

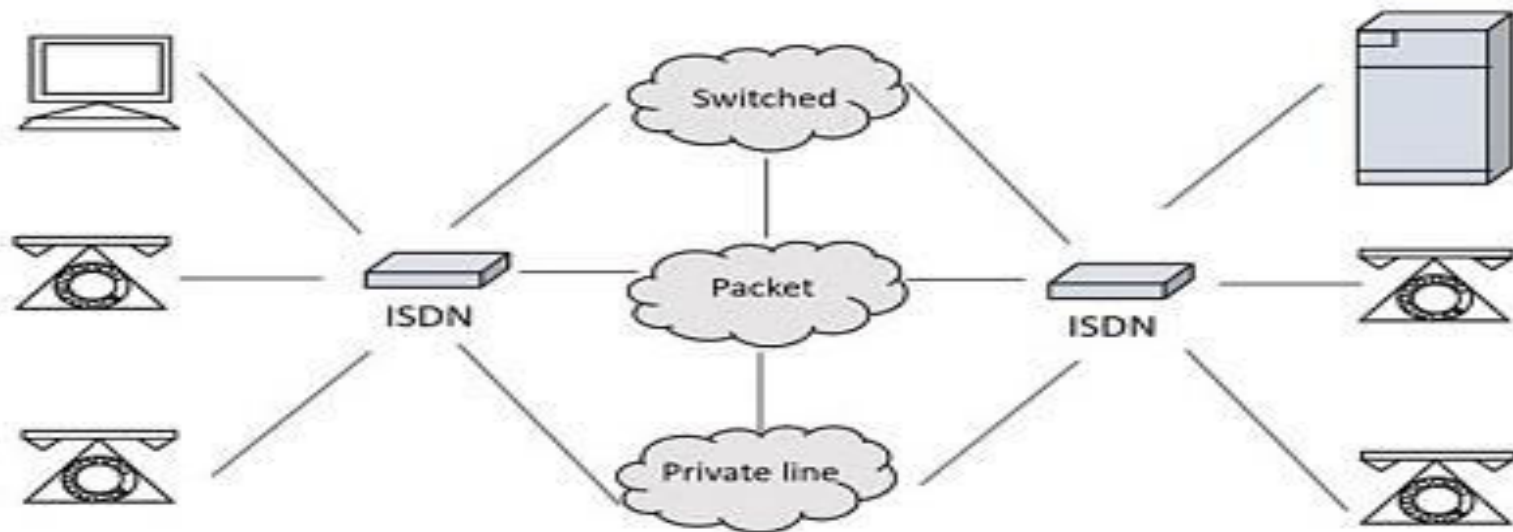
Computer Network

Lecture-16

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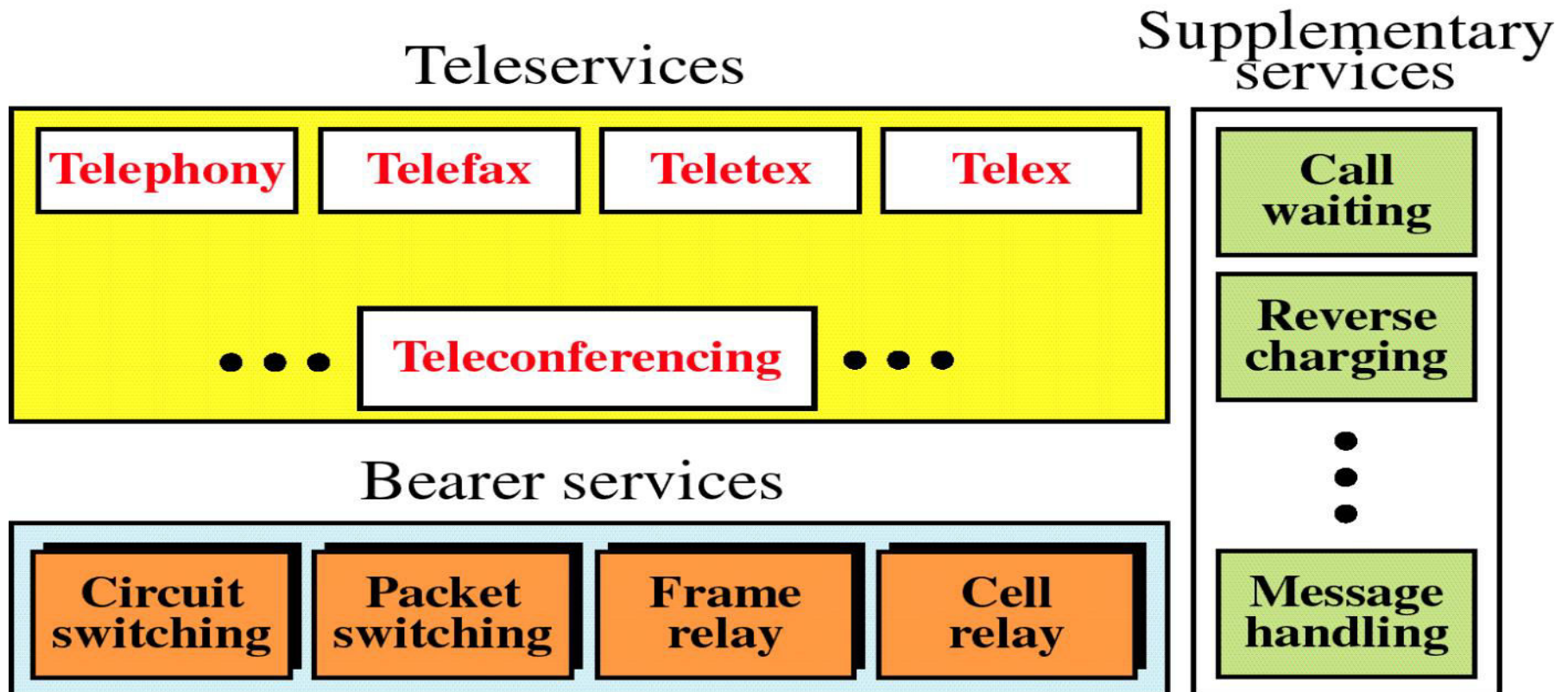
- Its full form is Integrated Services Digital Network.
- ISDN is a telephone network based infrastructure that allows the transmission of voice and data simultaneously at a high speed with greater efficiency.
- This is a circuit switched telephone network system, which also provides access to Packet switched networks.
- The model of a practical ISDN is as shown below:-



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ISDN Services

The purpose of the ISDN is to provide fully integrated digital services to users. These services fall into three categories: bearer services, teleservices and supplementary services.



