(2 Hours) **[Total Marks: 60]**

N. B.: (1) **All questions** are **compulsory**.
(2) **Make suitable assumptions** wherever **necessary** and **state the assumptions** made.
(3) **Answers** to the **same question** must be **written together**.
(4) **Numbers** to the **right indicate marks**.
(5) Draw **neat** labeled **diagrams wherever necessary**.

I. Answer *any two* of the following: **10**

a. Compare IPV4 with IPV6

b. Describe the concept of subnetting & supernetting in IPV4 class full addressing technique.

c. Draw &explain a neat labeled diagram of IPV4 datagram header format.

d. Explain Dual stack & tunneling in IPV6.

II. Answer *any two* of the following: **10**

a. Describe 3 phases of communication between remote host & mobiles host.

b. What are the types of OSPF packets? What is the purpose of each one?

c. Short note on ARP.

d. Describe the problem of counting infinity or instability in RIP distance vector routing.

III. Answer *any two* of the following: **10**

a. Explain TCP connection termination by 3 way handshaking concept.

b. What are the types of TCP timers? Explain the purpose of each one.

c. What are the services of UDP?

d. What is silly window syndrome? Explain the syndrome created by the sender and the receiver.

IV. Answer *any two* of the following: **10**

a. Explain SCTP association establishment.

b. What is domain? What are the types of domains in DNS? Explain.

c. What is resolution in DNS? Explain.

d. Describe the DHCP client server operations in the same & different network.

V. Answer *any two* of the following: **10**

a. Describe NVT character set for option negotiation.

b. What is the concept of out-of-band signalling?

c. Explain the architecture of WWW.

d. List & explain the types of FTP commands

VI. Answer *any two* of the following: **10**

a. Explain video compression using JPEG

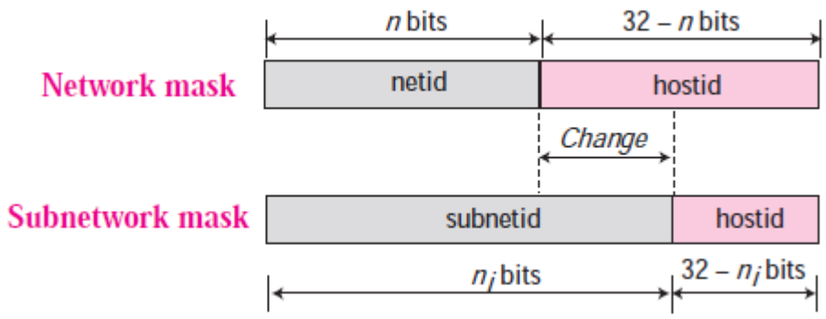
b. Describe Leaky bucket algorithm of traffic shaping.

c. Write a short note on MIME.

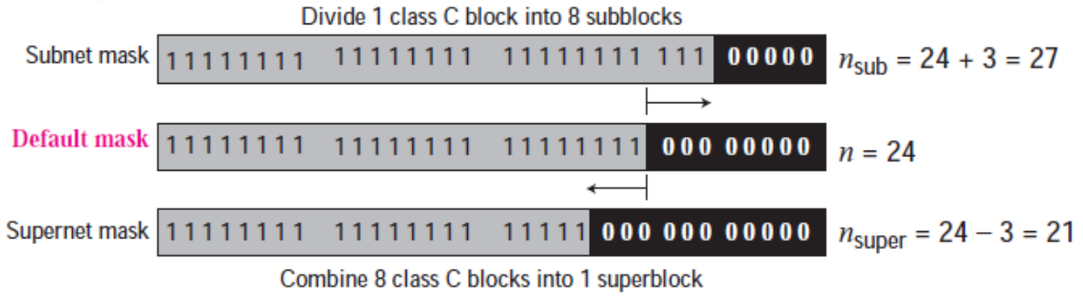
d. What are the services of internet audio & video communication? Explain the digitization process of video data.

Ans-1) a)
Comparison of IPV4 & IPV6-
Any five differences in terms of its datagram format or features as protocol bits, addressing, header options, TTL, security -----
1 M * 5 points = 5M

b) Subnetting & Supernetting concepts –
Definitions of subnetting & supernetting ----------1M

