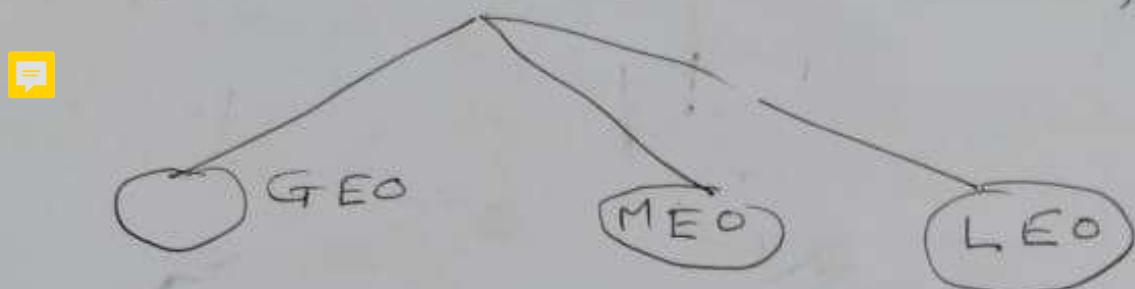


## 1 Satellite networks.

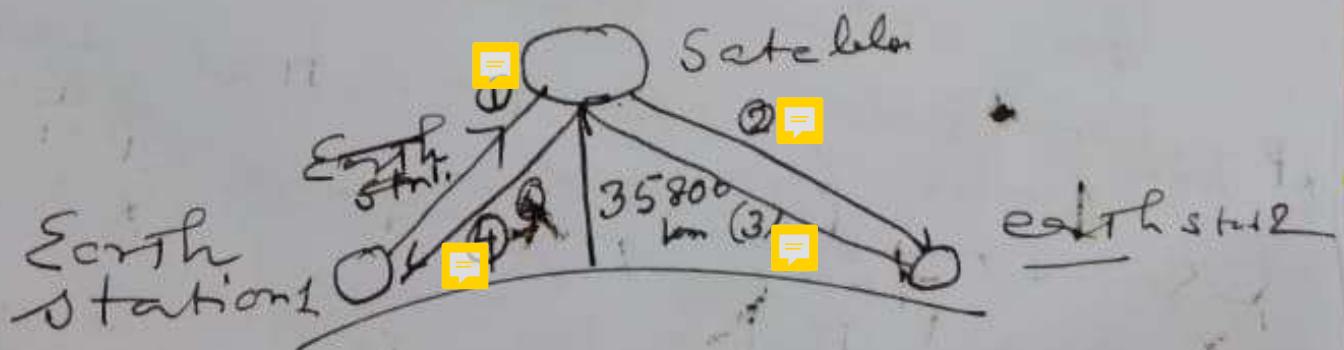
## (i) Satellite classifier.



