B.E-CSE **2018-2019**

14BECS604 **COMPUTER NETWORKS** **3H-5C**

Instruction Hours/week: L:3 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

COURSE OUTCOMES:

- Explain the functions of the different layer of the OSI Protocol.
  Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
  - For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
- For a given problem related TCP/IP protocol developed the network programming.
  - Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

UNIT 1:

Data communication Components: Representation of data and its flow Networks , Various
Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN:
Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT 2:

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction -
Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure

ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

UNIT 3:

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT 4:

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS
improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT 5:

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer
Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of
Cryptography

TEXT BOOKS:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

REFERENCES:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

KARPAGAM ACADEMY OF HIGHER EDUCATION

Faculty of Engineering

Department of Computer Science and Engineering

Lecture Plan

Subject Name: COMPUTER NETWORKS **Subject Code: 14BECS604**

S.No	Topic Name	No.of Periods	Supporting Materials	Teaching Aids
	UNIT- I DATA COMMUNICATIONS			
1	Discussion about the need of studying Computer Networks	1	Syllabus	BB
2	Discussion on various Network features	1	W(1)	
3	Discussion on various Connecting Cables	1	W(2)	
4	**Brain storming session - Social Media in Networks**	1	W(3)	
5	Components, Direction of Data flow,networks	1	T[2] Page no 6-9	PPT
6	Components and Categories, types of Connections, Topologies	1	T[2] Page no 11-15	PPT
7	Protocols and Standards, Elementary datalink protocols	1	T[2] Page no 20	BB
8	**Tutorial hour- Topologies and their Structures**	1		
9	Unrestricted simplex protocol, ISO / OSI model	1	R[4] Page no 25	BB
10	Transmission Media – Coaxial Cable, Fiber Optics	1	T[1] Page no 115 R[2] Page no 119	PPT
11	Line Coding, Modems, RS232 Interfacing sequences.	1	T[2] Page no 45	BB
	Total	**11**		
	UNIT- II DATA LINK LAYER			
12	Error, detection and correction, Parity	1	T[1] Page no 120-130	BB

13	LRC, CRC, Hamming code	1	T[1] Page no 145-160	PPT
14	low Control and Error control, stop and wait, go back-N ARQ	1	T[1] Page no 161-171	BB
15	**Tutorial hour-CRC Error Checking problems**	1		PPT
16	sliding window, HDLC, LAN	1	T[1] Page no 175-180	BB
17	Ethernet IEEE 802.3, IEEE 802.4, IEEE 802.5	1	T[1] Page no 185-220	BB
18	IEEE 802.11, FDDI	1	R[1] Page no 170-182	
19	SONET, Bridges	1	R[1] Page no 170-182	PPT
20	Alpha-Beta pruning	1	R[1]221	BB
21	**Tutorial hour -IEEE Standards and their features in supporting Networks**	1	R[1]221	PPT
Total		**10**		
	UNIT- III NETWORK LAYER			
22	Internetworks, Packet Switching and Datagram approach	1	R[3] Page no 3.1 to 3.7	PPT
23	IP addressing methods, Subnetting	1	T[1] Page no 220 to 225	
24	IP addressing methods, Subnetting	1	T[1] Page no 220 to 225	BB
25	IP addressing methods, Subnetting	1	T[1] Page no 220 to 225	PPT
26	Routing, Distance Vector Routing	1	T[1] Page no 190 to 201	BB
27	**Tutorial: Problem on splitting a global IP to local IP using subnetting**	1		
28	Link State Routing	1	T[1] Page no 234- 242	BB

29	Routers, Leaky bucket algorithm	1	T[1] Page no 234- 242	BB
30	Token Bucket algorithm	1	T[1] Page no 234- 242	BB
31	**Tutorial: Routing Algorithm**	1		
Total		**10**		
	UNIT- IV TRANSPORT LAYER			
32	Duties of transport layer, Multiplexing, Demultiplexing	1	R[2] Page no 160 to 170	PPT
33	Sockets, User Datagram Protocol (UDP)	1	R[2] Page no 171 to 180	BB
34	Transmission Control Protocol (TCP), Congestion Control	1	R[2] Page no 200 to 215	BB
35	**Tutorial: Video on Packet delivery, socket selection**	1		PPT
36	Quality of services (QOS), Integrated Services Connection management-Addressing,establishing	1	R[2] Page no 220 to 230	BB
37	Domain Name Space (DNS)	1	R[2] Page no 356 to 370 T[1] Page no 250 to 280	PPT
38	SMTP ,FTP	1	T[1] Page no 290 to 340	BB
39	HTTP, WWW	1	T[1] Page no 290 to 340	BB
40	Making simple decisions	1	web	PPT
41	**Tutorial: QoS in real time systems**	1	R[1]-133	BB
Total		**10**		
	UNIT- V NETWORK SIMULATOR 2			
42	Introduction to NS2	1	T[2] Page no 317 to 326	PPT
43	Installation of NS2	1	T[2] Page no 328 to 335	PPT

44	Directories and Convention	1	T[2] Page no 355 to 361	PPT
45	Running NS2 simulation	1	T[2] Page no 370-373	BB
46	Simulation example, including C++ modules into NS2	1	T[2] Page no 373-375	BB
47	Two language concepts in NS2(Otcl and C++)	1	R[2] Page no 390 to 401	BB
48	Language concepts in NS2	1	R[2] Page no 390 to 401	PPT
49	Passive reinforcement – Active reinforcement	1	T[1]-690	BB
50	**Tutorial: Hands on installation for Ns2 Simulator and running examples**	1	T[1]-690	PPT
51	Revision	1	T[1]-752	BB
52	**Discussion on Previous University Question Papers**			
	Total	**10**		
	Total Hours	**52**		

