CS366: Systems Networking

[1] Network Topologies

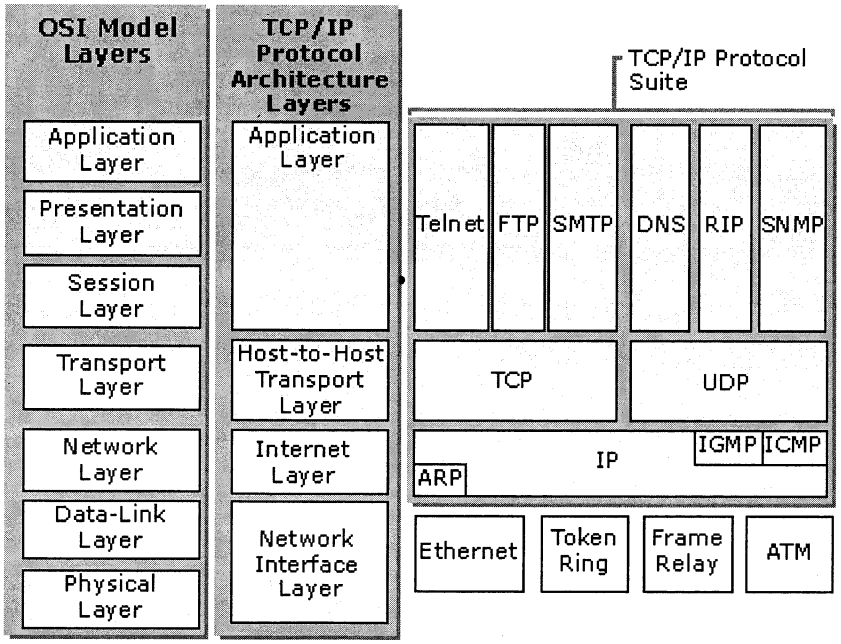
A. Star Network Topology
B. Bus Network Topology
C. Token-Ring Network Topology
D. Mesh Network Topology

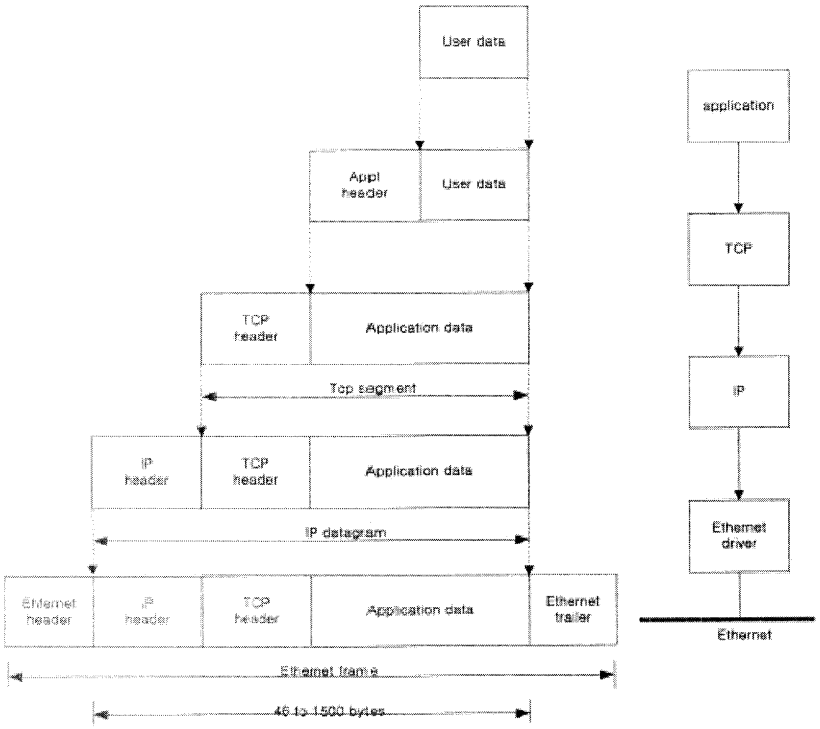
[2] ISO OSI (Open System Interconnect) 7 Layer Network Reference Model

Layer
7. Application
6. Presentation
5. Session
4. Transport
3. Network
2. Data-Link
1. Physical

[3] TCP/IP Network Model

Layer		
5. Application	System	
4. Transport		
3. Network	Network Devices	Routers
2. Data-Link		Switches, Bridges
1. Physical		Hubs





TCP/IP 4 Layer Model

OSI Model	TCP/IP Model	Functions	Protocol Suites
7. Application 6. Presentation 5. Session	4. Application	Defines the applications used to process requests and what ports and sockets are used	Telnet, FTP, SMTP, DNS, SNMP
4. Transport	3. Transport	Defines the type of connection established between hosts and how to acknowledgements are sent	TCP, UDP
3. Network	2. Internet	Defines the protocols used for addressing and routing the data packets	IP, ICMP, ARP
2. Data-Link 1. Physical	1. Network Interface	Defines how the host connects to the network	Ethernet, ATM, Token-Ring, Frame Relay

[4] Classes of IP Networks

A Class:	0.0.0.0 – 126.255.255.255	Governments, Very Large Networks
B Class:	128.0.0.0 – 191.255.255.255	Midsize Companies, Universities, etc.
C Class:	192.0.0.0 – 223.255.255.255	Small Networks

Private Network Addresses:
10.0.0.0 – 10.255.255.255
172.16.0.0 – 172.31.255.255
192.168.0.0 – 192.168.255.255

[5] CIDR: Classless InterDomain Routing

- Classful network: The IP addresses and subnets are within same network.
  A Class: 255.0.0.0
  B Class: 255.255.0.0
  C Class: 255.255.255.0

  There will be a lot of unused IP address space.
  Class A has more than 16 million IP addresses.
  Class B has more than 65000 IP addresses.
  Only a limited number of class A and B address space has been allocated for Internet uses.