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Bearer Services

These services provide the means to transfer information between users without the network manipulating the content of that information. The network does not need to process the information and therefore does not change the content. Bearer services belong to the first three layers of the OSI model. They can be provided using circuit-switched, packet-switched, frame-switched or cell switched networks.

Teleservices

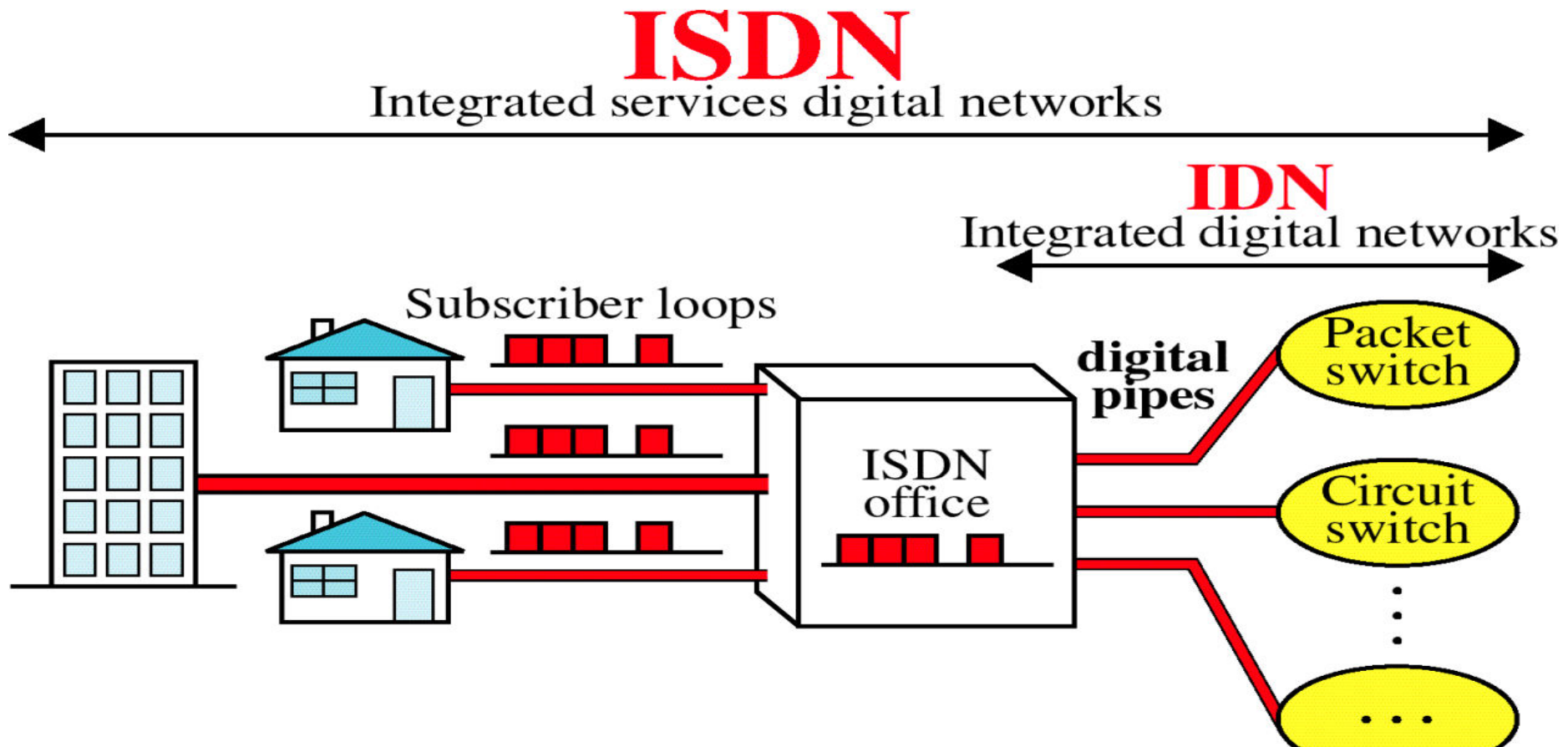
In teleservicing, the network may change or process the contents of the data. These services correspond to layers 4-7 of the OSI model. Teleservices include telephony, teletex, telefax, videotex, telex and teleconferencing.

