

* IPv6 :

- ↳ IPv6, or Internet Protocol version 6, is the latest version of the Internet Protocol used to identify devices on a network.
- ↳ It was developed to replace IPv4 due to the limited number of addresses available IPv4.
- ↳ IPv6 uses 128-bit addresses.
- ↳ IPv6 addresses can be notated using hexa-decimal colon notation.

* Interface ID :

- ↳ The MAC address of a system is composed of 48-bits and represented in Hexadecimal. MAC addresses are considered to be uniquely assigned worldwide.
- ↳ Interface ID takes advantages of this uniqueness, of MAC addresses.
- ↳ A host can auto-configure its interface ID by using IEEE's Extended Unique Identifier [EUI-64] format.
- ↳ First, a host divides its own MAC address into two 24-bit halves.
- ↳ Then 16-bit hex values FFFF is sandwiched into those two halves of MAC addresses, resulting in EUI-64 Interface ID.

22	23	45	BC	DE	AA			
22	23	45	FF	EF	BC	DE	AA	
0010 0010	23	45	FF	EF	BC	DE	AA	
0010 0000	23	45	FF	FF	BC	DE	AA	
90	93	45	FF	EF	BC	DE	AA	

* Types of IPv6 Unicast Addresses :

i) Global Unicast Address :

This address type is equivalent to IPv4's address. Global Unicast addresses in IPv6 are globally identifiable and uniquely addressable.

Global Routing Prefix	Subnet ID	Interface ID
48 Bits	16 Bits	64 Bits

ii) Link-Local Address :

This address type is equivalent to IPv4's broadcast address. The first 16 Bits of link-local address is always set to 1111 1110 1000 0000 [FE80]. The next 48-bits are set of 0.

1111 1110 1000 0000 0000 0000 ...	Interface ID
FE80 + 48 ZERO	64 Bits

iii) Unique-Local Address :

This address type is like to IPv4's private address. This type of IPv6 address is globally unique, but it should be used in local communication.

The second half of this address contains Interface ID and the first half is divided among Prefix, Local Bit, Global ID and Subnet ID.

1111 110	1	40 Bits	Interface ID
Prefix	1	Global ID	64 Bits

Prefix always set to 1111 110. 1 Bit, is set to 1 if the address is locally assigned. So far, the meaning of 1 Bit to 0 is not defined. Therefore, Unique local IPv6 address always starts with 'FD'.

↳ Scope of IPv6 Unicast Addresses :

Global Unicast
Address
[Global Scope]

Unique local
Address.
[Organization /
Site Scope]

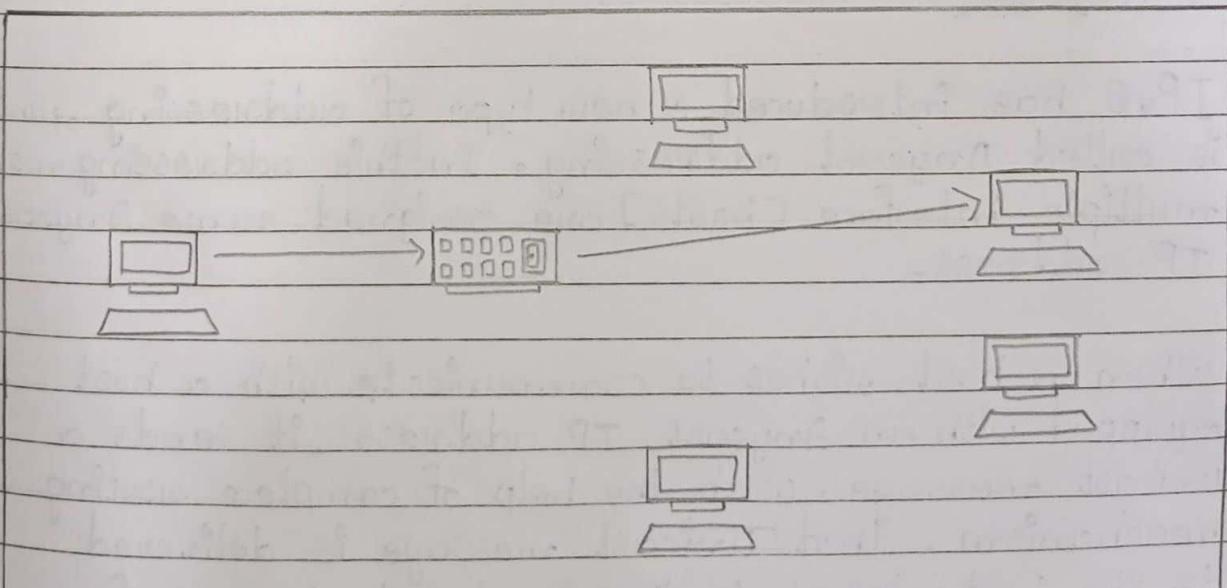
Link
Local Address
[Link Local Scope]

