Q.2 a. What are the responsibilities of the network and transport layers in TCP/IP model? (8)

Answer:

The **network access layer** is concerned with the exchange of data between end system (server, workstation, etc.) and the network to which it is attached. The sending computer must provide the network with the address of the destination computer, so that the network may route the data to the appropriate destination. The sending computer may wish to invoke certain services, such as priority, that might be provided by the network.The specific software used at this layer depends on the type of network to be used; different standards have been developed for circuit switching, packet switching (e.g., frame relay), LANs (e.g., Ethernet), and others. Thus it makes sense to separate those functions having to do with network access into a separate layer. By doing this, the remainder of the communications software, above the network access layer, need not be concerned about the specifics of the network to be used. The same higher-layer software should function properly regardless of the particular network to which the computer is attached.

Regardless of the nature of the applications that are exchanging data, there is usually a requirement that data be exchanged reliably. That is, we would like to be assured that all of the data arrive at the destination application and that the data arrive in the same order in which they were sent. As we shall see, the mechanisms for providing reliability are essentially independent of the nature of the applications.

Thus, it makes sense to collect those mechanisms in a common layer shared by all applications; this is referred to as the **host-to-host layer**, or **transport layer**. The Transmission Control Protocol (TCP) is the most commonly used protocol to provide this functionality.

b. What are the key elements of the internet, explain with simple network diagram? (5)

Answer:

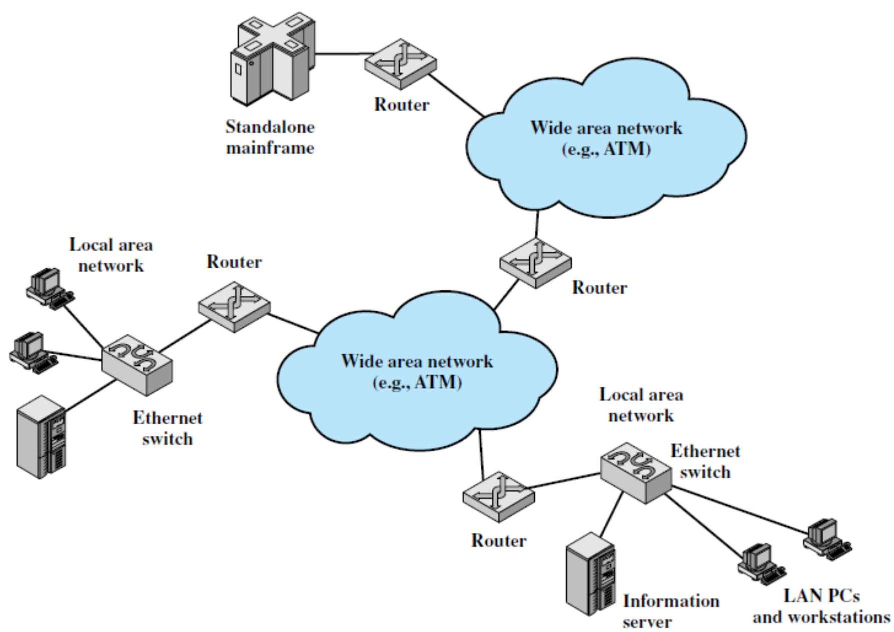


Figure 1.4 Key Elements of the Internet

A key element of the Internet is the set of hosts attached to it. Simply put, a host is a computer, computers come in many forms, including mobile phones and even many sensor based devices(smart devices) . All of these forms can be hosts on the Internet. Hosts are sometimes grouped together in a LAN.This is the typical configuration in a corporate environment.

Ethernet switch:

A network switch (also called switching hub, bridging hub, officially MAC bridge[1]) is a computer networking device that connects devices together on a computer network, by using packet switching to receive, process and forward data to the destination device.

Router :

A router is a networking device that forwards data packets between computer networks. Routers perform the "traffic directing" functions on the Internet.

LAN : A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, or office building

c. Explain half-duplex and full-duplex mode of communication between two devices. (3)

Answer:

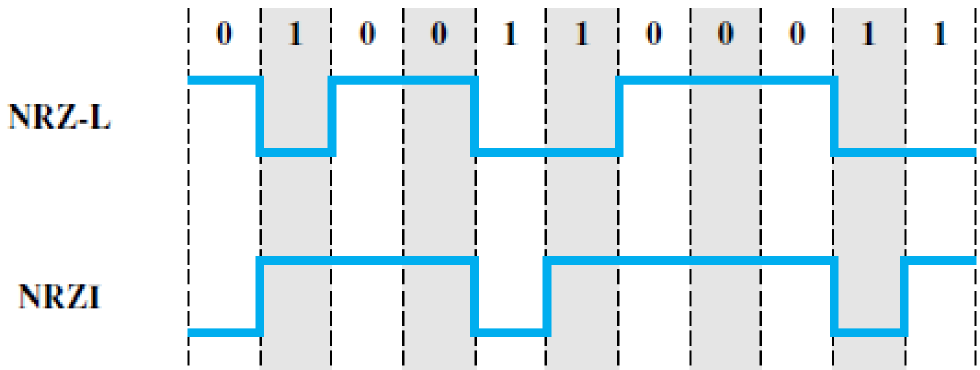
In a **full duplex** system, both parties can communicate with each other simultaneously. An example of a full-duplex device is atelephone; the parties at both ends of a call can speak and be heard by the other party simultaneously. The earphone reproduces the speech of the remote party as the microphone transmits the speech of the local party, because there is a two-way communication channel between them, or more strictly speaking, because there are two communication paths/channels between them.

In a **half-duplex** system, there are still two clearly defined paths/channels, and each party can communicate with the other but not simultaneously; the communication is one direction at a time. An example of a half-duplex device is a walkie-talkie two-way radio that has a "push-to-talk" button; when the local user wants to speak to the remote person they push this button, which turns on the transmitter but turns off the receiver, so they cannot hear the remote person. To listen to the other person they release the button, which turns on the receiver but turns off the transmitter.

Q.3 a. Explain the following line coding schemes with a graph- (8)
(i) Polar NRZ
(ii) Differential Manchester encoding
(iii) Bipolar-AMI

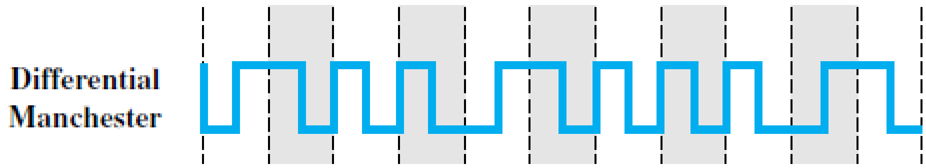
Answer:

(I). polar NRZ



The most common, and easiest, way to transmit digital signals is to use Two different voltage levels for the two binary digits. Codes that follow this strategy share the property that the voltage level is constant during a bit interval; there is no transition (no return to a zero voltage level). For example, the absence of voltage can be used to represent binary 0, with a constant positive voltage used to represent binary 1. More commonly, a negative voltage represents one binary value and a positive voltage represents the other. This latter code, known as **Nonreturn to Zero-Level** (NRZ-L), is illustrated2 in Figure 5.2. NRZ-L is typically the code used to generate or interpret digital data by terminals and other devices. If a different code is to be used for transmission, it is generated from an NRZ-L signal by the transmission system [in terms of Figure 5.1, NRZ-L is *g*(*t*) and the encoded signal is *x*(*t*)].
A variation of NRZ is known as **NRZI** (Nonreturn to Zero, invert on ones). As with NRZ-L, NRZI maintains a constant voltage pulse for the duration of a bit time.The data themselves are encoded as the presence or absence of a signal transition at the beginning of the bit time. A transition (low to high or high to low) at the beginning of a bit time denotes a binary 1 for that bit time; no transition indicates a binary 0.

