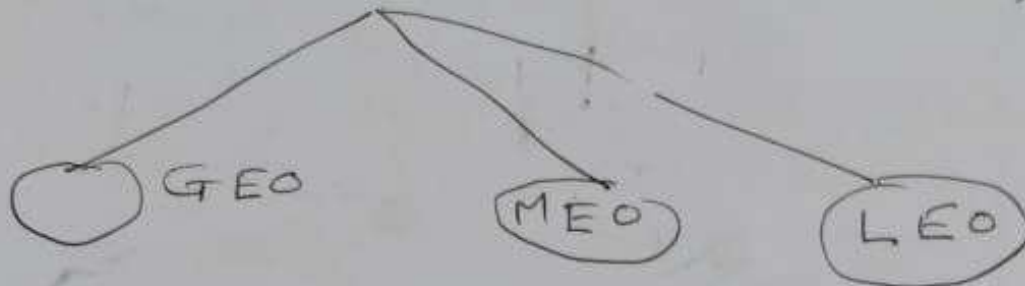


1 Satellite networks.

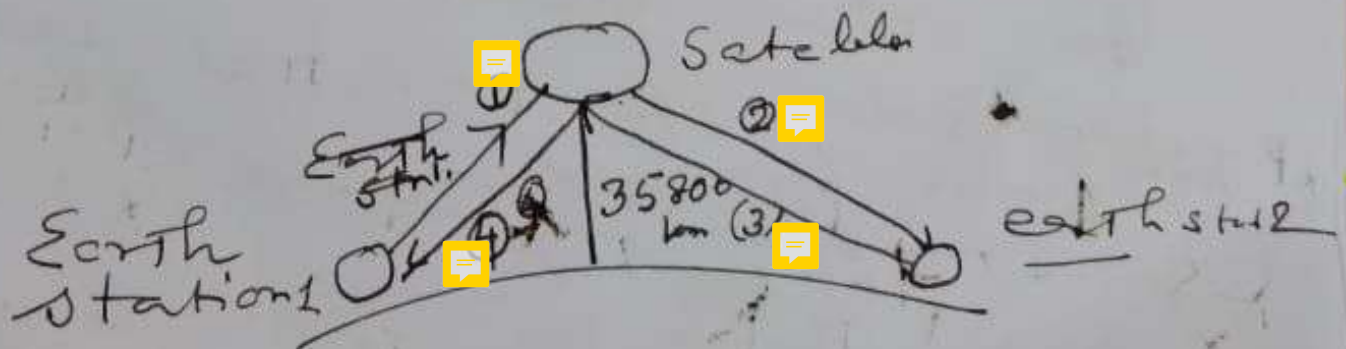
(i) Satellite classification