TEXT BOOKS

S.NO	Title of the book			Year of publication
1	Behrouz A. Forouzan, Data Communication and Networking, Tata			2011
2	Teerawat. Issariyakul, Ekram Hossain, Introduction to network simulator 2, Springer			2012

REFERNCE BOOKS

S.NO	Title of the book			Year of publication
1	James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down			2005

WEBSITES

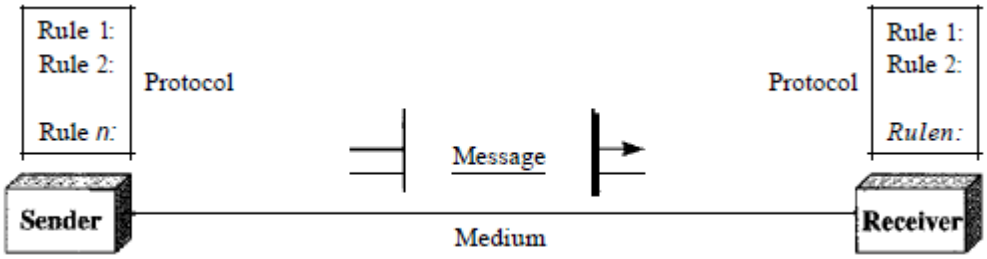
1. http://www.freeprogrammingresources.com/tcp.html
2. http://www.mcmcse.com/cisco/guides/osi.shtml
3. http://compnetworking.about.com/od/vpn/a/vpn_tunneling.htm

UNIT -I
Introduction to Computer Networks

1.1 Data Communication: When we communicate, we are sharing information. This sharing can be local or remote. Between individuals, local communication usually occurs face to face, while remote communication takes place over distance.

1.1.1 Components:

A data communications system has five components.



1. Message. The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.

2. Sender. The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

3. Receiver. The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

4. Transmission medium. The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves

5. Protocol. A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese.

Question Bank

1. What are the major advantages of STP over UTP?
2. Describe the components of fibre optic cable. Draw a picture.
3. Why are slots used in DQDB?
4. What is the difference between network layer delivery and transport layer delivery?
5. How can a device have more than one IP address?
6. Which control bit is involved in setting up a TCP session?
7. What factors effects the data rate of a link?
8. What are the advantages of FDDI over a basic token ring?
9. What 3 functions can SNMP perform to manage network devices?
10. What is the purpose of the timer at the sender in systems using ARQ?
11. Is there any drawback of using piggybacking?
12. Which of the following address does not belong to the same network(no subnetting)? Explain why?
    1. 130.31.23.31
    2. 130.31.24.22
    3. 130.32.23.21
    4. 130.31.21.23

---

1. What are the two reasons for using layered protocols?
2. What do you mean by link to link layers of OSI reference model? Explain their functions briefly?
3. Write a short note on ISDN?
4. What is the difference between boundary level masking and non- boundary level masking? Give examples
5. Draw the IP datagram header format. “IP datagram has a checksum field still it is called an unreliable protocol”. Justify?
6. What are the principles that were applied to arrive at the seven layers in OSI model?
7. Explain the working of 3 bit sliding window protocol with suitable example.
8. Explain the following ARQ techniques in detail
    1. Stop and wait ARQ
    2. Selective repeat ARQ

9. What are the reasons for using layered protocols ?
10. 10 Enumerate the main responsibilities of data link layer ?
11. Is the nyquist theorem true for optical fibre or only for copper wire ? Explain.
12. Why do data link layer protocols position the checksum in the trailer and not in the header ?
13. Compare the maximum window size in go-back-N and selective-repeat ARQs.
14. Why does ATM use the cell of small and fixed length ?
15. Give the equivalent binary word for the polynomial x^8+x^2+x+1.
16. In which of the 7 layers of OSI will a service handling conversion of characters is from EBCDIC to ASCII be normally implemented ?

17. Where is the special IP address 127.0.0.0. used ?
18. Convert the IP address 197.228.17.56 into binary ?
19. Compare satellite with fiber as a communication medium and enumerate the application areas where satellite still holds a niche(or special)marker.
20. A binary signal is sent over a 3-khz channel whose signal-to-noise ratio is 20 db.Calculate the maximum achievable data rate ?
21. What does 'data transparency' mean ? With the help of a flow chart, explain the process of bit de-stuffing at the receiver's end.
22. Assuming classful addressing, find the no of subnets and the no of hosts per subnet foe the following blocks:
    (i) 122.45.77.32/20
    (ii) A class B block having mask of 255.255.192.0

23. Write short note on any four of the following:
    (a) The ATM reference model
    (b) HDLC
    (c) Salient difference between ISO-OSI and TCP/IP models.
    (d) Network Topologies and their uses.
    (e) Wireless networks.

24. (a) Differentiate between static and dynamic channel allocation.
    (b) List out the main responsibilities of the network layer.
    (c) Give two examples of a 'collision-free' protocol ?
    (d) Why is IP called 'best-effort delivery' protocol?
    (e) What is a transparent bridge?
    (f) what are the two sub layers of data link layer called ?
    (g) What are the other names of IEEE 802.11 protocol or standard?
    (h) What is the baud rate of a standard 10 mbps Ethernet LAN ?
    (i) What is a minimum data size of an Ethernet frame ?