* IPv6 - Addressing Modes :

- ↳ Addressing mode refers to the mechanism of hosting an address on the network.
- ↳ IPv6 offers several types of mode by which a single host can be addressed.
- ↳ More than one host can be addressed at once or the host at the closest distance can be addressed.

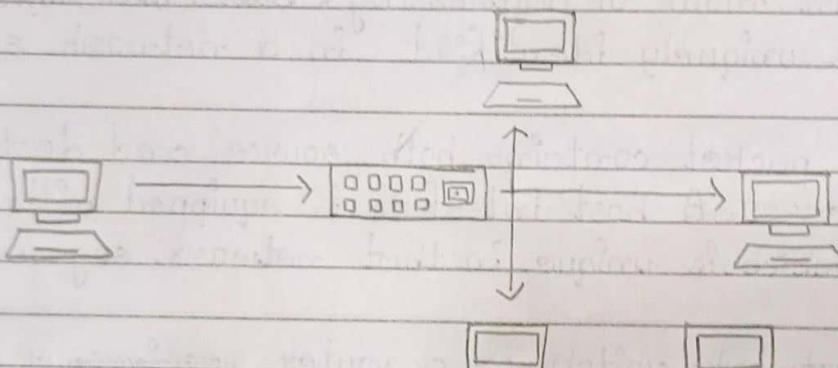
i) Unicast :

- In unicast mode of addressing, an IPv6 interface [host] is uniquely identified in a network segment.
- The IPv6 packet contains both source and destination IP addresses. A host interface is equipped with an IP address which is unique in that network segment.
- When a network switch or a router receives a unicast IP packet, destined to a single host, it sends out one of its outgoing interfaces which connects to that particular host.



ii) Multicast :

