Q.2 a. Explain simple model of communication with block diagram. (8)

Answer:

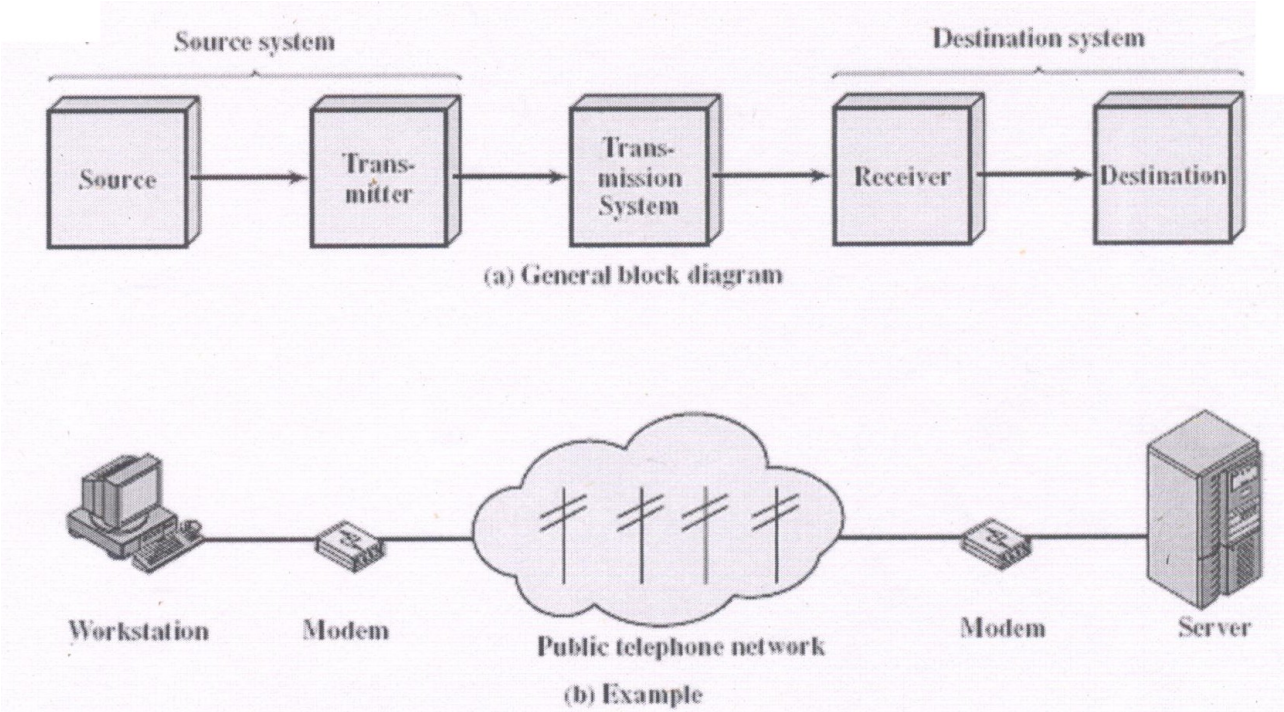


Figure 1.2 Simplified Communications Model

b. Compare OSI and TCP/IP Protocol Architectures. (8)

Answer:

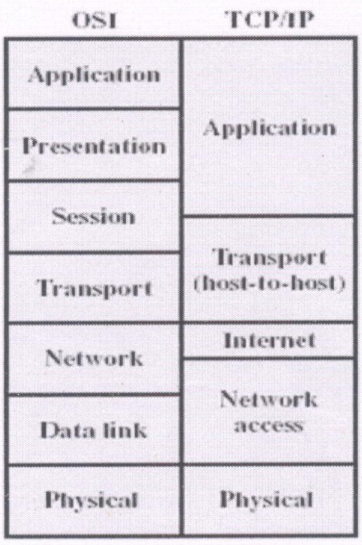


Figure 2.7 A Comparison of the OSI and TCP/IP Protocol Architectures

[4 TCP/IP & OSI Layer diagram + 4 for Explanation]

Q.3 a. Explain the following –
(i) Frequency, Spectrum and Bandwidth.
(ii) Relationship between Data Rate and Bandwidth
(iii) Attenuation and Attenuation Distortion. (8)

Answer:

The frequency is the rate [in cycles persecond, or Hertz (Hz)] at which the signal repeats.

