

# Lecture 16

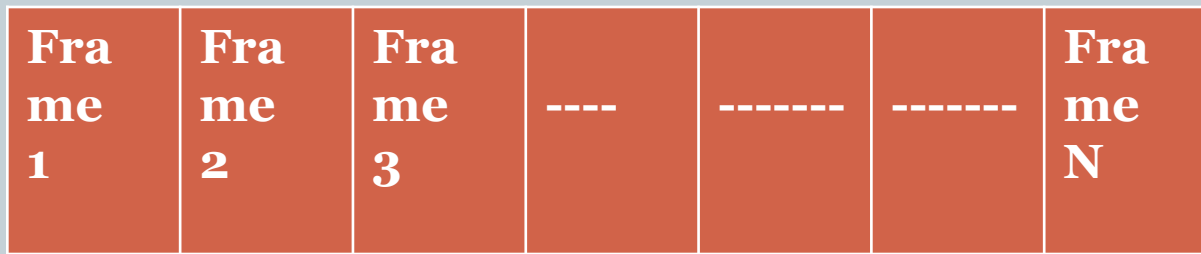


## **PRINCIPLES OF SATELLITE COMMUNICATION**

# TDMA super frame



TF



# Contt....



- Transmit timing Channel of the reference Burst position of the burst
- Management Channel Coordination of Traffic burst

# TDMA BURST TIME PLAN



- Transmit Burst time plan
- Receive Burst time plan
- A. MESSAGE DATA
- B. BURST DATA
- C. SUBBURST DATA

# MESSAGE DATA



- Burst time plan identification
- Traffic station identification
- No of transmit burst
- No of receive burst

# Burst data



- Burst identification
- Transmit –Receive flag
- Transponder Identification
- Burst position
- No of transmit –Receive subburst

# subburst



- Transmit Receive subburst identification
- Subburst position
- Subburst length

# FRAME acquisition and synchronization



- Transmit in the assigned time slot
- Receiving traffic meant for them
- Transmit frame timing(TFT)
- Transmit Burst Timing(TBT)
- Receive Frame Timing(RTF)
- Receive Burst Timing(RBT)



# Contt...



- Receiver frame acquisition (RFA)
- transmit frame acquisition (TFA)
- Receiver frame synchronization (RFS)
- transmit frame synchronization (TFS)

# Acquisition



- Acquisition process is required when traffic station enters or reenters operation
- Synchronization process is needed due to satellite movement in the orbit
- Perturbation caused by moon and sun
- Variation in satellite moment
- Variation in time delay between earth and satellite
- Error in burst position as they arrive in the transponder

# Synchronization



- Synchronization is achieved by introducing transmit frame delay

$$D_N = MT_F - \frac{2d_N}{C}$$

*T<sub>F</sub> is the frame period*

*d<sub>N</sub> is the distance between the satellite .N*

*C is the velocity of light*

*M is the smallest integer chosen such as  $D_N \geq 0$*

*for all d<sub>N</sub>*

# synchronization



- CLOSED LOOP
- OPEN LOOP
- Closed loop: station observes the position of its own burst by measuring time interval between the reference burst unique word and traffic burst unique word computes the error
- $D_n(i+1) = D_n(i) - E_n(i)$

