

Protocols

A network protocol is set of rules that govern the exchange of message between two or more processes in a network.

Protocol is agreed upon a way through which computer communicate with each another.

A protocol is the "language" of the network. A method by which two dissimilar systems can communicate.

- **Connection Oriented Protocols (TCP) Reliable**
- **Connectionless Protocols (UDP) Unreliable**

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TCP/UDP

- Transport Layer Protocol
- TCP is connection Oriented (uses checksum and acknowledgment)
- UDP is Connectionless
- Both use the concept of Connection Port Number (16 Bit Source Port Number and Destination Port Number)
- Standard Applications have standard Port Numbers (HTTP 80, Email 25, Telnet 23, FTP 20 & 21)

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The Suite of TCP/IP Protocols

TCP/IP uses the client server model of communication in which a user or machine (a client) is provided a service (like sending a webpage) by another computer (a server) in the network.

TCP/IP is highly scalable and, as a routable protocol, can determine the most efficient path through the network.

It is widely used in current internet architecture.

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The suite of TCP/IP protocols go hand in hand: it is not possible to separate the two. TCP/IP refers to a suite of protocols.

TCP stands for *Transmission Control Protocol*, TCP is a connection-oriented protocol that provides a reliable service

UDP stands for *User Datagram Protocol* is a connectionless protocol that provides an unreliable service.

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Transmission Control Protocol (TCP):

- Responsible breaking up the message into packets.
- Reassembling then at the other end.
- Resending any packet that gets lost.
- Putting thing back into the right order.

Internet Protocol(IP):

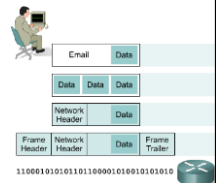
IP is a connectionless service responsible for routing packets between nodes.

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IP as a Routed Protocol

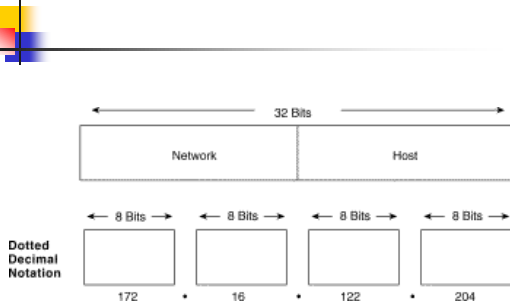
- IP is a connectionless, unreliable, best-effort delivery protocol.
- IP accepts whatever data is passed down to it from the upper layers and forwards the data in the form of IP Packets.
- All the nodes are identified using an IP address.
- Packets are delivered from the source to the destination using IP address



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IP Address



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IP addresses consist of a 32-bit number, and is represented by the dot-decimal format

Binary IP Address:

01101110 11101010 00001001 11001010

Decimal Representation of Each Octet:

110 234 9 202

Dotted Decimal IP Address:

110 . 234 . 9 . 202

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IP Addresses:

IP addresses consist of a 32-bit number, and is represented by the dot-decimal format. For example: 142.110.237.1 is an IP address. There are 4 decimal digits separated by three dots. Each digit is allowed the range of 0 to 255. This range corresponds to 8 bits (one byte) of information.

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IP Address Classifications:

There is a formal structure to the assignment of IP addresses.

IP addresses are assigned by the Network Information Center (NIC), a central authority with the responsibility of assigning network addresses.

There are several classifications of IP addresses: they include network addresses and special purpose addresses.

Internet Assigned Numbers Authority (IANA)

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- During the development of the TCP/IP protocol stack IP addresses were divided into classes
- There are three main address classes, A, B and C.

Class	First by value	Netmask	Number of hosts
A	1 to 127	255.0.0.0	16 million
B	128 to 191	255.255.0.0	64 000
C	192 to 223	255.255.255.0	254
Multicast	224 - 239	240.0.0.0	

A portion of an IP address represents the network address, and the remaining portion the host address.

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IP Addressing

- IP Address Classes
 - first byte netid - remaining three bytes used for hostid
 - called class A IP address
- first two byte netid - remaining two bytes used for hostid
- called class B IP address
- first three byte netid - remaining byte used for hostid
- called class C IP address

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The subnet mask is used to determine which portion of the IP address is the network address, and which is the host address. This means that the portions of network to host in an IP address can change. The most common subnet mask is 255.255.255.0. The simple explanation is that wherever there is a 255, this indicates that it is the network portion. Wherever there is a 0, this indicates the host portion.