The spectrum of a signal is the range of frequencies that it contains.

However, most of the energy in the signal is contained in a relatively narrow band of frequencies. This band is referred to as the effective bandwidth, or justbandwidth.

There is a direct relationship between data rate and bandwidth: The higher the data rate of a signal, the greater is its required effective bandwidth. Looked at the other way, the greater the bandwidth of a transmission system, the higher is the data rate that can be transmitted over that system.

Another observation worth making is this: If we think of the bandwidth of a signal as being centered about some frequency, referred to as the center frequency, then the higher the center frequency, the higher the potential bandwidth and therefore the higher the potential data rate.

Attenuation: The strength of a signal falls off with distance over any transmission medium. For guided media, this reduction in strength, or attenuation, is generally exponential and thus is typically expressed as a constant number of decibels per unit distance.

Attenuation distortion can present less of a problem with digital signals. The strength of a digital signal falls off rapidly with frequency most of the content is concentrated near the fundamental frequency or bit rate of the signal.

b. Explain the functioning of terrestrial and satellite systems in wireless transmission. Give their respective characteristics. (8)

Answer: Refer pages 107 to 110 of Text Book

Q.4 a. Explain with waveforms three basic encoding techniques for transforming digital data into analog signals. (8)

Answer:

There are three basic encoding or modulation techniques for transforming digital data into analog signals, as illustrated in Figure 5.7: amplitude shift keying (ASK), frequency shift keying (FSK), and phase shift keying (PSK). In all these cases, the resulting signal occupies a bandwidth centered on the carrier frequency.

ASK = 2 [1 for waveform + 1 for Explanation]

FSK = 2 [← do →]

PSK = 4 [2 for waveforms + 2 for Explanations]