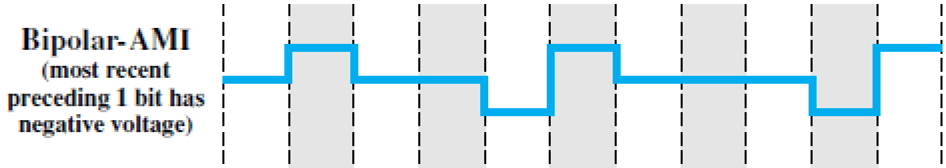
(II). differential Manchester encoding



In differential Manchester, the midbit transition is used only to provide clocking.The encoding of a 0 is represented by the presence of a transition at the beginning of a bit period, and a 1 is represented by the absence of a transition at the beginning of a bit period. Differential Manchester has the added advantage of employing differential encoding.

(III).BI polar AMI

ANS:



In the case of the **bipolar-AMI** scheme, a binary 0 is represented by no line signal, and a binary 1 is represented by a positive or negative pulse. The binary 1 pulses must alternate in polarity. There are several advantages to this approach.

First, there will be no loss of synchronization if a long string of 1s occurs. Each 1 introduces a transition, and the receiver can resynchronize on that transition. A long string of 0s would still be a problem. Second, because the 1 signals alternate in voltage from positive to negative, there is no net dc component. Also, the bandwidth of the resulting signal is considerably less than the bandwidth for NRZ (Figure 5.3). Finally, the pulse alternation property provides a simple means of error detection. Any isolated error, whether it deletes a pulse or adds a pulse, causes a violation of this property

b. Explain the process of Delta Modulation (DM) technique. (8)

Answer:

A variety of techniques have been used to improve the performance of PCM or to reduce its complexity. One of the most popular alternatives to PCM is delta modulation(DM).With delta modulation, an analog input is approximated by a staircase function that moves up or down by one quantization level at each sampling interval

An example is shown in Figure 5.20, where the staircase function is overlaid on the original analog waveform. The important characteristic of this staircase function is that its behavior is binary: At each sampling time, the function moves up or down a constant amount Thus, the output of the delta modulation process can be represented as a single binary digit for each sample. In essence, a bit stream is produced by approximating the derivative of an analog signal rather than its amplitude:A 1 is generated if the staircase function is to go up during the next interval; a 0 is generated otherwise.

The transition (up or down) that occurs at each sampling interval is chosen so that the staircase function tracks the original analog waveform as closely as possible.

Below figure illustrates the logic of the process, which is essentially a feedback mechanism. For transmission, the following occurs:

At each sampling time, the analoginput is compared to the most recent value of the approximating staircase function.

If the value of the sampled waveform exceeds that of the staircase function, a 1 is generated; otherwise, a 0 is generated. Thus, the staircase is always changed in the direction of the input signal. The output of the DM process is therefore a binary sequence that can be used at the receiver to reconstruct the staircase function. The staircase function can then be smoothed by some type of integration process or by passing it through a lowpass filter to produce an analog approximation of the analog input signal.

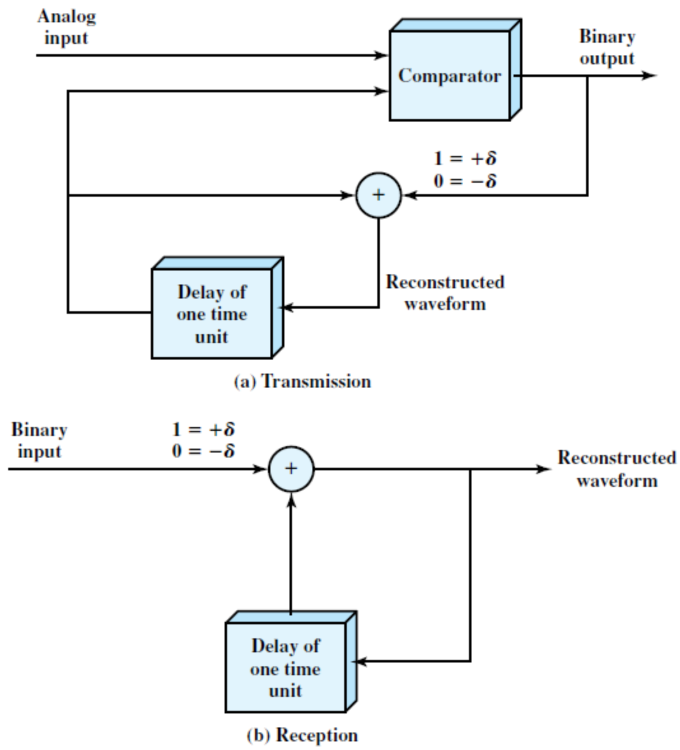


Figure 5.21 Delta Modulation

Q.4 a. Explain how error-detecting code CRC works. (8)

Answer:

A cyclic redundancy check (CRC) is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data. Blocks of data entering these systems get a short *check value* attached, based on the remainder of apolynomial division of their contents. On retrieval the calculation is repeated, and corrective action can be taken against presumed data corruption if the check values do not match.

CRCs are so called because the *check* (data verification) value is a *redundancy* (it expands the message without adding information) and the algorithm is based on *cyclic* codes. CRCs are popular because they are simple to implement in binary hardware, easy to analyze mathematically, and particularly good at detecting common errors caused by noise in transmission channels. Because the check value has a fixed length, the function that generates it is occasionally used as a hash function.

To compute an *n*-bit binary CRC, line the bits representing the input in a row, and position the (*n* + 1)-bit pattern representing the CRC's divisor (called a "polynomial") underneath the left-hand end of the row.

Start with the message to be encoded:

```
11010011101100
```

This is first padded with zeros corresponding to the bit length *n* of the CRC. Here is the first calculation for computing a 3-bit CRC:

```
11010011101100 000 <--- input right padded by 3 bits
1011               <--- divisor (4 bits) = x³ + x + 1
------------------
01100011101100 000 <--- result
```

The algorithm acts on the bits directly above the divisor in each step. The result for that iteration is the bitwise XOR of the polynomial divisor with the bits above it. The bits not above the divisor are simply copied directly below for that step. The divisor is then shifted one bit to the right, and the process is repeated until the divisor reaches the right-hand end of the input row. Here is the entire calculation:

```
11010011101100 000 <--- input right padded by 3 bits
1011               <--- divisor
01100011101100 000 <--- result (note the first four bits
are the XOR with the divisor beneath, the rest of the
bits are unchanged)
 1011              <--- divisor ...
00111011101100 000
  1011
00010111101100 000
   1011
00000001101100 000 <--- note that the divisor moves over
to align with the next 1 in the dividend (since quotient
for that step was zero)
       1011             (in other words, it doesn't
necessarily move one bit per iteration)
00000000110100 000
        1011
00000000011000 000
         1011
00000000001110 000
          1011
00000000000101 000
           101 1
```

```
-----------------
00000000000000 100 <--- remainder (3 bits).  Division
algorithm stops here as quotient is equal to zero.
```

Since the leftmost divisor bit zeroed every input bit it touched, when this process ends the only bits in the input row that can be nonzero are the n bits at the right-hand end of the row. These *n* bits are the remainder of the division step, and will also be the value of the CRC function (unless the chosen CRC specification calls for some postprocessing).