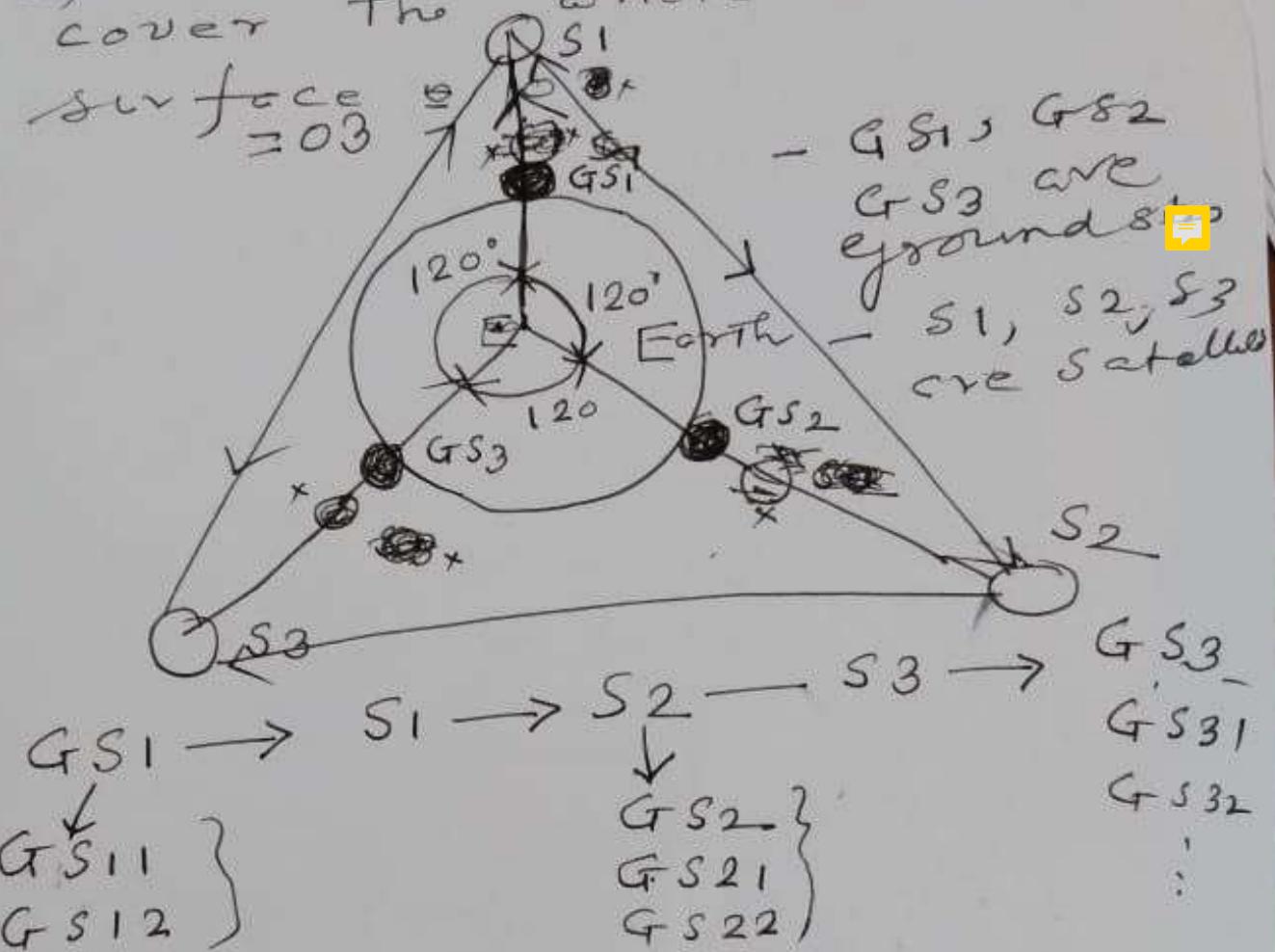
(ii) **GEO:** Geo stationary Earth orbit satellite

