

Introduction to TCP/IP

(Internet architecture, addressing,
routing)



By

Muhammad Niswar

TCP/IP

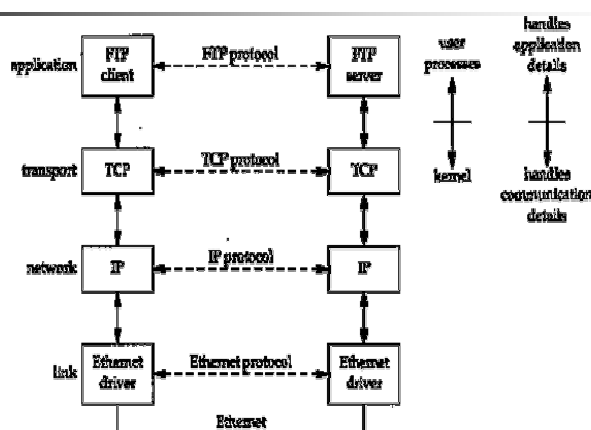


- The TCP/IP protocol suite allows computers of all sizes, from many different computer vendors, running totally different operating systems, to communicate with each other

TCP/IP Layer

Application	Telnet, FTP, e-mail, etc.
Transport	TCP, UDP
Network	IP, ICMP, IGMP
Link	device driver and interface card

Two hosts on a LAN running FTP.





IP Addressing

- 32-bit value. (IPv4)
- Usually, for convenience, it is presented in DECIMAL DOT NOTATION:
 - 4 octets (bytes) separated by a dot.
- Each physical network has its own unique network address.
- Each host has its own unique address.
- Routers or gateways have one or more addresses (depend on the links they have)

An IP address is therefore built of a network and a host identifications.



IP Addressing

Example:

- Address: 192.168.1.5
 - Subnet Mask: 255.255.255.0
- 255.255.255.0
11111111.11111111.11111111.00000000

24-bits ON and 8-bits OFF.

The first 24-bits ON = Network Number

The last 8-bits OFF = Host Address

Address/prefix-length:

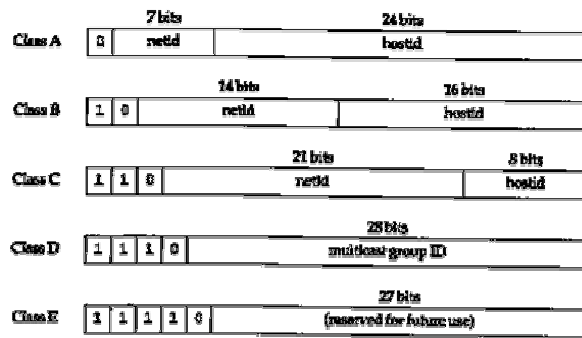
192.168.1.5/24

Total_bits - Prefix_length = 32 - 24 = 8 bits block addresses

Number of host = $2^8 - 2 = 254$ addresses



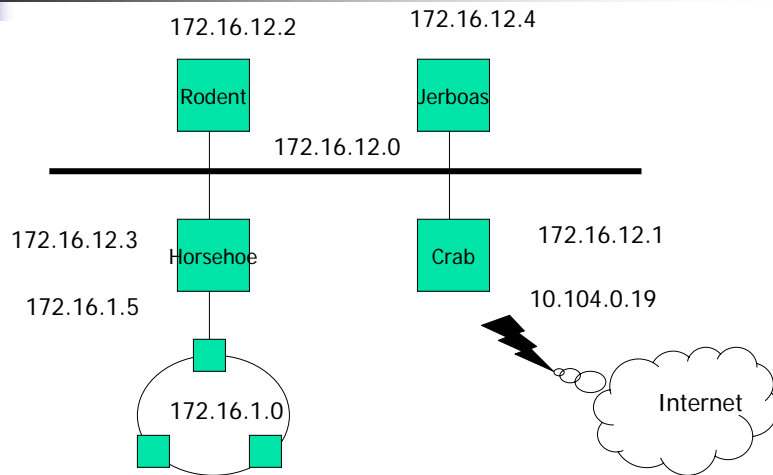
IP Addressing




IP Addressing

- There are five forms of IP addresses:
 - Class A :126 networks, each can have up to (16M-2) nodes.
(1.0.0.0 - 126.0.0.0)
 - Class B: (16K-2) networks, each can have up to (64K-2) nodes
(127.0.0.0 - 191.255.0.0)
 - Class C: (2M-2) networks, each can have up to 254 nodes.
(192.0.0.0 - 223.255.255.0)
 - Class D: a multicast address.
(224.0.0.0 - 240.0.0.0)
 - Class E: reserved for future use.
(241.0.0.0 - 248.0.0.0)

Sample Network Topology



Routing Table

- IP routing decisions are simply table lookups. Packets are routed toward their destinations as directed by the routing table (also called the forwarding table).
- The routing table maps destinations to the router and network interface that IP must use to reach that destination



Routing Table

The *netstat* command is used to examine the routing table

```
# netstat -n

IP routing table

Destination  Gateway  Genmask      Flags  Metric  Ref  Use  Iface
172.16.55.0  0.0.0.0  255.255.255.0  U      0        0    0   eth0
172.16.50.0  172.16.55.36  255.255.255.0  UG     0        0    0   eth0
127.0.0.0    0.0.0.0   255.0.0.0     U      0        0    0    lo
0.0.0.0      172.16.55.1  0.0.0.0       UG     0        0    0
```



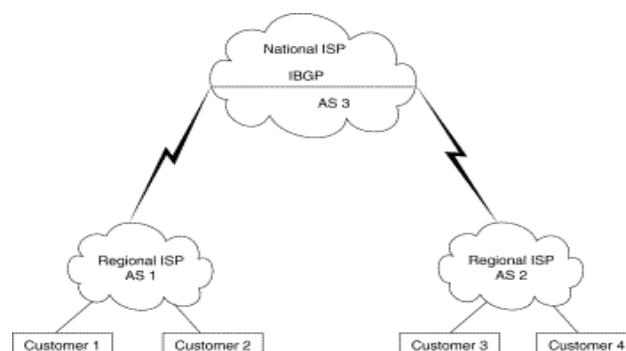
Internet Routing

- Static routing
 - A network with a limited number of gateways to other TCP/IP networks can be configured with static routing.
- Dynamic Routing
 - A network with more than one possible route to the same destination should use dynamic routing. A dynamic routing table is built from the information exchanged by routing protocols

Routing Protocol

- Interior Routing Protocols
 - An interior protocol is a routing protocol used inside—interior to—an independent network system (Autonomous System)
e.q. RIP
- Exterior Routing Protocols
 - Exterior routing protocols are used to exchange routing information between autonomous systems
e.q. EGP, BGP

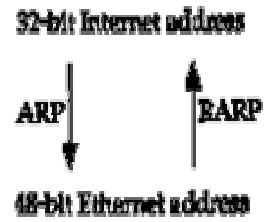
Border Gateway Protocol (BGP)





ARP/RARP

- Address Resolution Protocol (ARP)
 - map IP addresses to physical network addresses.
- Reverse Address Resolution Protocol (RARP)
 - Map physical network addresses to IP addresses




ARP

```
% arp rodent
(172.16.12.2) at 0:50:ba:3f:c2:5e

% arp -a
Net to Media Table: IPv4
Device  IP Address          Mask      Flags    Phys Addr
-----  -
dnet0 rodent  255.255.255.255      -         -        00:50:ba:3f:c2:5e
dnet0 crab   255.255.255.255      SP        00:00:c0:dd:d4:da
dnet0 224.0.0.0      240.0.0.0      SM
          01:00:5e:00:00:00
```