Supplementary Services

Supplementary services are those services that provide additional functionality to the bearer services and teleservices. These services are reverse charging, call waiting and message handling.

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Following figure gives a conceptual view of the connection between users and an ISDN control office.



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- Each user is linked to the central office through a digital pipe.
- Digital pipes between user and ISDN office are organized into multiple channels of different sizes. ISDN standard defines three channel types, each with different transmission rate: bearer channel, data channel and hybrid channels.

B-Channel (Bearer Channel): Bearer channel is defined at a rate of 64 kbps. It is the basic user channel and can carry any type of digital information in full duplex mode as long as the required information rate does not exceed 64 kbps.

D channel (Data Channel): Data channel can be either 16 or 64 kbps, depending on the needs of user. The primary function of D channel is to carry control signal for the B channel.

H channel (Hybrid Channel): Hybrid channels are available with data rates of 384 Kbps, 1536 Kbps or 1920 Kbps. These rates suit H channels for high data rate applications such as video, teleconferencing and so on.

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User Interfaces

Digital subscriber loops are of two types:

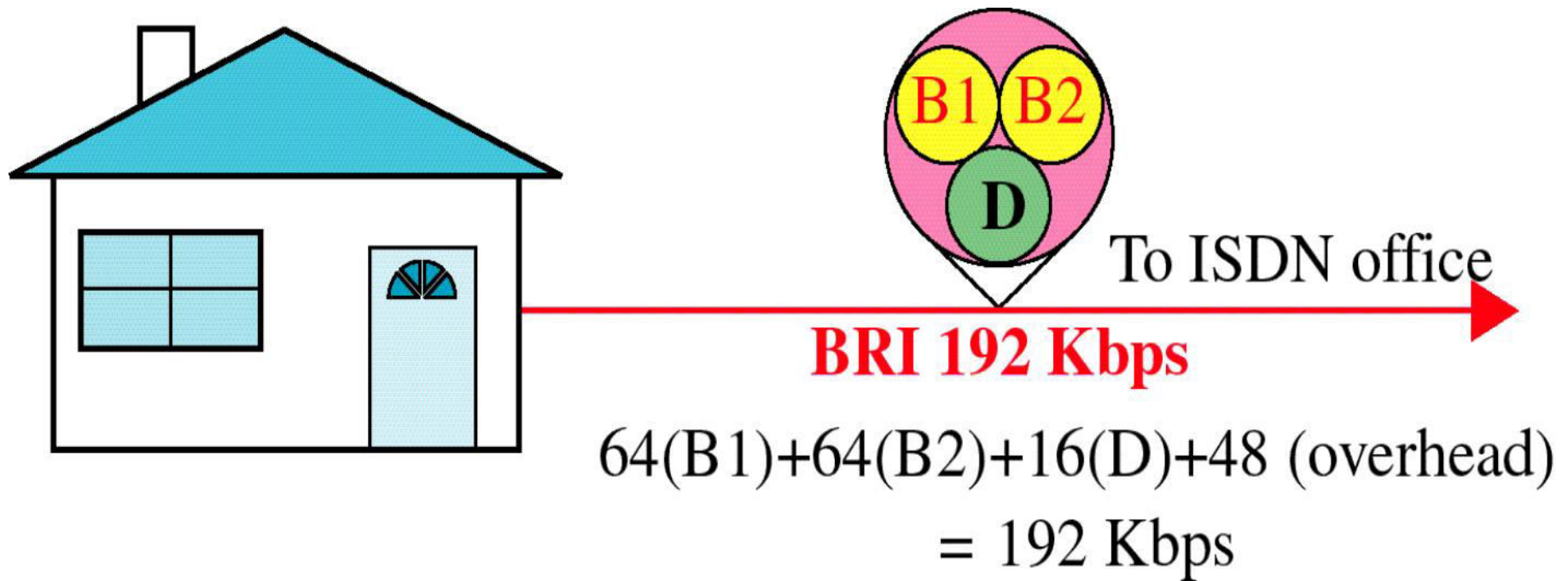
- (1) Basic rate interface (BRI)
- (2) Primary rate interface (PRI)