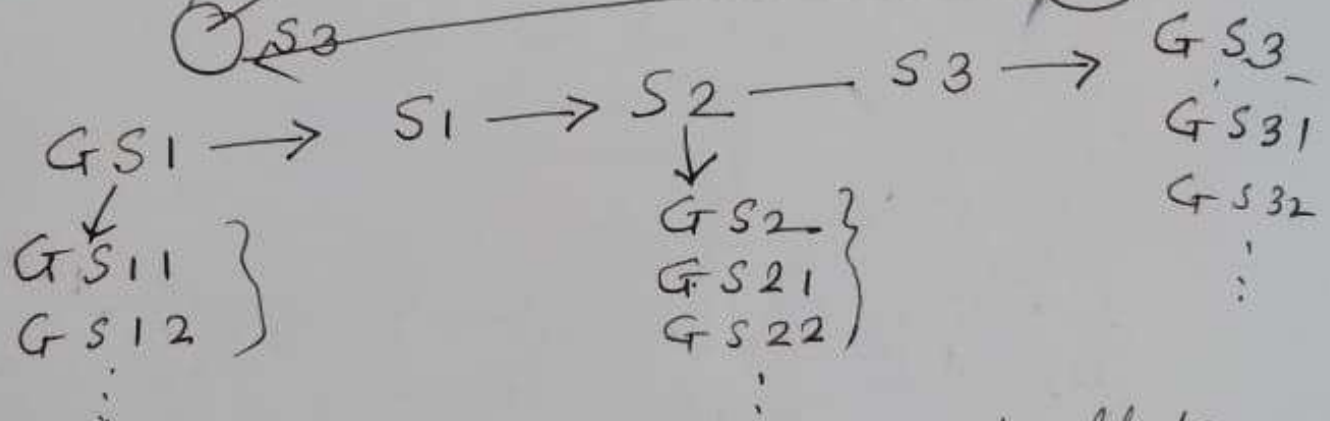
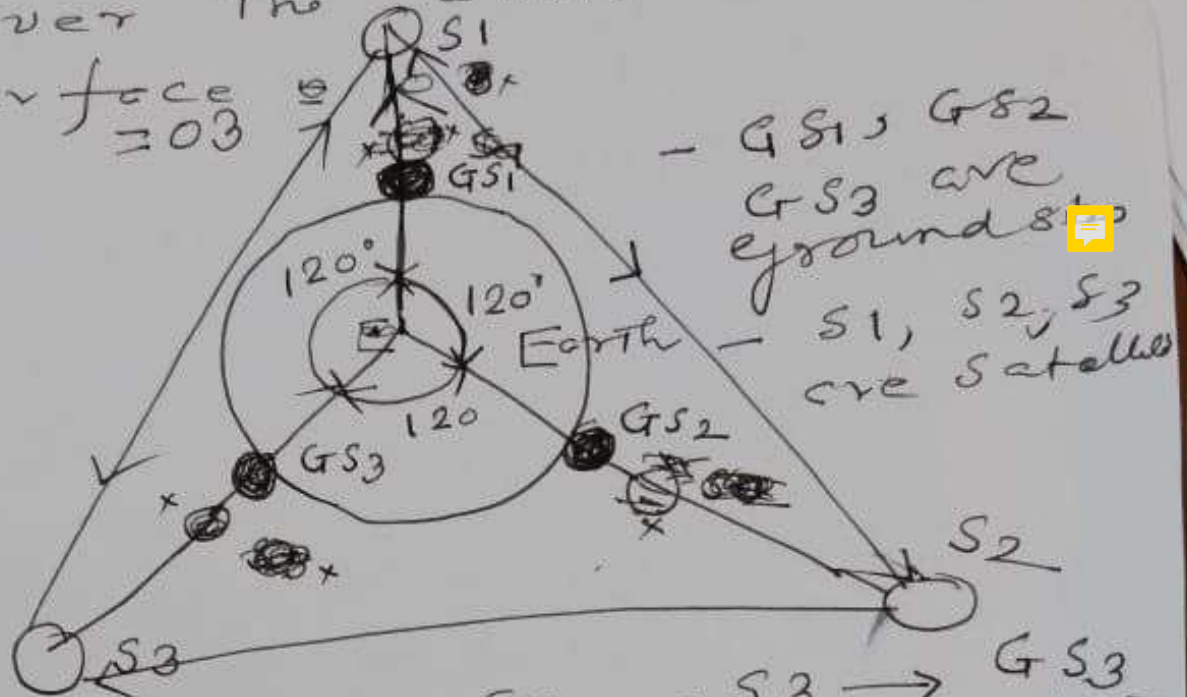
(ii) GEO: Geo Stationary Earth orbit satellite

