

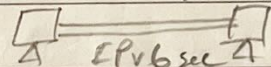
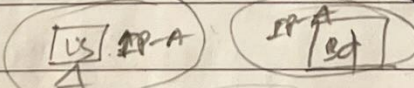
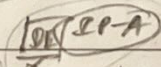
# Chapter - 7

## IPv6

Hexadecimal

128 bit / Eight segments / 16 bits (2<sup>4</sup>)

### Features

- ① Larger Address Space —  $34 \times 10^{38}$
- ② Simplified Header — 40 bytes (always) — 8 fields
- ③ End to end connectivity — Not NAT needed
- ④ Auto Configuration — both <sup>DHCPv6</sup> stateful & <sup>Self Config</sup> Stateless Config (auto)
- ⑤ Fast Forward routing — All important info is in starting of the header so router can take quick decision.
- ⑥ IPsec — enable but optional 
- ⑦ No Broadcast — only unicast, multicast, anycast  

- ⑧ Any Cast — Support —   
Multiple devices has the same IP and it sends the information to the nearest device who the same IP.
- ⑨ Mobility — dynamic  
No dynamic IP needed, because no IP crisis happens here.
- ⑩ Smooth Transaction — Dual state, Header translation, Tunneling
- ⑪ No class
- ⑫ Backward incompatible



# Conversions

$2^3$   $2^2$   $2^1$   $2^0$   
 1 1 1 1  
 8 4 2 1

Hexadecimal | Binary

0 | 0000

1 | 0001

2 | 0010

3 | 0011

4 | 0100

5 | 0101

6 | 0110

7 | 0111

8 | 1000

9 | 1001

10 — A | 1010

11 — B | 1011

12 — C | 1100

13 — D | 1101

14 — E | 1110

15 — F | 1111

Example

26 AB

0010 0110 1010 1011

FA 87

1111 1010 1000 0111

FA B D 1986

1111 1100 1101 1101 0001 1001 1000 0110



## Rules

① If <sup>or more</sup> two blocks contains consecutive zeros, omit them all and replace with double colon sign '::'.

$$\overset{16=44}{FFFF} : A890 : CDEF : 0000 : 0000 : A001 : 00AB : A000 = 128 \text{ bits}$$

$\frac{16 \text{ bits} + 16 + 16 + 16 + 16 + 16 + 16 + 16}{8}$

FFFF : A890 : CDEF :: A001 : 00AB : A000

② :: must be use to represent the longest of 16 bit set's of zero as possible, the :: can be use once in a address only

③ If there are multiple places where same numbers of 16 bit sets contains consecutive zero's then the :: will use on the left most sets of zeros.

④ Remove leading zeros; if you can remove left zeros of a 16 bit set

⑤ :: can't use to short single 16 bit set of zeros.

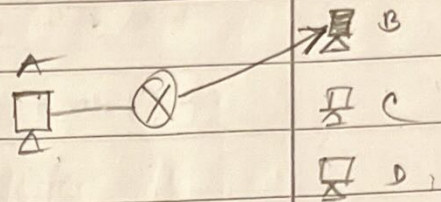


## Types

~~NO~~ Broadcast

Unicast — A unicast address used to refer to a single host.  
It is meant to send data to a single destination.

- Unicast — Global
- Link local
  - Unique local address

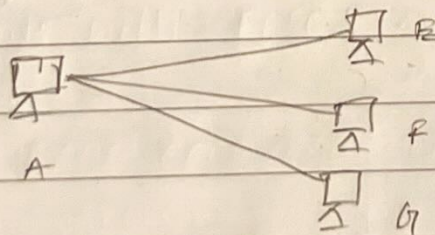


Range —  $2001::/16$

## Multicast

A multicast address can be used to deliver a package to a group of destination.

Any packet sent to a Multicast address will be delivered to every host that has joined to that particular group.



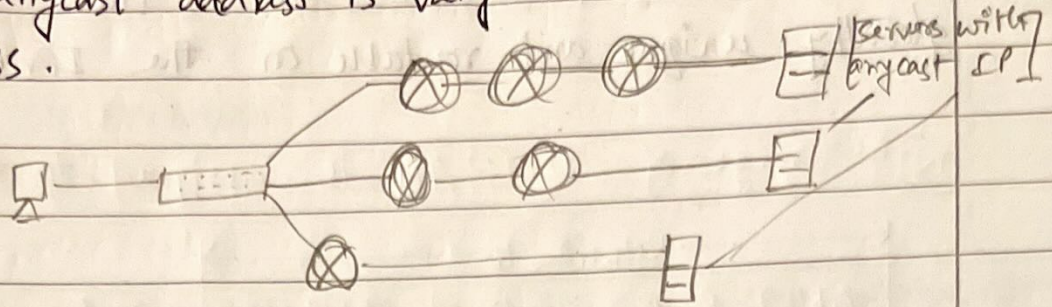
Range —  $FF00::/8$

$FF02::1$  → all nodes on the link



## Anycast:

The anycast address is very similar to the multicast address.