The validity of a received message can easily be verified by performing the above calculation again, this time with the check value added instead of zeroes. The remainder should equal zero if there are no detectable errors.

```
11010011101100 100 <--- input with check value
1011               <--- divisor
```

```
01100011101100 100 <--- result
 1011              <--- divisor ...
00111011101100 100

......

00000000001110 100
          1011
00000000000101 100
              101 1
   -----------------
```

0 <--- remainder

b. Explain physical description, applications and transmission characteristics of the least expensive and most widely used guided transmission medium (8)

Answer:

Twisted Pair

The least expensive and most widely used guided transmission medium is twisted pair.

Physical Description

A twisted pair consists of two insulated copper wires arranged in a regular spiral pattern. A wire pair acts as a single communication link. Typically, a number of these pairs are bundled together into a cable by wrapping them in a tough protective sheath. Over longer distances, cables may contain hundreds of pairs.The twisting tends to decrease the crosstalk interference between adjacent pairs in a cable. Neighboring pairs in a bundle typically have somewhat different twist lengths to reduce the crosstalk interference. On long-distance links, the twist length typically varies from 5 to 15 cm.The wires in a pair have thicknesses of from 0.4 to 0.9 mm.

Applications By far the most common guided transmission medium for both analog and digital signals is twisted pair. It is the most commonly used medium in the telephone network and is the workhorse for communications within buildings.
In the telephone system, individual residential telephone sets are connected to the local telephone exchange, or "end office," by twisted-pair wire. These are referred to as **subscriber loops**.Within an office building, each telephone is also connected to a twisted pair, which goes to the in-house private branch exchange (PBX) system or to a Centrex facility at the end office.These twisted-pair installations were designed to support voice traffic using analog signaling. However, by means of a modem, these facilities can handle digital data traffic at modest data rates.
Twisted pair is also the most common medium used for digital signaling. For connections to a digital data switch or digital PBX within a building, a data rate of 64 kbps is common. Twisted pair is also commonly used within a building for local area networks supporting personal computers. Data rates for such products are typically in the neighborhood of 100 Mbps. However, twisted-pair networks with data rates of to 10 Gbps have been developed, although these are quite limited in terms of the number of devices and geographic scope of the network. For long-distance applications, twisted pair can be used at data rates of 4 Mbps or more.
Twisted pair is much less expensive than the other commonly used guided transmission media (coaxial cable, optical fiber) and is easier to work with.

Transmission Characteristics Twisted pair may be used to transmit both analog and digital transmission. For analog signals, amplifiers are required about every 5 to 6 km. For digital transmission (using either analog or digital signals), repeaters are required every 2 or 3 km.

Q.5 a. Which layers of TCP/IP model uses sliding window protocol? (2)

Answer:

data link layer and transport layer

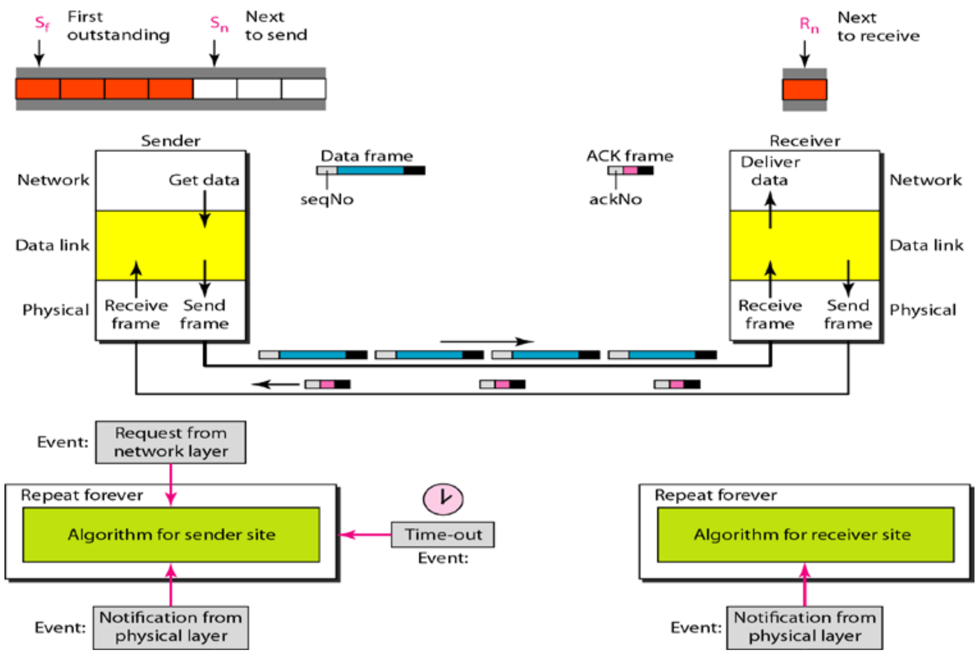
b. Explain Go-Back-N ARQ through suitable diagram. (6)

Answer:

Go-Back-N ARQ is a specific instance of the automatic repeat request (ARQ) protocol, in which the sending process continues to send a number of frames specified by a *window size* even without receiving an acknowledgement (ACK) packet from the receiver. It is a special case of the general sliding window protocol with the transmit window size of N and receive window size of 1. It can transmit N frames to the peer before requiring an ACK.

The receiver process keeps track of the sequence number of the next frame it expects to receive, and sends that number with every ACK it sends. The receiver will discard any frame that does not have the exact sequence number it expects (either a duplicate frame it already acknowledged, or an out-of-order frame it expects to receive later) and will resend an ACK for the last correct in-order frame. [1] Once the sender has sent all of the frames in its *window*, it will detect that all of the frames since the first lost frame are*outstanding*, and will go back to the sequence number of the last ACK it received from the receiver process and fill its window starting with that frame and continue the process over again.

Go-Back-N ARQ is a more efficient use of a connection than Stop-and-wait ARQ, since unlike waiting for an acknowledgement for each packet, the connection is still being utilized as packets are being sent. In other words, during the time that would otherwise be spent waiting, more packets are being sent. However, this method also results in sending frames multiple times – if any frame was lost or damaged, or the ACK acknowledging them was lost or damaged, then that frame and all following frames in the window (even if they were received without error) will be re-sent. To avoid this, Selective Repeat ARQ can be used.



ARQ

c. What are differences between Go-Back-N ARQ and Stop-and-Wait ARQ?(4)

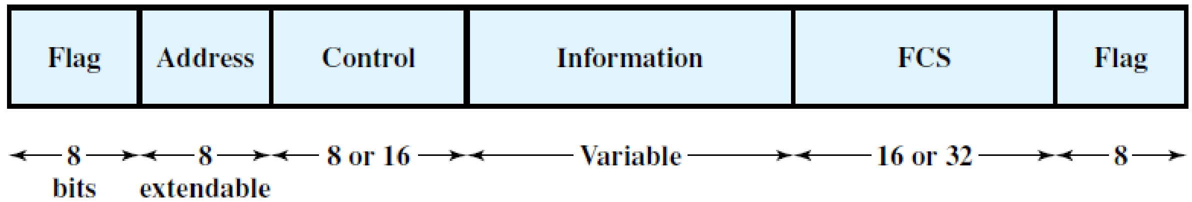
Answer:

Go-Back-N ARQ is a form of the automatic repeat request (ARQ) protocol, in which the sending party continues to send a stipulated number of frames without waiting for an acknowledgement (ACK) from the receiver. Once the sender has sent the specified number of frames, it detects the first lost frame from the acknowledgements. The sender will then go back to sequence number of the last ACK it received from the receiver process before this and resends the frames after that.