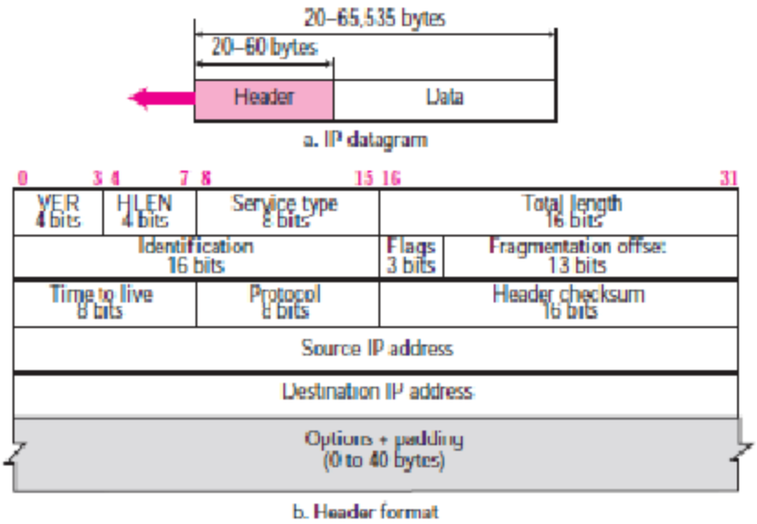


Supernetting



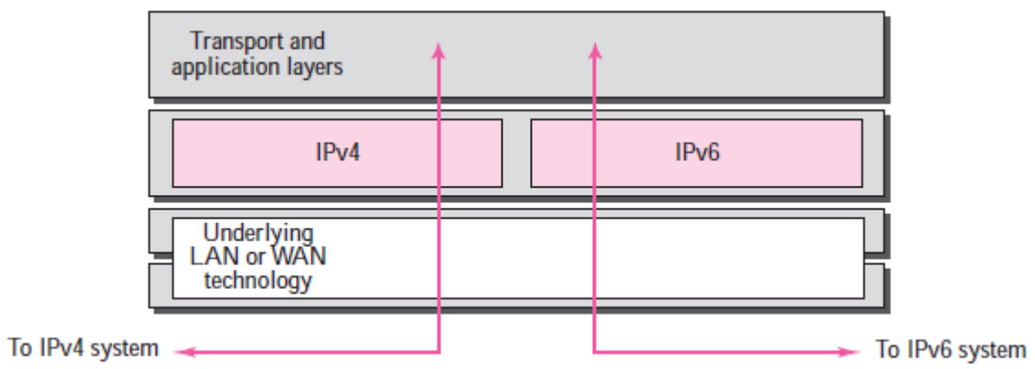
Conceptual diagram ----------2 M
Explanation with example ----------2M