25. Explain distance vector routing . What are its limitations and how are they overcome?

26.Explain pure-ALOHA and slotted- ALOHA systems.Give the expression for throughout for each,clearly explaining the various terms.

27. Explain 1-persistent, p-persistent and 0-persistent CSMA giving strong and weak points of each.

28. Explain network equipment used in wired-LANS and explain the function of Hub, Switch, and bridge.

29. Write short note on any four of the following:
    (a) Token ring
    (b) Various fields in Ethernet frame format
    (c) Difference between congestion control and QoS(or Quality of service)
    (d) FDDI
    (e) Traffic shaping using token bucket algorithm
    (f) CSMA/CD

30. If the transmitted code word is 10011000 and the received code word is 11001001. What is the error word ? Write transmitted code word , received code word and error word as polynomials.

31.Why transport layer protocols like TCP and UDP are called end-to-end protocols. What is the difference between them?

32. Differentiate between:
    (i) Baseband co-axial cable and broad band coaxial cable
    (ii) Optical fibre and twisted pair
    (iii) SMTP and SNMP
33. What are the basic functions of the data link layer? Write down the basic features of HDLC protocol? Could HDLC be used as a data link protocol for a LAN? Justify your answer.
34. The physical layer service is a non-confirmed service. Assume that some bits of data are lost during transmission over physical media,which layer will detect the loss and take some remedial measures. Explain any one method clearly depicting how this operation is performed.
35. What are the advantages of cell switching that is used in ATM?
36. Outline and discuss the main fields in Ethernet IEEE 802.3 frame. What are the main objectives of preamble ?
37. What is the average number of transmission required to send a frame of length 1600 bytes correctly, if the bit error rate is 1×10^{-6}.
38. Explain what is meant by the term 'integrated service digital network'. Give three reasons a company might choose an ISDN link in preference to a leased line.
39. Subnet the class C network address 198.67.25.0 into eight subnets. Why are the 'all ones' and 'all zeroes' subnets not used ?
40.What do you understand by the term 'structured cabling'. State the main rules that should be used when installing a cable. Show that maximum cabling area for LAN for horizontal cabling runs is approximately 200m.
41. What are the various classes of IP addressing? Calculate the maximum number of class A, B and C network Ids.
42. Why is a data link layer switch preferred over a hub ?
43. Which device is needed to connect two LANs with different network Ids ?
44. When is a translating bridge used ?
45. Can a switch be used to connect two LANs with different network IDs ?
46. Write two ways in which computer applications differ from network applications ?
47. What is count to infinity problem ?
48. What was the reason for selecting a speed of 155.52 Mbps in the original ATM standard ?
49. Contrast link state and distance vector routing protocols, giving an example of each.
50. What is ISO-OSI reference model ? Compare it with TCP/IP reference model. Why TCP/IP reference model is more popular than OSI model ? Which layer is used for the following :
    (i) to route packets
    (ii) to convert packets to frame
    (iii) to detect and correct errors
    (iv) to run services like FTP, Telnet etc.
51. Discuss Shannon's capacity. What implications does it have ?
52. Discuss how satellite network differs from traditional networks such as Ethernet, Tokenbus.
53. What is packet switching ? Explain two different approaches of packet switching. ?
54. Doscuss the different factors affecting congestion control algorithms. ?
55. How does a token ring network work ? In what way is it different from Ethernet ?
56. Describe and distinguish between FDMA, TDMA, and CDMA.
57. Discuss the following terms with respect to ATM: VPI, UNI, asynchronous, AAL, Cell , PVC.

58. What is sliding window protocol ? Differentiate between stop-and wait ARQ and Go-back-N protocol.
59. Differentiate between ISO-OSI and TCP/IP reference model.
60. Explain leaky bucket algorithm and compare it with token bucket algorithm.
61. Explain ATM reference model.
62. Explain different kinds of Switching techniques.
63. Differentiate between Link state and Distance Vector Routing algorithm.
64. Explain network layer in ATM,
65. Differentiate between IEEE 802.3, IEEE 802.4 and IEEE 802.5 standards.
66. Explain any three error detection and correction techniques.
67. Explain various cabling techniques used in IEEE 802.3 standard,

Question Bank

1. Which of the following protocols are examples of TCP/IP transport layer protocols?
a. Ethernet
b. HTTP
c. IP
d. UDP
e. SMTP
f. TCP

2. Which of the following protocols are examples of TCP/IP network access layer protocols?
a. Ethernet
b. HTTP
c. IP
d. UDP
e. SMTP
f. TCP
g. PPP

3. The process of HTTP asking TCP to send some data and make sure that it is received correctly is an example of what?
a. Same-layer interaction
b. Adjacent-layer interaction
c. The OSI model
d. All the other answers are correct.

4. The process of TCP on one computer marking a segment as segment 1, and the receiving computer then acknowledging the receipt of segment 1, is an example of what?
a. Data encapsulation
b. Same-layer interaction
c. Adjacent-layer interaction
d. The OSI model
e. None of these answers are correct.

5. The process of a web server adding a TCP header to a web page, followed by adding an IP header, and then a data link header and trailer is an example of what?
a. Data encapsulation
b. Same-layer interaction
c. The OSI model
d. All of these answers are correct.

6. Which of the following terms is used specifically to identify the entity that is created when encapsulating data inside data link layer headers and trailers?

a. Data
b. Chunk
c. Segment
d. Frame
e. Packet
f. None of these—there is no encapsulation by the data link layer.