Each type is suited to a different level of customer needs. Both include one D channel and some number of either B or H channels.

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Basic rate interface

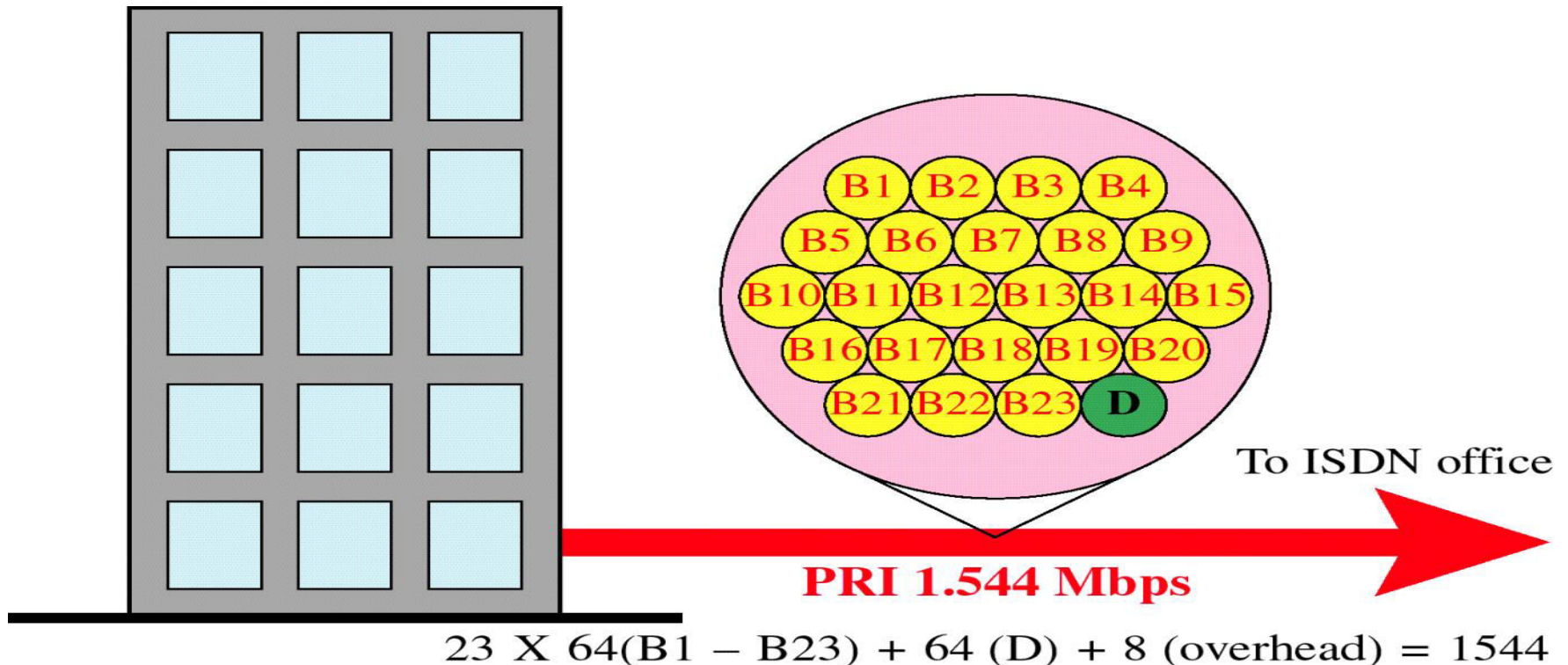
- The basic rate interface specifies a digital pipe consisting of two B channels and one 16 Kbps D channel.
- Two B channel of 64 Kbps each, plus one D channel of 16 Kbps, equal 144 Kbps. In addition, the BRI service itself requires 48 Kbps of operating overhead. Therefore, BRI requires a digital pipe of 192 Kbps.
- BRI is designed to meet the needs of residential and small-office customers.



