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Wireless Network

Q :1 (a)

Ans: Given:

B = 600Hz

SNR= 600dB

Solution:

We will use the Shannon Capacity Formula:

$C=B*\log_2(1+SNR)$

Where, SNR= Signal to noise ratio

B= Bandwidth of channel in

C= channel capacity

$C = B \log_2 (1+SNR)$

$= 600 \log_2 (1+600)$

$= 600 [\log_{10} 600/\log_2]$

$= 600 [2.778/0.301]$

$= 5537.54$ bps.

Q :1 (b)

Ans: Given: -

C=4800 bps

Log_2 M=8, because a signal element encodes an 8-bit word.

According to Nyquist's Equation: -

$C= 2B \text{ LOG}_2 M$

C= 4800

4800=2B*8

B=4800/2*8

=300 Hz (Ans)

~ The Minimum required band –width of the channel is 300 Hertz

Q :2 (a)

Ans:They can use TCP/Ip protocol to send the message and also to receive acknowledgement.

Q :2 (b)

Ans: TCP/IP PROTOCOL SUITE:

Communications between computers on a network is done through protocol suits. The most widely used and most widely available protocol suite is TCP/IP protocol suite. A protocol suit consists of a layered architecture where each layer depicts some functionality which can be carried out by a protocol. Each layer usually has more than one protocol options to carry out the responsibility that the layer adheres to. TCP/IP is normally considered to be a 4-layer system. The 4 layers are as follows:

1. Application layer
2. Transport layer
3. Network layer
4. Data link layer

1. Application layer

This is the top layer of TCP/IP protocol suite. This layer includes applications or processes that use transport layer protocols to deliver the data to destination computers.

At each layer there are certain protocol options to carry out the task designated to that particular layer. So, application layer also has various protocols that applications use to communicate with the second layer, the transport layer. Some of the popular application layer protocols are:

- HTTP (Hypertext transfer protocol)
- FTP (File transfer protocol)
- SMTP (Simple mail transfer protocol)
- SNMP (Simple network management protocol) etc.

2. Transport Layer

This layer provides backbone to data flow between two hosts. This layer receives data from the application layer above it. There are many protocols that work at this layer but the two most commonly used protocols at transport layer are TCP and UDP.

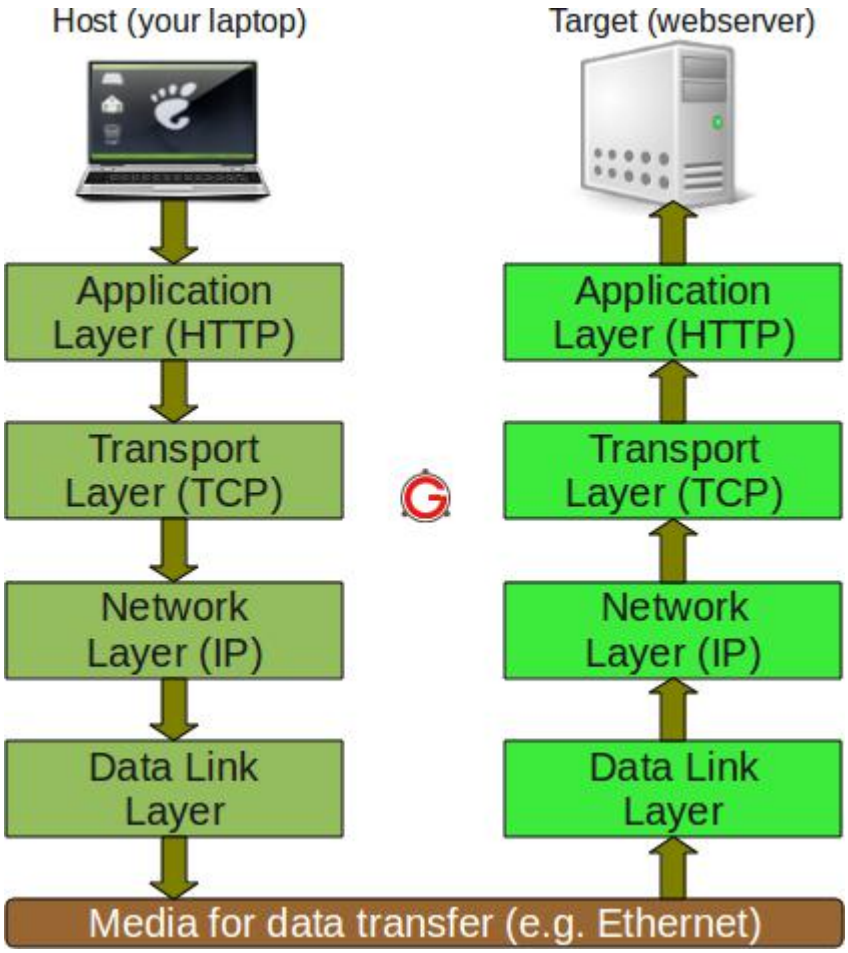
TCP is used where a reliable connection is required while UDP is used in case of unreliable connections

3. Network Layer

This layer is also known as Internet layer. The main purpose of this layer is to organize or handle the movement of data on network. By movement of data, we generally mean routing of data over the network. The main protocol used at this layer is IP. While ICMP (used by popular 'ping' command) and IGMP are also used at this layer.