7. Which OSI layer defines the functions of logical network-wide addressing and routing?

a. Layer 1
b. Layer 2
c. Layer 3
d. Layer 4
e. Layer 5
f. Layer 6
g. Layer 7

8. Which OSI layer defines the standards for cabling and connectors?

a. Layer 1
b. Layer 2
c. Layer 3
d. Layer 4
e. Layer 5
f. Layer 6
g. Layer 7

9. Which OSI layer defines the standards for data formats and encryption?

a. Layer 1
b. Layer 2
c. Layer 3
d. Layer 4
e. Layer 5
f. Layer 6
g. Layer 7

10. Which of the following terms are not valid terms for the names of the seven OSI layers?

a. Application
b. Data link
c. Transmission
d. Presentation
e. Internet
f. Session

Fill In The Blanks:

1. Number of links to connect n nodes in a mesh topology is = _____.

2. Mesh Topology is _____ flexible and has a _____ expandability

3. In BUS topology, at each end of the bus is a _____, which absorbs any signal, removing it from the bus.

4. In BUS topology, One can easily add any new node or delete any node with-out affecting other nodes; this makes this topology easily _____.

5. _____ and _____ will force a maximum length of shared medium which can be used in BUS topology.

6. The two alternatives for the operation of the central node in STAR topology are:

_____ and _____.

7. In Ring Topology, the links are _____; that is, data are transmitted in _____ direction only and all are oriented in the same way

8. In Ring Topology, Repeater works in 3 modes: _____, _____ and _____.

9. _____ topology can be considered as an extension to BUS topology.

10. _____ is suitable for use in star and ring topologies

11. Coaxial cable is suitable for use in _____ topology.

Solutions:

1. n(n-1)/2

2. not, poor

3. terminator

4. expandable.

5. Delay, signal unbalancing

6. repeater, switch

7. unidirectional, one

8. Listen, Transmit, By-Pass

9. Tree

10. Twisted pair

11. BUS

Short Answer Questions:

Q-1. List out the advantages and drawbacks of bus topology.

Ans: Advantages:

i) Easy to implement

ii) It is very cost effective because only a single segment required

iii) It is very flexible

iv) Moderate reliability.

v) Can add new station or delete any station easily (scalable)

Disadvantages:

i) Required suitable medium access control technique.

ii) Maximum cable length restriction imposed due to delay and signal

unbalancing problem.

Q-2. List out the advantages and drawbacks of ring topology.

Ans: Advantages:

i) Data insertion, data reception and data removal can be provided by repeater

ii) It can provide multicast addressing.

iii) Point-to-point links to its adjacent nodes (moderate cost)

Disadvantages:

i) The repeater introduces a delay

ii) The topology fails if any link disconnects or a node fails.

iii) Direct link not provided

iv) It provides complex management

Q-3. Why star topology is commonly preferred?

Ans: It gives high reliability, more flexible and higher bandwidth. Since there is a central control point, the control of network is easy and priority can be given to selected nodes.

Q-4. Is there any relationship between transmission media and topology?

Ans: Yes, medium should be selected based on the topology. For example, for bus topology coaxial cable medium is suitable, and for ring/star topology twisted-pair or optical fiber can be used.

Fill In The Blanks:

1. The basic question which has to be answered by the medium-access control techniques is "How Goes _____"?

2. In _____ technique, each node gets a chance to access the medium by rotation.

3. The key issues involved in MAC protocol are - Where and _____ the control is exercised.

4. 'Where' refers to whether the control is exercised in a _____ or _____ manner.

5. The _____ techniques can be broadly categorized into three types; Round-Robin, Reservation and_____.

6. _____ is an example of centralized control and _____ is an example of distributed control

Version 2 CSE IIT, Kharagpur 7. In Polling technique, if there is no data, usually a _____ message is sent back.

8. In pure ALOHA, channel utilization, expressed as throughput S, in terms of the offered load G is given by _____

9. In slotted ALOHA, a maximum throughput of _____ percent at 100 percent of offered load can be achieved, while it is _____ percentage for pure ALOHA.

10. _____ is abbreviated as CSMA/CD and is also known as ._____

11. To achieve stability in CSMA/CD back off scheme, a technique known as _____ is used

Solutions:

1. Next

2. token passing

3. How

4. centralized, distributed

5. asynchronous, Contention

6. Polling, token passing

7. poll reject

8. S=Ge-2G

9. 37, 18

10. Carrier Sensed Multiple Access with Collision Detection, Listen-While-Talk .

11. binary exponential back off

Short Answer Questions:

Q-1. In what situations contention based MAC protocols are suitable?

Ans: Contention based MAC protocols are suitable for bursty nature of traffic under light to moderate load. These techniques are always decentralized, simple and easy to implement.

Q-2. What is vulnerable period? How it affects the performance in MAC protocols?

Ans: The total period of time when collision may occur for a packet is called vulnerable period. Let, all packets have a fixed duration λ. Then vulnerable period is 2λ in pure ALOHA scheme

and λ in slotted ALOHA scheme. If vulnerable period is long, probability of the occurrence collision increases leading to reduction in throughput.

Q-3. How throughput is improved in slotted ALOHA over pure ALOHA?

Ans: In pure ALOHA vulnerable period is 2λ.

So, S/G = e-2G or throughput S = G e-2G , where G is the total number of packets.

Maximum value of G = 0.5 or maximum throughput Smax = 1/2e.

In slotted ALOHA, vulnerable period is λ and S/G = e-G or throughput S = G e-G . Here,

maximum value of G is 1 and maximum throughput Smax = 1/e.

Q-4. What is the parameter 'a'? How does it affect the performance of the CSMA protocol?