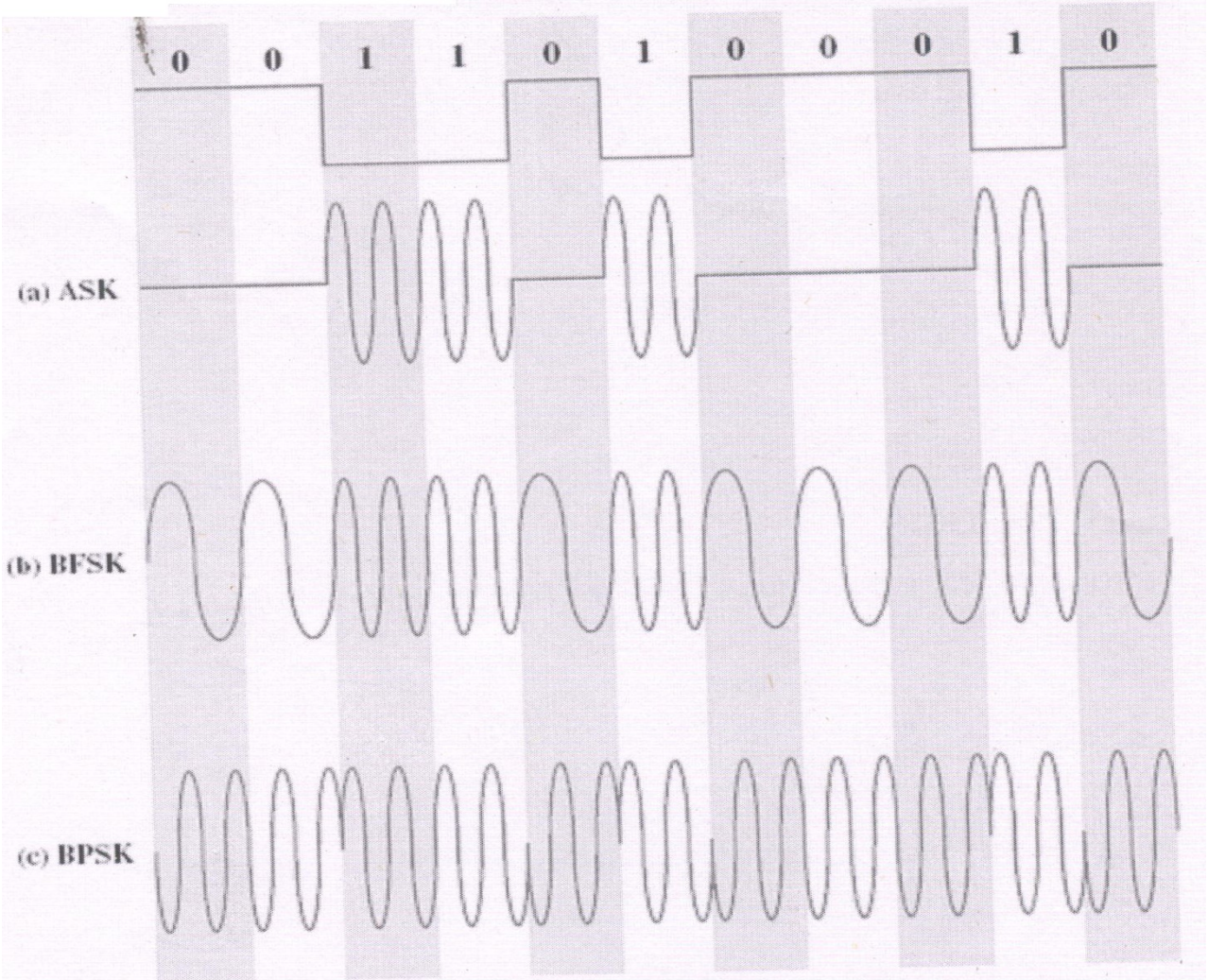


Figure 5.7 Modulation of Analog Signals for Digital Data

b. An asynchronous transmission scheme uses 8 data bits, an even parity bit, and a stop element of length 2 bits. What percentage of clock inaccuracy can be tolerated at the receiver with respect to the framing error? Assume that the bit samples are taken at the middle of the clock period. Also assume that at the beginning of the start bit the clock and incoming bits are in phase. (8)

Answer: Refer problem 8.5 of Text Book

Q.5 a. Explain the basic characteristics of data link protocol HDLC. (8)

Answer:

Basic Characteristics

To satisfy a variety of applications, HDLC defines three types of stations, two link configurations, and three data transfer modes of operation. The three station types are

- **Primary station:** Responsible for controlling the operation of the link. Frames issued by the primary are called commands.
- **Secondary station:** Operates under the control of the primary station. Frames issued by a secondary are called responses. The primary maintains a separate logical link with each secondary station on the line.
- **Combined station:** Combines the features of primary and secondary. A combined station may issue both commands and responses.

