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Internal Assessment Test III – Nov. 2017

Sub:	Computer Networks					Sub Code:	16MCA31	Branch:	MCA
Date:	9/11/2017	Duration:	90 min's	Max Marks:	50	Sem / Sec:	III /A		

1. Explain Bluetooth architecture

The Bluetooth standard has many protocols grouped loosely into the layers shown in Fig. 4-35. The first observation to make is that the structure does notfollow the OSI model, the TCP/IP model, the 802 model, or any other model.The bottom layer is the physical radio layer, which corresponds fairly well tothe physical layer in the OSI and 802 models. It deals with radio transmission and modulation. Many of the concerns here have to do with the goal of making thesystem inexpensive so that it can become a mass-market item.

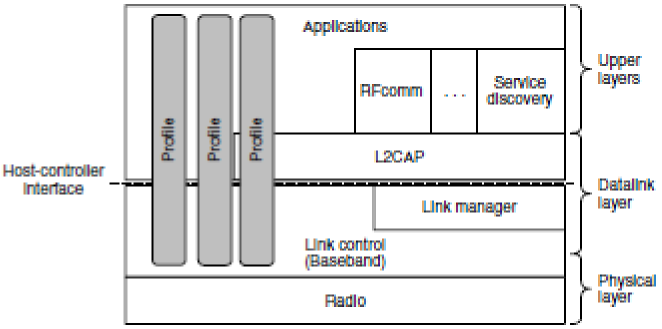


Figure 4-35. The Bluetooth protocol architecture.

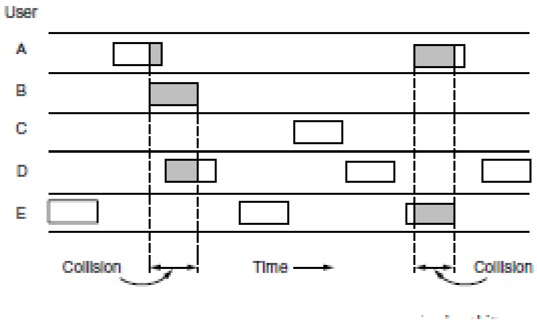
The link control (or baseband) layer is somewhat analogous to the MAC sublayer but also includes elements of the physical layer. It deals with how the master controls time slots and how these slots are grouped into frames.Next come two protocols that use the link control protocol. The link manager
handles the establishment of logical channels between devices, including power management, pairing and encryption, and quality of service. It lies below the host controller interface line. This interface is a convenience for implementation: typically, the protocols below the line will be implemented on a Bluetooth chip, and the protocols above the line will be implemented on the Bluetooth device that
hosts the chip.The link protocol above the line is L2CAP (Logical Link Control Adaptation Protocol). It frames variable-length messages and provides reliability if needed. Many protocols use L2CAP, such as the two utility protocols that areshown. The service discovery protocol is

used to locate services within the network.The RFcomm (Radio Frequency communication) protocol emulates the standard serial port found on PCs for connecting the keyboard, mouse, and modem, among other devices.

The top layer is where the applications are located. The profiles are represented by vertical boxes because they each define a slice of the protocol stack for a particular purpose. Specific profiles, such as the headset profile, usually contain only those protocols needed by that application and no others.

2 .Discuss the types of ALOHA collision resolution protocol in detail.

The basic idea of an ALOHA system is simple: let users transmit whenever they have data to be sent. There will be collisions, of course, and the colliding frames will be damaged. Senders need some way to find out if this is the case. In the ALOHA system, after each station has sent its frame to the central computer, this computer rebroadcasts the frame to all of the stations. A sending station can thus listen for the broadcast from the hub to see if its frame has gotten through. In other systems, such as wired LANs, the sender might be able to listen for collisions while transmitting



Slotted ALOHA divide timeinto discrete intervals called slots, each interval corresponding to one frame. This approach requires the users to agree on slot boundaries. One way to achieve synchronization would be to have one special station emit a pip at the start of each interval, like a clock

The first carrier sense protocol that we will study here is called 1-persistent CSMA (Carrier Sense Multiple Access).When a station has data to send, it first listens to the channelto see if anyone else is transmitting at that moment. If the channel is idle, the stations sends its data. Otherwise, if the channel is busy, the station just waits until it becomes idle. Then the station transmits a frame. If a collision occurs, the station waits a random amount of time and starts all over again. The protocol is called 1-persistent because the station transmits with a probability of 1 when it finds the channel idle.