Ans: The efficiency of CSMA scheme depends on propagation delay, which is represented by a parameter 'a' as defined below.

$$a = \frac{\text{propagation delay}}{\text{packet transmission time}}$$

Smaller the value of propagation delay, lower is the vulnerable period and higher is the efficiency. If propagation delay is zero, collision cannot occur in CSMA scheme. But in practice, there is some delay and depending on the value of 'a' collision occurs.

Q-5. How performance is improved in CSMA/CD protocol compared to CSMA protocol?

Ans: In CSMA scheme, a station monitors the channel before sending a packet. Whenever a collision is detected, it does not stop transmission leading to some wastage of time. On the other hand, in CSMA/CD scheme, whenever a station detects a collision, it sends a jamming signal by which other station comes to know that a collision occurs. As a result, wastage of time is reduced leading to improvement in performance.

Fill In The Blanks :

1. The 802.2 standard describes the _____, which is the upper part of the data link layer.

2. LLC offers three types services: Unreliable datagram service, _____ and _____.

3. IEEE 802 bundle also includes a MAN standard IEEE 802.6 which is also known as _____.

4. 100Base-T2 means _____

5. 100 Mbps, baseband, long wavelength over optical fiber cable will be abbreviated as _____

6. Ethernet uses _____ encoding

Answers:

1. LLC (logical link layer)

2. Acknowledged datagram service, Reliable connection oriental service

3. Distributed Queue Dual Bus (DQDB)

4. 100 Mbps, baseband, over two twisted-pair cables

5. 1000Base F

6. Bi-phase Manchester

Short question Answers

Q-1 What are the goals in mind of IEEE 802 committee?

Ans: IEEE 802 committee has few goals in mind, namely

– To promote compatibility

– Implementation with minimum efforts

– Accommodate diverse applications

Q-2. List the functions performed by the physical layer of 802.3 standard?

Ans. Functions of physical layer are:

i) Data encoding/decoding (To facilitate synchronization and efficient transfer of signal through the medium).

ii) Collision detection (It detects at the transmit side)

iii) Carrier sensing (Channel access senses a carrier on the channel at both the transmit and receive sides)

iv) Transmit/receive the packets (Frame transmitted to all stations connected to the channel)

v) Topology and medium used (Mediums are co-axial cable, twisted pair and fiber optic cable)

Q-3. Why do you require a limit on the minimum size of Ethernet frame?

Ans. To detect collision, it is essential that a sender continue sending a frame and at the same time receives another frame sent by another station. Considering maximum delay with five Ethernet segments in cascade, the size of frame has been found to be 64 bytes such that the above condition is satisfied.

Q-4. What are the different types of cabling supported by Ethernet standard?

Ans. Types of cabling are:

i) 10 BASE 5 - Maximum cable length is 500 meters using 4" diameter coaxial cable.

ii) 10 BASE 2 - Maximum cable length is 185 meters using 0.25" diameter CATV cable.

iii) 10 BASE T - Maximum cable length is 100 meters using twisted-pair cable (CAT-3 UTP).

iv) 10 BASE FL - Maximum cable length is 2 Km using multimode fiber optic cable (125/62.5 micrometer).

Fill In The Blanks:

1. Originally, _____ developed Token Ring network in the _____.

2. A disadvantage of this topology is that it is vulnerable to _____ or _____ failure.

3. Unlike CSMA/CD networks (such as Ethernet), token-passing networks are _____, which means that it is possible to calculate the maximum time that will pass before any end station will be capable of transmitting.

4. Token Ring frames have two fields that control priority: _____ and the _____field.

Version 2 CSE IIT, Kharagpur 5. In Token Ring inside the wire center, _____ are used to isolate a broken wire or a faulty station.

6. The Mac sublayer in Token BUS consists of four major functions: _____, the access control machine (ACM), _____and ._____

7. _____ determines when to place a frame on the bus, and responsible for the maintenance of the logical ring including the error detection and fault recovery.

Answers:

1. IBM, 1970

2. link, station

3. deterministic

4. the priority field, reservation

5. bypass relays

6. the interface machine (IFM), the receiver machine (RxM), the transmit machine (TxM).

7. Access control machine (ACM)

Short question Answers:

Q-1. What is the advantage of token passing protocol over CSMA/CD protocol?

Ans. Advantage of token passing protocol over CSMA/CD protocol:

The CSMA/CD is not a deterministic protocol. A packet may be delivered after many (up to 15) collisions leading to long variable delay. An unfortunate packet may not get delivered at all. This feature makes CSMA/CD protocol unsuitable for real-time applications. On the other hand, token passing protocol is a

deterministic approach, which allows a packet to be delivered within a known time frame. It also allows priority to be assigned to packets. These are the two key advantages of token passing protocol over CSMA/CD protocol.

Q-2. What are the drawbacks of token ring topology?

Ans. Token ring protocol cannot work if a link or a station fails. So, it is vulnerable to link and station failure.

Q-3. How the reliability of token ring topology can be improved?

Ans. Reliability of the ring network can be improved by implementing the ring topology using a wiring concentrator. This allows not only to detect fault, but also to isolate the faulty link/station with the help of a bypass relay.

Q-4. What role the active token monitor performs?

Ans. Token ring is maintained with the help of active token monitor. Any one of the stations has the capability to act as active token monitor, but at a particular instant only one acts as active token monitor. It monitors various error situations such as multiple token, orphan packet, etc, and takes appropriate action to come out of the error situation.

Fill In The Blanks:

1. The high speed LANs that have emerged can be broadly categorized into three types_____, successors of Ethernet and _____.

