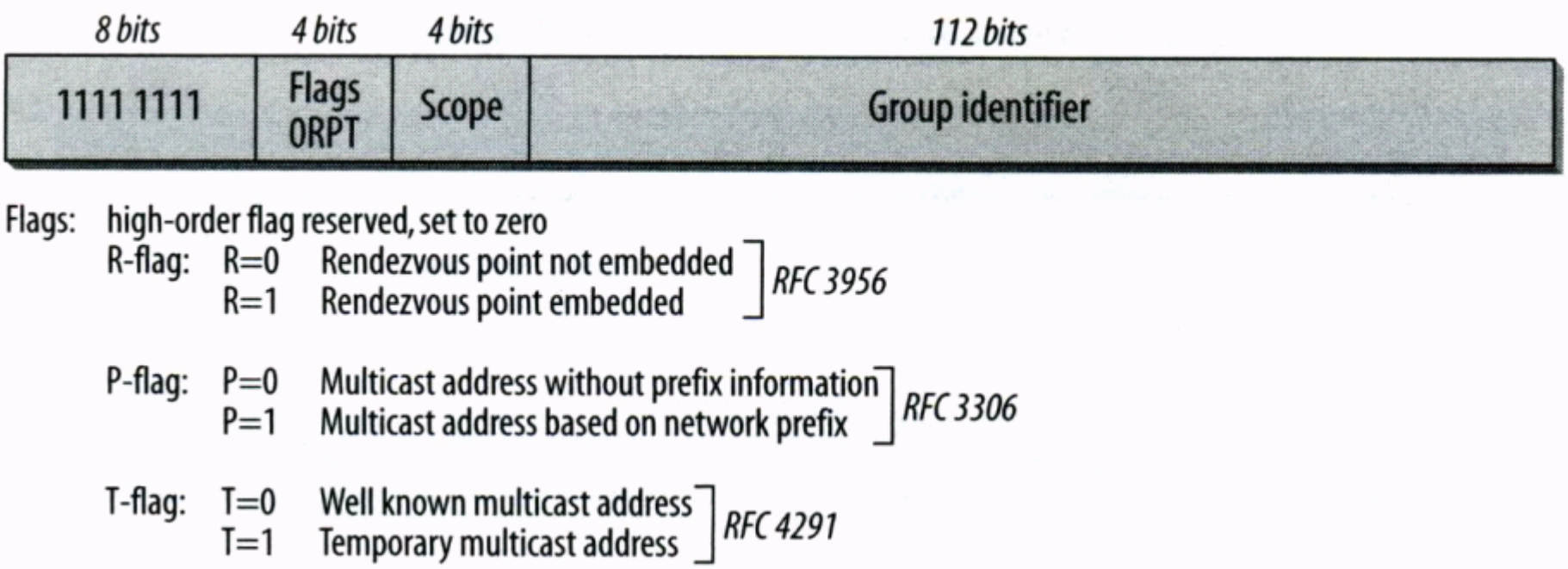
Decimal	Hexadecimal	Description
127	7F	Reserved
126	7E	Mobile IPv6 Home-Agents anycast
0–125	00-7D	Reserved

Multicast Address (1)

- A multicast address is identified by the high-order byte FF (hex), or 1111 1111 (binary).
  - 1111 1111 0000 → 0000 is Flag field:
    - 000: definition is ongoing.
    - 0: is the permanent & well-known multicast addresses assigned by the IANA.
  - 1111 1111 0001 → 0001 is Flag field:
    - 000: definition is ongoing.
    - 1: is for temporary multicast address.
  - The Scope field is used to limit the scope of a multicast address.
- Multicast addresses should not be used as a source address in IPv6 packets or appear in any routing header.
- A node can belong to more than one multicast group.
- The MAC address for IPv6 multicast address is: 33-33-XX-XX-XX-XX.
  - 33-33 is for multicast in MAC address.

Multicast Address (2)

- Format of the multicast address.



Multicast Address (3)

- Values for the scope field.

Value	Description
0	Reserved
1	Interface-local scope (used to be called Node-local scope in earlier specs)
2	Link-local scope
3	Reserved
4	Admin-local scope
5	Site-local scope
6, 7	Unassigned
8	Organization-local scope
9, A, B, C, D	Unassigned
E	Global scope
F	Reserved

Multicast Address (4)

- The well-known Multicast Addresses:
  - The last 112 bits of the address carry the multicast group ID.
  - RFC 2375 defines the initial assignment of IPv6 multicast addresses that are permanently assigned.

Address	Description
Interface-local scope	
FF01:0:0:0:0:0:0:1	All-nodes address
FF01:0:0:0:0:0:0:2	All-routers address
Link-local scope	
FF02:0:0:0:0:0:0:1	All-nodes address
FF02:0:0:0:0:0:0:2	All-routers address
FF02:0:0:0:0:0:0:3	Unassigned
FF02:0:0:0:0:0:0:4	DVMRP routers

Multicast Address (5)

- The well-known Multicast Addresses.