@ \approx 35800 km above earth surface on the equatorial plane

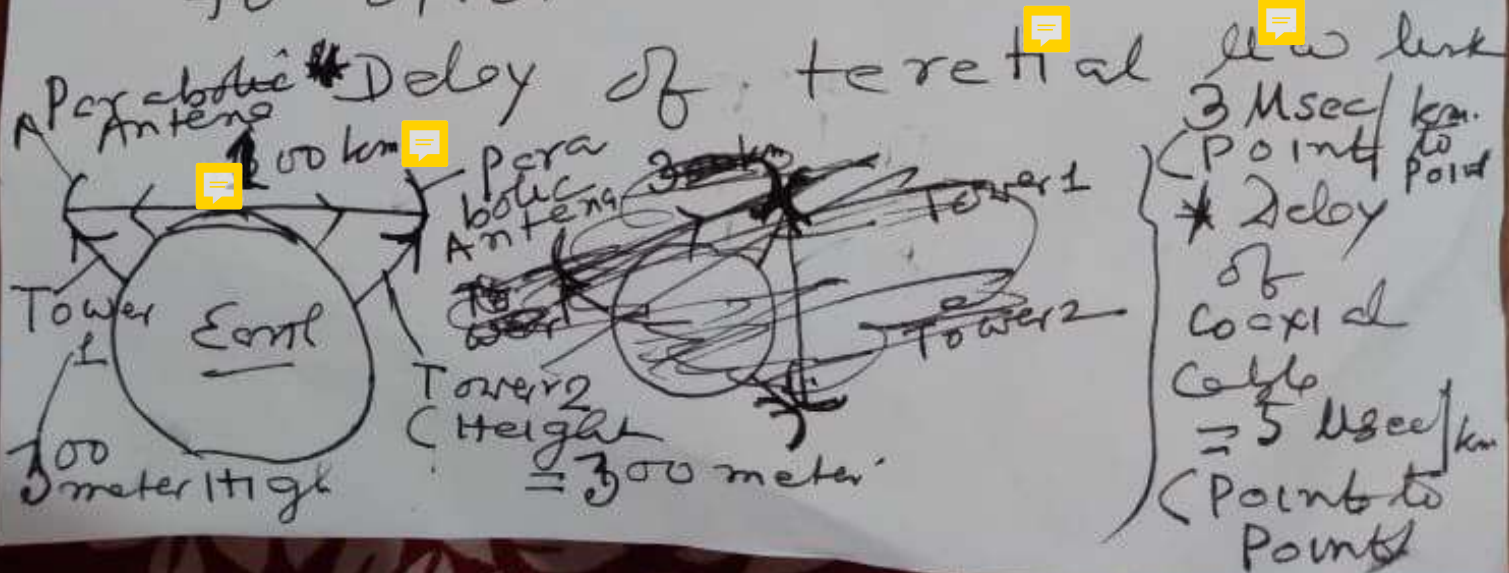
(b) To and fro delay (1+2+3+4) from Earth station to earth station = $(270 + 270) = 540$



(c) Satellites required to cover the whole earth surface = 03



(d) Comparison of Satellite to other medium delay



GEO

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(e) A Satellite is basically a broadcast network covering some area of earth below the satellite.

(f) GEO Satellite Bands

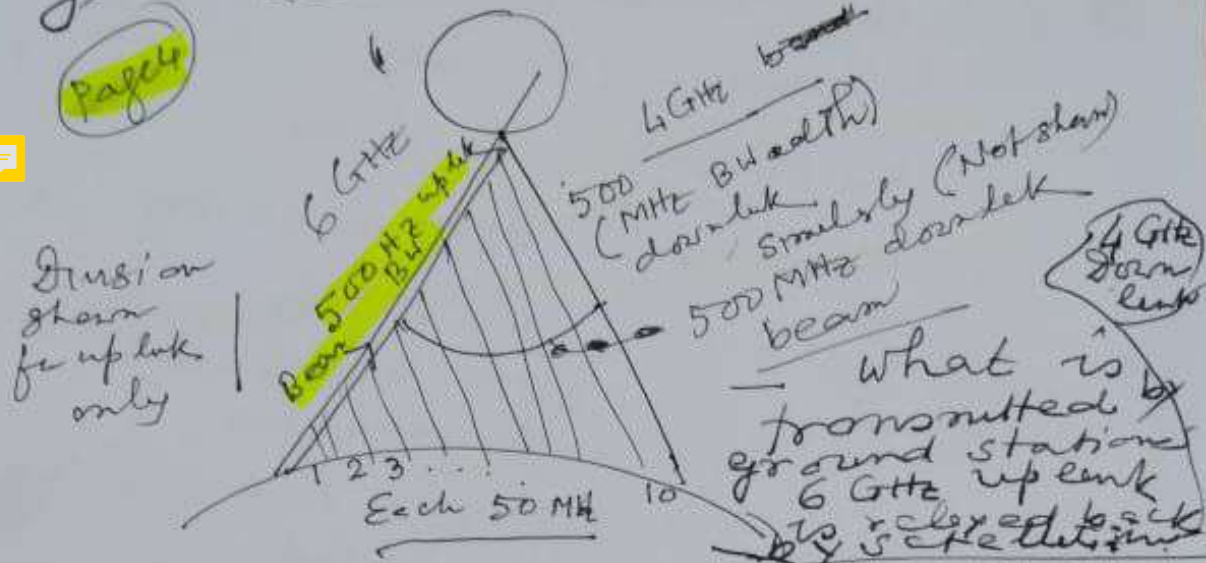
Band	Down Link (GHz)	Uplink (GHz)	BW (MHz)	Problem
L	1.5 -	1.6 -	15 -	Low Bandwidth crowded
S	1.9 -	2.2 -	70 -	80 - 80
C	4.0 -	6.0 -	500	Terrestrial Interference
Ku	11.0	14.0	500	Rain fog Absorption
Ka.	20.0	30.0	3500	80 + costly equipment