④ @  $\approx$  35800 km above earth surface on the equatorial plane

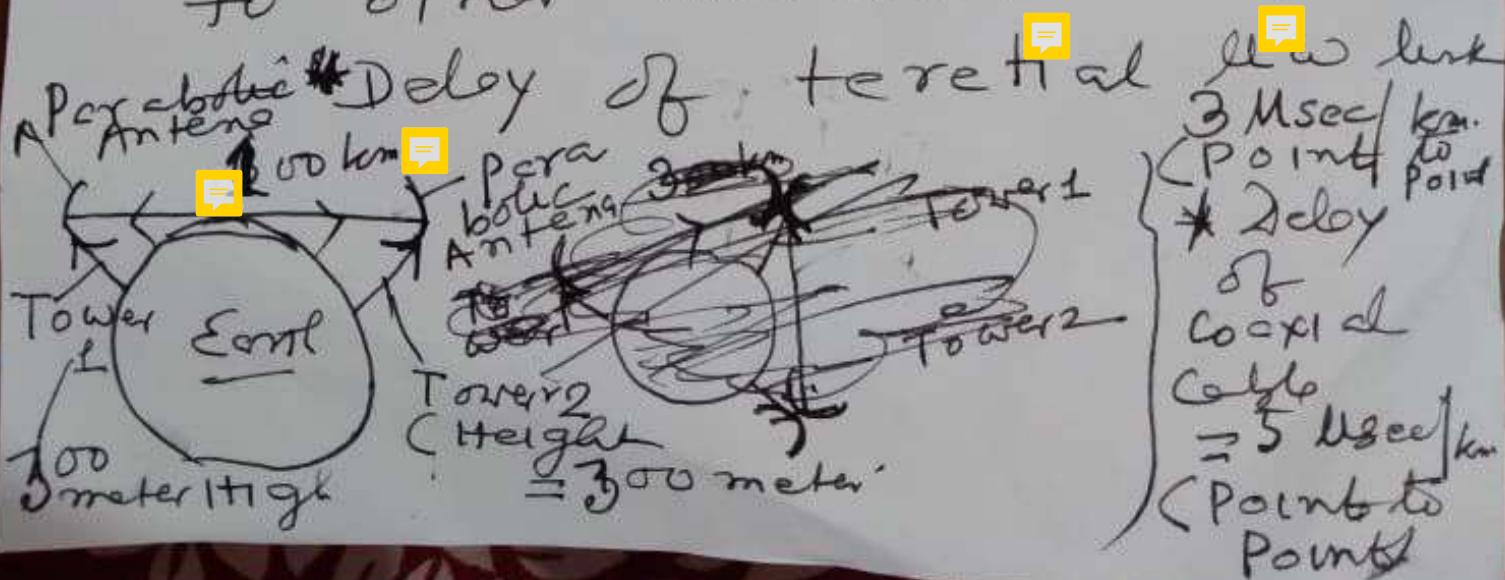
(b) To and fro delay (1+2+3+4)  
from Earth station to Earth station =  $(270 + 270) = 540 \text{ ms}$



(e) satellites required to cover the whole earth surface



(d) Comparison of satellite to other medium delay



(e) GEO Page-03  
 A Satellite is basically  
 a broad cast network covering  
 some area of earth below  
 the satellite.

(f) GEO Satellite Bands

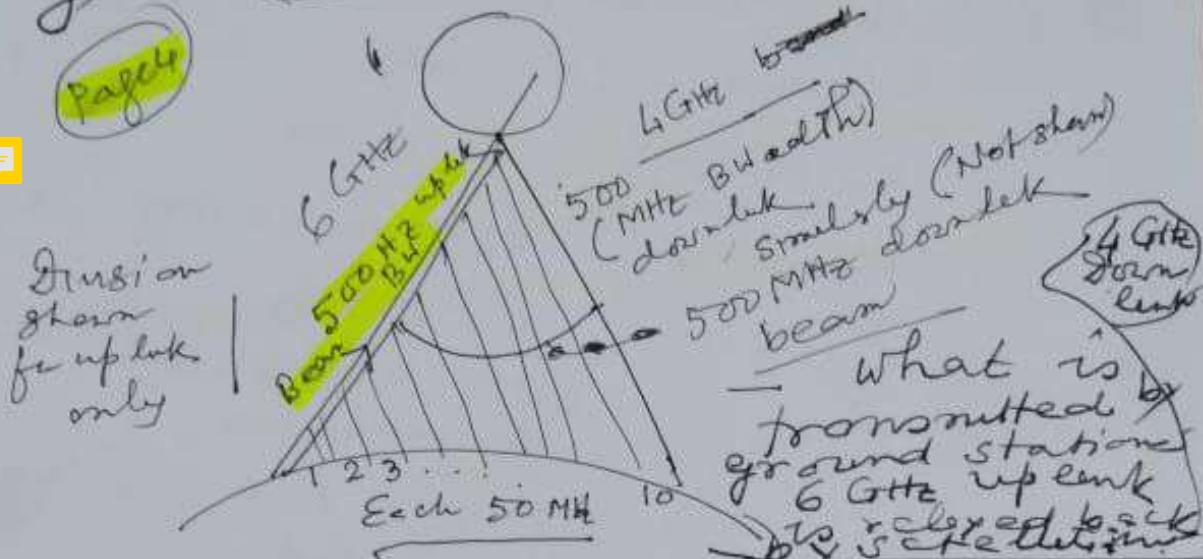
Band	Downlink (GHz)	Uplink (GHz)	BW MHz	Problem
L	1.5 -	1.6 -	15 -	Low Bandwidth crowded
S	1.9 -	2.2 -	70 -	80 - 80
C	4.0 -	6.0 -	500	Terrestrial Interference
Ku	11.0	14.0	500	Rain fog Absorption
Ka	20.0	30.0	3500	+ costly equipment