c) IPV4 Datagram header format ---diagram ----------2M

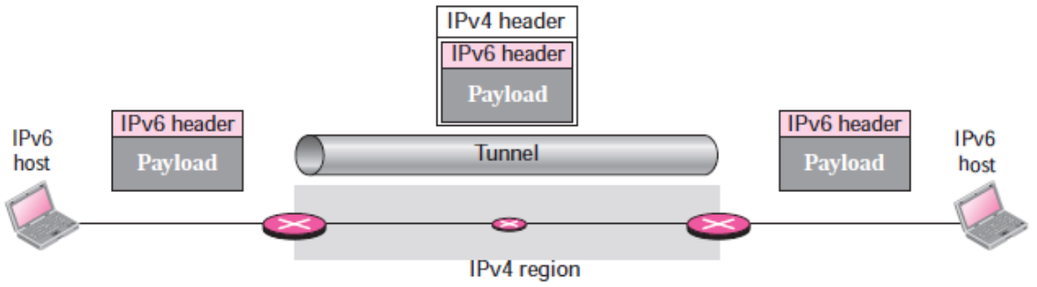


Explanation of each attributes ----------3M

d) IP dual stack & tunneling –
Diagram Dual stack ----------1M

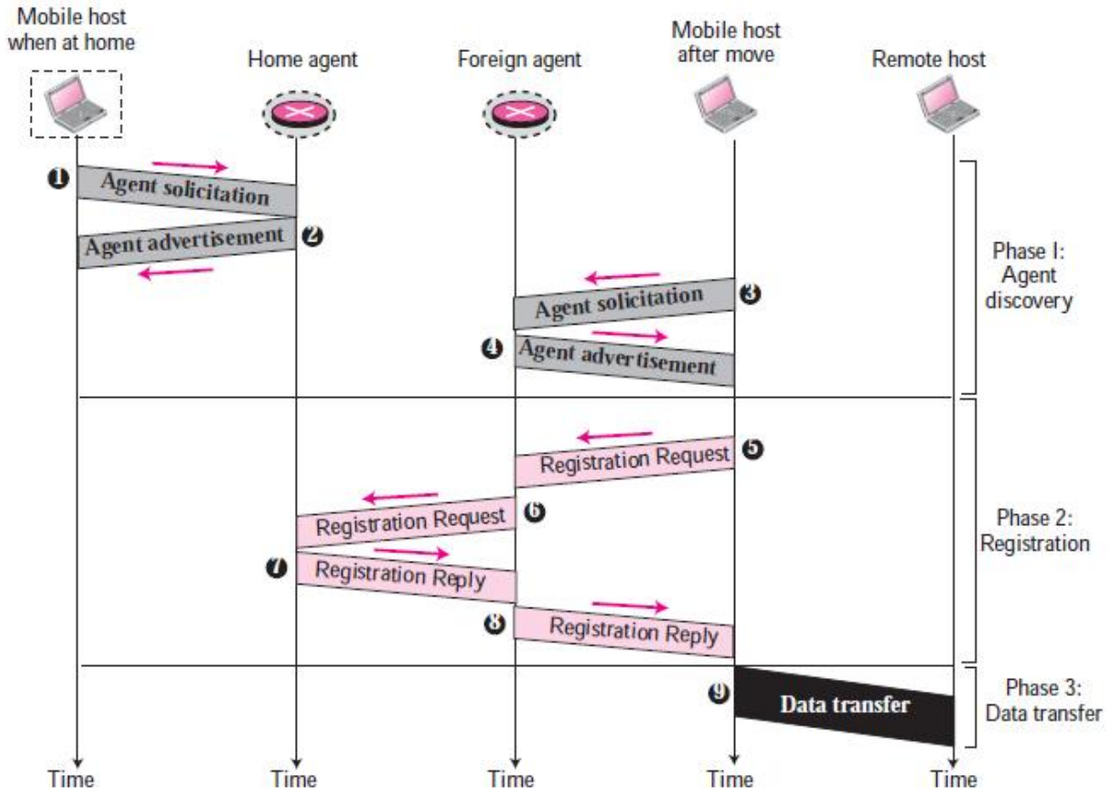


Description ----------1M
Diagram tunneling ----------1M



Description ----------2M

Ans -2) a) Diagram of mobile host communication----------2M



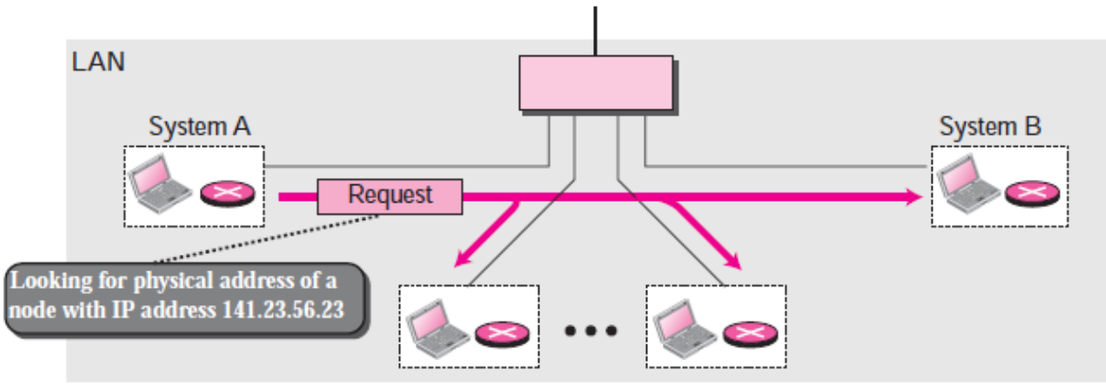
Explanation ----------3M

b) OSPF packets –
Hello, database description, link state request, link state update,
link state acknowledgement---------- –**1M**
Purpose of each one ----------4M
If diagrams drawn then marks to be given as per the accuracy of the answer

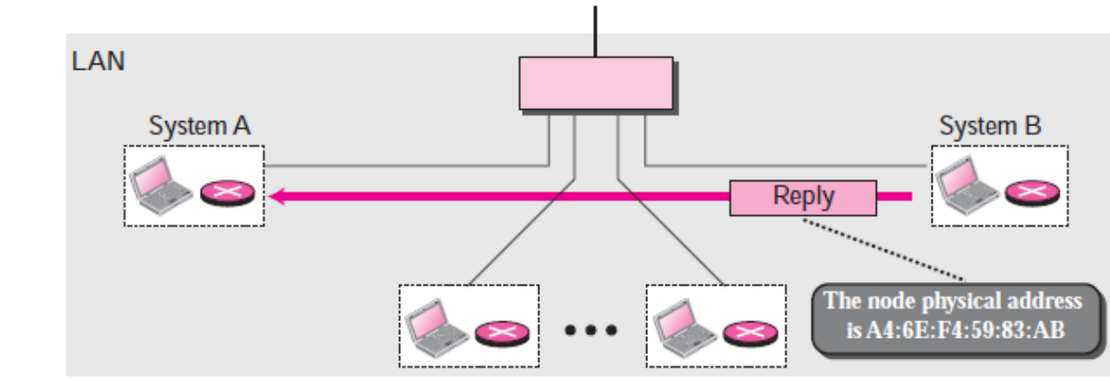
c) ARP -----
Diagram ----------packet format or conceptual diagram ----------1M

Hardware Type		Protocol Type
Hardware length	Protocol length	Operation Request 1, Reply 2
Sender hardware address (For example, 6 bytes for Ethernet)		
Sender protocol address (For example, 4 bytes for IP)		
Target hardware address (For example, 6 bytes for Ethernet) (It is not filled in a request)		
Target protocol address (For example, 4 bytes for IP)		