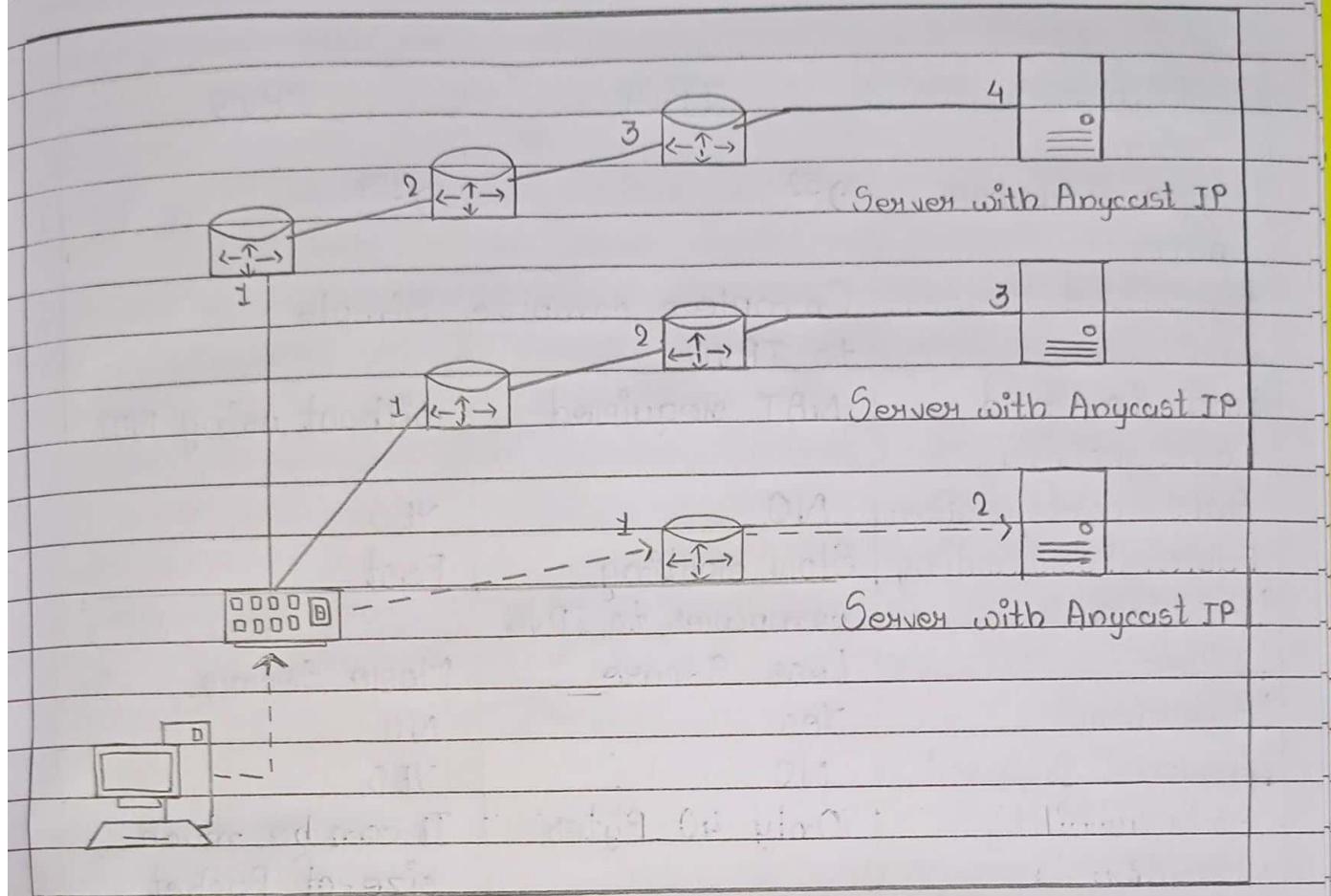
- The IPv6 multicast mode is same as that of IPv4. The packet destined to multiple hosts is sent on a special multicast address. All the hosts interested in that multicast information, need to join that multicast group first.
- All the interfaces that joined the group receive the multicast packet and process it, while other hosts not interested in multicast packets ignore the multicast information.



iii) Anycast :

- IPv6 has introduced a new type of addressing, which is called Anycast addressing. In this addressing mode, multiple interface [hosts] are assigned same Anycast IP address.
- When a host wishes to communicate with a host equipped with an Anycast IP address, it sends a unicast message. With the help of complex routing mechanism, that unicast message is delivered to the host closest to the sender in terms of

Routing Costs.



* Difference between IPv4 and IPv6 :

Features	IPv4	IPv6
Larger Address Space	2^{32}	2^{128}
Simplified Header	Complex compare to IPv6	Simple
End-to-End Connectivity	NAT required	without using NAT
Auto-configuration	NO	YES
Faster-Forwarding Routing	Slow routing compares to IPv6	Fast
IPsec	Less Secure	More Secure.
Broadcast	Yes	NO
Anycast Support	NO	YES
Extensibility Header	Only 40 Bytes	It can be much size of Packet itself.
Notation	Binary and Dotted Notation	Hexadecimal Notation
Anycasting Types of Addresses	NO i) Public ii) Private	YES i) Global unicast ii) Link Local iii) Unique Local.
Concept of Class	YES	NO