(g) GEO

C Band

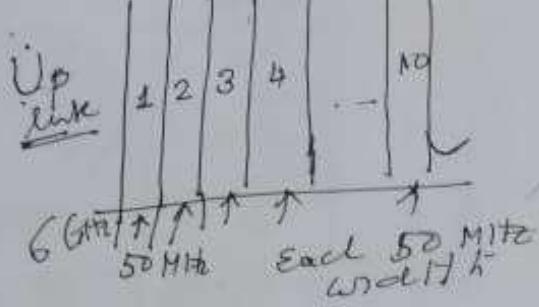
page 4

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(h) Transponders

$500 \text{ MHz} \rightarrow 10 \text{ up link channels}$   
uplink each  $50 \text{ MHz}$   
Indeed each  $50 \text{ MHz}$



(h)  $500 \text{ MHz} =$

10 downlink  
channels  
each 50  
MHz



1st uplink 1st downlink  $\Rightarrow$  transponder 1  
2nd 2nd  $\Rightarrow$  " 2  
⋮ ⋮  
10th 10th  $\Rightarrow$  transponder 10

(i)

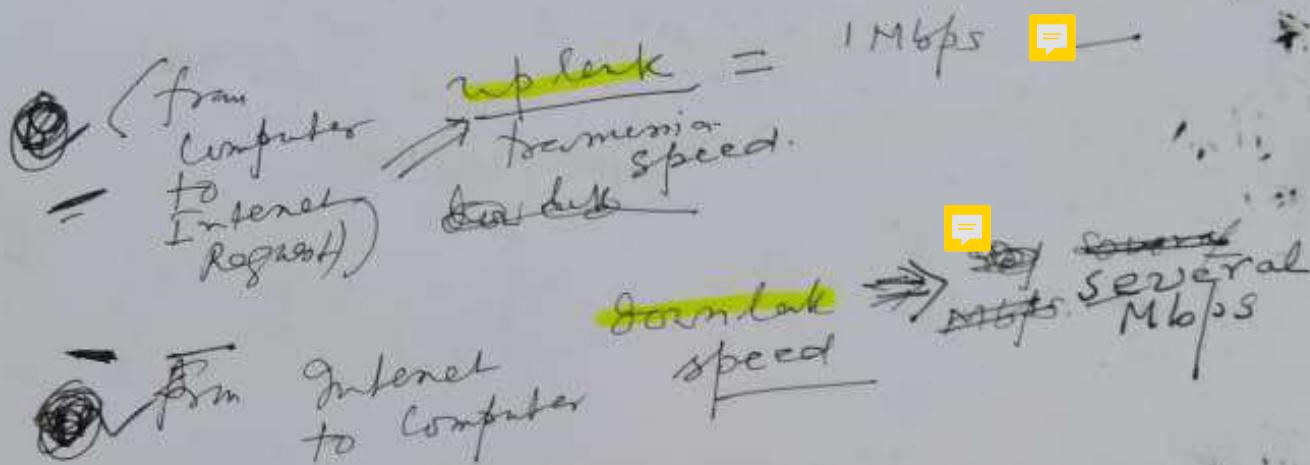
Whatever sent transponder i ( $1 \leq i \leq 10$ )