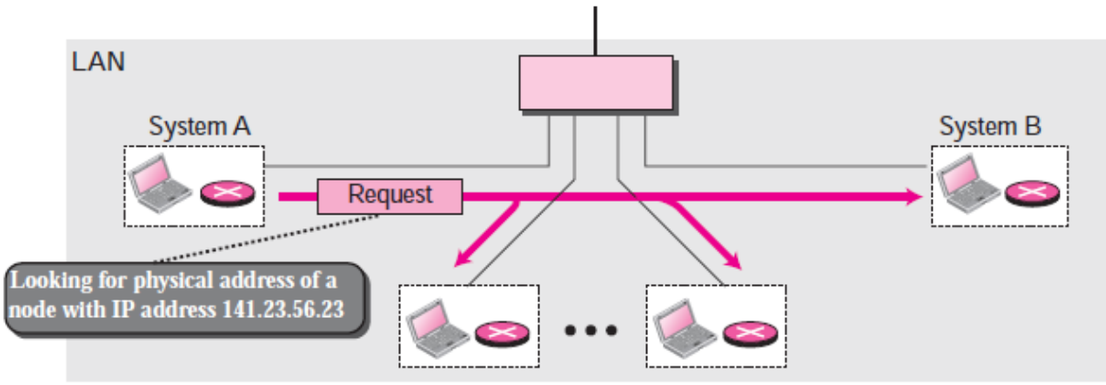
OR



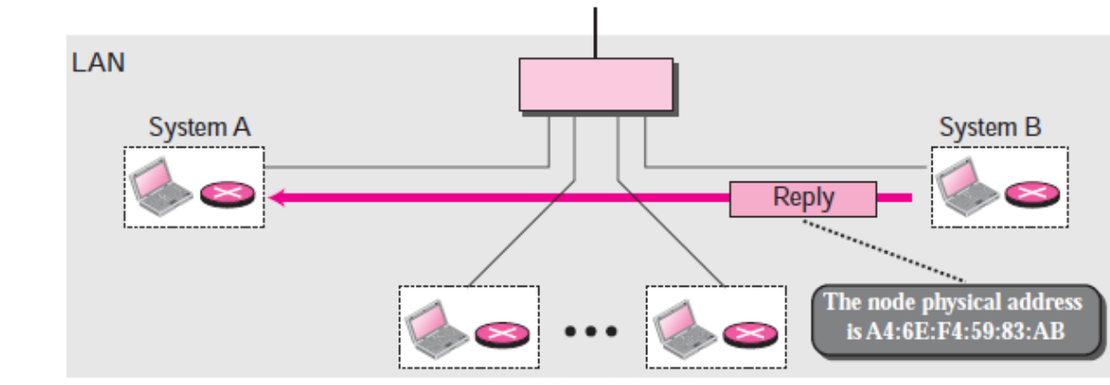
a. ARP request is multicast



b. ARP reply is unicast



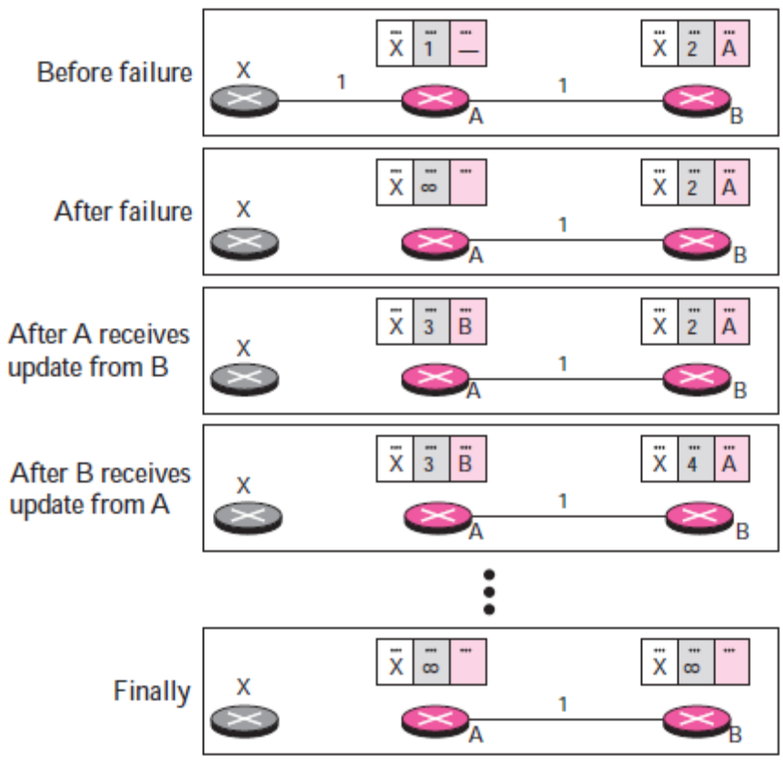
a. ARP request is multicast



b. ARP reply is unicast

Explanation ----------3M

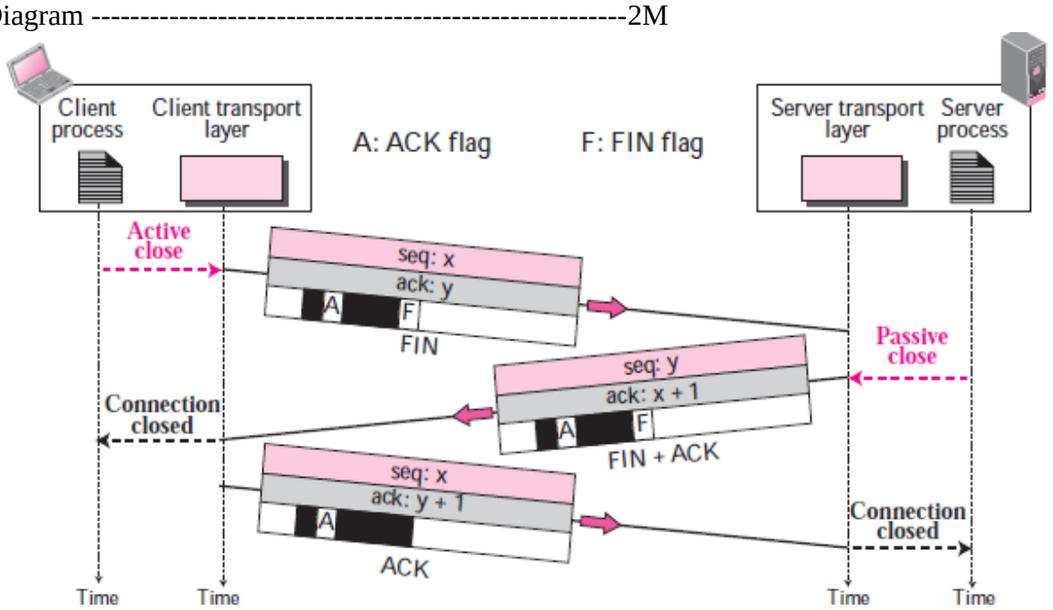
d) RIP problem of instability / count to infinity --------
Diagram of 2 node / 3 node looping ----------2M