If we assign a unicast address to multiple device than the unicast address will work as a Anycast address. packet<sup>request</sup> will sent to the nearest address/server, this way the request ~~at~~ delivered with less time.



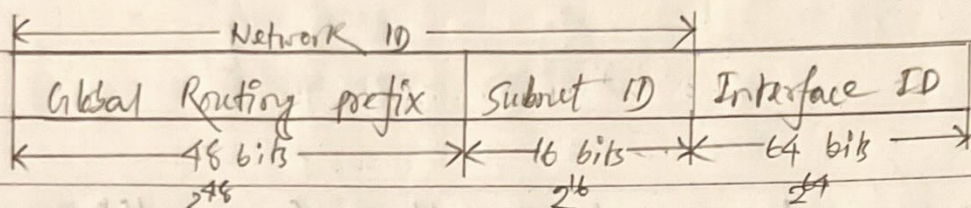
## Types of Unicast Address

Global address: starts with 2000 :: /3 [the first 3 bits are fixed]

public IP

It works as public IP of IPv4; These addresses are globally unique and routable on the IPv6 internet.

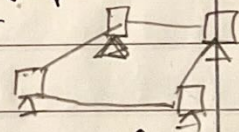
The range of 2001::/16 is assigned to the global Registrar



The Most Significant bit of Global Routing prefix is set to 0001

Link local Address: FE80 :: /10 (starts with)

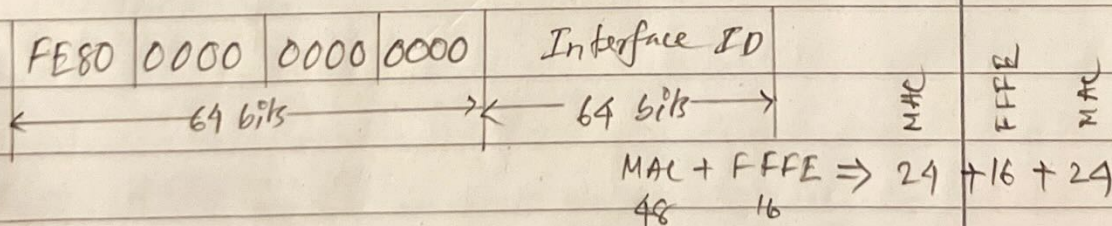
are designed to be used for addressing on a single link for purpose such as automatic address configuration, Neighbor discovery or when no router is present.



private IP

Automatically generated for each IPv6 network interface.

Always starts with FE80; next 48 bits are zero



These addresses are not routable



## Unique Local Address $FE00::7$ (starts with)

Used for local communication within the site or organization

private  
IP

$FC00::/8$  (reserved)

$FD00::/8$  (commonly used)

FE00	global ID; company	Subnet ID	Interface ID
← 48 bit →		× 16 bit ×	× 64 bit →

## Loopback Address — $::1/128$

used by ~~host~~ host to send packets to itself.

local to the host not routable.

## Unspecified Address $::/128$

Indicates the absence of an address; It is used during the initial configuration of an interface or in DHCP.

## IPv4-Mapped — IPv6 Address

Range —  $::FFFF:0:0/96$



## NDP (Neighbor Discovery protocol)

IPv4

- ARP

- Broadcast

IPv6

- NDP

- ICMPv6

- Multicast

NDP consist of

- Router Solicitation
- Router Advertisement
- Neighbor Solicitation
- Neighbor Advertisement
- Re-direct

### Router Solicitation

Once a Host attached to a network for the first time, it sends a Router Solicitation msg to discover the Router.

The router solicitation msg sends to all router solicitation Multicast address  $\text{ff02::2}$ .

Router Solicitation packet details —

Source address -  $::$  or  $\text{fe80::aa:bb:cc:9}$

Destination address -  $\text{ff02::2}$  [all router Multicast address]

### Router Advertisement

A Router send the advertisement when it is requested or connect in the network first time or as per routine.

The Router Advertisement contains —

- Link prefixes
- MTU
- Specific routers
- Use SLAAC?



## Router Advertisement packet

Source Address : fe80::ff:ee:dt:1

Destination Address : ff02::1 or the NDP IPv6 interface address the host  
[all node Multicast] requested for

## Neighbor Solicitation

Any host can send Neighbor Solicitation message at any time, it can be done to request another host's link layer address or to verify that an old cash link layer address can still be used to reach a neighbour. In response to a neighbor solicitation message the other host sends a neighbor advertisement.

## Redirect

Re-direct messages are used by routers to either point host toward a more preferable router or to indicate that the destination actually resides on the link.