In the case of the stop-and-wait ARQ, the sender sends one frame at a time. After sending each frame, the sender waits until it receives and acknowledgement (ACK) signal. After receiving a good frame, the receiver sends an ACK. If the senderdoes not receive the ACK before a certain time, known as the timeout, the sender sends the same frame again

d. Draw the structure of the HDLC frame explain its trailer part fields. (4)

Answer:



The trailer part contains FCS and The Flags.

FCS :

Frame Check Sequence Field The frame check sequence (FCS) is an errordetecting code calculated from the remaining bits of the frame, exclusive of flags. The normal code is the 16-bit CRC-CCITT . An optional 32-bit FCS, using CRC-32, may be employed if the frame length or the line reliability dictates this chice

Flag Fields Flag fields delimit the frame at both ends with the unique pattern 01111110.A single flag may be used as the closing flag for one frame and the opening flag for the next. On both sides of the user-network interface, receivers are continuously hunting for the flag sequence to synchronize on the start of a frame. While receiving a frame, a station continues to hunt for that sequence to determine the end of the frame. Because the protocol allows the presence of arbitrary bit patterns (i.e., there are no restrictions on the content of the various fields imposed by the link protocol), there is no assurance that the pattern 01111110 will not appear somewhere inside the frame, thus destroying synchronization.To avoid this problem, a procedure known as *bit stuffing* is used. For all bits between the starting and ending flags, the transmitter inserts an extra 0 bit after each occurrence of five 1s in the frame. After detecting a starting flag, the receiver monitors the bit stream.When a pattern of five 1s appears, the sixth bit is examined. If this bit is 0, it is deleted. If the sixth bit is a 1 and the seventh bit is a 0, the combination is accepted as a flag. If the sixth and seventh bits are both 1, the sender is indicating an abort condition.
With the use of bit stuffing, arbitrary bit patterns can be inserted into data field of the frame.This property is known as **data transparency**.

Q.6 a. Compare the Circuit Switching and Packet Switching with event timing diagram. (8)

Answer:

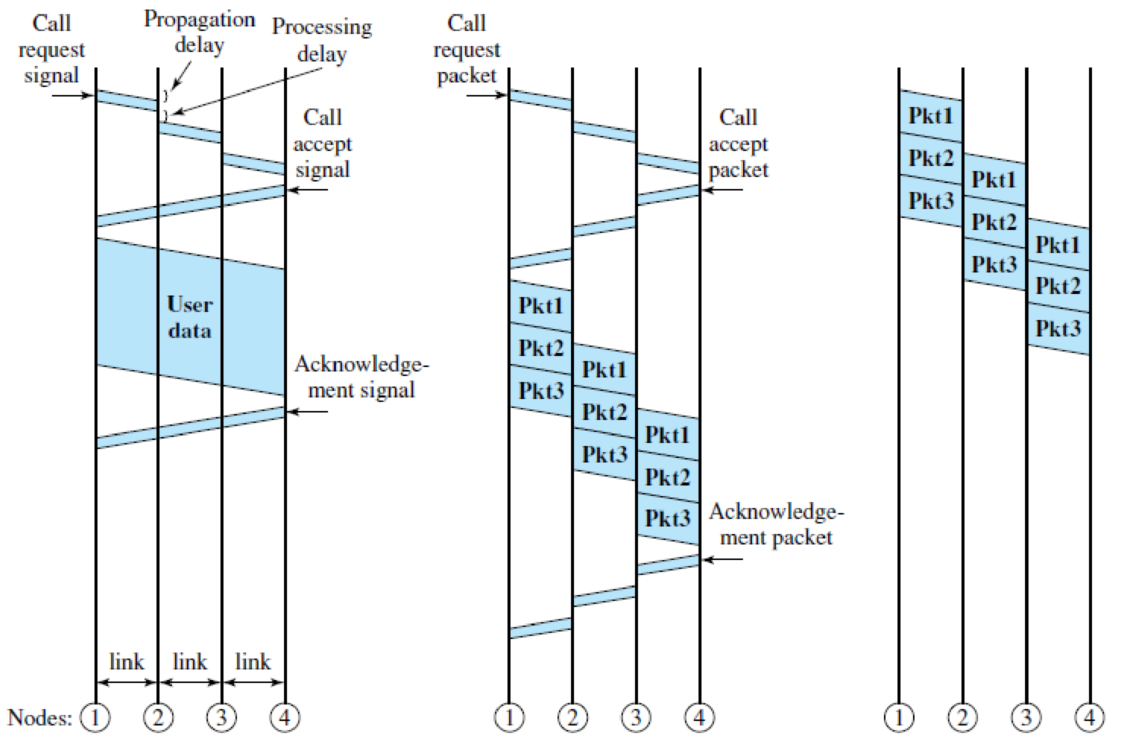
A common temptation when considering alternatives such as these is to ask which is "better"—and as usually is the case, the answer is "neither". There are places where one is more suited than the other, but if one were clearly superior, both methods wouldn't be used.

One important issue in selecting a switching method is whether the network medium is *shared* or *dedicated*. Your phone line can be used for establishing a circuit because you are the only one who can use it—assuming you can keep that pesky wife/husband/child/sister/brother/father/mother off the phone.

However, this doesn't work well in LANs, which typically use a single shared medium and baseband signaling. If two devices were to establish a connection, they would "lock out" all the other devices for a long period of time. It makes more sense to chop the data into small pieces and send them one at a time. Then, if two other devices want to communicate, *their* packets can be interspersed and everyone can share the network.

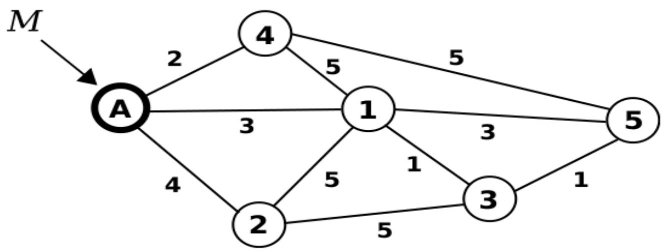
The ability to have many devices communicate simultaneously without dedicated data paths is one reason why packet switching is becoming predominant today. However, there are some disadvantages of packet switching compared to circuit switching. One is that since all data does not take the same, predictable path between devices, it is possible that some pieces of data may get lost in transit, or show up in the incorrect order. In some situations this does not matter, while in others it is very important indeed.

While the theoretical difference between circuit and packet switching is pretty clear-cut, understanding how they are used is a bit more complicated. One of the major issues is that in modern networks, they are often combined. For example, suppose you connect to the Internet using a dial-up modem. You will be using IP datagrams (packets) to carry higher-layer data, but it will be over the circuit-switched telephone network. Yet the data may be sent over the telephone system in digital packetized form. So in some ways, both circuit switching and packet switching are being used concurrently.