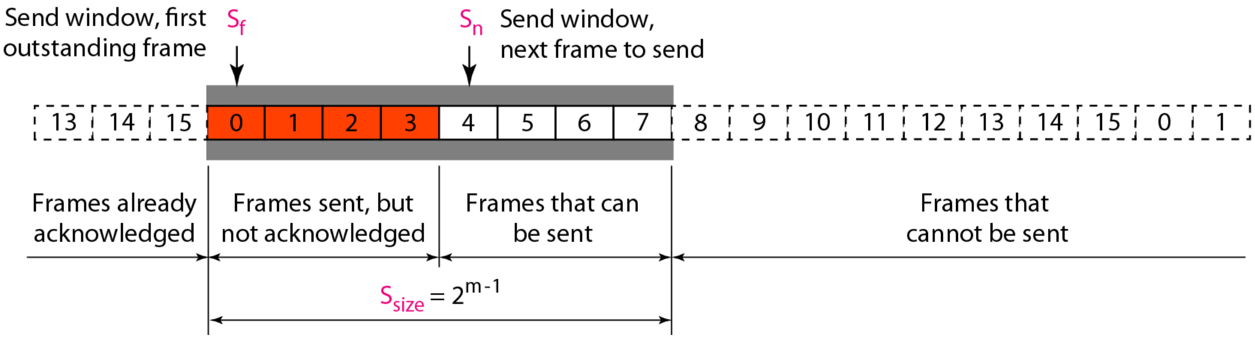
A second carrier sense protocol is nonpersistent CSMA. A station senses the channel when it wants to send a frame, and if no one else is sending, the station begins doing so itself. However, if the channel is already in use, the station does not continually sense it for the purpose of seizing it immediately upon detecting the end of the previous transmission. Instead, it waits a random period of time and then repeats the algorithm. Consequently, this algorithm leads to better channel utilization but longer delays than 1-persistent CSMA.

The last protocol is p-persistent CSMA. It applies to slotted channels and works as follows. When a station becomes ready to send, it senses the channel. If it is idle, it transmits with a probability p. With a probability q = 1 − p, it defers until the next slot. If that slot is also idle, it either transmits or defers again, with probabilities p and q. This process is repeated until either the frame has been transmitted or another station has begun transmittingand starts again). If the station initially senses that the channel is busy, it waits. until the next slot and applies the above algorithm. IEEE 802.11 uses a refinement of p-persistent CSMA

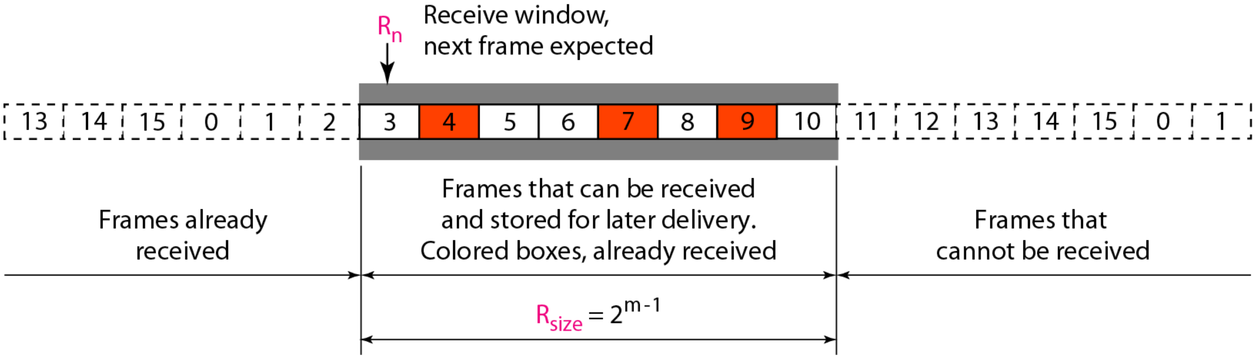
3. Explain the working of Selective repeat sliding window protocol in flow control