- Supernetting: Allow multiple networks to be specified by one subnet mask.
- CIDR (pronounced "cider"): CIDR notion specifies the number of bits set to a 1 that make up the subnet mask.
  A Class: 255.0.0.0 11111111.00000000.00000000.00000000 (8 bits)
  B Class: 255.255.0.0 11111111.11111111.00000000.00000000 (16 bits)
  C Class: 255.255.255.0 11111111.11111111.11111111.00000000 (24 bits)

CIDR	Number of bits	Subnet Mask
/8	11111111.00000000.00000000.00000000	255.0.0.0
/9	11111111.10000000.00000000.00000000	255.128.0.0
/10	11111111.11000000.00000000.00000000	255.192.0.0
/11	11111111.11100000.00000000.00000000	255.224.0.0
/12	11111111.11110000.00000000.00000000	255.240.0.0
/13	11111111.11111000.00000000.00000000	255.248.0.0
/14	11111111.11111100.00000000.00000000	255.252.0.0
/15	11111111.11111110.00000000.00000000	255.254.0.0
/16	11111111.11111111.00000000.00000000	255.255.0.0
/17	11111111.11111111.10000000.00000000	255.255.128.0
/18	11111111.11111111.11000000.00000000	255.255.192.0
/19	11111111.11111111.11100000.00000000	255.255.224.0
/20	11111111.11111111.11110000.00000000	255.255.240.0
/21	11111111.11111111.11111000.00000000	255.255.248.0
/22	11111111.11111111.11111100.00000000	255.255.252.0
/23	11111111.11111111.11111110.00000000	255.255.254.0
/24	11111111.11111111.11111111.00000000	255.255.255.0
/25	11111111.11111111.11111111.10000000	255.255.255.128
/26	11111111.11111111.11111111.11000000	255.255.255.192
/27	11111111.11111111.11111111.11100000	255.255.255.224
/28	11111111.11111111.11111111.11110000	255.255.255.140
/29	11111111.11111111.11111111.11111000	255.255.255.248
/30	11111111.11111111.11111111.11111100	255.255.255.252
/31	11111111.11111111.11111111.11111110	255.255.255.254
/32	11111111.11111111.11111111.11111111	255.255.255.255

[6] IP ADDRESS DECODING:

IP: 139.182.148.50
NM: 255.255.254.0

128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1

NA: NETWORK ADDRESS
139.182.148.50 = 10001010.10110110.10010100.00110010
AND 255.255.254.0 = 11111111.11111111.11111110.00000000

10001010.10110110.10010100.00000000
139 . 182 . 148 . 0

BA: BROADCAST ADDRESS
139.182.148.50 = 10001010.10110110.10010100.00110010
OR 255.255.254.0 = 00000000.00000000.00000001.11111111

10001010.10110110.10010101.11111111
139 . 182 . 149 . 255

PRACTICE: PLEASE CALCULATE [NA] AND [BA]

- IP: 192.168.0.100
- NM: 255.255.252.0

NA: _____ (First Address of the Network)

BA: _____ (Last Address of the Network)

How many IP addresses are available to use in this network?

[7] MAC (Media Access Control) Address:

Example: 00:06:5B:90:E3:0F

MAC = OUI + S/N OUI = [redacted]:90:E3:0F S/N: 00:06:5B:[redacted]

How to get MAC Address: Linux **ifconfig**
Windows: **ipconfig**
Mac OS: **Network Utility** -> Click on **Info** tab

[8] Ethernet Cable Standard:

Pin #	Function:	EIA/TIA 568A COLOR CODE	EIA/TIA 568B COLOR CODE
1	Transmit +	Green Stripe	Orange Stripe
2	Transmit -	Green	Orange
3	Receive +	Orange Stripe	Green Stripe
4	Not Used	Blue	Blue
5	Not Used	Blue Stripe	Blue Stripe
6	Receive -	Orange	Green
7	Not Used	Brown Stripe	Brown Stripe
8	Not Used	Brown	Brown

Straight Through Cable:

1	Transmit +	Green Stripe	Green Stripe
2	Transmit -	Green	Green
3	Receive +	Orange Stripe	Orange Stripe
4	Not Used	Blue	Blue
5	Not Used	Blue Stripe	Blue Stripe
6	Receive -	Orange	Orange
7	Not Used	Brown Stripe	Brown Stripe
8	Not Used	Brown	Brown

Crossover Cable:

1	Transmit +	Green Stripe	Orange Stripe
2	Transmit -	Green	Orange
3	Receive +	Orange Stripe	Green Stripe
4	Not Used	Blue	Blue
5	Not Used	Blue Stripe	Blue Stripe
6	Receive -	Orange	Green
7	Not Used	Brown Stripe	Brown Stripe
8	Not Used	Brown	Brown

Categories of Twisted Pair Cables:

Category	Description:	Bandwidth/Data Rate
CAT3	Telephone Network Class C	~ 16Mbps
CAT5	Computer Network Class D	~ 100MHz/100 Mbps (100m)
CAT5e	Computer Network	~ 100MHz/1000 Mbps
CAT6	Hi-Speed Computer Network Class E	~ 250 MHz
CAT7	Hi-Speed Computer Network Class F	~ 600 MHz