FF02:0:0:0:0:0:0:5	OSPFIGP
FF02:0:0:0:0:0:0:6	OSPFIGP designated routers
FF02:0:0:0:0:0:0:7	ST routers
FF02:0:0:0:0:0:0:8	ST hosts
FF02:0:0:0:0:0:0:9	RIP routers
FF02:0:0:0:0:0:0:A	EIGRP routers
FF02:0:0:0:0:0:0:B	Mobile agents
FF02:0:0:0:0:0:0:D	All PIM routers
FF02:0:0:0:0:0:0:E	RSVP encapsulation
FF02:0:0:0:0:0:0:16	All MLDv2-capable routers
FF02:0:0:0:0:0:0:6A	All snoopers
FF02:0:0:0:0:0:1:1	Link name
FF02:0:0:0:0:0:1:2	All DHCP agents
FF02:0:0:0:0:0:1:3	Link-local Multicast Name Resolution
FF02:0:0:0:0:0:1:4	DTCP Announcement
FF02:0:0:0:0:1:FFXX:XXXX	Solicited-node address

Sender's partial MAC address. →

Multicast Address (6)

- The well-known Multicast Addresses.

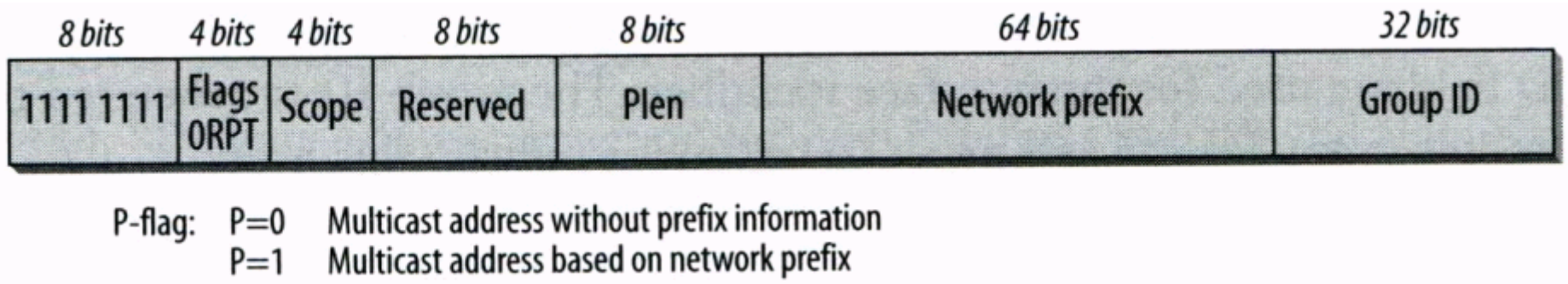
Address	Description
Site-local scope	
FF05:0:0:0:0:0:0:2	All-routers address
FF05:0:0:0:0:0:1:3	All DHCP servers
FF05:0:0:0:0:0:1:4	Deprecated
FF05:0:0:0:0:0:1:1000 to FF05:0:0:0:0:01:13FF	Service location (SLP) Version 2

Multicast Address (7)

- Ex) In RFC 2373, there is a multicast group ID defined for all NTP servers. The multicast group ID is 0x101.
- These multicast addresses are:
  - FF01:0:0:0:0:0:0:101 → the sender & all NTP servers are on the same node.
  - FF02:0:0:0:0:0:0:101 → the sender & all NTP servers are on the same link.
  - FF05:0:0:0:0:0:0:101 → the sender & all NTP servers are on the same site.
  - FF0E:0:0:0:0:0:0:101 → the sender & all NTP servers are in the Internet.
- Solicited-Node Multicast Address:
  - It is used in the DAD (Duplicate Address Detection) process (RFC 2373).
  - From FF02:0:0:0:0:1:FF00:0000 to FF02:0:0:0:0:1:FFFF:FFFF.
    - The last 24-bit is the host ID → last part of MAC address.

Multicast Address (8)

- Ex) A host has the MAC address 00-02-B3-1E-83-29 & the IPv6 address fe80::202:b3ff:fe1e:8329.
  - The host sends the DAD NS packet.
  - The solicited-node multicast address is FF02::1:ff1e:8329.
- Dynamic allocation of multicast addresses (RFC 3306).
  - Format of the extended multicast address.



Required Addresses

- The IPv6 standard specifies that
  - Each host must assign the following addresses:
    - Its link-local address for each interface → FE80:XXXX:…
    - Its global unicast addresses → 001XXXXX (2XXX:XXXX:…, or 3XXX:XXXX:…)
    - Its loopback address → ::1
    - The all-nodes multicast address → FF02::1
    - Solicited-node multicast address → FF02::1:FFXX:XXXX
    - Multicast addresses of other host groups → FFXX:XXXX:…
  - Each router needs to recognize all of the above & the following addresses:
    - The subnet-router anycast address → subnet prefix ::
    - Configured anycast address → subnet prefix:interface ID:identifier
    - All-routers multicast address → FF01::2, FF02::2, & FF05::2
    - Multicast addresses of other router groups → FFXX:XXXX:…