



Computer Networks – Internet Protocol

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May 16, 2011

PREREQUISITE

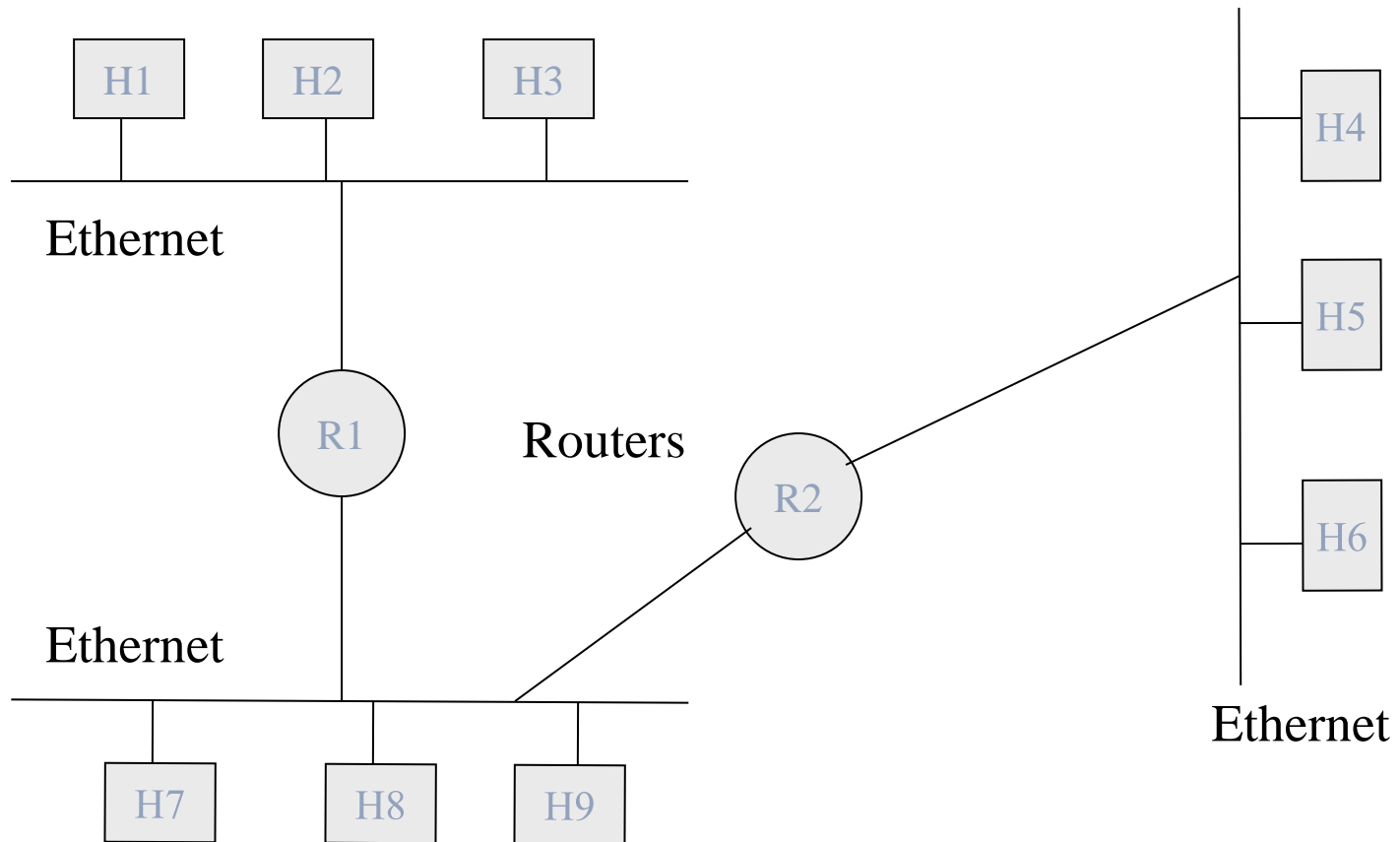
- Understanding of Binary Number System.
- Understanding of Hexadecimal Number System.
- Conversion from Decimal to Binary and Binary to Decimal.
- Conversion from Binary to Hexadecimal and Hexadecimal to Binary.
- Conversion from Hexadecimal to Decimal and Decimal to Hexadecimal.

OBJECTIVE

- Understand classful IPv4 addressing
- Understand Address Mask
- Introduction to subnetting.

