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CS 335
Assignment 1

1.
(i) [3] Write the three basic elements of a Computer Network ?
Solution -> The three basic element of Computer Network are :

- Host/ Endpoint = devices the are connected to the network
- Communication link = It is the Physical connection between the equipment connected to the internet. Example - Coaxial cable, fiber optics, HFC
- Packet switching = the data is sent from one Host/Endpoint to destination using Routers and switches and it's called packet switching. Example - Routers, Switches

(ii) [2] Write any two protocols which are used in internet.
Solution -

- TCP -> Transmission Control protocol
- HTTP -> Hypertext transfer protocol

(iii) [2] What is an access network?
Solution - the connection from the Endpoint/ host to the first router is called Access Network
(iv) [3] Give a name of access technology used for each of the following: home, enterprise and mobile communication.
Solution -
The Access technology used for home is DSL, Cable.
The Access technology used for Enterprise is Ethernet.
The Access technology used for Mobile Communication is 3g, LTE..

(v) [2] Why is DSL asymmetric access?
Solution - DSL is asymmetric because the Upstream and Downstream rates are different.

(vi) [3] Give any three communication links which are mostly used.
Solution - The communication links mostly used are:

- Coaxial cables -> hybrid fiber cable
- Fiber optics cable
- Wide -Area -> LTE

2.
Assume that a network uses the packet switching technique to send its packets. The transmission rate for each communication link is R bps. The length of each packet is L bits.
(i) [2] If there is a single communication link between the sending host A and the receiving host B, what is the transmit time for a packet from A to B?
Solution -

The Transmission time between A and B for a packet with length L and transmission rate B will be (1)*L/R

(ii) [2] If there are 2 communication links between A and B, what is the transmit time for a packet from A to B?

Solution -

The Transmission time for 2 communication links between A and B for a packet with length L and transmission rate B will be (2)*L/R

(iii) [3] If there are N communication links between A and B, what is the transmit time for a packet from A to B?

Solution -

The Transmission time for N communication links between A and B for a packet with length L and transmission rate B will be (N)*L/R

(iv) [5] If there are N communication links between A and B, what is the transmit time for P packets from A to B?

Solution -

The Transmission time for N communication links between A and B for P packets with length L and transmission rate B will be ((N)*L/R) *((P-1)*L/R)

= > (N+P-1)L/R

3.

(i) [4+2] What are the various packet delays in computer network? Which delays are constant and which are variable?

Solution -

The various type of packet delays in Computer network are

- Processing delay -> its is donated as Dproc.amount of time used to process the packet headers and determine the destination host.
- Queuing delay -> It's the time it take for the packet to go through the buffer before it's pushed forward
- Transmission Delay -> It's the time it takes to push the bits to the link
- Propagation Delay -> Its the time it takes for bits to travel through the link

Processing and Propagation delay are constant delay and Queuing delay and Transmission delay are Variable.

(ii) [2+2] Define traffic intensity. What happens if the traffic intensity is greater than 1?

Solution ->

Traffic Intensity is the average packet arrival rate times the length of the packet over the link Bandwidth

NI -> La/R

When the network intensity is greater than one that means either the length of the packet or the average packet arrival rate is high which indicates high congestion and infinite delay.

(iii) [10] Consider a packet of 1500 bytes that begins at host A and travels over three links over destination host B, using the packet switching technique. The specification of the links are as follows:

Communication link 1:

Length = 5000 km

Propagation speed = 2.5 * 10_8 m/s Transmission rate = 1 Mbps

Communication link 2:

Length = 4000 km

Propagation speed = 2 * 10_8 m/s Transmission rate = 1.5 Mbps
Communication link 3:
Length = 1000 km
Propagation speed = 3 * 10_8 m/s Transmission rate = 2 Mbps
The processing delay for each packet switch is 3 msec. Assuming that there is no queueing delay in the network. What is the end-to-end delay for a packet from A to B?

Solution -

First communication link ->

$d_{end-end} = N[d_{trans} + d_{prop} + d_{proc} + d_{queue}]$

N= 1 ,d_{trans} = L/R = (1500*8)/1000000 = 0.012 sec = 12000 msec

D_{prop} = 5000/ (2.5 * 10_8)= 0.00002 sec = 20 msec

D_{proc} = 3 msec

Total = 12000 + 20 +3 = 12023 msec

Second communication link ->

$d_{end-end} = N[d_{trans} + d_{prop} + d_{proc} + d_{queue}]$

N= 1 ,d_{trans} = L/R = (1500*8)/15000000 = 0.008 sec = 8000 msec

D_{prop} = 4000/ (2.0 * 10_8)= 0.00002 sec = 20 msec

D_{proc} = 3 msec

Total = 8000 + 20 +3 = 8023 msec

Third communication link ->

$d_{end-end} = N[d_{trans} + d_{prop} + d_{proc} + d_{queue}]$

N= 1 ,d_{trans} = L/R = (1500*8)/2000000 = 0.006 sec = 6000 msec

D_{prop} = 1000/ (3 * 10_8)= 0.000003 sec = 3 msec

D_{proc} = 3 msec

Total = 6000 + 3 +3 = 6006 msec

Total End to End time = > 12023 +8023 +6006 = 26052 msec = 0.026052 sec

(i) [4] What are the various layers of the TCP/IP protocol stack?
Solution - The layers of the TCP/Ip protocol stack are:

- Application, Transport , Network, Link, Physical

(ii) [7] Give the full name and the corresponding layer to the following protocols: HTTP, SMTP, FTP, TCP, UDP, IP, BGP.
Solution -

- HTTP - Hypertext transfer Protocol -> Application Layer

- SMTP - Simple mail transfer protocol -> Application Layer
- FTP - File transfer protocol -> Application Layer
- TCP - Transmission control Protocol -> Transport layer
- UDP - User datagram protocol -> Transport Layer
- IP - Internet protocol -> Network layer
- BGP - Border gateway protocol -> Network Layer

(iii) [4] What are message, segment, datagram and frame?
Solution -

Message -> The data that's being sent from Source is encrypted in the application layer and it is called Message

Segment -> It consist of the Message from the Application layer and the transport layer header which contains the information about which protocol is being used to send the message. Example - TCP header

Datagram -> It consist of Segment from transport layer and network layer header which includes

Frame -> Datagram + Mac Address(source) +Mac Address(destination) = Frame in from of packet . It consist of Datagram from Network layer and the source mac address as well as the destination mac address. It contain link layer packets.

(iv) [3] What is the difference between a virus and a worm?
Solution -

- Virus -> It is a self replicating infection by receiving or executing objects.
- Worm -> It is a self replicating infection that gets executed by itself.