uplink same thing shall be relayed

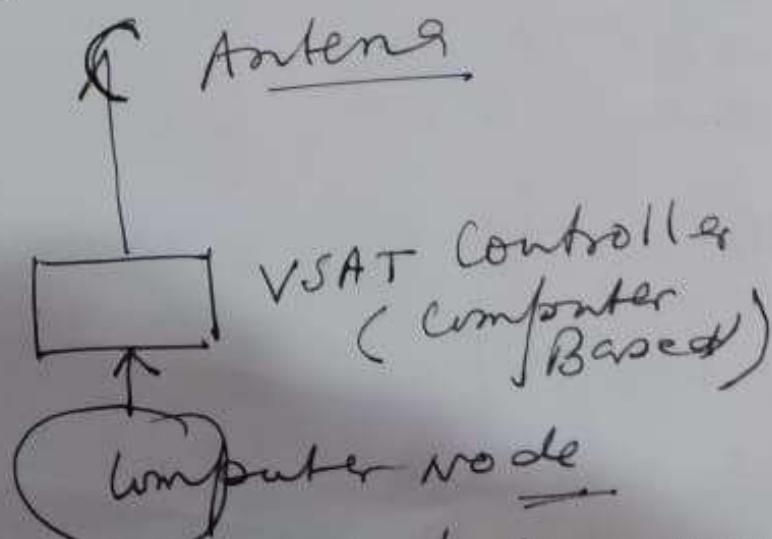
by satellite to transponder downlink.

(j) Each uplink and downlink no interference  
Each transponder may be further subdivided into

- small slot channels <sup>tree & door</sup>  
→ Page 5
- (K) — VSAT Network  
(Very small Aperture Terminal)
- 1 meter diameter Antennas.
  - 1 watt of power
  - GEO Antennas 10 meters diameter



— Each VSAT



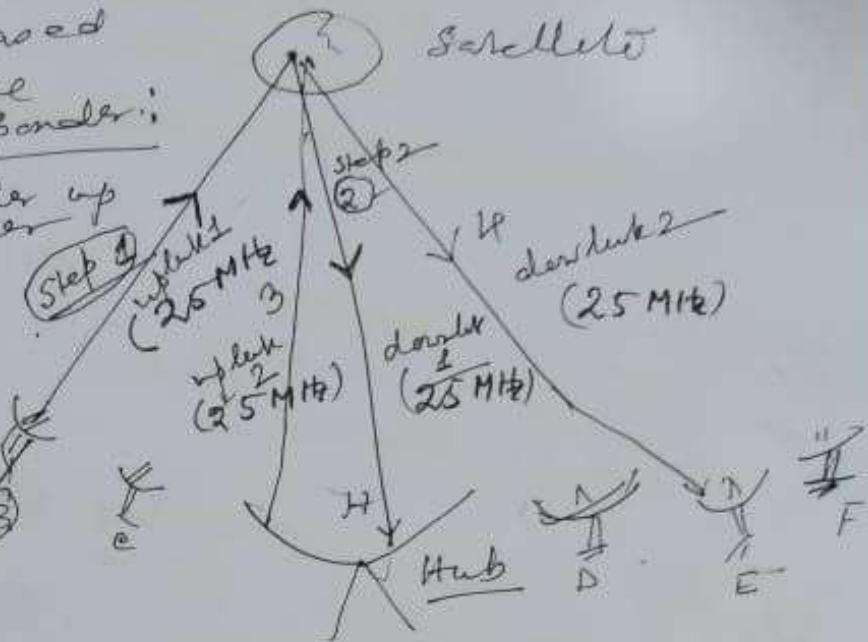
— One of the computer nodes is Router to INTERNET.

Page 6

(b) VSAT communication steps: B to E  
(via H)

Soy based  
on one  
transponder;

\* One transponder up  
link is further  
divided into  
2 up links  
of 25 MHz  
simultaneously  
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) ~~→ FDMA/FDD~~  $\rightarrow$  FDMA/FDD via Hub

~~→ TDMA/PDD~~  $\rightarrow$  TDMA/PDD

~~→ CDMA/PDD~~  $\rightarrow$  CDMA/PDD

~~→ clear link channels~~, By planning Hubs.

- Page 7
- MEO: - Medium Earth orbit Satellite
- ① Lower Height than GEO -  
 $(24 \text{ hrs rev.})$   
 $\text{MEO 6 hrs -}$
  - ② to circle earth
  - ③ 30 Satellites for Global positioning system (GPS)  
 one appearing and other disappears  
 $H = 20,200 \text{ km}$
  - ④ delay 30 to 85 ms one way
  - ⑤ Hand's off between two satellite