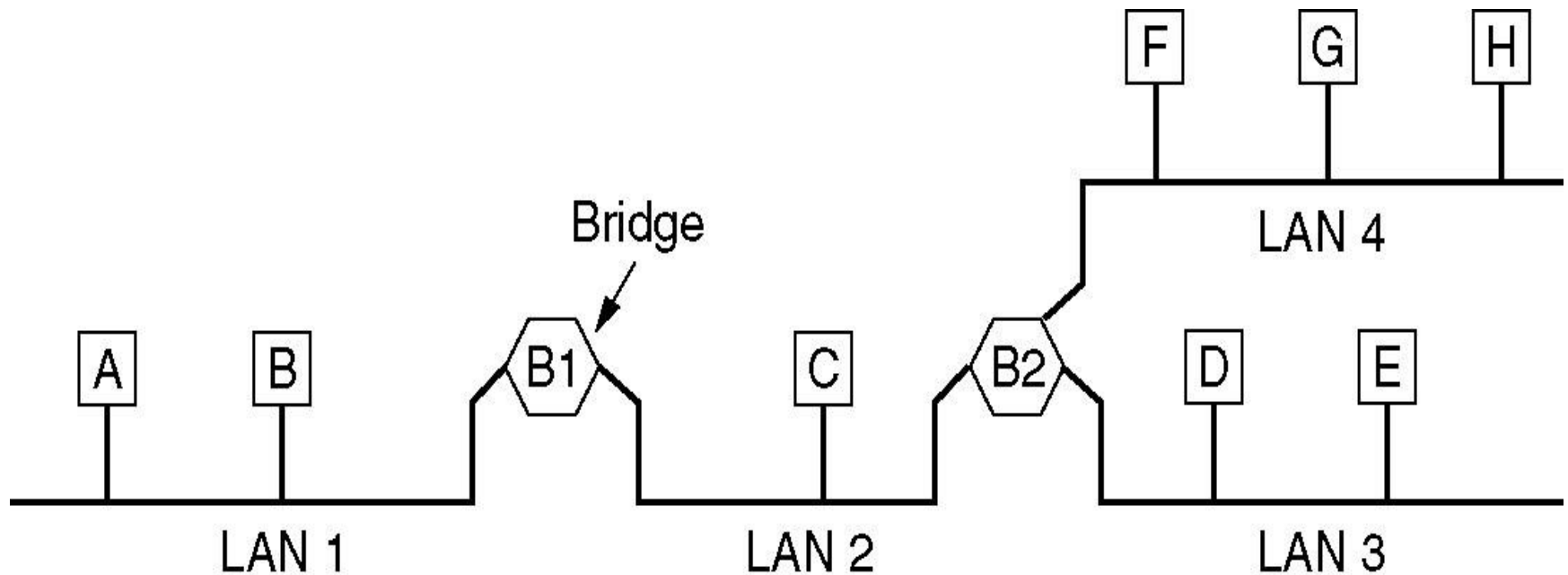


Internetworking



Local Internetworking

A configuration with four LANs and two bridges.



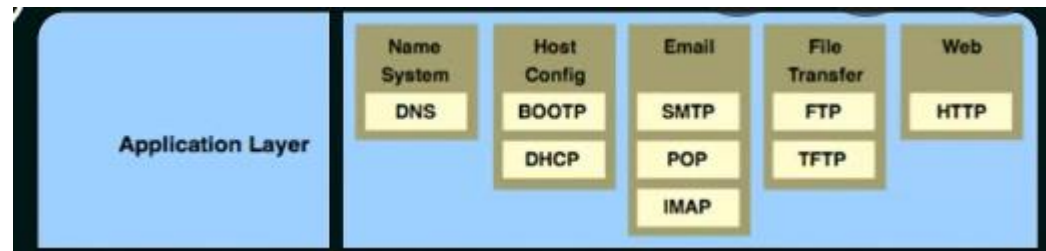
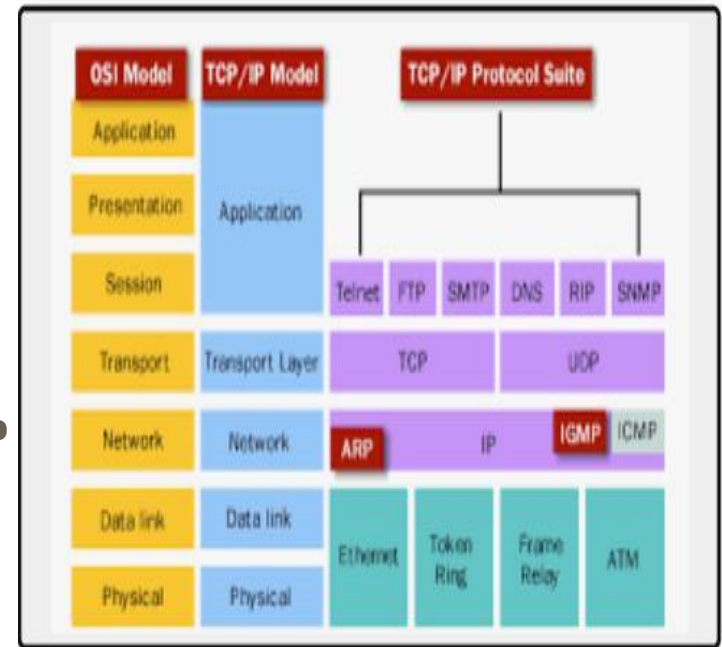
Internet Architecture