- Go-Back-N always discards out-of-order frames
  - Losing one frame may result in retransmission of multiple frames
  - Very inefficient in noisy link
- Selective Repeat ARQ allows frames to be received out of order
  - Therefore, receive window > 1
- Sender and receiver share window space equally
- For m-bit sequence numbers
- Send window: up to 2m-1
- Receive window: up to 2m-1

Sender window:


Send window, first outstanding frame
S_f
S_n
Send window, next frame to send
13
14
15
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0
1
Frames already acknowledged
Frames sent, but not acknowledged
Frames that can be sent
Frames that cannot be sent
$S_{size} = 2^{m-1}$

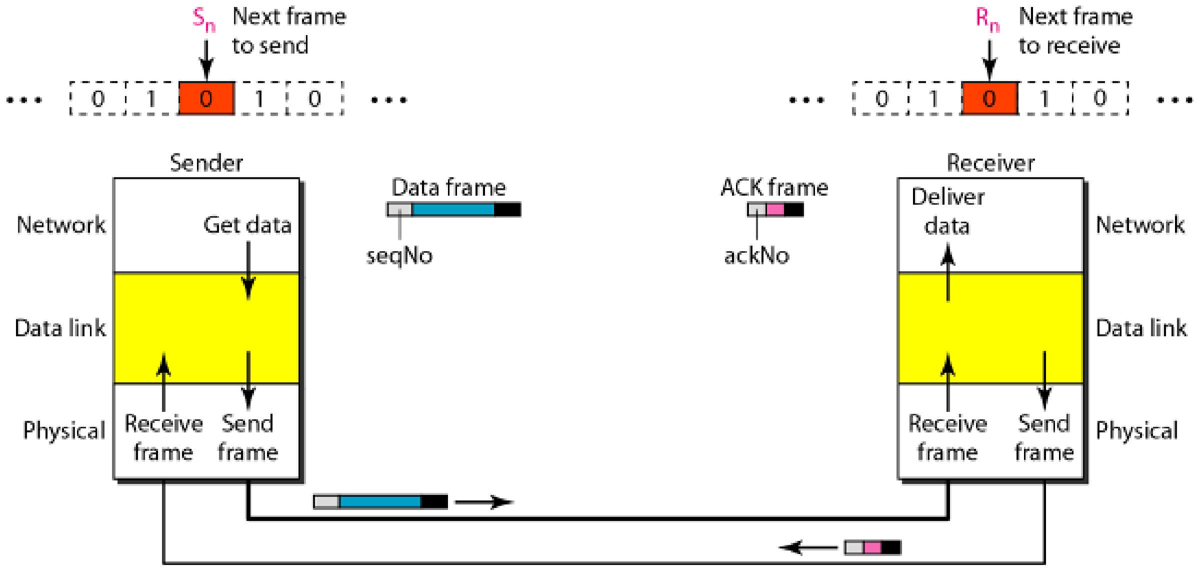
Receiver Window:

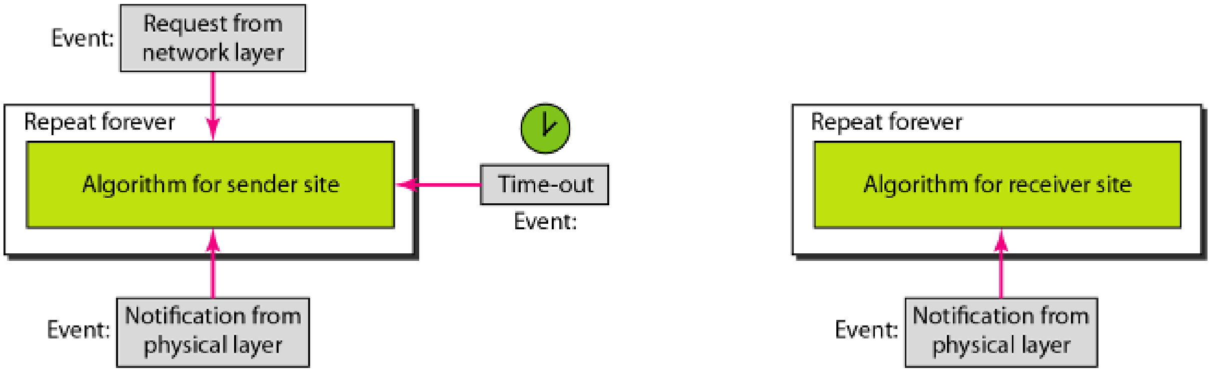

R_n
Receive window, next frame expected
13
14
15
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0
1
Frames already received
Frames that can be received and stored for later delivery. Colored boxes, already received
Frames that cannot be received
$R_{size} = 2^{m-1}$

4. Explain stop and wait ARQ

- Sender keeps a copy of sent frame until successful delivery is ensured
- Receiver responds with an ack when it successfully receives a frame
- Both data and ack frames must be numbered

When sender does not receive an ack within certain time, it assumes frame is lost, then retransmits the same frame.




Event:
Request from network layer
Repeat forever
Algorithm for sender site
Time-out
Event:
Event:
Notification from physical layer
Repeat forever
Algorithm for receiver site
Event:
Notification from physical layer

5. Explain CSMA in detail

Protocols in which stations listen for a carrier (i.e., a transmission) and act accordingly are called carrier sense protocols.

CSMA is a network access method used on shared network topologies such as Ethernet to control access to the network. Devices attached to the network cable listen (carrier sense) before transmitting. If the channel is in use, devices wait before transmitting. MA (Multiple Access) indicates that many devices can connect to and share the same network. All devices have equal access to use the network when it is clear.

CSMA protocol was developed to overcome the problem found in ALOHA i.e. to minimize the chances of collision, so as to improve the performance. CSMA protocol is based on the principle of 'carrier sense'. The station senses the carrier or channel before transmitting a frame. It means the station checks the state of channel, whether it is idle or busy.

There Are Three Different Type of CSMA Protocols

(I) I-persistent CSMA

(ii) Non- Persistent CSMA

(iii) p-persistent CSMA

(i) I-persistent CSMA:

• In this method, station that wants to transmit data continuously senses the channel to check whether the channel is idle or busy.

• If the channel is busy, the station waits until it becomes idle.

• When the station detects an idle-channel, it immediately transmits the frame with probability 1. Hence it is called I-persistent CSMA.

• This method has the highest chance of collision because two or more stations may find channel to be idle at the same time and transmit their frames.

(ii) Non-persistent CSMA

• In this scheme, if a station wants to transmit a frame and it finds that the channel is busy (some other station is transmitting) then it will wait for fixed interval of time.
• After this time, it again checks the status of the channel and if the channel is free it will transmit.

• A station that has a frame to send senses the channel.

• If the channel is idle, it sends immediately.

• If the channel is busy, it waits a random amount of time and then senses the channel again.

• In non-persistent CSMA the station does not continuously sense the channel for the purpose of capturing it when it detects the end of previous transmission.

(iii) p-persistent CSMA

• This method is used when channel has time slots such that the time slot duration is equal to or greater than the maximum propagation delay time.

• Whenever a station becomes ready to send, it senses the channel.

• If channel is busy, station waits until next slot.

• If channel is idle, it transmits with a probability p.

• With the probability q=l-p, the station then waits for the beginning of the next time slot.

• If the next slot is also idle, it either transmits or waits again with probabilities p and q.

• This process is repeated till either frame has been transmitted or another station has begun transmitting.