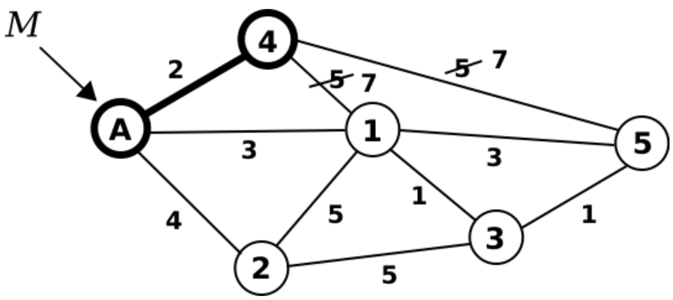
(a) Circuit switching (b) Virtual circuit packet switching (c) Datagram packet switching

b. Explain Dijkstra's Algorithm for least cost. Find the least costs from node A, for the following graph. (8)

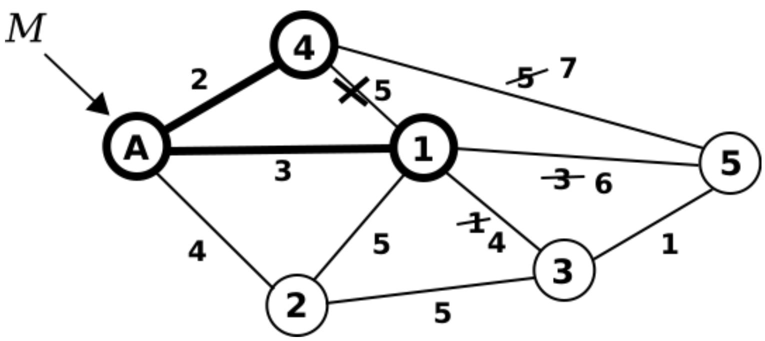


Answer:

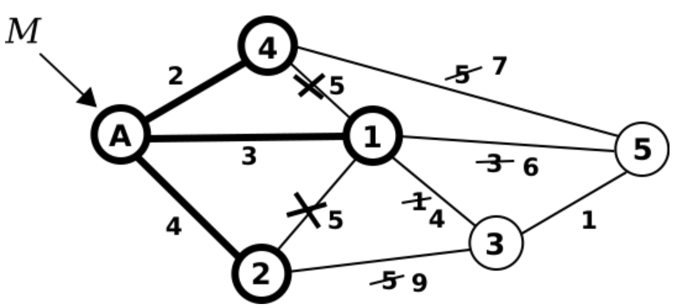
Step 1:



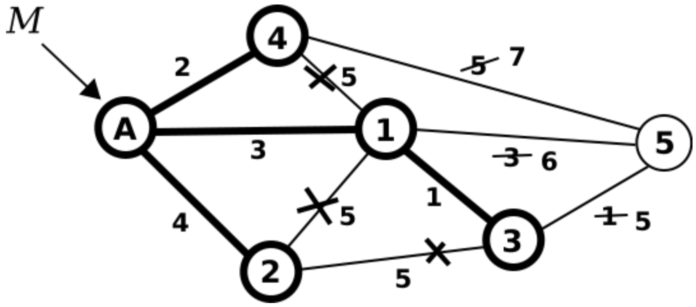
Step 2:



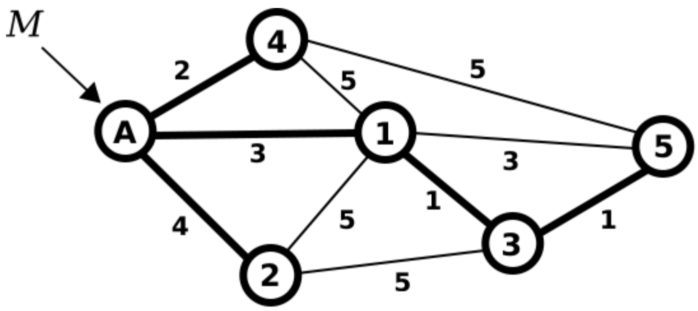
Step 3:



Step 4:



Step 5:



Q.7 a. Write a short note on Bridges. Explain how two LANs are connected by using bridges (8)

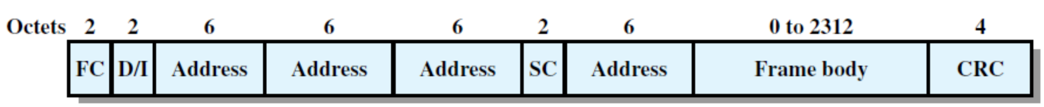
Answer:

The bridge is designed for use between local area networks (LANs) that use identical protocols for the physical and link layers (e.g., all conforming to IEEE 802.3). Because the devices all use the same protocols, the amount of processing required at the bridge is minimal. More sophisticated bridges are capable of mapping from one MAC format to another (e.g., to interconnect an Ethernet and a token ring LAN).

Wireless has taken a huge leap in usage thanks to a huge improvement in its usability over the years. That's good for many portable devices such as laptops, smart phones, etc. But for people using desktops, a wireless adapter may not be included. Or, you may want to have a more stable wireless connection than the one you currently have.Bridging an internet connection refers to making connections between different ports that will be used by your computer, such as ethernet and wireless. Shown in this article are simple steps that you can use to create your own bridged connection

b. Draw the 802.3 frame format. Write down the specifications of 100 Mbps Fast Ethernet specified under 100 Base-X and 100 Base-14. What are the Band rates in different versions/parts of Ethernet? (4)

Answer:



FC = Frame control
D/I = Duration/connection ID
SC = Sequence control

c. What is CSMA/CD? (4)

Answer:

Carrier sense multiple access with collision detection (**CSMA/CD**) is a media access control method used most notably in local area networking using early Ethernet technology. It uses a carrier sensing scheme in which a transmitting data station detects othersignals while transmitting a frame, and stops transmitting that frame, transmits a jam signal, and then waits for a random time interval before trying to resend the frame.[1]

CSMA/CD is a modification of pure carrier sense multiple access (CSMA). CSMA/CD is used to improve CSMA performance by terminating transmission as soon as a collision is detected, thus shortening the time required before a retry can be attempted

Collision detected procedure

The following procedure is used to resolve a detected collision. The procedure is complete when retransmission is initiated or the retransmission is aborted due to numerous collisions.

1. Continue transmission (with a jam signal instead of frame header/data/CRC) until minimum packet time is reached to ensure that all receivers detect the collision
2. Increment retransmission counter
3. Was the maximum number of transmission attempts reached? If so, abort transmission.
4. Calculate and wait random backoff period based on number of collisions.
5. Re-enter main procedure at stage 1.

This can be likened to what happens at a dinner party, where all the guests talk to each other through a common medium (the air). Before speaking, each guest politely waits for the current speaker to finish. If two guests start speaking at the same time, both stop and wait for short, random periods of time (in Ethernet, this time is measured in microseconds). The hope is that by each choosing a random period of time, both guests will not choose the same time to try to speak again, thus avoiding another collision.

Methods for collision detection are media dependent, but on an electrical bus such as 10BASE5 or 10BASE2, collisions can be detected by comparing transmitted data with received data or by recognizing a higher than normal signal amplitude on the bus.

//refer DATA AND COMP UTER COMMUNICATIONS *Eighth Edition* **William Stallings**
CHAPTER 16 / HIGH-SPEED LANS 488//

Q.8 a. Which version of IP is currently in use? (1)

Answer:

IPV4

b. Explain about next genration IP protocal version IPv6. Draw its header diagram. (8)

Answer:

refer DATA AND COMP UTER COMMUNICATIONS *Eighth Edition* **William Stallings**
CHAPTER 18 / INTERNET PROTOCOLS 586

The Internet Protocol (IP) has been the foundation of the Internet and virtually all multivendor private internetworks.This protocol is reaching the end of its useful life and a new protocol, known as IPv6 (IP version 6), has been defined to ultimately replace IP.6

We first look at the motivation for developing a new version of IP and then examine some of its details.