- Autonomous networks connected by routers/gateways
- User views the Internet as a single unified network
- IP provides internetworking support
- UDP and TCP are the transport protocols over IP
- Protocols for conversion between IP and MAC addresses
- Protocol for conversion between name and IP address
- Applications use TCP/UDP support



Internet Protocol Suite

- Network Layer - IP
- Control Message - ICMP
- Multicast Groups - IGMP
- Address resolution - ARP, RARP
- Booting and Configuration - BOOTP, DHCP
- Transport Layer - TCP, UDP
- Name-Address mapping - DNS



Internet Service Model

- **Connectionless Packet Delivery**

- IP datagrams are forwarded without any explicit connection, possibly via several Routers

- **Unreliable Service**

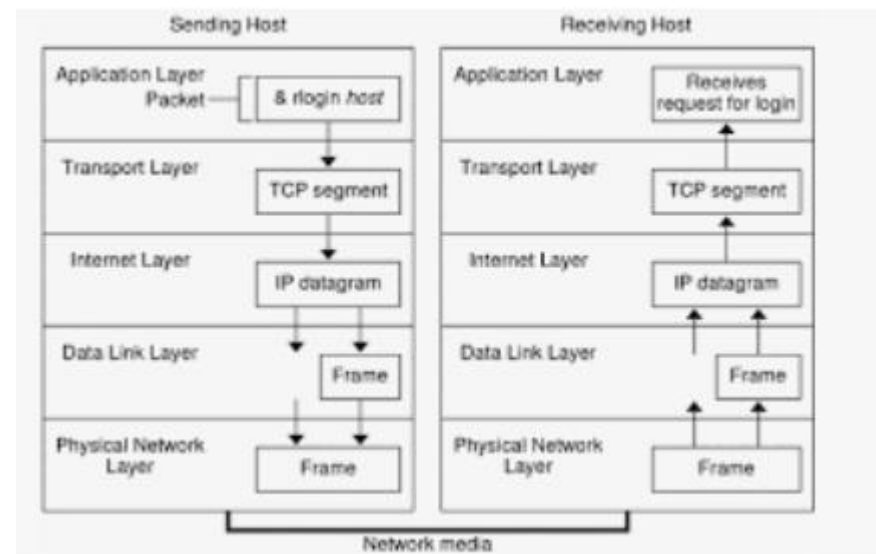
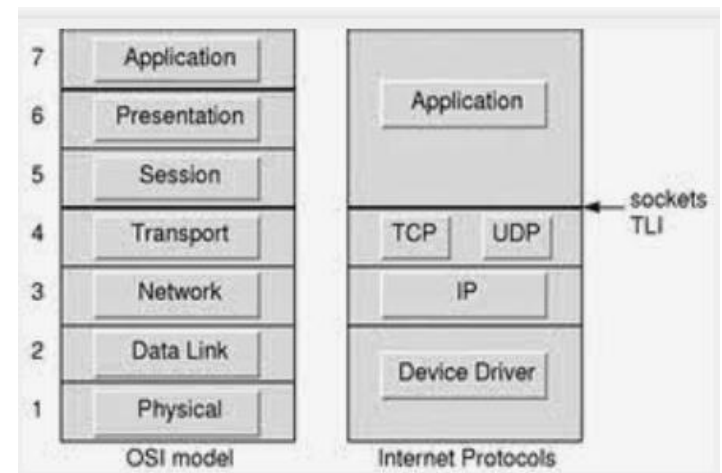
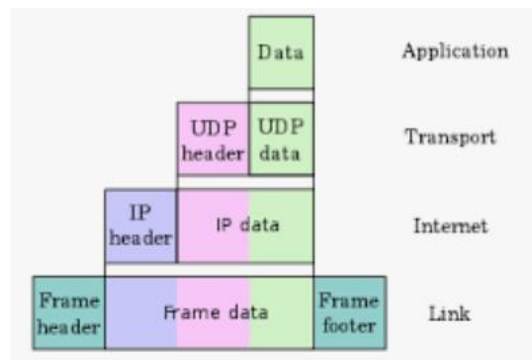
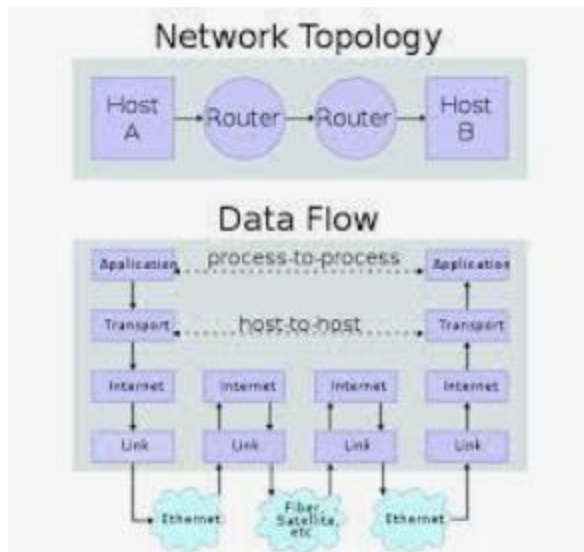
- Packets may be lost, corrupted, duplicated or delivered out of order
- Packets can be delayed for long time