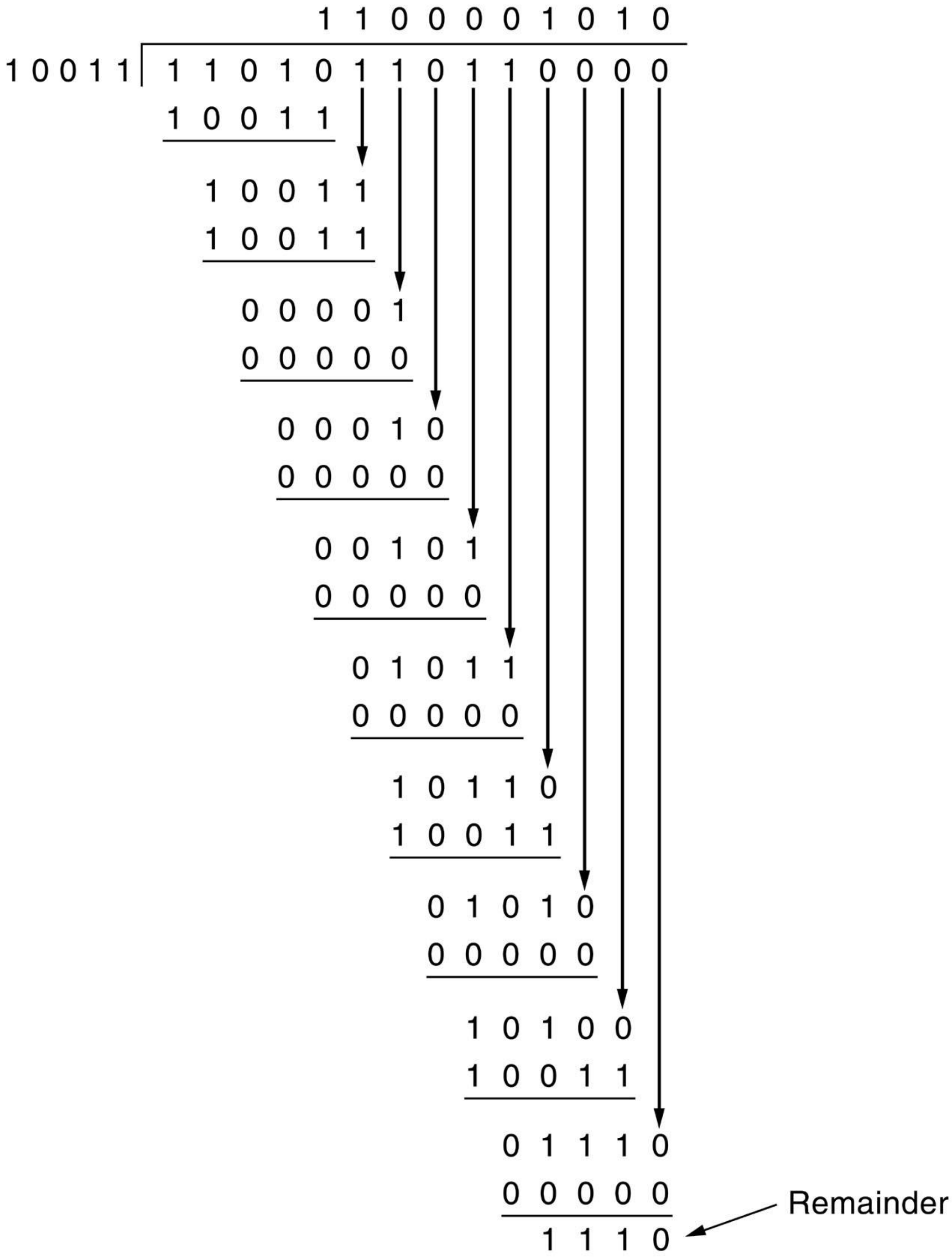
• In case of the transmission by another station, the station acts as though a collision has occurred and it waits a random amount of time and starts again.

6. Suppose we want to transmit the message 1101011011 and protect it from errors using CRC* polynomial x4+x+1.
i) Use polynomial long division to determine the message that should be transmitted.
Suppose the left most bit is inverted due to the noise on transmission link on the above message. What is the result of receivers CRC calculation? How does the receiver know that an error has occurred?

