Lecture 15

PRINCIPLES OF SATELLITE COMMUNICATION

Section - C
MULTIPLE ACCESS TECHNIQUE

ALLOWS INTERCONNECTION OF LARGE NO OF EARTH STATION TERMINALS SIMULTANEOUSLY VIA SATELLITE

MAT

- CAPACITY OF SATELLITE TRANSPONDER – 120 Mbps
- 3562 voice channels 32 Kbps
- FDM For analog
- TDM for digital
- Access scheme FDMA,TDMA,CDMA

1. Fixed
2. Demand

Multiple Access

- MAT represents a traffic feature of satellite communication.
- A technique in which several users share a common transponder to transmit and receive information.
- There for 3 different ways to share transponder relative to its utility parameters such as – bandwidth, power & time. (i.e. FDMA, TDMA, CDMA)

FDMA

- FDMA – an access in which each user has –
- ✓ a part of bandwidth
- ✓ part of power
- ✓ And all of the time

This kind of access technique used in analog voice communication satellite.

TDMA

- TDMA – an access in which each user has –
  - all of the power
  - All of the bandwidth
  - And part of the time

This kind of access technique is frequently used in data and digital voice transmission of satellite.

CDMA

- CDMA – an access in which each user has –
- ✓ all of the bandwidth
- ✓ all of the time
- ✓ And only part of the power.

This kind of access technique is frequently used in data and digital voice transmission of satellite & analogous to TDMA.

Important About Access Technique

- MAT has ability to support multiple transmitters often lead to higher complexity and cost than for a multiplexer with similar capacity.

- Unlike multiplexers, multiple –access systems do not usually provide for the grouping of channels into groups and super groups.

Why we need this?

- With the increase of –
- ✓ Channel demand
- ✓ No of earth stations
- ✓ Efficient use of satellite transponder in conjunction with many stations

All these factors resulted in the development of multiple access techniques

MAT - definition

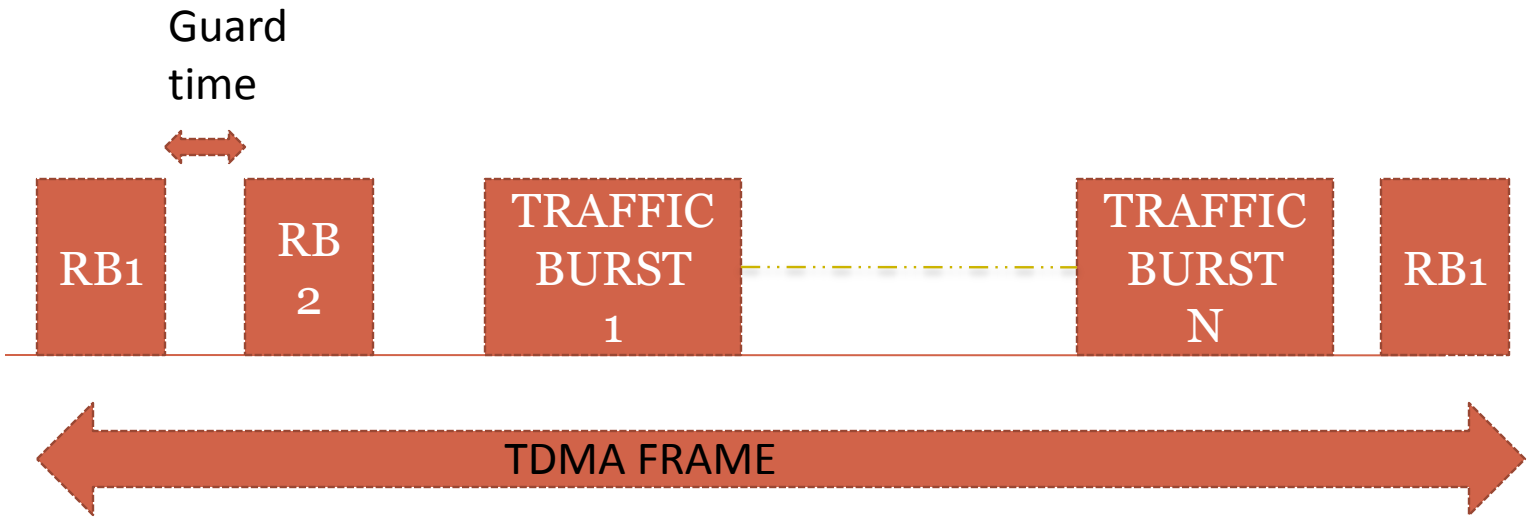
Hence,

MULTIPLE ACCESS is a technique in which the satellite resource (bandwidth or time) is divided into number of non overlapping segments and each segment is allocated exclusively to each of the large no of earth stations who seek to communicate with each other.