- **Best Effort**

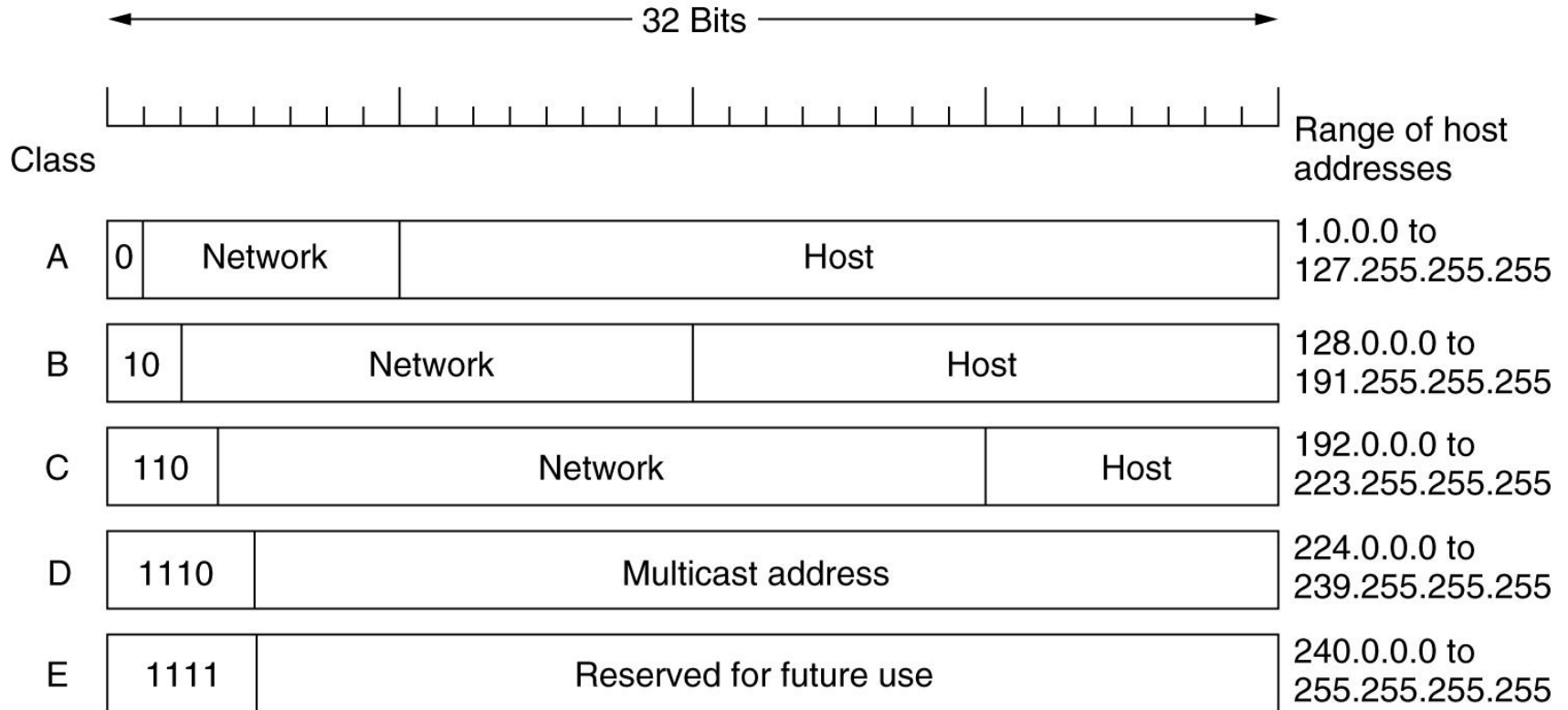
- Packets not discarded capriciously, delivery failure not necessarily reported