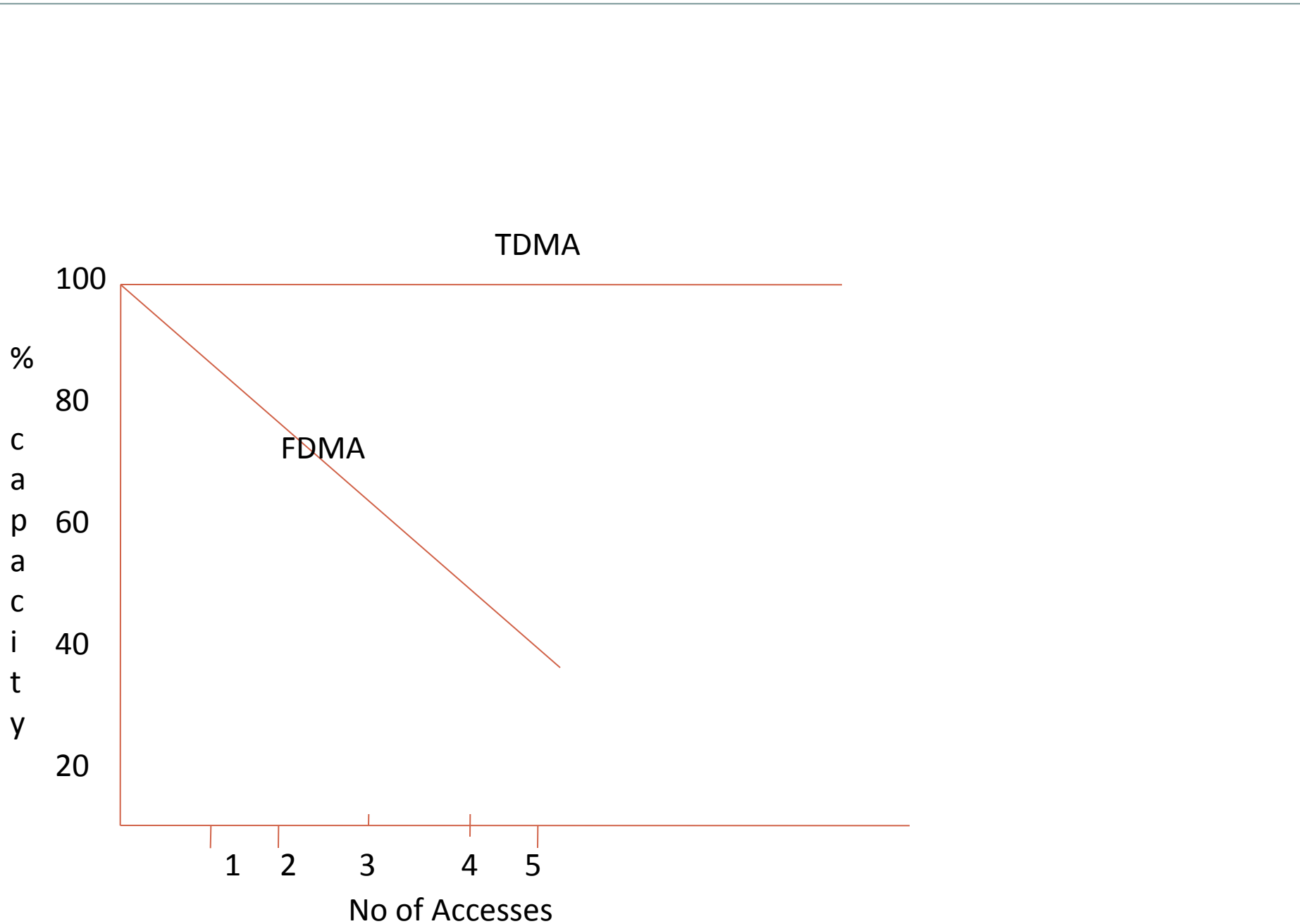


- Open loop : control system listen to the bursts and sends instruction back to the transmitting station
- INTELSAT TDMA system, control station transmits Dn values to all network members once every 32 multiframes

# FDMA vs TDMA



S.No	FDMA	TDMA
1	Not suitable for the increased system traffic Due to inter modulation products	Intermodulation distortion is avoided
2	As no of access increases the ,capacity decreases significantly	Capacity decreases a little
3	Modify the capacity is difficult	Easily modified by changing the duration and position of each burst