2. ATM, fiber channel and the Etherswitches comes under high speed LANs based on _____.

3. _____ is abbreviated as FDDI.

4. FDDI over copper is referred to as _____.

5. The basic topology for FDDI is _____.

6. An _____ provides continuous dual-ring operation if a device on the dual ring fails

7. Each data frame in FDDI carries up to _____ bytes.

8. FDDI gives fair and equal access to the ring by using a _____ protocol.

9. FDDI implements MAC using three timers namely: _____, Token Rotation Timer (TRT) and _____

10. Token holding Timer (THT), which determines ._____

11. The frame status (FS) byte is set by the _____ and checked by the _____ station which removes its frame from the ring and generates another token.

12. When the frame returns to the sending station, that station removes the frame from the ring by a process called _____.

13. The physical layer is divided into two sub layers - _____ and _____

Solutions.

1. based on token passing, based on switching technology.

2. based on switching technology.

3. Fiber Distributed Data Interface

4. Copper-Distributed Data Interface (CDDI).

5. dual counter rotating rings

6. optical bypass switch

7. 4500

8. timed token

9. Token holding Timer (THT), Valid Transmission Timer (VTT)

10. how long a station may continue once it has captured a token

11. destination, source

12. stripping

13. PMD, PHY

Short Questions:

Q-1. In what way the MAC protocol of FDDI differs from that of token ring?

Ans: In the frame format of FDDI protocol, preamble is eight bytes instead of one byte in token ring. Also token has one additional byte. FDDI can have multiple frames simultaneously, which cannot be present in token ring. Here, the access method is timed token passing. Multiple frames can be transmitted after capturing a token. First, the entire token is captured and then the data frames are introduced, whereas token ring follows token passing protocol and beginning of token is converted to the header of a frame. In case of token ring token is released after receiving the acknowledgement (as the data frame returns after circulating the

ring). On the other hand, in case of FDDI, token is released immediately after sending data frame, which is known as early token release.

Q-2. How FDDI offers higher reliability than token ring protocol?

Ans: Token ring protocol is applicable in a single ring. Disadvantage of this protocol is that, if one segment of wires fails or a node fails, the protocol cannot work. To increase reliability, dual counter ring topology used in FDDI protocol, where there are two rings, called primary ring and secondary ring. In case of failure of a node or a fiber link, the ring is restored the by wrapping up the primary ring to the secondary ring. Further improvement in reliability can achieve by using dual ring of trees and dual homing mechanism. It will provide multiple paths and if one path fails, another path will be available for passing token or data.

Q-3 What are the functionalities of a Optical Bypass Switch?

Ans: An optical bypass switch provides continuous dual-ring operation if a device on the dual ring fails. This is used both to prevent ring segmentation and to eliminate failed stations from the ring. The optical bypass switch performs this function using optical mirrors that pass light from the ring directly to the DAS (dual-attachment station) device during normal operation. If a failure of the DAS device occurs, such as a power-off, the optical bypass switch will pass the light through itself by using internal mirrors and thereby will maintain the ring's integrity. When using the OB, you will notice a tremendous digression of your network as the packets are sent through the OB unit.

Q-4 What are the functionalities provided by SMT standard?

Ans: The Station Management (SMT) standard provides services that monitor and control a FDDI station. SMT include facilities for connection management, node configuration, recovery from error condition, and encoding of SMT frames.

Q-5 Describe various fields in frame format of FDDI?

Ans: Let us have a look at the various fields:

SD: The first byte, after the preamble, of the field is the frame’s starting flag. As in

Token ring these bits are replaced in physical layer by the control codes.

FC: it identifies the frame type i.e. token or a data frame.

Address: the next 2 fields are destination and source addresses. Each address consists of 2-6 bytes.

Data: Each data frame carries up to 4500 bytes.

FCS: FDDI uses the standard IEEE four-byte cyclic redundancy check.

ED: this field consists of half a byte in data frame or a full byte in token frame. This represents end of the Token.

FS: FDDI FS field is similar to that of Token Ring. It is included only in data/Command frame and consists of one and a half bytes.

Fill In The Blanks:

1. Switched Ethernet gives dedicated 10 Mb/s bandwidth on _____ of its ports.

2. In Ethernet (IEEE 802.3) the topology, though physically is _____ but logically is BUS. i.e. the collision domain of all the nodes in a LAN is ._____

3. In Switched Ethernet, collision domain is separated. Hub is replaced by a ._____

4. There are two techniques used in the implementation of Ethernet switches: _____ and _____

5. IEEE has designed two categories of Fast Ethernet: _____ and ._____

6. 100-Base-X itself is divided into two: _____ and _____

7. The Gigabit Ethernet Alliance was formed in _____ by _____ companies.

8. The GMII is the interface between the _____ layer and the _____ layer.

9. _____, a sublayer of GMII provides a medium-independent means for the PCS to support various serial bit-oriented physical media.

10. Packet Bursting is an extension of _____. Packet Bursting is "Carrier Extension plus a _____".

Solutions:

1. each

2. star, common

3. switch

4. store-and-forward, cut-through

5. 100Base-X, 100Base-T4

6. 100Base-TX, 100base-FX.

7. May 1996, 11

8. MAC, Physical

9. PMA (Physical Medium Attachment)

10. Carrier Extension, burst of packets

Short Questions:

Q-1. Explain the basic difference between IEEE 802.3 and switched Ethernet, as far as implementation is concerned.

Ans: In Ethernet (IEEE 802.3) the topology, though physically is start but logically is BUS. i.e. the collision domain of all the nodes in a LAN is common. In this situation only one frame can send the frame, if more than one station sends the frame, there is a collision.