Q) GEO

C Band

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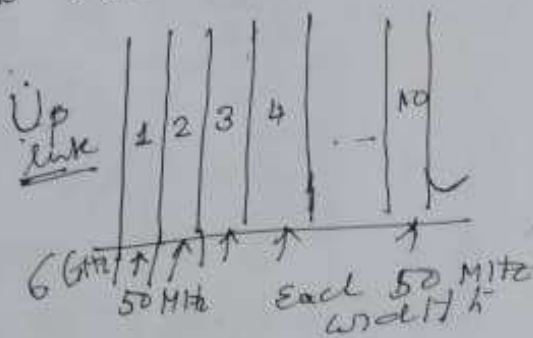
Page



(M) Transponders

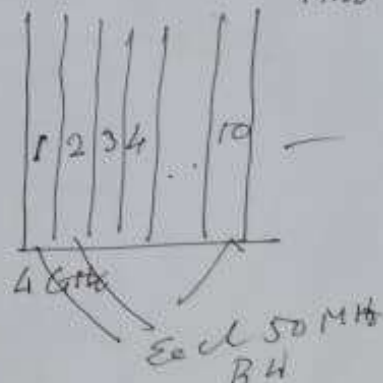
500 MHz \Rightarrow 10 up link channels

Divided Each 50 MHz



(N) 500 MHz =

10 downlink channels each 50 MHz



1st up link 1st down link \Rightarrow transponder 1

2nd " 2nd " \Rightarrow " 2

" " \Rightarrow transponder 10th

10th " " \Rightarrow " 10th

(i)

Whatever sent transponder i ($1 \leq i \leq 10$) uplink same thing shall be relayed by satellite to transponder downlink.

(j) Each transponder may be further subdivided into

smaller slot ^{uplink & down} channels link (Page 5)

(Page 5)

(K) ~~Q1~~

V SAT Network
(Very Small Aperture Terminal)

1 meter diameter Antenna
14 off of pole

GEO Antenna 10 meters diameter

(from Computer to Internet Request) uplink = 1 Mbps
Transmission speed

From Internet to Computer downlink speed \Rightarrow several Mbps

Each V SAT

Antenna

V SAT Controller
(Computer Based)

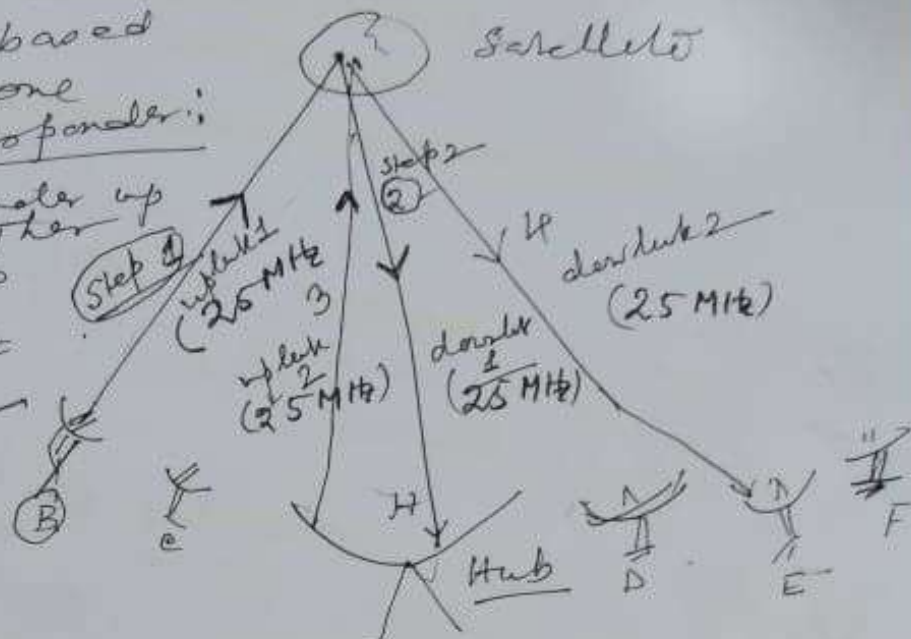
Computer node

One of the Computer node is Router to INTERNET.