Internet Protocol Suite



IPv4 Addresses



IP Addresses (2)

Special IP addresses

0 0																																This host
0 0 0 0								Host																								A host on this network
1 1																																Broadcast on the local network
Network								1 1 1 1 . . . 1 1 1 1								Broadcast on a distant network																
127				(Anything)																												Loopback



Anatomy of an IP Address

- Every interface on an internet must have a unique Internet Address (also called an IP Address).
- These are 32 bit numbers .
- Not Flat , there is a structure to these addresses.
- Normally written as four decimal numbers , one for each byte of the address
✓ E.g 140.252.13.33
- Divided into a Network Id and Host Id



Class A Addresses

Maximum networks	2^7-2	126
Maximum usable networks	2^7-4	124
Hosts per network	$2^{24}-2$	16,777,214
Private IP address	10.0.0.0	1
Address range	1.0.0.0	126.0.0.0



Class B Addresses

Maximum networks	$2^{14}-2$	16,382
Maximum usable networks	$2^{14}-18$	16,366
Hosts per network	$2^{16}-2$	65,534
Private IP address	172.16.0.0 to 172.31.255.255	16
Address range	128.0.0.0	191.255.0.0



Class C Addresses

Maximum networks	$2^{21}-2$	2,097,150
Maximum usable networks	$2^{21}-256$	2,096,894
Hosts per network	2^8-2	254
Private IP address	192.168.0.0 to 192.168.255.255	256
Address range	192.0.0.0	223.255.255.255



Assignment

- Find out the IP address of your machine.
- Identify its CLASS
- Identify its category – Private or Public



Network Masks

- Used to identify the network ID and Host ID from IP Address.
- Class A , Class B and Class C addresses have default masks called as natural masks.

Class A : 255.0.0.0

Class B : 255.255.0.0

Class C : 255.255.255.0

- IP address and it's Network mask is represented in a pair as follows:

IP address : 15.23.109.12 Network Mask : 255.0.0.0

OR

IP address : 15.23.109.12/8 (Prefix/length representation of Network Mask).

- AND (Dot product) of IP address and Network Mask gives the Network ID of a device.



Subnetting

- Create multiple logical networks that exists within a single Class A, Class B or Class C network.
- Extend the natural mask, using some bits from the host ID portion to create subnetwork ID.

Eg: Class C Address : 204.17.5.0 Address Mask : 255.255.255.224

11001100.00010001.00000101.00000000

11111111.11111111.11111111.11100000

-----|sub|-----

3 bits has been taken from Host ID.

2^3 i.e 8 subnetwork can be formed from the Class C address.

Each subnetwork can have $(2^5 - 2)$ i.e (32-2) hosts.



Subnetting

Advantages of Subnetting:

1. Helps to reorganize the resources within the same network.
2. Helps to provide security to the critical resources.
3. Easy maintenance.
4. Speeds up the network.

Disadvantages of Subnetting.

1. Cost increases as switches/routers are required for connectivity.
2. Requires proper network administration.



Assignment

1.What is the Network Mask of your machine. Use it to find the Network ID of your machine.

2.The IP address and Mask combination , written in prefix/length notation is given below:

Device A: 172.16.17.30/20

Device B: 172.16.28.15/20

Find out if both the devices belong to the same subnet or not ?



References

- Computer networks ,Andrew S. Tanenbaum
- Computer networking ,James F. Kurose, Keith W. Rose



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Thank You