In Switched Ethernet, this collision domain is separated. Hub is replaced by a switch, a device that can recognize the destination address and can route the frame to the port to which the destination station is connected, the rest of the media is not involved in the transmission process. The switch can receive another frame from another station at the same time and can route this frame to its own final destination.

Q-2. Explain the two techniques for implementing Ethernet switches.

Ans: There are two techniques used in the implementation of Ethernet switches: storeand-forward and cut-through. In the first case, the entire frame is captured at the incoming port, stored in the switch's memory, and after an address lookup to determine the LAN destination port, forwarded to the appropriate port. The lookup table is automatically built up. On the other hand, a cut-through switch begins to transmit the frame to the destination port as soon as it decodes the destination address from the frame header.

Store-and-forward approach provides a greater level of error detection because damaged frames are not forwarded to the destination port. But, it introduces longer delay of about 1.2 msec for forwarding a frame and suffers from the chance of loosing data due to reliance on

buffer memory. The cut-through switches, on the other hand, has reduced latency but has higher switch cost.

Q-3. What are the different categories of Fast Ethernet?

Ans: IEEE has designed two categories of Fast Ethernet: 100Base-X and 100Base-T4. 100Base-X uses two cables between hub and the station while 100Base-T4 uses four. 100-Base-X itself is divided into two: 100Base-TX and 100base-FX. * 100 BASE-T4: This option is designed to avoid overwriting. It is used for half-duplex communication using four wire-pairs of the existing category 3 UTP cable, which is already available for telephone services in homes/offices. Two of four pairs are bi-directional; other two are

unidirectional. This means that there are 3 pairs to be used for carrying data, in each direction (2 bi-directional and 1 unidirectional). Because 100Mbps data cannot be handled by voicegrade UTP, this specification splits the 100 Mbps flow into three 33.66Mbps flow.

*100 BASE TX: This option uses two category 5 UTP or two shielded (STP) cable to connect a station to hub. One pair is used to carry frames from the hub to the station and other to carry frames from station to hub. Encoding is 4B/5B to handle 100 Mbps; signaling is NRZ-I. The distance between station and hub should be less than 100 meters.

*100 BASE FX: This option uses two Fiber optic cables, one carry frames from station to hub and other from hub to station. The encoding is 4B/5B and signaling in NRZ-I. the distance between station and hub should be less than 2000 meters.

Q-4. What are the Objectives of The Gigabit Ethernet Alliance?

Ans: The objectives of the alliance are:

• supporting extension of existing Ethernet and Fast Ethernet technology in response to demand for higher network bandwidth.

• developing technical proposals for the inclusion in the standard

• establishment of inter-operability test procedures and processes

Q-5. Explain GMII (Gigabit Media Independent Interface) in brief.

Ans: The GMII is the interface between the MAC layer and the Physical layer. It allows any physical layer to be used with the MAC layer. It is an extension of the MII (Media Independent Interface) used in Fast Ethernet. It uses the same management interface as MII. It supports 10, 100 and 1000 Mbps data rates. It provides separate 8-bit wide receive and transmit data paths, so it can support both full-duplex as well as half-duplex operation.

The GMII provides 2 media status signals: one indicates presence of the carrier, and the other indicates absence of collision. With the GMII, it is possible to connect various media types such as shielded and unshielded twisted pair, and single-mode and multi mode optical fiber, while using the same MAC controller. It has three sub-layers namely: PCS (Physical Coding Sublayer), PMA (Physical Medium Attachment) and PMD (Physical Medium Dependent).

Sample Questions

1. What are the major advantages of STP over UTP?
2. Describe the components of fibre optic cable. Draw a picture.
3. Why are slots used in DQDB?
4. What is the difference between network layer delivery and transport layer delivery?
5. How can a device have more than one IP address?
6. Which control bit is involved in setting up a TCP session?
7. What factors effects the data rate of a link?
8. What are the advantages of FDDI over a basic token ring?
9. What 3 functions can SNMP perform to manage network devices?
10. What is the purpose of the timer at the sender in systems using ARQ?
11. Is there any drawback of using piggybacking?
12. Which of the following address does not belong to the same network(no subnetting)? Explain why?
    1. 130.31.23.31
    2. 130.31.24.22
    3. 130.32.23.21
    4. 130.31.21.23

---

1. What are the two reasons for using layered protocols?
2. What do you mean by link to link layers of OSI reference model? Explain their functions briefly?
3. Write a short note on ISDN?
4. What is the difference between boundary level masking and non- boundary level masking? Give examples
5. Draw the IP datagram header format. “IP datagram has a checksum field still it is called an unreliable protocol”. Justify?
6. What are the principles that were applied to arrive at the seven layers in OSI model?
7. Explain the working of 3 bit sliding window protocol with suitable example.
8. Explain the following ARQ techniques in detail
    1. Stop and wait ARQ
    2. Selective repeat ARQ