The two link configurations are

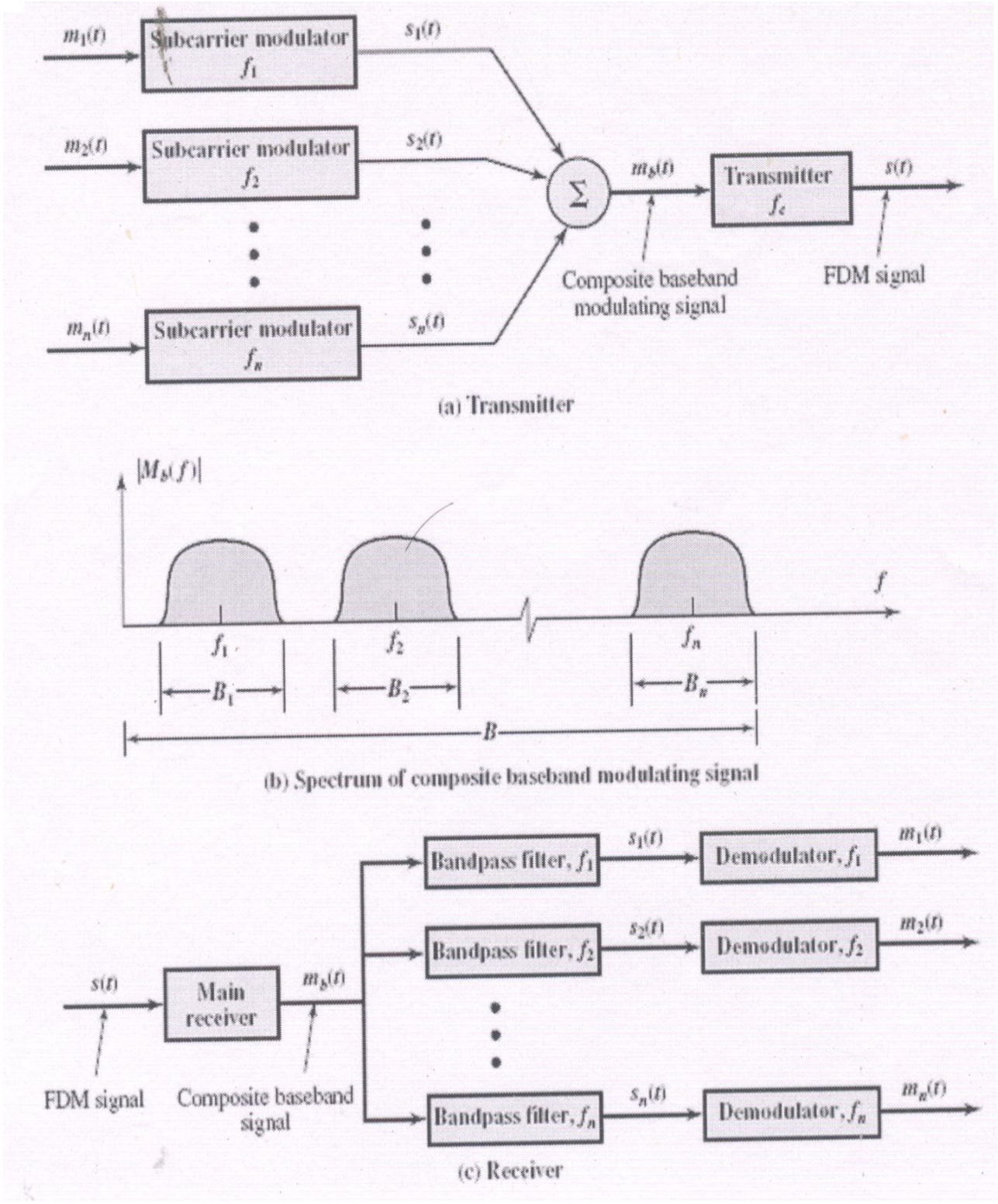
- **Unbalanced configuration:** Consists of one primary and one or more secondary stations and supports both full-duplex and half-duplex transmission.
- **Balanced configuration:** Consists of two combined stations and supports both full-duplex and half-duplex transmission.

The three data transfer modes are

- **Normal response mode (NRM):** Used with an unbalanced configuration. The primary may initiate data transfer to a secondary, but a secondary may only transmit data in response to a command from the primary.
- **Asynchronous balanced mode (ABM):** Used with a balanced configuration. Either combined station may initiate transmission without receiving permission from the other combined station.
- **Asynchronous response mode (ARM):** Used with an unbalanced configuration. The secondary may initiate transmission without explicit permission of the primary. The primary still retains responsibility for the line, including initialization, error recovery, and logical disconnection.