Explanation / concept ----------3M

Ans -3) a) TCP connection termination –3 way handshaking

Diagram ----------2M



Explanation----------3M

b) TCP timers –
Retransmission , persistence , keep alive, time waited timer ----------1M

Description of each one ----------1M * 4 = 4M

c) UDP services ---------
Connectionless services
Process to Process communication
Flow control
Error control
Checksum
UDP function –encapsulation / de-capsulation
Multiplexing / de-multiplexing
Queuing ----------listing 1M

Concept of each one----------4M

d)
Silly Window Syndrome

A serious problem can arise in the sliding window operation when either the sending application program creates data slowly or the receiving application program consumes data slowly, or both. Any of these situations results in the sending of data in very small segments, which reduces the efficiency of the operation. For example, if TCP sends segments containing only 1 byte of data, it means that a 41-byte datagram (20 bytes of TCP header and 20 bytes of IP header) transfers only 1 byte of user data. Here the overhead is 41/1, which indicates that we are using the capacity of the network very inefficiently. The inefficiency is even worse after accounting for the data link layer and physical layer overhead. This problem is called the **silly window syndrome.** ----- **1M**

Syndrome Created by the Sender

The sending TCP may create a silly window syndrome if it is serving an application program that creates data slowly, for example, 1 byte at a time. The application program writes 1 byte at a time into the buffer of the sending TCP. If the sending TCP does not have any specific instructions, it may create segments containing 1 byte of data. The result is a lot of 41-byte segments that are traveling through an internet. The solution is to prevent the sending TCP from sending the data byte by byte. The sending TCP must be forced to wait and collect data to send in a larger block. How long should the sending TCP wait? If it waits too long, it may delay the process. If it does not wait long enough, it may end up sending small segments. Nagle found an elegant solution.
---------- 1M

Nagle's Algorithm **Nagle's algorithm** is simple:

1. The sending TCP sends the first piece of data it receives from the sending application program even if it is only 1 byte.

2. After sending the first segment, the sending TCP accumulates data in the output buffer and waits until either the receiving TCP sends an acknowledgment or until enough data has accumulated to fill a maximum-size segment. At this time, the sending TCP can send the segment.

3. Step 2 is repeated for the rest of the transmission. Segment 3 is sent immediately if an acknowledgment is received for segment 2, or if enough data have accumulated to fill a maximum-size segment. ----------1 M

{The elegance of Nagle's algorithm is in its simplicity and in the fact that it takes into account the speed of the application program that creates the data and the speed of the network that transports the data. If the application program is faster than the network, the segments are larger (maximum-size segments). If the application program is slower than the network, the segments are smaller (less than the maximum segment size). }

Syndrome Created by the Receiver

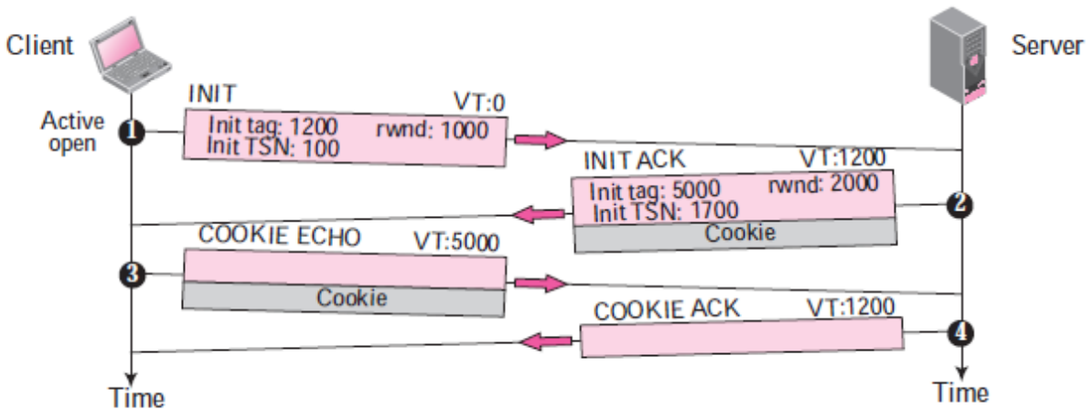
The receiving TCP may create a silly window syndrome if it is serving an application program that consumes data slowly, for example, 1 byte at a time. Suppose that the sending application program creates data in blocks of 1 kilobyte, but the receiving application program consumes data 1 byte at a time. Also suppose that the input buffer of the receiving TCP is 4 kilobytes. The sender sends the first 4 kilobytes of data. The receiver stores it in its buffer. Now its buffer is full. It advertises a window size of zero, which means the sender should stop sending data. The receiving application reads the first byte of data from the input buffer of the receiving TCP. Now there is 1 byte of space in the incoming buffer. The receiving TCP announces a window size of 1 byte, which means that the sending TCP, which is eagerly waiting to send data, takes this advertisement as good news and sends a segment carrying only 1 byte of data. The procedure will continue. One byte of data is consumed and a segment carrying 1 byte of data is sent. Again we have an efficiency problem and the silly window syndrome. Two solutions have been proposed to prevent the silly window syndrome created by an application program that consumes data slower than they arrive.
----------1 M