9. What are the reasons for using layered protocols ?
10. 10 Enumerate the main responsibilities of data link layer ?
11. Is the nyquist theorem true for optical fibre or only for copper wire ? Explain.
12. Why do data link layer protocols position the checksum in the trailer and not in the header ?
13. Compare the maximum window size in go-back-N and selective-repeat ARQs.
14. Why does ATM use the cell of small and fixed length ?
15. Give the equivalent binary word for the polynomial x^8+x^2+x+1.
16. In which of the 7 layers of OSI will a service handling conversion of characters is from EBCDIC to ASCII be normally implemented ?
17. Where is the special IP address 127.0.0.0. used ?
18. Convert the IP address 197.228.17.56 into binary ?
19. Compare satellite with fiber as a communication medium and enumerate the application areas where satellite still holds a niche(or special)marker.
20. A binary signal is sent over a 3-khz channel whose signal-to-noise ratio is 20 db.Calculate the maximum achievable data rate ?
21. What does 'data transparency' mean ? With the help of a flow chart, explain the process of bit de-stuffing at the receiver's end.
22. Assuming classful addressing, find the no of subnets and the no of hosts per subnet foe the following blocks:

    (i) 122.45.77.32/20

    (ii) A class B block having mask of 255.255.192.0

23. Write short note on any four of the following:

    (a) The ATM reference model

    (b) HDLC

    (c) Salient difference between ISO-OSI and TCP/IP models.

    (d) Network Topologies and their uses.

    (e) Wireless networks.

24. (a) Differentiate between static and dynamic channel allocation.

    (b) List out the main responsibilities of the network layer.

(c) Give two examples of a 'collision-free' protocol ?

(d) Why is IP called 'best-effort delivery' protocol?

(e) What is a transparent bridge?

(f) what are the two sub layers of data link layer called ?

(g) What are the other names of IEEE 802.11 protocol or standard?

(h) What is the baud rate of a standard 10 mbps Ethernet LAN ?

(i) What is a minimum data size of an Ethernet frame ?

25. Explain distance vector routing . What are its limitations and how are they overcome?

26.Explain pure-ALOHA and slotted- ALOHA systems.Give the expression for throughout for each,clearly explaining the various terms.

27. Explain 1-persistent, p-persistent and 0-persistent CSMA giving strong and weak points of each.

28. Explain network equipment used in wired-LANS and explain the function of Hub, Switch, and bridge.

29. Write short note on any four of the following:

(a) Token ring

(b) Various fields in Ethernet frame format

(c) Difference between congestion control and QoS(or Quality of service)

(d) FDDI

(e) Traffic shaping using token bucket algorithm

(f) CSMA/CD

30. If the transmitted code word is 10011000 and the received code word is 11001001. What is the error word ? Write transmitted code word , received code word and error word as polynomials.

31.Why transport layer protocols like TCP and UDP are called end-to-end protocols. What is the difference between them?

32. Differentiate between:

(i) Baseband co-axial cable and broad band coaxial cable

(ii) Optical fibre and twisted pair

(iii) SMTP and SNMP

33. What are the basic functions of the data link layer? Write down the basic features of HDLC protocol? Could HDLC be used as a data link protocol for a LAN? Justify your answer.

34. The physical layer service is a non-confirmed service. Assume that some bits of data are lost during transmission over physical media,which layer will detect the loss and take some remedial measures. Explain any one method clearly depicting how this operation is performed.

35. What are the advantages of cell switching that is used in ATM?

36. Outline and discuss the main fields in Ethernet IEEE 802.3 frame. What are the main objectives of preamble ?

37. What is the average number of transmission required to send a frame of length 1600 bytes correctly, if the bit error rate is 1×10^{-6}.

38. Explain what is meant by the term 'integrated service digital network'. Give three reasons a company might choose an ISDN link in preference to a leased line.

39. Subnet the class C network address 198.67.25.0 into eight subnets. Why are the 'all ones' and 'all zeroes' subnets not used ?

40.What do you understand by the term 'structured cabling'. State the main rules that should be used when installing a cable. Show that maximum cabling area for LAN for horizontal cabling runs is approximately 200m.

41. What are the various classes of IP addressing? Calculate the maximum number of class A, B and C network Ids.

42. Why is a data link layer switch preferred over a hub ?

43. Which device is needed to connect two LANs with different network Ids ?

44. When is a translating bridge used ?

45. Can a switch be used to connect two LANs with different network IDs ?

46. Write two ways in which computer applications differ from network applications ?

47. What is count to infinity problem ?

48. What was the reason for selecting a speed of 155.52 Mbps in the original ATM standard ?

49. Contrast link state and distance vector routing protocols, giving an example of each.

50. What is ISO-OSI reference model ? Compare it with TCP/IP reference model. Why TCP/IP reference model is more popular than OSI model ? Which layer is used for the following :

(i) to route packets

(ii) to convert packets to frame

(iii) to detect and correct errors

(iv) to run services like FTP, Telnet etc.

51. Discuss Shannon's capacity. What implications does it have ?

52. Discuss how satellite network differs from traditional networks such as Ethernet, Tokenbus.

53. What is packet switching ? Explain two different approaches of packet switching. ?

54. Doscuss the different factors affecting congestion control algorithms. ?

55. How does a token ring network work ? In what way is it different from Ethernet ?

56. Describe and distinguish between FDMA, TDMA, and CDMA.

57. Discuss the following terms with respect to ATM: VPI, UNI, asynchronous, AAL, Cell , PVC.

58. What is sliding window protocol ? Differentiate between stop-and wait ARQ and Go-back-N protocol.

59. Differentiate between ISO-OSI and TCP/IP reference model.

60. Explain leaky bucket algorithm and compare it with token bucket algorithm.

61. Explain ATM reference model.

62. Explain different kinds of Switching techniques.

63. Differentiate between Link state and Distance Vector Routing algorithm.

64. Explain network layer in ATM,

65. Differentiate between IEEE 802.3, IEEE 802.4 and IEEE 802.5 standards.

66. Explain any three error detection and correction techniques.

67. Explain various cabling techniques used in IEEE 802.3 standard,