IP Next Generation

The driving motivation for the adoption of a new version of IP was the limitation imposed by the 32-bit address field in IPv4.With a 32-bit address field, it is possible in principle to assign different addresses, which is over 4 billion possible addresses. One might think that this number of addresses was more than adequate to meet addressing needs on the Internet. However, in the late 1980s it was perceived that there would be a problem, and this problem began to manifest itself in the early 1990s. Reasons for the inadequacy of 32-bit addresses include the following:

• The two-level structure of the IP address (network number, host number) is convenient but wasteful of the address space. Once a network number is assigned to a network, all of the host-number addresses for that network number are assigned to that network.The address space for that network maybe sparsely used, but as far as the effective IP address space is concerned, if a network number is used, then all addresses within the network are used.

• The IP addressing model generally requires that a unique network number be assigned to each IP network whether or not it is actually connected to the Internet.

• Networks are proliferating rapidly. Most organizations boast multiple LANs, not just a single LAN system.Wireless networks have rapidly assumed a major role.The Internet itself has grown explosively for years.

• Growth of TCP/IP usage into new areas will result in a rapid growth in the demand for unique IP addresses. Examples include using TCP/IP to interconnect electronic point-of-sale terminals and for cable television receivers.

• Typically, a single IP address is assigned to each host. A more flexible arrangement is to allow multiple IP addresses per host. This, of course, increases the demand for IP addresses.

So the need for an increased address space dictated that a new version of IP was needed. In addition, IP is a very old protocol, and new requirements in the areas of address configuration, routing flexibility, and traffic support had been defined.

In response to these needs, the Internet Engineering Task Force (IETF) issued a call for proposals for a next generation IP (IPng) in July of 1992. A number of proposals were received, and by 1994 the final design for IPng emerged. A major milestone was reached with the publication of RFC 1752, “The Recommendation for the IP Next Generation Protocol,” issued in January 1995. RFC 1752 outlines the requirements for IPng, specifies the PDU formats, and highlights the IPng approach in the areas of addressing, routing, and security. A number of other Internet documents defined details of the protocol, now officially called IPv6; these include an overall specification of IPv6 (RFC 2460), an RFC dealing with addressing structure of IPv6 (RFC 2373), and numerous others.

IPv6 includes the following enhancements over IPv4:

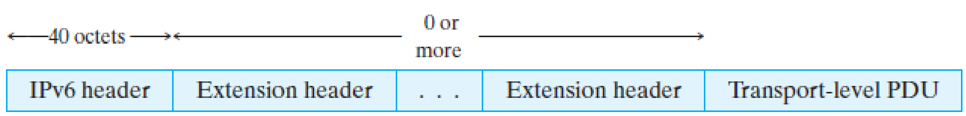
• **Expanded address space:** IPv6 uses 128-bit addresses instead of the 32-bit addresses of IPv4. This is an increase of address space by a factor of It has been pointed out [HIND95] that this allows on the order of unique addresses per square meter of the surface of the earth. Even if addresses are very inefficiently allocated, this address space seems inexhaustible.

• **Improved option mechanism:** IPv6 options are placed in separate optional**Address autoconfiguration:** This capability provides for dynamic assignment of IPv6 addresses.

• **Increased addressing flexibility:** IPv6 includes the concept of an anycast address, for which a packet is delivered to just one of a set of nodes.The scalability of multicast routing is improved by adding a scope field to multicast addresses.
• **Support for resource allocation:** IPv6 enables the labeling of packets belonging to a particular traffic flow for which the sender requests special handling. This aids in the support of specialized traffic such as real-time video.
All of these features are explored in the remainder of this section.

IPv6 Structure

An IPv6 protocol data unit (known as a packet) has the following general form:
The only header that is required is referred to simply as the IPv6 header.This is of fixed size with a length of 40 octets, compared to 20 octets for the mandatory portion of the IPv4 header the following extension headers have been defined:



• **Hop-by-Hop Options header:** Defines special options that require hop-by-hop processing
• **Routing header:** Provides extended routing, similar to IPv4 source routing
• **Fragment header:** Contains fragmentation and reassembly information
• **Authentication header:** Provides packet integrity and authentication
• **Encapsulating Security Payload header:** Provides privacy
• **Destination Options header:** Contains optional information to be examined by the destination node
The IPv6 standard recommends that, when multiple extension headers are used, the IPv6 headers appear in the following order:
1. IPv6 header: Mandatory, must always appear first
2. Hop-by-Hop Options header
3. Destination Options header: For options to be processed by the first destination that appears in the IPv6 Destination Address field plus subsequent destinations listed in the Routing header
4. Routing header
5. Fragment header
6. Authentication header
headers that are located between the IPv6 header and the transport-layer header. Most of these optional headers are not examined or processed by any router on the packet's path.This simplifies and speeds up router processing of IPv6 packets compared to IPv4 datagrams.[7] It also makes it easier to add additional options.

c. Explain the following: **(7)**
(i) Routing
(ii) Datagram
(iii) Subnetting

Answer:

(I). Routing

Routing is the process of selecting best paths in a network. In the past, the term **routing** also meant forwarding network traffic among networks. However, that latter function is better described as forwarding

(2).Datagram

A **datagram** is a basic transfer unit associated with a packet-switched network. The delivery, arrival time, and order of arrival need not be guaranteed by the network.

(3).Subnetting

A **subnetwork**, or **subnet**, is a logical, visible subdivision of an IP network.[1] The practice of dividing a network into two or more networks is called **subnetting**.

Computers that belong to a subnet are addressed with a common, identical, most-significant bit-group in their IP address. This results in the logical division of an IP address into two fields, a network or routing prefix and the rest field or host identifier. The rest field is an identifier for a specific host or network interface

Q.9 a. Which transport-level protocol provides connection-less communication? Draw its header and explain how it works? (8)

Answer:

UDP

In addition to TCP, there is one other transport-level protocol that is in common use as part of the TCP/IP protocol suite: the user datagram protocol (UDP), specified in RFC 768. UDP provides a connectionless service for application-level procedures. Thus, UDP is basically an unreliable service; delivery and duplicate protection are not guaranteed. However, this does reduce the overhead of the protocol and may be adequate in many cases. An example of the use of UDP is in the context of network management.