Frame : 1 1 0 1 0 1 1 0 1 1

Generator: 1 0 0 1 1

Message after 4 zero bits are appended: 1 1 0 1 0 1 1 0 1 1 0 (0



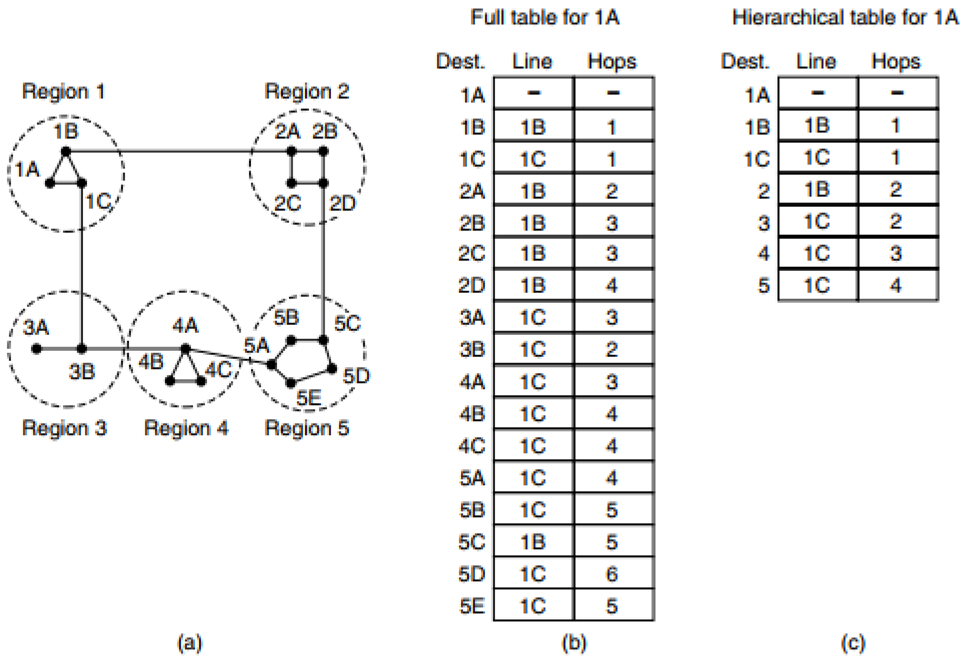
```
                  1 1 0 0 0 0 1 0 1 0
        ______________________________
1 0 0 1 1 | 1 1 0 1 0 1 1 0 1 1 0 0 0 0
            1 0 0 1 1
            ---------
              1 0 0 1 1
              1 0 0 1 1
              ---------
                0 0 0 0 1
                0 0 0 0 0
                ---------
                  0 0 0 1 0
                  0 0 0 0 0
                  ---------
                    0 0 1 0 1
                    0 0 0 0 0
                    ---------
                      0 1 0 1 1
                      0 0 0 0 0
                      ---------
                        1 0 1 1 0
                        1 0 0 1 1
                        ---------
                          0 1 0 1 0
                          0 0 0 0 0
                          ---------
                            1 0 1 0 0
                            1 0 0 1 1
                            ---------
                              0 1 1 1 0
                              0 0 0 0 0
                              ---------
                                1 1 1 0
```

Transmitted frame: 1 1 0 1 0 1 1 0 1 1 1 1 1 0

7. Explain hierarchical routing

When hierarchical routing is used, the routers are divided into what we will call regions. Each router knows all the details about how to route packets to destinations within its own region but knows nothing about the internal structure of other regions. When different networks are interconnected, each one will be created as a separate region to free the routers in one network from having to know the topological structure of the other ones.

The full routing table for router 1A has 17 entries, as shown in Fig. 5-14(b). When routing is done hierarchically, as in Fig. 5-14(c), there are entries for all the local routers, as before, but all other regions are condensed into a single router, so all traffic for region 2 goes via the 1B-2A line, but the rest of the remote traffic goes via the 1C-3B line. Hierarchical routing has reduced the table from 17 to 7 entries. As the ratio of the number of regions to the number of routers per region grows, the savings in table space increase. Unfortunately, these gains in space are not free. There is a penalty to be paid: increased path length. For example, the best route from 1A to 5C is via region 2, but with hierarchical routing all traffic to region 5 goes via region 3, because that is better for most destinations in region 5



Full table for 1A

Dest.	Line	Hops
1A	–	–
1B	1B	1
1C	1C	1
2A	1B	2
2B	1B	3
2C	1B	3
2D	1B	4
3A	1C	3
3B	1C	2
4A	1C	3
4B	1C	4
4C	1C	4
5A	1C	4
5B	1C	5
5C	1B	5
5D	1C	6
5E	1C	5

(b)

Hierarchical table for 1A

Dest.	Line	Hops
1A	–	–
1B	1B	1
1C	1C	1
2	1B	2
3	1C	2
4	1C	3
5	1C	4

(c)

8. What is channel capacity? What are the factors needed to ensure channel capacity? Explain Shannon’s capacity in detail

The max rate at which data can be transmitted over a given communication path or channel under given conditions is referred to as channel capacity

Data Rate: rate in bits per sec at which data can be communicated.