TDMA

FDMA

%  
c  
a  
p  
a  
c  
i  
t  
y

1 2 3 4 5  
No of Accesses

# Multiple beam / (satellite switched) TDMA satellite system

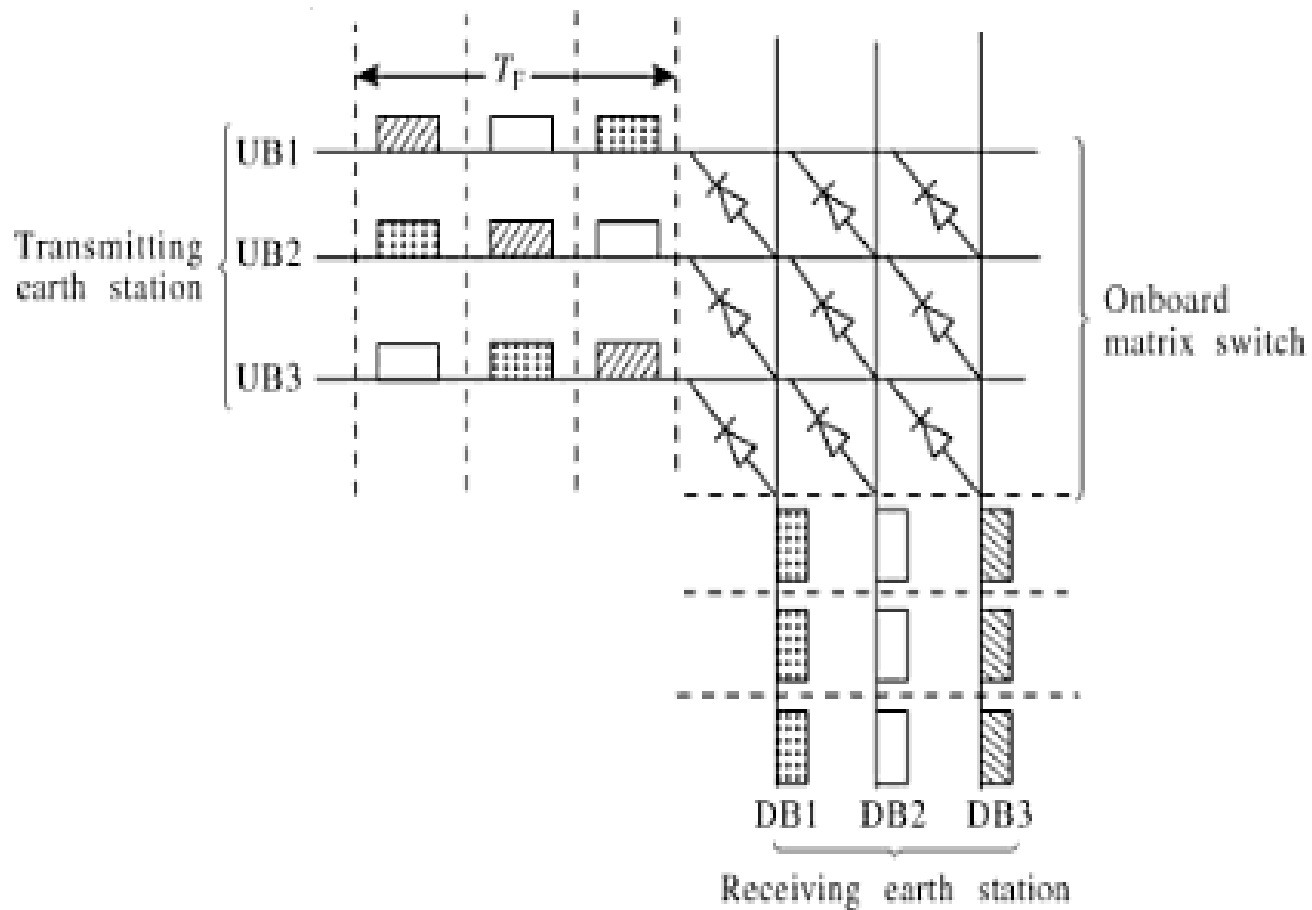


- Zone beam
  - Spot beam
  - Narrowing the satellite beam width  $\uparrow$  communication capacity
- High gain for the coverage area
- Power saving in uplink & downlink
- Same frequency can be reused many times





- INTELSAT VI multi spot beam concept
- Six up beams (UBs)
- Six down beams(DBs)
- Interconnectivity
- On board switching technique(satellite switching)
- SSTDMA– microwave satellite switch on board



SS-TDMA concept used in INTELSAT-VI.