IPv6 Address

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IPv6 :

IPv6 uses 128-bit (2^{128}) addresses, allowing 3.4 x 10^{38} unique IP addresses. This is equal to 340 trillion trillion trillion IP addresses. IPv6 is written in hexadecimal notation, separated into 8 groups of 16 bits by the colons, thus (8 x 16 = 128) bits in total.

The Addressing Space :

Address space is the amount of memory allocated for all possible addresses for a computational entity, such as a device, a file, a server, or a networked computer. Address space may refer to a range of either physical or virtual addresses accessible to a processor or reserved for a process. As unique identifiers of single entities, each address specifies an entity's *location* (unit of memory that can be addressed separately). On a computer, each computer device and process is allocated address space, which is some portion of the processor's address space. A processor's address space is always limited by the width of its address bus and registers. Address space may be differentiated as either *flat*, in which addresses are expressed as incrementally increasing integers starting at zero, or *segmented*, in which addresses are expressed as separate segments augmented by *offsets* (values added to produce secondary addresses). In some systems, address space can be converted from one format to the other through a process known as thunking.

Allocation of the IPv6 addressing space:

Allocation	Prefix (binary)	Fraction of Address Space
Reserved	0000 0000	1/256
Unassigned	0000 0001	1/256
Reserved for NSAP addresses	0000 001	1/128
Reserved for IPX addresses	0000 010	1/128
Unassigned	0000 011	1/128
Unassigned	0000 1	1/32
Unassigned	0001	1/16
Aggregatable global unicast addresses	001	1/8
Unassigned	010	1/8
Unassigned	011	1/8
Reserved for Geographic-based addresses	100	1/8
Unassigned	101	1/8
Unassigned	110	1/8
Unassigned	1110	1/16
Unassigned	1111 0	1/32
Unassigned	1111 10	1/64
Unassigned	1111 110	1/128
Unassigned	1111 1110 0	1/512
Link Local addresses	1111 1110 10	1/1024

SYNTAX OF IPv6 ADDRESSESS :

IPv4 addresses are represented in dotted-decimal format. The 32-bit address is divided along 8-bit boundaries. Each set of 8 bits is converted to its decimal equivalent and separated by periods. In contrast, IPv6 addresses are 128 bits divided along 16-bit boundaries. Each 16-bit block is converted to a 4-digit hexadecimal number and separated by colons. The resulting representation is called colon-hexadecimal.

Types of IPv6 Addresses:

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1.Unicast 2.Anycast 3.Multicast

1.Unicast Addressing :

This type is the address of a single interface. A packet forwarded to a unicast address is delivered only to the interface identified by that address.

A unicast address identifies a single interface. When a network device sends a packet to a unicast address, the packet goes only to the specific interface identified by that address. Unicast addresses support a global address scope and two types of local address scopes.

A unicast address consists of *n* bits for the prefix, and 128 – *n* bits for the interface ID.

Global unicast address—A unique IPv6 address assigned to a host interface. These addresses have a global scope and essentially the same purposes as IPv4 public addresses. Global unicast addresses are routable on the Internet.

Link-local IPv6 address—An IPv6 address that allows communication between neighboring hosts that reside on the same link. Link-local addresses have a local scope, and cannot be used outside the link. They always have the prefix FE80::/10.

Loopback IPv6 address—An IPv6 address used on a loopback interfaces. The IPv6 loopback address is 0:0:0:0:0:0:0:1, which can be notated as ::1/128.

Unspecified address—An IPv6 unspecified address is 0:0:0:0:0:0:0:0, which can be notated as ::/128.

2.Anycast Address:

An anycast address identifies a set of interfaces that typically belong to different nodes. Anycast addresses are similar to multicast addresses, except that packets are sent only to one interface, not to all interfaces. The routing protocol used in the network usually determines which interface is physically closest within the set

of anycast addresses and routes the packet along the shortest path to its destination.

There is no difference between anycast addresses and unicast addresses except for the subnet-router address. For an anycast subnet-router address, the low-order bits, typically 64 or more, are zero. Anycast addresses are taken from the unicast address space.

3.Multicast Addresses:

A multicast address identifies a set of interfaces that typically belong to different nodes. When a network device sends a packet to a multicast address, the device broadcasts the packet to all interfaces identified by that address. IPv6 does not support broadcast addresses, but instead uses multicast addresses in this role.

Multicast addresses support 16 different types of address scope, including node, link, site, organization, and global scope. A 4-bit field in the prefix identifies the address scope.

The following types of multicast addresses can be used in an IPv6 subscriber access network:

1.Solicited-node multicast address—Neighbor Solicitation (NS) messages are sent to this address.

2.All-nodes multicast address—Router Advertisement (RA) messages are sent to this address.

3.All-routers multicast address—Router Solicitation (RS) messages are sent to this address.

Which Addresses for a Node?

1.Addresses of a Host:

1.Its Link Local address for each interface

2.Unicast addresses assigned to interfaces

3.The loopback address

4.All-Nodes multicast address

5. Neighbor Discovery multicast addresses associated with all uni-cast and anycast addresses assigned to interfaces

6. Multicast Addresses of groups to which the node belongs

2.Addresses of a Router:

1.Its Link Local address for each interface

2.Unicast addresses assigned to interfaces

3.The loopback address

4.The Subnet Router anycast address for all links on which it has

interfaces

5.Other anycast addresses assigned to interfaces

6. All-nodes multicast address

7. All-routers multicast address

8. Neighbor Discovery multicast addresses associated with all uni-cast

and anycast addresses assigned to interfaces

9. Multicast addresses of groups to which the node belongs