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Primary rate interface

- The primary rate interface specifies a digital pipe with 23 B channels and one 64 Kbps D channel.
- Twenty three B channels of 64 Kbps each plus one D channel of 64 Kbps equals 1.536 Mbps. In addition, the PRI service itself uses 8 Kbps of overhead. Therefore, PRI requires a digital pipe of 1.544 Mbps.



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Broadband ISDN

- When ISDN was originally designed, data rates of 64 Kbps to 1.544 Mbps were sufficient to handle all existing transmission needs. But after sometimes, this rate is insufficient.
- To provide for the needs of next generation of technology, B-ISDN has been developed. The original ISDN is now known as narrow ISDN(N-ISDN). B-ISDN provides subscribers to the network with data rates in the range of 600 Mbps.

Some questions

Question-1:

A path in a digital circuit-switched network has a data rate of 1 Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 5000 km. Answer the following questions if the propagation speed is 2×10^8 m/s:

- What is the total delay if 1000 bits of data are exchanged during the data transfer phase?
- What is the total delay if 100,000 bits of data are exchanged during the data transfer phase?
- What is the total delay if 1,000,000 bits of data are exchanged during the data transfer phase?
- Find the delay per 1000 bits of data for each of the above cases and compare them. What can you infer?

Some questions

Question-1: Five equal-size datagrams belonging to the same message leave for the destination one after another. However, they travel through different paths as shown in Table.

<i>Datagram</i>	<i>Path Length</i>	<i>Visited Switches</i>
1	3200Km	1,3,5
2	11,700 Km	1,2,5
3	12,200 Km	1,2,3,5
4	10,200 Km	1,4,5
5	10,700 Km	1,4,3,5

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is 2×10^8 m/s, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

AKTU Examination Questions

1. What are header and trailers and how do they get added and removed?
2. What is the difference between network layer delivery and the transport layer delivery?
3. Define topology and explain the advantage and disadvantage of Bus, Star and Ring topologies.
4. What is OSI Model? Explain the functions, protocols and services of each layer?
5. Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with four signal levels. What is the maximum bit rate?

AKTU Examination Questions

6. Encode the data-stream 10011010 using the following encoding scheme:
 - i. Unipolar
 - ii. Bipolar NRZ-L
 - iii. Bipolar NRZ-I
 - iv. RZ
 - v. Manchester
 - vi. Differential Manchester
 - vii. AMI
7. Write four differences between circuit switching and packet switching.
8. Sketch Manchester and differential Manchester encoding for the following bit stream:
10111100010010011101

AKTU Examination Questions

9. What are the services of Transport Layer?
10. What are the major advantages of using optical fiber over twisted pair cable?
11. What do you mean by network architecture? What should be their design issues? Explain briefly.
12. Discuss different types of transmission media with their advantages and disadvantages.
13. Differentiate OSI and TCP/IP reference model. Which one is more popular and why?

AKTU Examination Questions

14. Suppose a signal travels through a transmission medium then find:
 - i. The attenuation (loss of power) if the power is reduced to one half.
 - ii. The amplification (gain of power) if the power is Increased 10 times.
15. What do you mean by transmission impairment? Explain different types of transmission impairment.
16. What are the applications of Computer Networks?
17. List the advantages and disadvantages of ring topology.
18. If a binary signal is sent over a 3KHZ channel. Whose signal to noise ratio is 20db. What is the maximum achievable data rate?

AKTU Examination Questions

19. Explain network topological design with necessary diagram and brief the advantages and disadvantages of various topologies.
20. Discuss the different physical layer transmission media.
21. Write about user access in ISDN.
22. List the advantages and disadvantages of star topology.
23. Explain functionalities of every layer in OSI reference model with neat block diagram.