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Internal Assessment Test 1 – March 2017

Sub:	Advances In Computer Networks	**Code:**	**16SCS22**
Date:	27-03-2017 Duration: 90 mins Max Marks: 50 **Sem:** II	**Branch:**	M.Tech(CSE)

Total marks: 50

1. Explain the requirements to build computer networks that will support different applications. [10 Marks]

   OR

   Briefly discuss the different performance metrics of networks. Calculate the delay * bandwidth product for channel with one way latency of 10µs and bandwidth of 100Mbps. [10 Marks]

2. Explain stop and wait algorithm showing the timeline for four different scenarios. [10 Marks]

   OR

   With Illustration, explain the sliding window algorithm. [10 Marks]

3. Suppose a 150 kbps point-to-point link is setup between the Earth and a Rover on Mars. The distance from the earth to mars (when they are closest together) is approximately 55 Gm and data travels over the link at the speed of light $3x10^8$ m/s. [10 Marks]
   i)Calculate the minimum RTT for the link
   ii)Calculate the delay x bandwidth product for the link
   iii) A camera on the rover takes pictures of its surrounding and sends these to earth. How quickly after a picture is taken, can it reach mission control on Earth? Assume that each image is 10Mb in size.

   OR

   a) Consider a point-to-point link 2 km in length. At what bandwidth would propagation delay (at a speed of 2×10^8 m/s) equal transmit time for 100-byte packets? What about 512-byte packets? [4 Marks]
   b) Calculate the total time required to transfer a 1000 KB file in the following case, assuming an RTT of 100 ms, a packet size of 1-KB data, and an initial 2 x RTT of "handshaking" before data is sent. Case: The bandwidth is 1.5 Mbps, and the packets can be sent continuously. [6 Marks]

4. Explain the virtual circuit switching and datagram switching with suitable examples. [10 Marks]

   OR

   Explain in detail the packet cell format of ATM architecture. [10 Marks]

5. Describe the spanning tree protocol algorithm. [10 Marks]

   OR

   Write notes on a) IPV4 header format b) Subnetting with example. [10 Marks]

Scheme & Solution

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1a)	■ Application Programmer ■ List the services that his application needs: delay bounded delivery of data ■ Network Designer ■ Design a cost-effective network with sharable resources ■ Network Provider (usually called Service Provider, for the Inernet, it ISP) ■ List the characteristics of a system that is easy to administer and manage. ■ Add new clients and remove/isolate faulty nodes ■ Connectivity ■ Cost-Effective Resource Sharing ■ Support for Common Services ■ Reliability ■ Manageability ----------------------------------Explain all the points in detail
b)	■ Two fundamental ways to measure the performance ---Bandwidth ■ Frequency band (measured in Hertz): we don't mean that ■ Number of bits per second that can be transmitted over a communication link ■ Throughput vs. bandwidth (from the most confusing terms in computer networks. ■ Bandwidth: the **maximum** data rate (bits per second) ■ Throughput: number of bits per second that we actually transmit over the link **in practice** ■ 1 Mbps: 1 x 10^6 bits/second = $1x2^{20}$ bits/sec ■ 1 x 10^{-6} seconds to transmit each bit or imagine that a timeline, now each bit occupies 1 micro second space. ■ On a 2 Mbps link the width is 0.5 micro second. ■ Smaller the width more will be transmission per unit time ------Latency How long it takes a message to travel from one end of a network to the other. ■ Measured in time ■ Three components ■ Speed-of-light propagation delay ■ Different media at different speeds ■ 3.0×10^8 m/s in a vacuum ■ 2.3×10^8 m/s in copper cable ■ 2.0×10^8 m/s in optical fiber ■ Amount of time to transmit a unit of data ■ Queuing delays (switches store packets) ■ Latency = Propagation + transmit + queue ■ Propagation = distance/speed of light ■ Distance: the length of the wire ■ Transmit = size/bandwidth ■ Size: the size of the packet Latency = 10 micro sec

Bandwidth = 100 Mbps

Delay * Bw = $10*10^{-6} * 100* 10^{6} = 1000$ bits

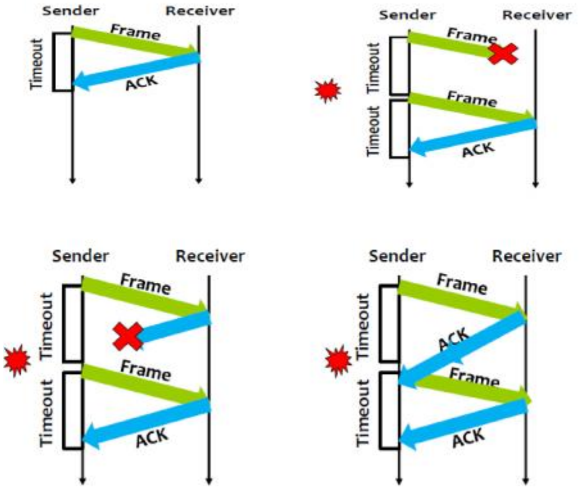
2.

1) ARQ

Idea of stop-and-wait protocol is straightforward

After transmitting one frame, the sender waits for an acknowledgement before transmitting the next frame.

If the acknowledgement does not arrive after a certain period of time, the sender times out and retransmits the original frame



(a)The ACK is received before the timer expires;

(b)The original frame is lost;

(c) The ACK is lost;

(d) The timeout fires too soon (or the ACK is delayed)

-- 1 bit seq number

2) Sliding window

Sender assigns a sequence number denoted as SeqNum to each frame.

