IP Addresses

An Internet Protocol address (IP address) is a layer three logical address assigned by a network administrator. IP addresses are used to identify specific devices on a network. An IP address is a 32-bit binary address usually written in dotted decimal formats. These 32 bits are further subdivided into four 8 bit segments called octets. Each octet is separated by a period.

Every IP address can be broken down into two main portions.

1. Network Address Portion (Network ID)
2. Host Address Portion (Host ID)

The Network address portion is used to identify a specific network. Routers maintain routing tables that contain the network addresses. The Host address portion is used to identify a specific endpoint on a network such as servers, printers, computers, mobile phones, etc. (Please Note – Routers build their routing tables based on network address not based on Host addresses.)

Types Of IP Address Classes (Address Classes/Classful Networks)

This is a network addressing architecture used in the internet from 1981 until the introduction of CIDR (Classless Inter-Domain Routing) in 1993.
This method divides IPv4 address space into five types of ip address classes.

1. Class A
2. Class B
3. Class C
4. Class D
5. Class E

Class	1st Octet Decimal Range	1st Octet High Order Bit	Default Subnet Mask	Number of Networks	Hosts Per Network
A	1 – 126	0	255.0.0.0	126	16,777,214
B	128 – 191	10	255.255.0.0	16,382	65,534
C	192 – 223	110	255.255.255.0	2,097,150	254
D	224 – 239	1110	Reserved	for	Multi casting
E	240 – 254	1111	Used	for	Research

Class A, Class B, and Class C provide unicast addresses. Class D is for multicast networking and the class E address range is reserved for future or experimental purposes.
These Address classes were determined and allocated by the Internet Assigned Numbers Authority (IANA)
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Breaking Down Of Class A IP Address

In Class A addresses the first bit of the first octet is always set to Zero.

0OOOOOOO – 01111111

Therefore in Class A addresses the first octet ranges from 0 – 127.

0.0.0.0 – 127.255.255.255

But 127 is reserved for loopback IP addresses. For example, you can't configure an IP address of 127.0.0.1 as a static IP on a PC. 0 is reserved for the default network. So that can't be used either to configure an IP address on a PC. For example, you can't configure an IP address of 0.1.1.1 as a static IP on a PC.

Because of the reasons mentioned above the actual range of Class A addresses is from 1 – 126.

1.0.0.0 – 126.255.255.255

Class A IP Address Structure

In these addresses, the first 8 Bits denotes the Network Portion and the last 24 Bits denotes the Host Portion.

Breaking Down Of Class A IP Address

In Class A addresses the first bit of the first octet is always set to Zero.

00000000 – 01111111

Therefore in Class A addresses the first octet ranges from 0 – 127.

0.0.0.0 – 127.255.255.255

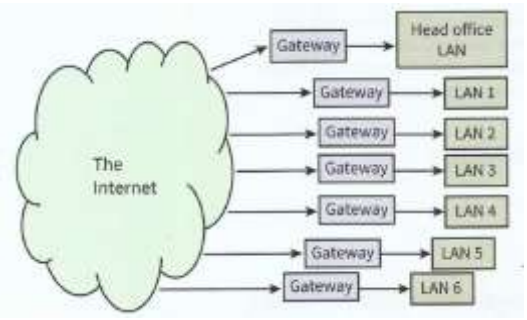
But 127 is reserved for loopback IP addresses. For example, you can't configure an IP address of 127.0.0.1 as a static IP on a PC. 0 is reserved for the default network. So that can't be used either to configure an IP address on a PC. For example, you can't configure an IP address of 0.1.1.1 as a static IP on a PC.

Because of the reasons mentioned above the actual range of Class A addresses is from 1 – 126.

1.0.0.0 – 126.255.255.255

In these addresses, the first 8 Bits denotes the Network Portion and the last 24 Bits denotes the Host Portion.

Class A IP Address Structure



IPV4

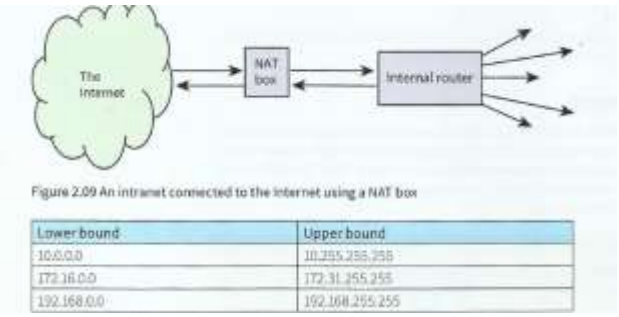


Figure 2.09 An intranet connected to the Internet using a NAT box

Lower bound	Upper bound
10.0.0.0	10.255.255.255
172.16.0.0	172.31.255.255
192.168.0.0	192.168.255.255

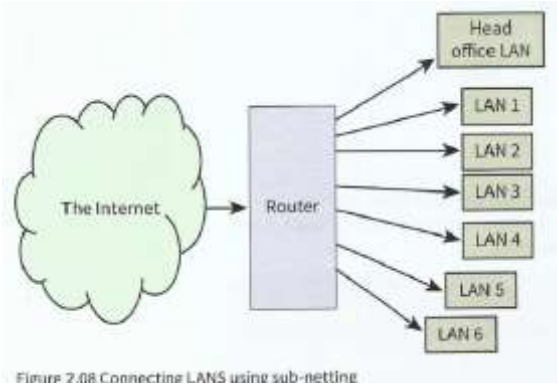


Figure 2.08 Connecting LANS using sub-netting

NAT: Network Address Translation

It can be used to link with Private network Intranet with public network. The solution for dealing with the addressing is to use network address translation (NAT).Figure 2.09 shows a schematic diagram of how this can be used. The NAT box has one IP address which is .visible over the Internet so can be used as a sending address or as areceiving address. Internally the IP addresses have to be chosen from one of t he three ranges of IP addresses shown in Table 2.03 that have been allocated for such networks.

Domain name system: (DNS) was invented in 1983. The DNS system allocates readable domain names for Internet hosts and provides a system fo r finding the IP address for an individual domain name. *Domain name system* (DNS): a hierarchical distributed database installed on domain name servers that is responsible for mapping a domain name to an IP address. There are more than 250 top-level domainswhi ch are either generic (e.g .. com, .edu, and .gov) or represent countries (e.g . . uk and .nl).The domain name is included in a universal resource allocator (URL), which identifies a webpage, or an email address. A domain is named by the path upward from it. For example, .eng.cisco.com . refers to the .eng subdomain in the .cisco domain of the .com top-level domain(which is the reverse of that used for a pathname of a file). Looking up a domain name to find an IP address is called 'name resolution'. For such a query there are three possible outcomes:

1- If the domain is under the jurisdiction of the server to which the query is sent then an authoritative and correct IP address is returned.
2- If the domain is not under the jurisdiction of the server, an IP address can still be returned if it is stored in a cache of recently requested addresses but it might be out of date.
3- If the domain in the query is remote then the query is sent to a root server which can provide an address for the name server of the appropriate top-level domain which in turn can provide the address for the name server in the next lower domain. This continues until the query reaches a name server that can provide an authoritative IP address.