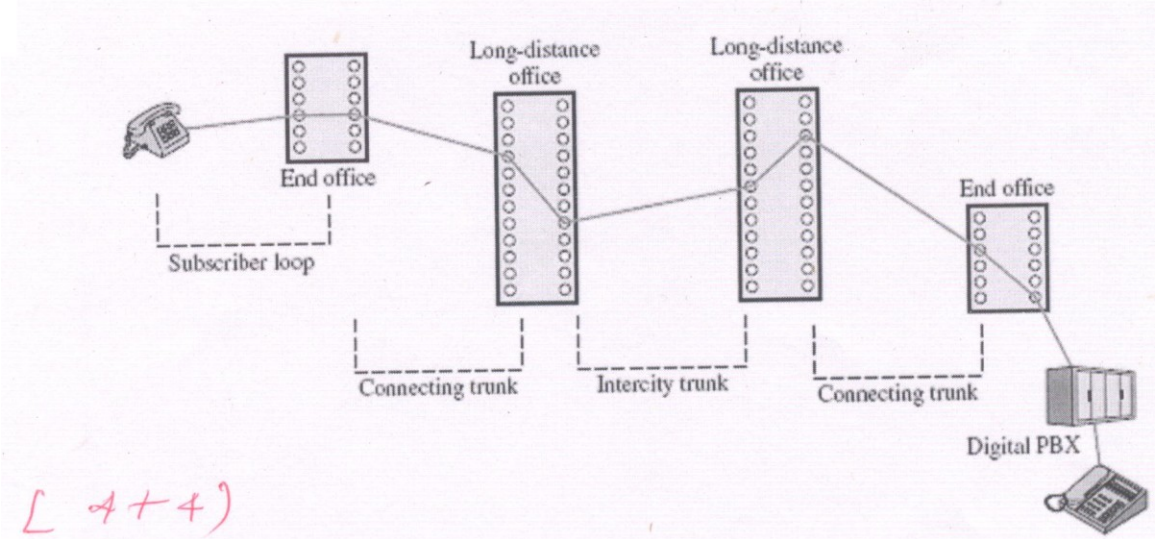
b. Explain the working of FDM system transmitter and Receiver. (8)

Answer:



Q.6 a. Explain with example connection over a Public Circuit-Switching Network. (8)

Answer:

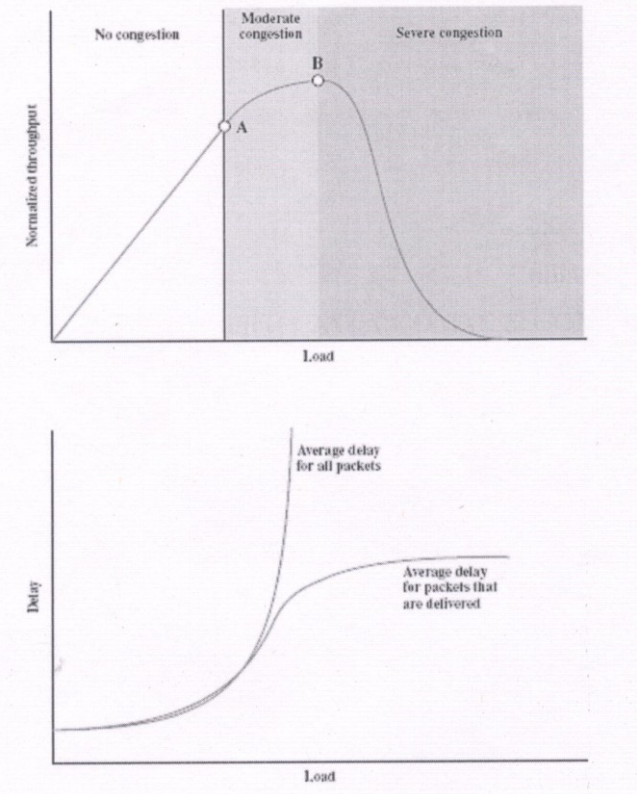


[4+4]