TDMA

- Single carrier for transmission via the satellite transponder on TDM basis
- 125µs
- Earth station has access to the entire bandwidth of the transponder
- Guard time between the individual burst
- Fixed assignment
- Demand assignment

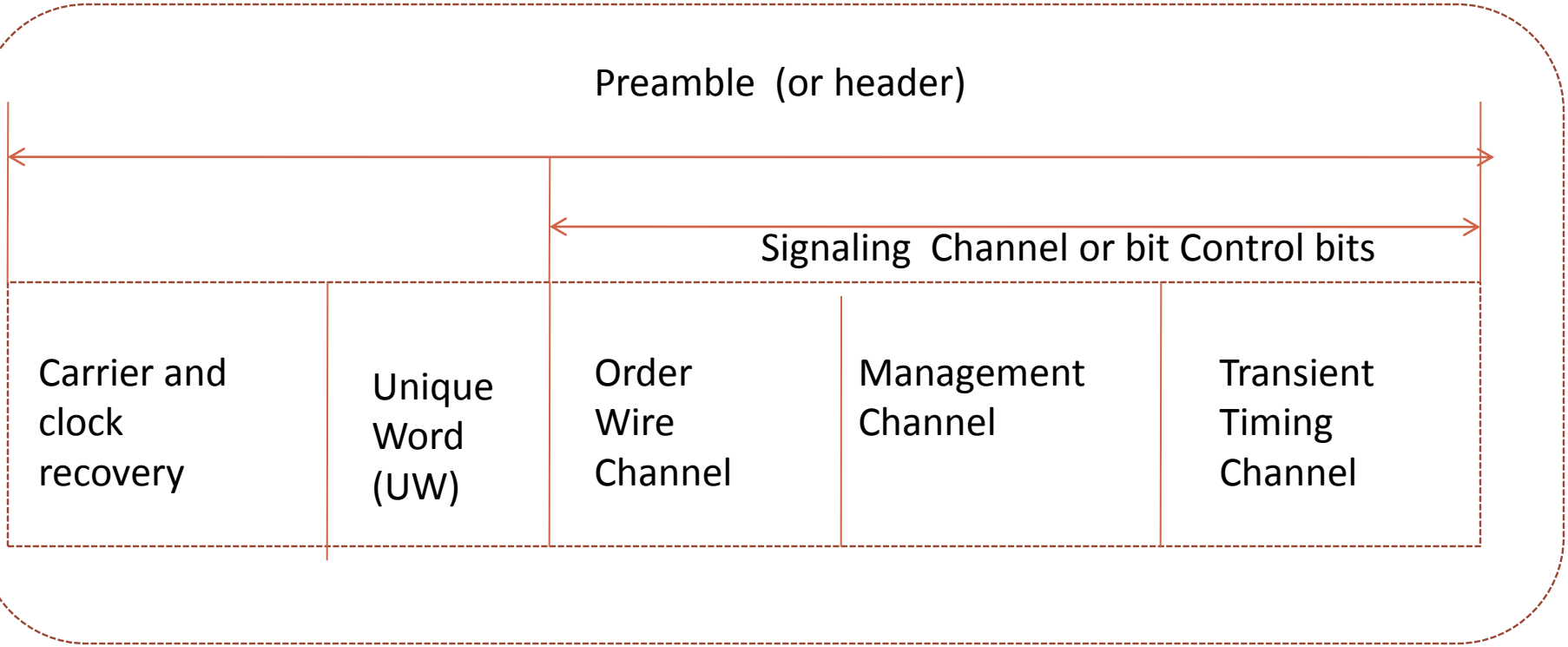
TDMA FRAME STRUCTURE



TDMA FRAME STRUCTURE

- Two reference burst
- Primary secondary reference burst
- Synchronization and identify the frame
- Traffic burst
- Traffic station
- Guard time
- Burst time plan

REFERENCE BURST STATION



CARRIER AND CLOCK RECOVERY:

- Each burst begins,
- Enables the earth station demodulator to recover the carrier phase and regenerate the BIT or symbol timing clock for data demodulation
- Depends upon C/N ratio

Unique word

- Burst code word
- UW follows the CCR sequence
- marks each frame
- Receiver frame timing that allows a station to locate the position of traffic burst in a frame

Order wire Channel

- Voice
- Data
- Instruction are passed to and fro from earth station

Management Channel

Reference burst is sent by reference station to all traffic station

Instruction frame management

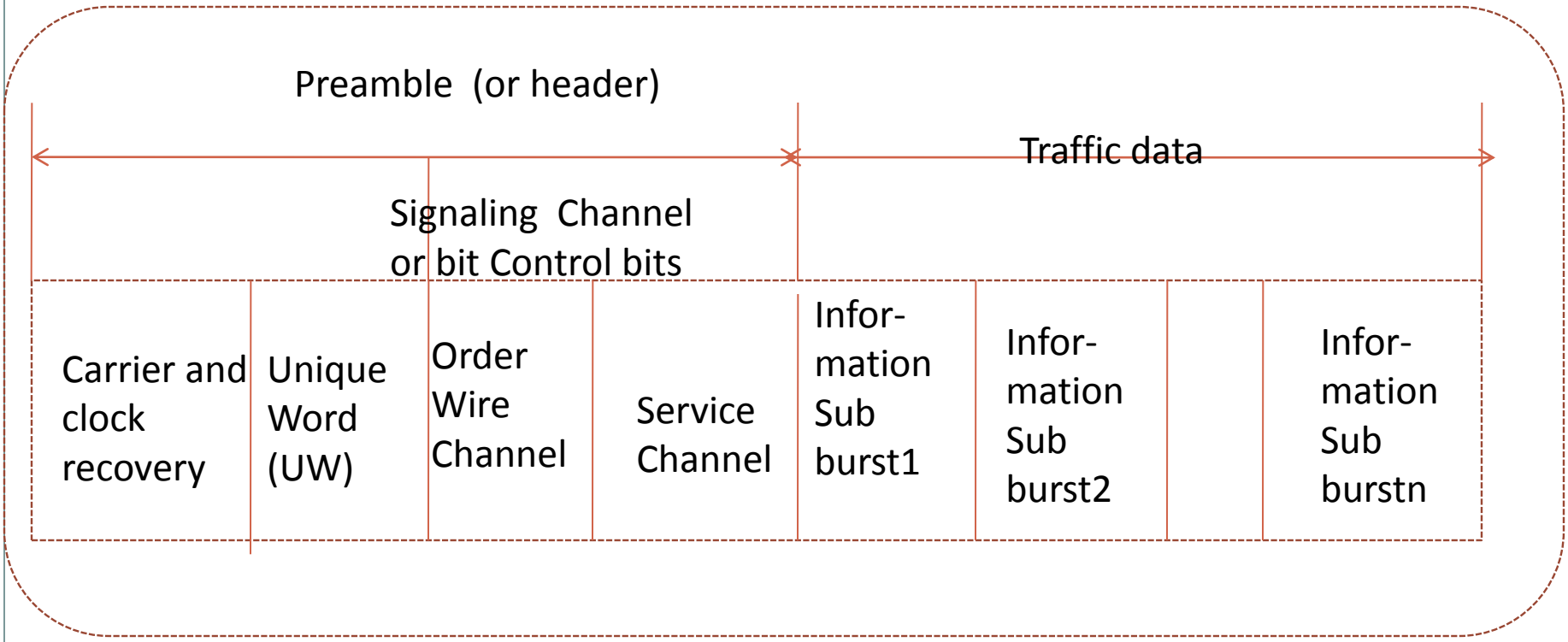
Burst time plan changes

Position length source or destination

Transient timing Channel

- acquisition and synchronization
- Transmit burst timing

TRAFFIC BURST STATION



Unique word

- Marks time of occurrence of the traffic burst
- Provides receiver burst timing
- Extract only wanted sub burst within the traffic burst

Service Channel

Traffic station status to the Reference Station

TDMA frame efficiency

$$\eta = 1 - \frac{\sum t}{T_F}$$

$$\sum t = \frac{(n+2)P}{R}$$

R satellite transmission link bit rate

N no of traffic burst in a frame

P no of bits in the preamble plus guard time

TF is the frame period

$$\nu = \frac{R}{r\eta}$$

No of voice channels can be calculated