Clark's Solution **Clark's solution** is to send an acknowledgment as soon as the data arrive, but to announce a window size of zero until either there is enough space to accommodate a segment of maximum size or until at least half of the receive buffer is empty. ----------1 M

Delayed Acknowledgment The second solution is to delay sending the acknowledgment.

This means that when a segment arrives, it is not acknowledged immediately. The receiver waits until there is a decent amount of space in its incoming buffer before acknowledging the arrived segments. The delayed acknowledgment prevents the sending TCP from sliding its window. After the sending TCP has sent the data in the window, it stops. This kills the syndrome. Delayed acknowledgment also has another advantage: it reduces traffic. The receiver does not have to acknowledge each segment. However, there also is a disadvantage in that the delayed acknowledgment may result in the sender unnecessarily retransmitting the unacknowledged segments. TCP balances the advantages and disadvantages. It now defines that the acknowledgment should not be delayed by more than 500 ms. ----------1 M

Ans -4) a) SCTP association establishment ----------diagram ----------2M



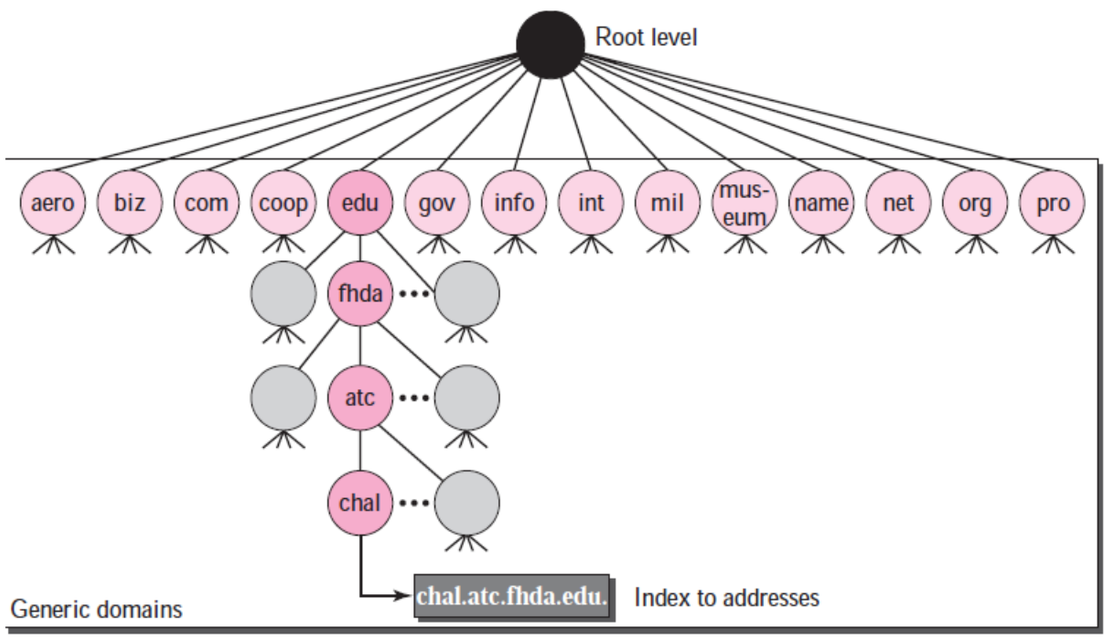
Explanation ----------3M

b) DNS domain

Each node in the DNS tree has a domain name. A full **domain name** is a sequence of labels separated by dots (.). The domain names are always read from the node up to the root.
The last label is the label of the root (null). ----------1M