4. Data Link Layer

This layer is also known as network interface layer. This layer normally consists of device drivers in the OS and the network interface card attached to the system. Both the device drivers and the network interface card take care of the communication details with the media being used to transfer the data over the network. In most of the cases, this media is in the form of cables. Some of the famous protocols that are used at this layer include ARP (Address resolution protocol), PPP (Point to point protocol) etc.



Q :3 (a)

Ans: Sol:

Pi= $20 \log_{10} (6*10^9) + 20 \log_{10} (35.863*10^6) - 147.56$dB

Pi= 199.09 dB

Q :3 (b)

Ans: Particular signal system = -155dbw

Link transmitting 2400bps

Temperature 1600k

We know that

Eb/ No = -155dbw – 10 log (2400) -10 log (1600) + 228.6

= -155dbw -10 (3.3) -10 (3.2) + 228.6

= -155dbw -33 -32 + 228.6

= -155 + 229.6

= 74.6

Q :4 (a)

Ans: GEO satellite:

A geostationary orbit, also referred to as a geosynchronous equatorial orbit (GEO), is a circular geosynchronous orbit 35,786 kilometres (22,236 miles) above Earth's equator and following the direction of Earth's rotation

MEO satellite:

A medium earth orbit (MEO) satellite is one with an orbit within the range from a few hundred miles to a few thousand miles above the earth's surface. Satellites of this type orbit higher than low earth orbit (LEO) satellites, but lower than geostationary satellites.

LEO satellites:

A low Earth orbit (LEO) is an Earth-centered orbit with an altitude of 2,000 km (1,200 mi) or less (approximately one-third of the radius of Earth),[1] or with at least 11.25 periods per day (an orbital period of 128 minutes or less) and an eccentricity less than 0.25.[2] Most of the manmade objects in outer space are in LEO

COMPARISON:

Parameter	LEO	MEO	GEO
Satellite Height	500-1500 km	5000-12000 km	35,800 km
Orbital Period	10-40 minutes	2-8 hours	24 hours
Number of Satellites	40-80	8-20	3
Satellite Life	Short	Long	Long
Number of Handoffs	High	Low	Least(none)

Gateway Cost	Very Expensive	Expensive	Cheap
Propagation Loss	Least	High	Highest

Q :4 (b)

Ans: These satellites are around 36,786km from the Earth, which means using the speed of light it takes ~0.1193559 light seconds to travel to the satellite and approximate the same time back, equaling a minimum delay to the equator of ~0.2387 seconds round trip time (RTT).

Q :4 (c)

Ans: **Satellite Subsystems**

A Complete Satellite consists of several subsystems, but the most important of them are as follow:

1) Power Supply System.
2) Altitude and Orbit Control System.
3) Telemetry, Tracking and Command System.
4) Communication Subsystem.

Power Systems

We know that the satellite present in an orbit should be operated continuously during its life span. So, the satellite requires internal power in order to operate various electronic systems and communications payload that are present in it.

Power system is a vital subsystem, which provides the power required for working of a satellite. Mainly, the solar cells (or panels) and rechargeable batteries are used in these systems

Altitude and Orbit Control System:

Altitude control subsystem takes care of the orientation of satellite in its respective orbit. Following are the two methods to make the satellite that is present in an orbit as stable.

- Spinning the satellite
- Three axes method

Orbit Control Subsystem:

Orbit control subsystem is useful in order to bring the satellite into its correct orbit, whenever the satellite gets deviated from its orbit.

The TTCM subsystem present at earth station monitors the position of satellite. If there is any change in satellite orbit, then it sends a signal regarding the correction to Orbit control subsystem. Then, it will resolve that issue by bringing the satellite into the correct orbit.

In this way, the **AOC subsystem** takes care of the satellite position in the right orbit and at right altitude during entire life span of the satellite in space

Telemetry, Tracking and Command System

Data received from the Satellite about status of attitude, orbit and other involve parameters is processed at the ground station. Telemetry, Tracking and Command Subsystem is a part of satellite management task and it is involves an Earth Station. The main function of the TT&C Subsystem is as follow:

a) Measuring of angle and range for the localization of the satellite.
b) Transmission of housekeeping information.
c) Status of a satellite to the ground control station.
d) Receiving command signals for the station keeping operations of the on-board equipment's.

Communication Subsystem:

The communication subsystem is one of the primary systems for Earth observation satellites. It is used for tele command/telemetry signalling besides downlink data transfer.