(1) VSAT Communication Steps: B to E (via H)

Sat based on one transponder;

(i) One transponder up link is further divided into 2 up links of 25 MHz
(ii) Similarly down 2 links each 25 MHz BW



(iii) * \rightarrow A, B, C, D, E, F \Rightarrow VSAT
H = Hub (dedicated Controller with Higher Autonomy)

(iv) Master/Slave Configuration
VSATs \Rightarrow Slave
Hub = Master

(v) * \rightarrow FDMA/FDD \checkmark via Hub
* \rightarrow TDMA/FDD
* \rightarrow CDMA/FDD

(vi) * \rightarrow clear link channels; By passing Hubs.

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- MEO: - Medium Earth orbit Satellite
- ① Lower Height than GEO - (24 Hrs rotation)
 - MEO 6 hrs - to circle earth
 - ② 30 Satellite for Global Positioning system (GPS) one appearing and other disappear
 - ③ $H = 20,200 \text{ km}$ - stands off reqd.
 - ④ delay 30 to 85 ms one way
 - ⑤ stands off between two satellite

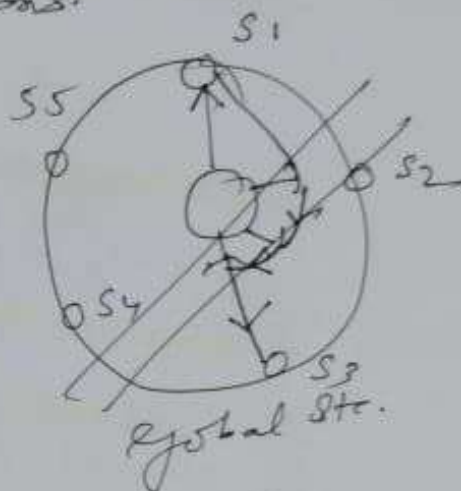
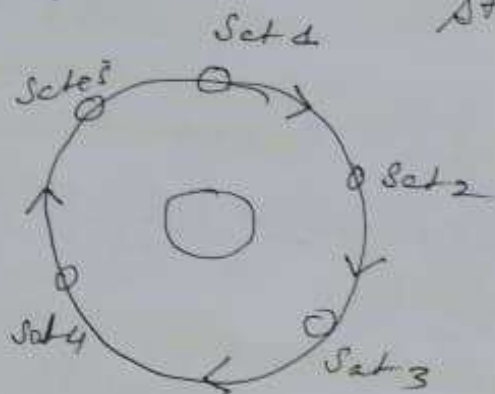
LEO Satellite: Low Earth orbit

Satellite

- ① - very near to earth Less than 5000 km
- ② - delay 1-7 ms
- ③ - Low battery
- ④ - Large No required to cover -
- ⑤ - 50 Satellite required
- ⑥ - medium project (element 77 atomic no 750 km high) - Mobile phone call per min - But the mobile cellular took over
- ⑦ - Lost project
- ⑧ - Navigation for Marine, Aviation
- ⑨ - exploration
- ⑩ - place where No telecom infrastructure possible
- ⑪ - Each satellite 48 cells (spot beams) 3840 channels paging, navigation
- ⑫ - Globalstar data & voice Satellite

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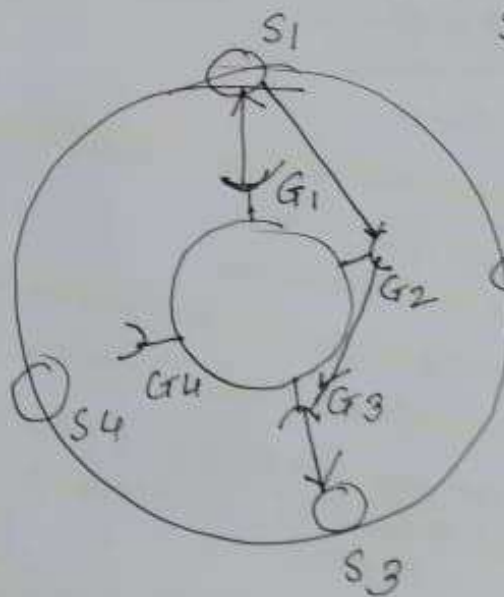
Problem: satellites switches in space $\xrightarrow{\text{with switching device}}$ satellites
 global pter - switches is through earth stations.



Principle:

(Communication only through satellites)

S1 to S3
 Communication)



S1 \rightarrow S4
 Satellites
 G1 to G4
 ground stations

① S1 to S3 Communication

G1 \rightarrow S1 -
 S1 \rightarrow G2 -
 G2 \rightarrow G3 -
 G3 \rightarrow S3.