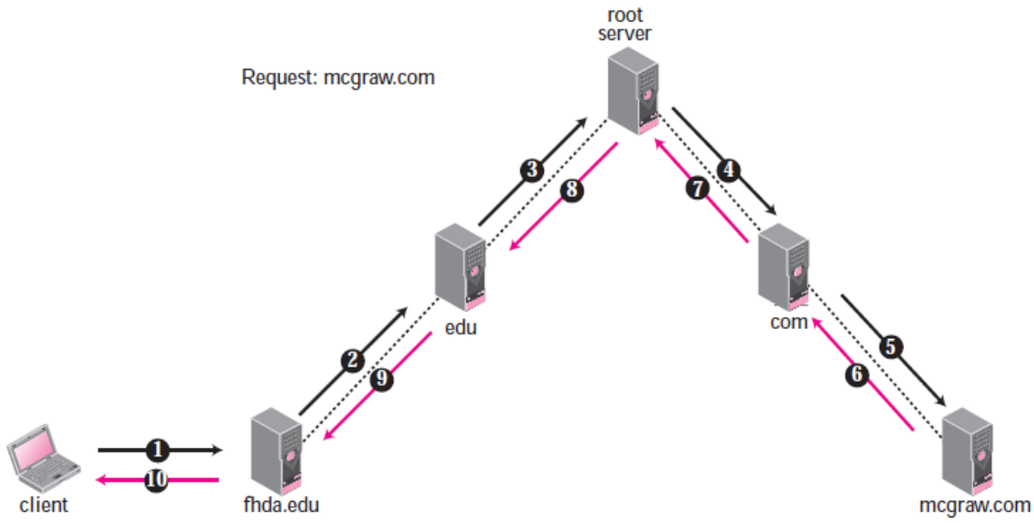
Types – generic, country , inverse domain ----------1M

Diagrams ----------1M



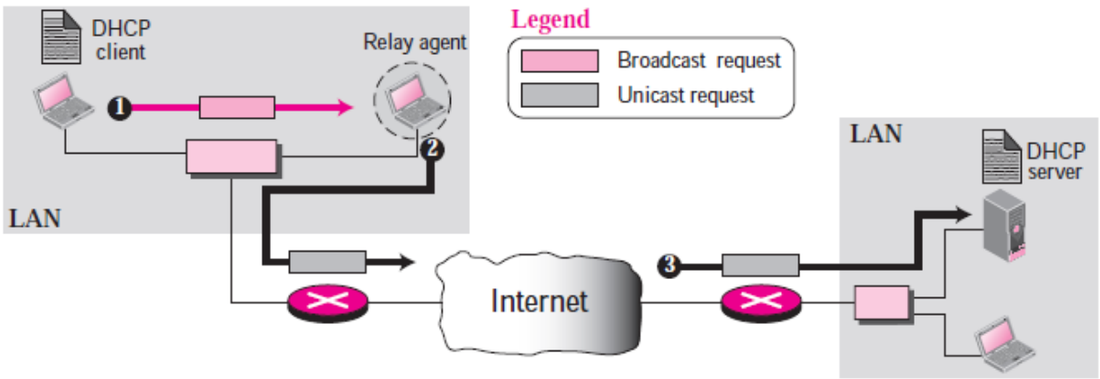
Description----------2M

c) Mapping a name to an address or an address to a name is called name-address resolution.
Names to address mapping
Address to names mapping
Recursive resolution
Iterative resolution ----------1M
Diagram ----------1M Recursive resolution



Or diagram of iterative reoslution
Description ----------3M

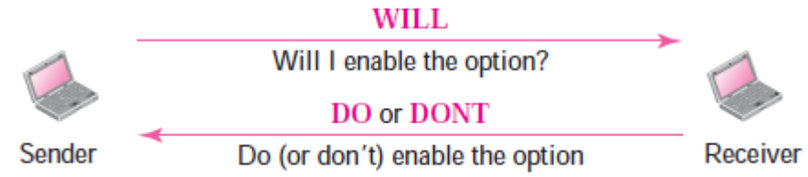
d) DHCP client server opearation Diagram ----------2M



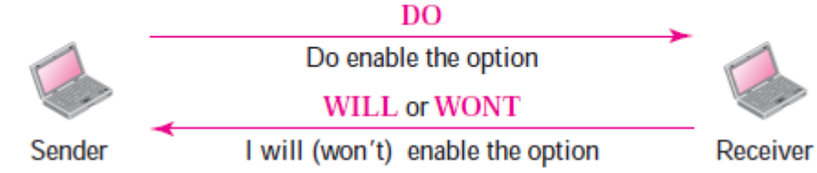
Description ----------3M

Ans – 5) a) NVT char set for option negotiation -----
WILL, WONT, DO, DONT ----------1M
Diagrams ----------3M

