Logical addressing

A logical address is **the address at which an item (memory cell, storage element, network host) appears to reside from the perspective of an executing application program**. A logical address may be different from the physical address due to the operation of an address translator or mapping function.

- Network layer is responsible for host-to-host delivery and for routing mechanism.
- It adds a logical address that is source and destination address as a part of IP header to the segment coming from above Transport Layer.

Logical Addressing:

The logical addresses added by Network layer are known as IP address, it can be either IPv4 or IPv6.

IPv4 Addresses:

An IPv4 address is a **32-bit address** that uniquely and universally defines the connection of a device. These addresses are unique in the sense that each address defines one, and only one, connection to the internet.

Address Space:

It defines the range of addresses used by the protocol. Each networking devices will get a address from this address space.

Since IPv4 address is a 32 bit in size, hence the total number of address possible is: 2^{32} = 4,294,967,296. This means theoretically 4 billion devices can be connected to internet, but practically this number is way less because of some restrictions.

Representation of IP address: An IP address can be represented in two formats:

Dotted-Decimal Notation:

In this format, an IP address is represented as 4 octets, each octet of 8 bits (1 bytes) and are separated with a decimal point(dot).

Example:

192.168.0.1

Binary Notation:

In this IP address is represented as 32 bits.

Example:

Dotted decimal : 192. 168.0.1

Binary Notation: 1110101 10101000 00000000 00000001

Classful Addressing:

- Classful Addressing, the address space is divided into five classes: A, B, C, D and E. Each class has has some part of the address space.
- Class A, B, C are mostly used for unicast communication whereas class D is for multicast communication and class E is reserved.

Range of each class of IP address:

Range of each class is depicted in the below diagram:

CLASS	LEADING BITS	NET ID BITS	HOST ID BITS	NO. OF NETWORKS	ADDRESSES PER NETWORK	START ADDRESS	END ADDRESS
CLASS A	0	8	24	2^7 (128)	2^{24} (16,777,216)	0.0.0.0	127.255.255.255
CLASS B	10	16	16	2^{14} (16,384)	2^{16} (65,536)	128.0.0.0	191.255.255.255
CLASS C	110	24	8	2^{21} (2,097,152)	2^8 (256)	192.0.0.0	223.255.255.255
CLASS D	1110	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	224.0.0.0	239.255.255.255
CLASS E	1111	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	240.0.0.0	255.255.255.255

Host ID and Network ID: In classful addressing, IP address can be divided into two portions, one is called Host ID, which identifies the host in the network and other is called network Id which identifies the network.
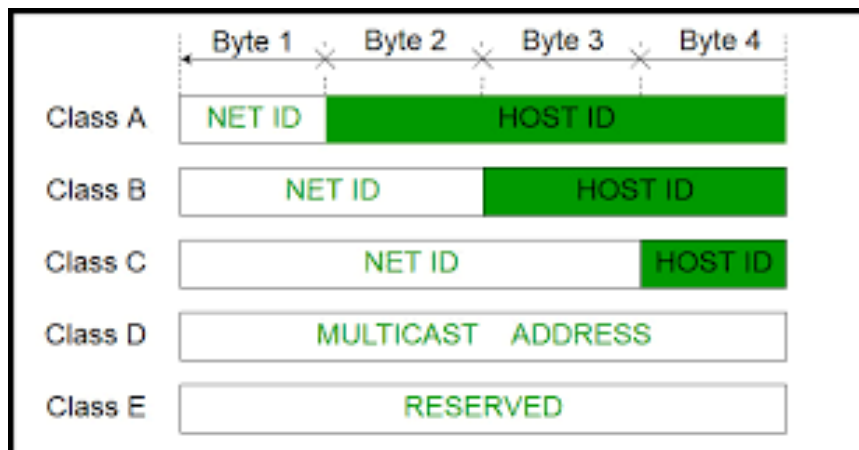
Subnet Mask:

It is also 32-bit address which is used to distinguish the host part and network part of an IP address.

In classful addressing each class has a default subnet mask:

Class A Subnet Mask	Netwok	Host	Host	Host
	255	0	0	0

Class B Subnet Mask	Netwok	Network	Host	Host
	255	255	0	0

Class C Subnet Mask	Netwok	Network	Network	Host
	255	255	255	0

Class A: 255.0.0.0

Class B: 255.255.0.0

Class C: 255.255.255.0

Class D: 255.255.255.255