### LEO Satellite: Low Earth orbit

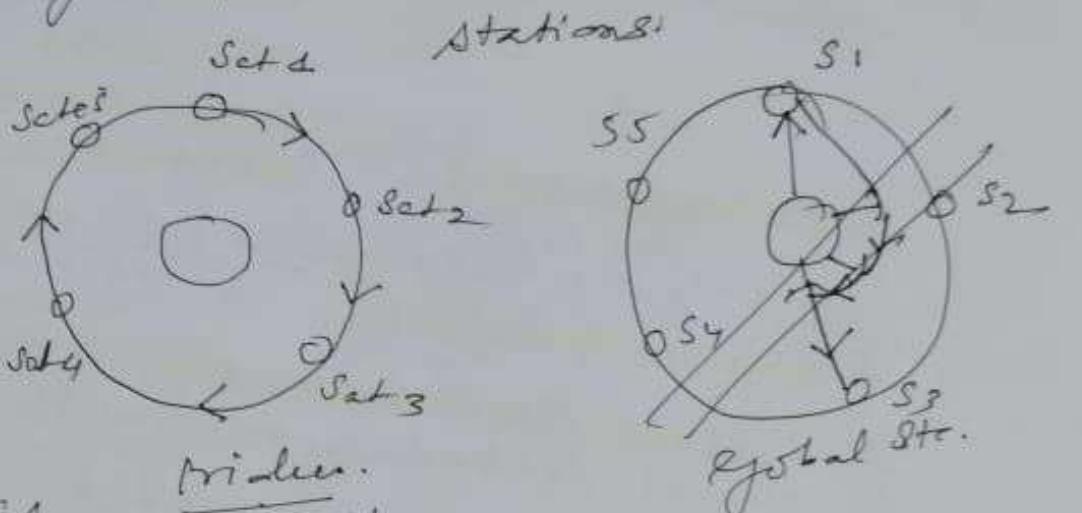
#### Satellite

- 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 satellites required (element 77 atoms no)
- ⑥ medium project (750 km height) - Mobile phone cell phones - But the mobile cellular took over lost project
- ⑦ Navigation for Marine, Aviation
- ⑧ exploration - place where no telecom infrastru possible
- ⑨ each satellite 48 cells (spot beam)  
 3840 channels paging, navigation
- ⑩ Globalstar data & voice satellite

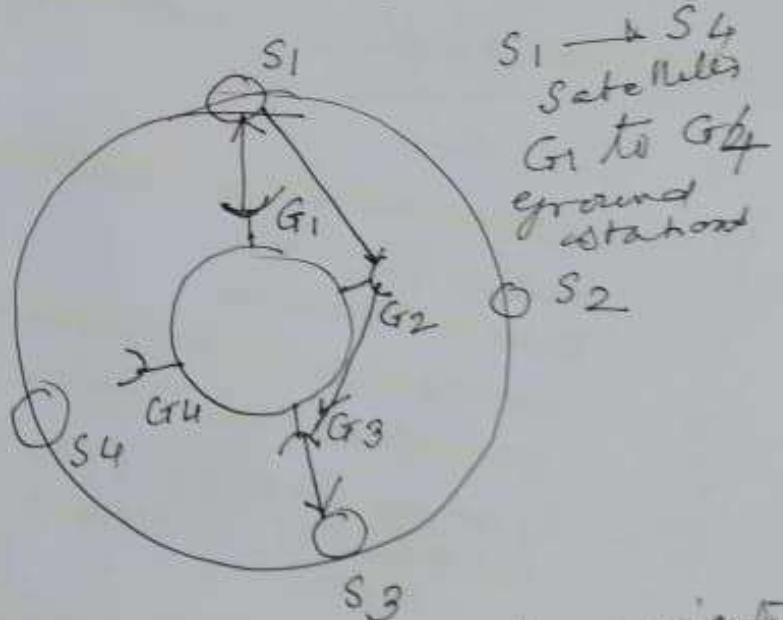
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Problem: packet into patches in space - <sup>WLL</sup> putting elements in satellites

(page 8)  
global stor - patches is through earth



bridge.  
(Communication  
only through  
satellites)  
S1 to S3  
Communication



S1 to S3 Communication  
 $G_1 \rightarrow S_1$   
 $S_1 \rightarrow G_2$   
 $G_2 \rightarrow G_3$   
 $G_3 \rightarrow S_3$