Figure 10.2 Example Connection Over a Public Circuit-Switching Network

b. Explain the Effects of Congestion drawing profiles of Delay v/s Load and Normalized throughput and Load. (8)

Answer:



Q.7 a. Explain the Typical characteristics of Backend Networks and Storage Area Networks. (8)

Answer:

Backend Networks Typical characteristics include the following:

- **High data rate:** To satisfy the high-volume demand, data rates of 100 Mbps or more are required.
- **High-speed interface:** Data transfer operations between a large host system and a mass storage device are typically performed through high-speed parallel I/O interfaces, rather than slower communications interfaces. Thus, the physical link between station and network must be high speed.
- **Distributed access:** Some sort of distributed medium access control (MAC) technique is needed to enable a number of devices to share the transmission medium with efficient and reliable access.
- **Limited distance:** Typically, a backend network will be employed in a computer room or a small number of contiguous rooms.
- **Limited number of devices:** The number of expensive mainframes and mass storage devices found in the computer room generally numbers in the tens of devices.

A SAN is a separate network to handle storage needs. The SAN detaches storage tasks from specific servers and creates a shared storage facility across a high-speed network. The collection of networked storage devices can include hard disks, tape libraries, and CD arrays. Most SANs use Fibre Channel. In a typical large LAN installation, a number of servers and perhaps mainframes each has its own dedicated storage devices. If a client needs access to a particular storage device, it must go through the server that controls that device. In a SAN, no server sits between the storage devices and the network; instead, the storage devices and servers are linked directly to the network. The SAN arrangement improves client-to-storage access efficiency, as well as direct storage-to-storage communications for backup and replication functions.

b. Explain the functions Frame Format of IEEE 802.3 and explain the function of each field. (8)

Answer:

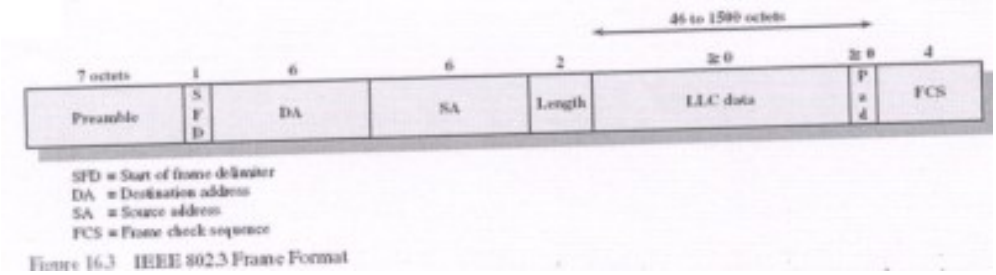


Figure 16.3 IEEE 802.3 Frame Format

- **Preamble:** A 7-octet pattern of alternating 0s and 1s used by the receiver to establish bit synchronization.
- **Start Frame Delimiter (SFD):** The sequence 10101011, which indicates the actual start of the frame and enables the receiver to locate the first bit of the rest of the frame.
- **Destination Address (DA):** Specifies the station(s) for which the frame is intended. It may be a unique physical address, a group address, or a global address.

Q.8 a. Explain the protocol functions of Encapsulation, Fragmentation and reassembly. (8)

Answer:

Encapsulation

For virtually all protocols, data are transferred in blocks, called protocol data units (PDUs). Each PDU contains not only data but also control information. Indeed, some PDUs consist solely of control information and no data. The control information falls into three general categories:

- **Address:** The address of the sender and/or receiver may be indicated.
- **Error-detecting code:** Some sort of frame check sequence is often included for error detection.
- **Protocol control:** Additional information is included to implement the protocol functions listed in the remainder of this section.