Noise: Average level of noise over communication path.

Error Rate: rate at which error occurs

Shannon capacity: The higher the data rate, the more damage that unwanted noise can do. For a given level of noise, we would expect that a greater signal strength would improve the ability to receive data correctly in the presence of noise. The key parameter involved in this reasoning is the signal-to-noise ratio (SNR, or S/N),10 which is the ratio of the power in a signal to the power contained in the noise that is present at a particular point in the transmission. Typically, this ratio is measured at a receiver, because it is at this point that an attempt is made to process the signal and recover the data. For convenience, this ratio is often reported in decibels:

$$\mathrm{SNR_{dB}} = 10 \log_{10} \frac{\text{signal power}}{\text{noise power}}$$

This expresses the amount, in decibels, that the intended signal exceeds the noise level.

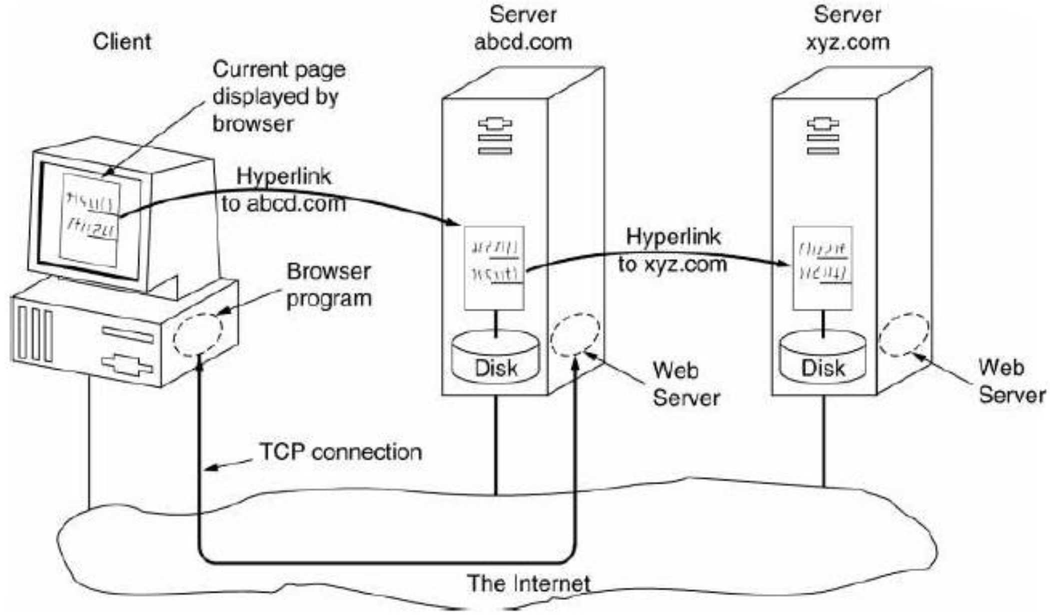
A high SNR will mean a high-quality signal and a low number of required intermediate repeaters. The signal-to-noise ratio is important in the transmission of digital data because it sets the upper bound on the achievable data rate. Shannon's result is that the maximum channel capacity, in bits per second, obeys the equation

$$C = B \log_2(1 + \mathrm{SNR})$$

9.a Explain WWW.

The Web, as the World Wide Web is popularly known, is an architectural framework for accessing linked content spread out over millions of machines all over the Internet.

The Web consists of a vast, worldwide collection of content in the form of **Web pages**, often just called **pages** for short. Each page may contain links to other pages anywhere in the world. Users can follow a link by clicking on it, which then takes them to the page pointed to. This process can be repeated indefinitely. The idea of having one page point to another, now called **hypertext**.



The parts of the Web model.