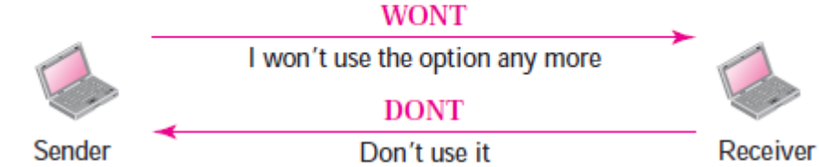
Offer to enable an option

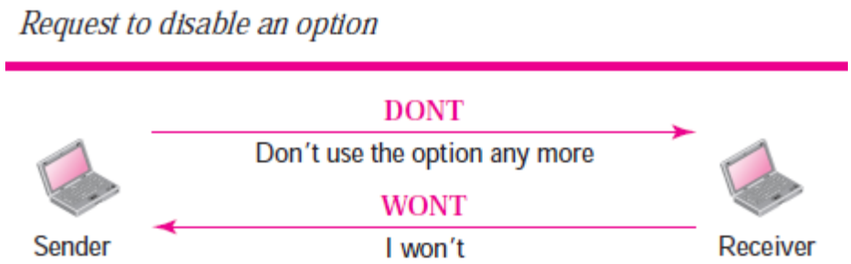


Request to enable an option



Offer to disable an option





Concepts ----------1M

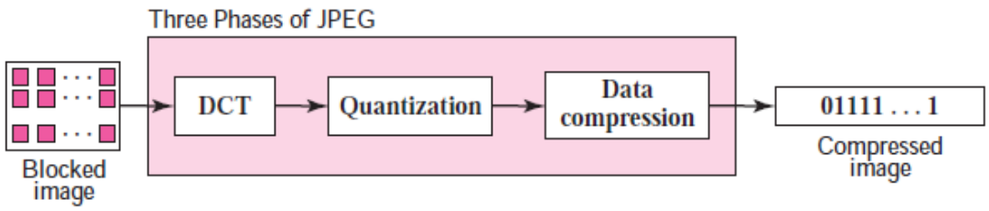
b) To make control characters effective in special situations, TELNET uses **out-of-band signaling.** In out-of-band signaling, the control characters are preceded by IAC and are sent to the remote process.----------1M
----------explanation ----------4M

c) Architecture of WWW-
Concept of the following -
WWW ----------1M
Web server ,Web client ----------1M
Hypertext , Hypermedia ----------1M
URL----------1M
Web pages -------1M

d) FTP commands
Commands, which are sent from the FTP client control process, are in the form of ASCII uppercase, which may or may not be followed by an argument. We can roughly divide the commands into six groups:
access commands, file management commands,
data formatting commands, port defining commands,
file transferring commands, and miscellaneous commands. ----------2M
----------description or purpose of each one ----------3M

Q.6) a) Video is composed of multiple frames. Each frame is one image. We can compress video by first compressing images. Two standards are prevalent in the market. **Joint Photographic Experts Group (JPEG)** is used to compress images. **Moving Picture Experts Group (MPEG)** is used to compress video. ----------1M

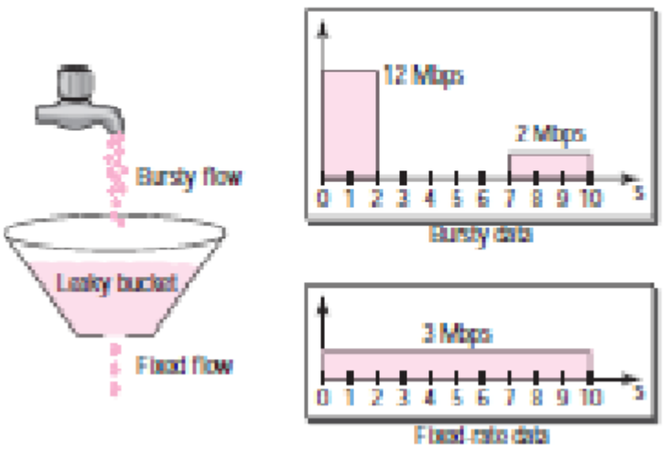
Steps of JPEG compression
DCT
Quantization
Compression ----------1M
Diagram----------1M



Description ----------2M

c) Leaky bucket algorithm ----
Diagram ----------1M

Leaky bucket



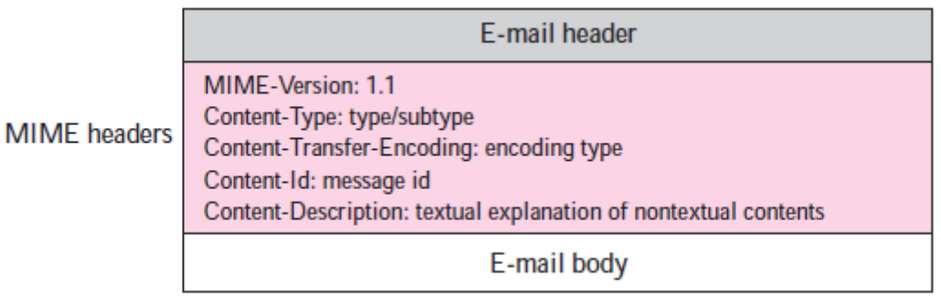
Description ----------4M

c)) Concept ----------1M

Electronic mail has a simple structure. It can send messages only in NVT 7-bit ASCII format. In other words, it has some limitations. It cannot be used for languages other than English (such as French, German, Hebrew, Russian, Chinese, and Japanese). Also, it cannot be used to send binary files or video or audio data.

Multipurpose Internet Mail Extensions (MIME) is a supplementary protocol that allows non-ASCII data to be sent through e-mail. MIME transforms non-ASCII data at the sender site to NVT ASCII data and delivers it to the client MTA to be sent through the Internet. The message at the receiving site is transformed back to the original data. We can think of MIME as a set of software functions that transforms non-ASCII

MIME header format ---------diagram ------1M



Description ----------3M

d) It can divide audio and video services into three broad categories: **streaming stored audio/video, streaming live audio/video,** and **interactive audio/video** ----------**1M**

Concept of digitization of video data using calculation ----------**4M**