A protocol is concerned with exchanging data between two entities. Usually, the transfer can be characterized as consisting of a sequence of PDUs of some bounded size. Whether the application entity sends data in messages or in a continuous stream, lower-level protocols typically organize the data into blocks. Further, a protocol may need to divide a block received from a higher layer into multiple blocks of some smaller bounded size. This process is called fragmentation.

b. Draw and explain functions of IPv4 Header. (8)

Answer:

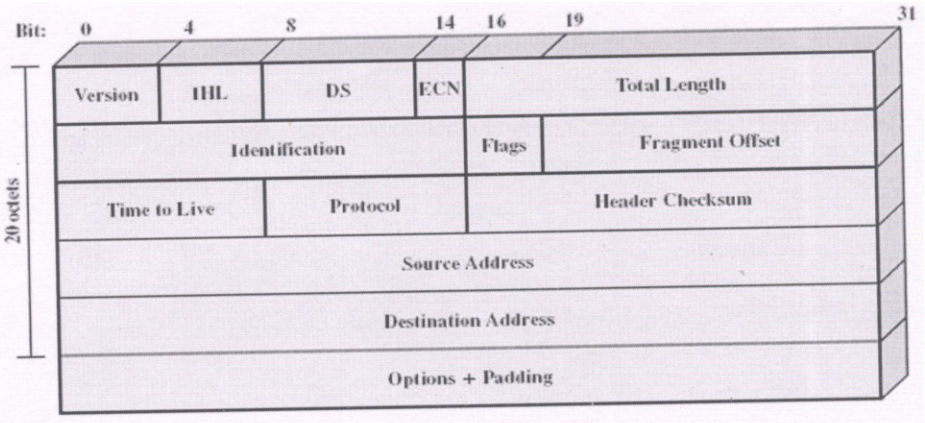


Figure 18.6 IPv4 Header

4 for drawing
+4 for explanation

Q.9 a. Explain the functions of BGP and also justify why BGP has become the preferred exterior router protocol for internet. (8)

Answer:

Border Gateway Protocol

The Border Gateway Protocol (BGP) was developed for use in conjunction with internets that employ the TCP/IP suite, although the concepts are applicable to any internet. BGP has become the preferred exterior router protocol for the Internet.

Functions BGP was designed to allow routers, called gateways in the standard, in different autonomous systems (ASs) to cooperate in the exchange of routing information. The protocol operates in terms of messages, which are sent over TCP connections. The repertoire of messages is summarized in Table 19.2. The current version of BGP is known as BGP-4 (RFC 1771).

Three functional procedures are involved in BGP:

- Neighbor acquisition
- Neighbor reachability
- Network reachability

Two routers are considered to be neighbors if they are attached to the same network. If the two routers are in different autonomous systems, they may wish to exchange routing information. For this purpose, it is necessary first to perform **neighbor acquisition**. In essence, neighbor acquisition occurs when two neighboring routers in different autonomous systems agree to exchange routing information regularly. A formal acquisition procedure is needed because one of the routers may not wish to participate. For example, the router may be overburdened and does not want to be responsible for traffic coming in from outside the system. In the neighbor acquisition process, one router sends a request message to the other, which may either accept or refuse the offer. The protocol does not address the issue of how one router knows the address or even the existence of another router, nor how it decides that it needs to exchange routing information with that particular router. These issues must be dealt with at configuration time or by active intervention of a network manager.

b. Explain the MIME transfer Encodings. (8)

Answer:

Table 22.4 MIME Transfer Encodings

7bit	The data are all represented by short lines of ASCII characters.
8bit	The lines are short, but there may be non-ASCII characters (octets with the high-order bit set).
binary	Not only may non-ASCII characters be present but the lines are not necessarily short enough for SMTP transport.
quoted-printable	Encodes the data in such a way that if the data being encoded are mostly ASCII text, the encoded form of the data remains largely recognizable by humans.
base64	Encodes data by mapping 6-bit blocks of input to 8-bit blocks of output, all of which are printable ASCII characters.
x-token	A named nonstandard encoding.

4 for naming types of encoding
4 for Short Explanation

TEXT BOOK

I. Data and Computer Communications, Eight Edition (2007), William Stallings, Pearson Education Low Price Edition.