Steps a client (browser) takes to follow a hyperlink:

− Determine the protocol (HTTP)

− Ask DNS for the IP address of server

− Make a TCP connection to server

− Send request for the page; server sends it back

− Fetch other URLs as needed to display the page

− Close idle TCP connections

Steps a server takes to serve pages:

− Accept a TCP connection from client

− Get page request and map it to a resource (e.g., file name)

− Get the resource (e.g., file from disk)

− Send contents of the resource to the client.

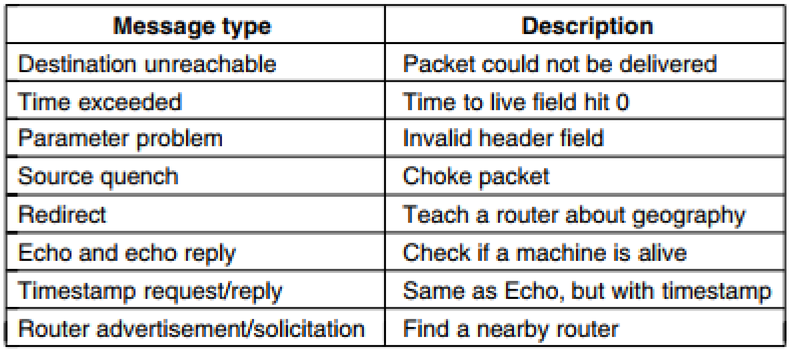
− Release idle TCP connections

b. Explain BGP

- BGP provides each AS a means to:
  - Obtain subnet reachability information from neighboring ASs
  - Propagate reachability information to all AS-internal routers
  - Determine “good” routes to subnets based on reachability information and policy
- Pairs of routers (BGP peers) exchange routing info over semi-permanent TCP connections: BGP sessions
  - BGP sessions need not correspond to physical links
- when AS2 advertises a prefix to AS1:
  - AS2 promises it will forward datagrams towards that prefix
  - AS2 can aggregate prefixes in its advertisement

10.a Explain ICMP

When something unexpected occurs during packet processing at a router, the event is reported to the sender by the ICMP (Internet Control Message Protocol). ICMP is also used to test the Internet.

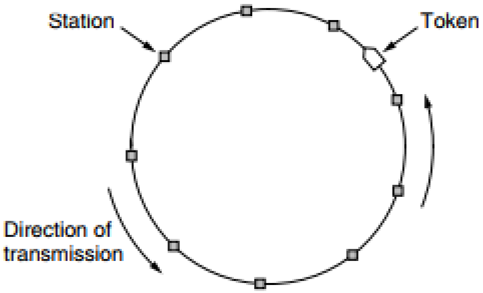


Message type	Description
Destination unreachable	Packet could not be delivered
Time exceeded	Time to live field hit 0
Parameter problem	Invalid header field
Source quench	Choke packet
Redirect	Teach a router about geography
Echo and echo reply	Check if a machine is alive
Timestamp request/reply	Same as Echo, but with timestamp
Router advertisement/solicitation	Find a nearby router

b. Explain token ring

The essence of the bit-map protocol is that it lets every station transmit a frame in turn in a predefined order. Another way to accomplish the same thing is to pass a small message called a token from one station to the next in the same predefined order. The token represents permission to send. If a station has a frame queued for transmission when it receives the token, it can send that frame before it passes the token to the next station. If it has no queued frame, it simply passes the token. In a token ring protocol, the topology of the network is used to define the order in which stations send. The stations are connected one to the next in a single ring. Passing the token to the next station then simply consists of receiving the token in from one direction and transmitting it out in the other direction, as seen in Fig. 4-7. Frames are also transmitted in the direction of the token. This way they will circulate around the ring and reach whichever station is the destination. However, to stop the frame circulating indefinitely (like the token), some station needs to remove it from the ring. This station may be either the one that originally sent the frame, after it has gone through a complete cycle, or the station that was the intended recipient of the frame.

The channel connecting the stations might instead be a single long bus. Each station then uses the bus to send the token to the next station in the predefined sequence. Possession of the token allows a station to use the bus to send one frame, as before. This protocol is called token bus.


Station
Token
Direction of transmission