Assume it can grow infinitely large

Sender maintains three variables

Sending Window Size (SWS)

Upper bound on the number of outstanding (unacknowledged) frames that the sender can transmit

Last Acknowledgement Received (LAR)

Sequence number of the last acknowledgement received

Last Frame Sent (LFS)

Sequence number of the last frame sent

When an acknowledgement arrives

- the sender moves LAR to right, thereby allowing the sender to transmit another frame
- Also the sender associates a timer with each frame it transmits
- It retransmits the frame if the timer expires before the ACK is received
- Note that the sender needs to buffer up to SWS frames for retransmissions, if necessary

	Receiver maintains three variables Receiving Window Size (RWS) Upper bound on the number of out-of-order frames that the receiver is willing to accept Largest Acceptable Frame (LAF) Sequence number of the largest acceptable frame Last Frame Received (LFR) Sequence number of the last frame received Explain with figure and steps ------------------------
3.	1)i) Propagation delay = Distance/speed of light= $55*10^9$ / $3*10^8$ = 184 s RTT = 2*pd = 2*184 = 368 s ii) D* BW = 184 * 150* 10^{3} = 27600000 bits iii)latency = delay + transmit + queue transmit = size/BW For 1 bit , transmit = 1/150*10^3 For 10 Mb, transmit= 10 * 10^6 / 150 * 10^3 2) a) Propagation delay=D/V= (2*10^3)/(2*10^8)=10^-5 sec - Transmission time for 100-bytes packets=L/R=(100*8)/R=10^-5, so R= 80Mbps - Transmission time for 512-bytes packets=L/R=(512*8)/R=10^-5, R= 409.6Mbps b) Packets sent continuously without need for acknowledgment Total time = initial delay + transmission time + propagation time =(2*RTT)+(L/R)+(RTT/2) =(2*100*10^-3)+(1000*10^3*8)/(1.5*10^6)+(50*10^-3)=5.58sec
4.	■ Datagrams ■ Key Idea ■ Every packet contains enough information to enable any switch to decide how to get it to destination Every packet contains the complete destination address To decide how to forward a packet, a switch consults a *forwarding table* (sometimes called a *routing table*) Characteristics of Connectionless (Datagram) Network ■ A host can send a packet anywhere at any time, since any packet that turns up at the switch can be immediately forwarded (assuming a correctly populated forwarding table) ■ When a host sends a packet, it has no way of knowing if the network is capable of delivering it or if the destination host is even up and running ■ Each packet is forwarded independently of previous packets that might have been sent to the same destination. ■ Thus two successive packets from host A to host B may follow completely different paths A switch or link failure might not have any serious effect on communication if it is possible to find an alternate route around the failure and update the forwarding table accordingly Virtual Circuit Switching ■ Widely used technique for packet switching ■ Uses the concept of *virtual circuit* (VC)

- Also called a connection-oriented model
- First set up a virtual connection from the source host to the destination host and then send the data

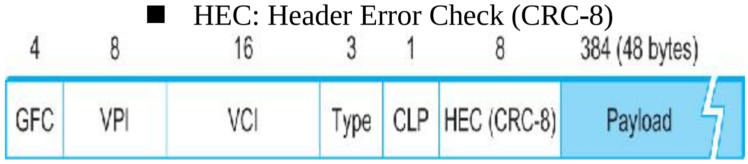
Two-stage process

- Connection setup
- Data Transfer

- Connection setup
  - Establish “connection state” in each of the switches between the source and destination hosts
  - The connection state for a single connection consists of an entry in the “VC table” in each switch through which the connection passes

2) ATM

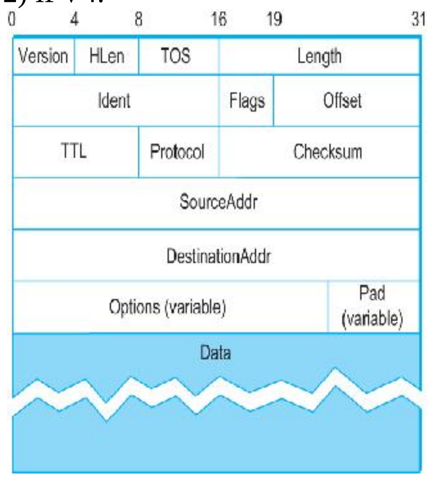
- GFC: Generic Flow Control (not used)
- VPI: Virtual Path Identifier
- VCI: Virtual Circuit Identifier
  - (VPI + VCI together makes the VC number we talked about)
- Type: management, congestion control
- CLP: Cell Loss Priority
- HEC: Header Error Check (CRC-8)



5.

1)

2) IPV4:



Subnetting:

Allocate a single network number and use it for **several physical networks**

- called **subnets**
- Several things need to be done
  - Subnets need to be **physically** close to each other
    - From the Internet point of view, they all look **ONE** network
    - A perfect situation to use subnetting is for large campus or corporation
  - Configure all nodes on each subnet with a **subnet mask**
    - It masks the network part
    - Introduces the **subnet number**
    - All nodes on the same subnet have the same subnet number

and the same mask

- The IP address of a nodes **ANDed** with the subnet mask give the subnet number

IP **AND** subnet mask ➔ subnet number

- When a host wants to send a packet to a certain IP address
  - First, it does the bitwise AND between its own subnet mast and destination IP address
  - If the result equals the subnet number of the sender, then the destination host is on the same subnet so the packet can be delivered directly (without a router)

Else, the packet will be forwarded to another subnet (through a router)

Forwarding Algorithm

D = destination IP address
for each entry < SubnetNum, SubnetMask, NextHop>
D1 = SubnetMask & D
if D1 = SubnetNum
if NextHop is an interface
  deliver datagram directly to destination
else
  deliver datagram to NextHop (a router)