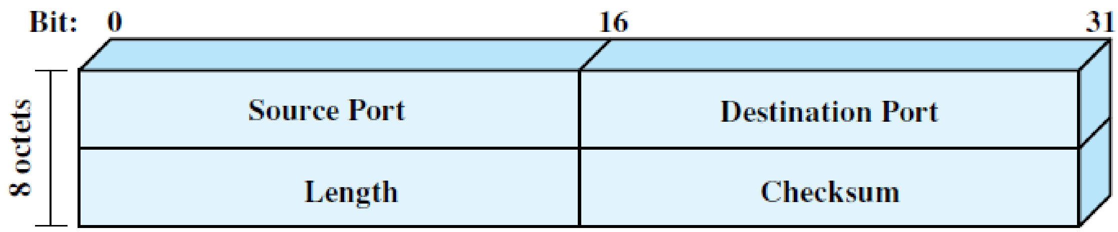
The strengths of the connection-oriented approach are clear. It allows connection-related features such as flow control, error control, and sequenced delivery. Connectionless service, however, is more appropriate in some contexts. At lowerlayers (internet, network), a connectionless service is more robust In addition, it represents a “least commondenominator” ofservice to be expected at higher layers. Further, even at transport and above there is justification for a connectionless service.There are instances in which the overhead of connection establishment and termination is unjustified or even counterproductive. Examples include the following:

- **Inward data collection:** Involves the periodic active or passive sampling of data sources, such as sensors, and automatic self-test reports from security equipment or network components. In a real-time monitoring situation, the loss of an occasional data unit would not cause distress, because the next report should arrive shortly.
- **Outward data dissemination:** Includes broadcast messages to network users, the announcement of a new node or the change of address of a service, and the distribution of real-time clock values.
- **Request-response:** Applications in which a transaction service is provided by a common server to a number of distributed TS users, and for which a single request-response sequence is typical. Use of the service is regulated at the application level, and lower-level connections are often unnecessary and cumbersome.
- **Real-time applications:** Such as voice and telemetry, involving a degree of redundancy and/or a real-time transmission requirement.These must not have connection-oriented functions such as retransmission.

Thus, there is a place at the transport level for both a connection-oriented and a connectionless type of service.

UDP sits on top of IP. Because it is connectionless, UDP has very little to do. Essentially, it adds a port addressing capability to IP.This is best seen by examining the UDP header, below figure The header includes a source port and destination port.The Length field contains the length of the entire UDP segment, including header and data.The checksum is the same algorithm used for TCP and IP. For UDP, the checksum applies to the entire UDP segment plus a pseudoheader prefixed to the

UDP header at the time of calculation and which is the same pseudoheader used for TCP. If an error is detected, the segment is discarded and no further action is taken. The Checksum field in UDP is optional. If it is not used, it is set to zero. However, it should be pointed out that the IP checksum applies only to the IP header and not to the data field, which in this case consists of the UDP header and the user data. Thus, if no checksum calculation is performed by UDP, then no check is made on the user data at either the transport or internet protocol layers.



b. List out any four of the domain names which are related to money and finance (2)

Answer:

.ACCOUNTANT

One of the best ways to increase business is to increase the ability to network. For accountants, .ACCOUNTANT provides a perfect networking resource, creating a digital hub for accountants all over the world to build websites, forums, and networking sites specifically related to the accounting sector. With .ACCOUNTING, Internet users will have a recognizable and relevant signifier when looking for accounting services, increasing the chance of accountants and clients connecting online.

.ACCOUNTANTS

Businesses, non-profits, and individuals all over the world rely on accounting services, from tax preparation to bookkeeping. As a way to better facilitate the global network of accountants, increase visibility online, and create a trustworthy space for users to find accounting services, .ACCOUNTANTS provides a TLD specialized for the accounting sector. .ACCOUNTANTS is perfect for accountants, firms, support companies offering software and tools, as well as educational programs and non-profits.

.BANK

There are 7,500 banks in the United States alone, and whether a bank is a small, community credit union, or a large, corporate investing powerhouse, .BANK offers a new digital hub to call home. .BANK may be registered by banks that pass a vetting process, ensuring that the .BANK domain extension is used explicitly for the purpose of being a namespace for banking entities and their service partners. Users will be able to trust .BANK pages as credible sources with safe information.

.BANQUE

A French term that carries the appeal of easy, intuitive translation, .BANQUE is a targeted namespace meant to serve bankers and banking professionals in the French-speaking world and beyond. Whether customers, investors, associations or regulatory bodies, any professional entity recognized by the worldwide banking industry can qualify to use the .BANQUE extension to reach clients and investors with a term they can easily identify and trust. .BANQUE may be a French word, but it inspires worldwide confidence.

.BROKER

Although all brokers facilitate interactions between two parties (usually a buyer and a seller), there are a variety of different types of brokers, from stock brokers, marriage brokers, insurance brokers, mortgage brokers, to auto brokers. Whatever the type of brokerage, .BROKER offers a relevant, specific, and flexible domain namespace for promoting, informing, and networking. Use as a broker or firm, or as a brokerage review site, broker informational site, or financial news source for brokers.

.CAPITAL

In order to raise capital, a business has to be able to effectively market itself. The .CAPITAL domain extension creates built-in marketing by acting as a signpost to potential investors and creating a virtual network supporting the investment community. .CAPITAL suits start-ups, firms, brokers, investment bankers, money magazines, and analysts alike by establishing a go-to TLD for capital needs and fostering the connection and communication needed to gain investment opportunities.

.CASH

Every day online users turn to the Internet to figure out cash exchange rates, apply for cash advances, and look for cash converters. For all these purposes and more, .CASH provides a relevant, targeted keyword TLD for the purpose of better connected users with their cash-related needs. .CASH may be registered by any individual, group, or business, and is perfect for banks, brokers, analysts, advisors, and any writer or blogger who writes about exchange rates, money markets, or trades.

.CPA

There are about 400,000 CPAs in the United States, and for these accounting professionals, establishing a credible online presence is a primary component to expanding business and finding new clientele. .CPA provides a trustworthy domain name extension for CPAs, linking accounting professionals in a targeted network meant to ease user confusion. .CPA is specialized for any CPA or firm offering CPA services, CPA review forums, and any CPA educators or testers.

.CREDIT

The credit industry comprises many different types of businesses, groups, and individuals, and .CREDIT opens up a new realm of domain names for each member. .CREDIT provides a highly searchable, relevant, and brand new TLD for the purposes of creating a network hub for users to more easily connect with the services they need. .CREDIT is perfect for credit card companies, creditors, credit score assessors or providers, credit repair groups, credit advice sites, and more.

.CREDITCARD

There are about 609 million credit cards held by U.S. consumers alone, according to the Federal Reserve Bank, and between the credit card companies, credit companies, banks, financers, credit card holders, and the publications specializing in giving financial advice to consumers, .CREDITCARD is sure to be a busy TLD. .CREDITCARD can be registered by any person, business, or organization, making this a flexible and obtainable TLD, for everyone from bloggers to non-profit credit building organizations.

.CREDITUNION

Over 180 million people worldwide belong to credit unions, not-for-profit, member-owned financial cooperatives. .CREDITUNION provides a credible and hierarchical namespace for credit unions, credit union trade associations, credit union service associations, regulatory bodies, and entities offering services and merchandise aimed directly at credit union members. Whatever the use, .CREDITUNION enables credit union members and employees to create an online community to support the goals of these organizations.

.ESTATE

For those who work in real estate or estate law, .ESTATE presents a perfect TLD option. .ESTATE is an open registry, meaning that it can be used for any kind of application, and by any individual, group, or organization. .ESTATE can be used by a land owner looking to sublet and sell lots, by a company that owns large collections of buildings, by anyone looking to establish their own estate, or by professionals that help others settle family estate legalities.

.EXCHANGE

Whether “exchange” calls to mind the stock exchange, exchange rates, or exchanging goods, .EXCHANGE can encompass them all. This TLD is an open registry, meaning its use will be defined by the businesses, groups, and individuals that create domain names within its namespace. In exchange, .EXCHANGE offers a dynamic, unique, and marketable TLD that, because it caters to a variety of different purposes, will serve as a distinctive marker on the Web to enable more fluid searching for users.