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- Network portion is called the Network ID or netid
- Host portion is called the host ID or hostid
- IP addresses logically described as {netid, hostid}

- Network ID
 - describes each connected network
- Host ID
 - identifies the host within that network

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IP Address

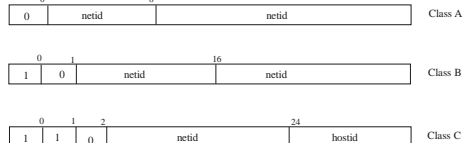
- Class A : Address begins with bit 0. It has 8 bit network number (range 0.0.0.0-to-127.255.255.255), 24 bit host number.
- Class B : Address begins with bits 10. It has 16 bit network number (range 128.0.0.0-to-191.255.255.255), 16 bit host number.
- Class C : Address begins with bits 110. It has 24 bit network number (range 192.0.0.0-to-223.255.255.255), 8 bit host number.
- Class D : Begins with 1110, multicast addresses (224.0.0.0-to-239.255.255.255)
- Class E : Begins with 11110, unused

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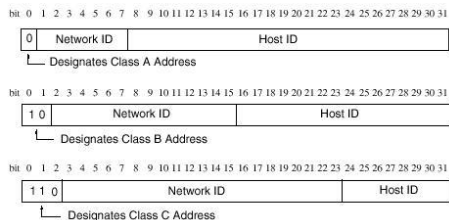
IP Addressing

- IP Address Classes
 - most significant bits are used to determine IP address class



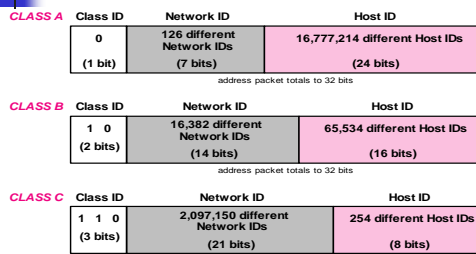
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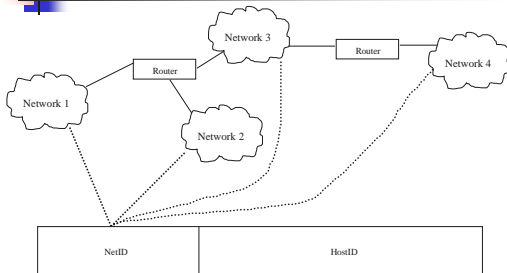


NOTE: The contents of each CLASS ID segment is constant for each CLASS.

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IP Addressing



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Class A addresses:

IP address range 1.0.0.0 to 127.0.0.0 Number of networks available:

Number of hosts per network:16,777,214

Net Mask:255.0.0.0 (first 8 bits are ones)Special Addresses:
10.0.0.0 is used for networks not connected to the Internet

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IP Address

- IP address is for the INTERFACE of a host. Multiple interfaces mean multiple IP addresses, i.e., routers.
- 32 bit IP address in dotted-decimal notation for ease of reading, i.e., 193.140.195.66
- Address 0.0.0.0, 127.0.0.1 and 255.255.255.255 carries special meaning.
- IP address is divided into a network number and a host number.

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Class B addresses:

IP addresses range from 128.0.0.0 to 191.0.0.0

Number of networks available:16,382 (see special addresses below)

Number of hosts per network:65,534 Net Mask:255.255.0.0
(first 16 bits are ones)

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Class C addresses:

IP address range 192.0.0.0 to 223.0.0.0
Number of networks available: 2,097,150
Number of hosts per network: 254Net
Mask:255.255.255.0 (first 24 bits are ones)

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- If setting up a network to connect to the internet, must be allocated addresses from central controlling organization
- If your network will not be connected to the Internet, you can choose from a range of addresses which have been set aside for private use.
- Known as private addresses, or non-routed addresses (non routed on the internet)

Network Class	Addresses
A	10.0.0.0 to 10.255.255.254
B	172.16.0.0 to 172.31.255.254
C	192.168.0.0 to 192.168.255.254

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Private IP Address Independent ID's (Local IP Addresses)

- A=1.0.0.0 to 10.255.255.255
- B=169.254.0.0 to 169.254.255.255
- C= 172.16.0.0 to 172.31.255.255
- C= 192.168.0.0 to 192.168.255.255

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IP Configuration of an Interface

The image shows two side-by-side screenshots of the 'Internet Protocol (TCP/IP) Properties' dialog box in Windows. The left window is titled 'Static' and the right is titled 'DHCP'. Both windows have a 'General' tab. In the 'Static' window, the 'Use the following IP address' radio button is selected, and the IP address, subnet mask, and default gateway are entered. In the 'DHCP' window, the 'Obtain an IP address automatically' radio button is selected. Both windows also have sections for DNS server addresses.

The Internet Protocol, Version 6 (IPv6), provides an addressing capability of 2¹²⁸, or addresses.

There are other major differences between IPv4 and IPv6:

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Domain Name System (DNS):

IDs all hosts by name & translates host name to IP address & vice-versa

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