.FINANCE

Financing a car, putting together a retirement portfolio, coming up with a small business plan – "finance" applies to many different market sectors, and represents a broadly-defined need for monetary support. .FINANCE creates a TLD specifically for the purpose of catering to all financing needs, and may be registered by any individual, group, or business, making this the perfect namespace option for brokers, advisors, analysts, forums, non-profits, review services, and blogs alike.

.FINANCIAL

Day traders, investors, analysts, banks, private student loan services, accountants, and budget software hosts can all find a home at .FINANCIAL. This TLD is suited for any individual, organization, or company that either helps others find the financing they seek, or specializes in asking investors to help start-up companies. .FINANCIAL is also well-suited for scholarship services, money magazines, and anyone who blogs about market trends and how to safely invest in stocks and bonds.

.FUND

Whatever the purpose, the transfer of money is integral to any business or economic model, and .FUND creates a perfect extension for making that happen. Whether used for funding or receiving funds—or even to signal certain types of funds, such as hedge funds and mutual funds—.FUND is specific enough to provide an easily identifiable purpose for users and broad enough to have a wide variety of uses. Because it's an open registry, anyone can use .FUND for any purpose.

.GOLD

Gold is one of the most valued metals because it holds value as a currency, and because it doesn't change in color or shape, it's still regarded as one of the finest materials for making jewelry. .GOLD offers the perfect TLD for jewelers, banks, gold-to-cash businesses, scientists, and bloggers – anyone who deals in gold for business purposes, who studies the properties of gold as a scientist, or who writes about the value of gold as a monetary system.

.INVESTMENTS

Investments are one of the primary ways to start businesses, save for future endeavors like retirement or college, and to make a financial return on the market. .INVESTMENTS offers a domain namespace for investment firms, brokers, and companies, as well as for start-up companies looking for capital, or even for companies that serve as hosts for start-up companies to advertise new ideas. .INVESTMENTS may also benefit bloggers and writers who focus on reviewing investment opportunities and strategies.

.LOAN

Loans help individuals all over the world go to college, buy cars and homes, persevere tough economic times, or even invest in new products or businesses. In order to create a go-to hub for loans online, .LOAN creates a viable, relevant, and targeted namespace for loan services, organizations that help consumers consolidate loans or choose loaning options responsibly, and review forums for consumers to discuss the best loan groups and practices, making this TLD as dynamic as loans themselves.

.LOANS

For the variety of different loans, and the brokers, banks, groups, advisors, and publications that help consumers find the right loan options for them, .LOANS provides a market-specific TLD for the purpose of creating an online loan community. .LOANS can be used as webpages for loan providers, looking for more marketable domain name options, for organizations that help consumers consolidate loans, or for individuals writing about loans trends, options, and types.

.MONEY

Money is one of the most talked-about subjects online – how to make it, invest it, save it, and what it's value is, in all countries and markets across the globe. .MONEY, like the "business" section of a newspaper, flags sites that deal in money-related business for Internet users, making money-related content easier to find. .MONEY is perfect for money magazines, traders, brokers, banks, analysts, exchange programs, and for any business that offers finance services.

.MORTGAGE

The mortgage industry weighs in as one of the most important sectors in the global marketplace, and an indicator of economic health overall. As a blank canvas for the entire mortgage industry, .MORTGAGE provides a malleable and relevant TLD for the purpose of creating a credible hub for consumers, professionals, analysts, and regulators. .MORTGAGE is perfect for brokers, lenders, support groups, regulating agencies, or any other entity involved in the mortgage industry.

.PAY

One of the most important factors contributing to whether or not a customer decides to purchase a service or product online is whether or not the e-storefront provides a secure and easy-to-use payment option. With .PAY, businesses, pay services, receipt services, and shopping carts have a recognizable, intuitive, and credible TLD. .PAY creates an online hub for payments, acting as a signpost to direct users to the correct page for payment, and creating a .TLD users can grow to know and trust.

.REIT

.REIT represents the worldwide Real Estate Investment Trust community. REITS are companies that manage and own commercial real estate that brings in a working profit. The U.S. is home to the majority of REITs, but this group has expanded in the last 60 years to include many nations, across all continents. By developing this TLD, the REIT community will create a credible and trustworthy namespace for better serving clients, networking within the group, and enabling promotion.

.RICH

Although .RICH is open to all registrants, this TLD is meant to cater to the rich, or those whose assets, property, and income are worth more than $1 million. .RICH provides a recognizable, identifiable, and niche TLD for the purpose of creating a community of businesses, groups, and individuals that either provide services and products for the rich, write about luxury living and high society lifestyles, or for the rich themselves, to carve out their own place on the Web.

.TAX

Although the number of people who file their taxes online increases every year, more than half the taxpaying population still opts for paper filing because they don't feel secure and supported submitting their taxes online. .TAX creates a secure and identifiable domain extension for tax filing services, tax accountants, tax gurus, and money magazines that specialize in giving tax advice. Now tax service providers have another tool to establish trust and credibility online.

.工行

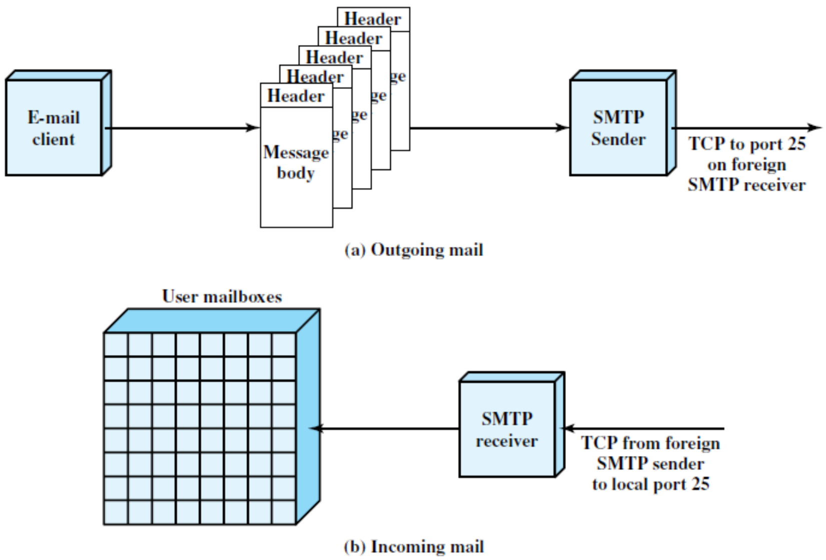
.工行 represents the Industrial and Commercial Bank of China and provides a trademarked extension for the ICBC, as the Internet expands to include internationalized TLDs. The ICBC is the largest bank in the world, and one of the four major banks in China. By securing .工行, the ICBC can continue to develop into the International marketplace and better reach the ever-growing population of Internet users that speak, write, and read in Chinese.

c. Explain the protocol SMTP. (6)

Answer:

Simple Mail Transfer Protocol (SMTP)

SMTP is the standard protocol for transferring mail between hosts in the TCP/IP suite; it is defined in RFC 821.
Although messages transferred by SMTP usually follow the format defined in RFC 822, described later, SMTP is not concerned with the format or content of messages themselves, with two exceptions.This concept is often expressed by saying that SMTP uses information written on the *envelope* of the mail (message header), but does not look at the contents (message body) of the envelope. The two exceptions are as follows:
1. SMTP standardizes the message character set as 7-bit ASCII.
2. SMTP adds log information to the start of the delivered message that indicates the path the message took.



TEXT BOOK

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