MOBILE AND WIRELESS COMMUNICATION

Course code	ESC-CSE-308G				
Category	Engineering Science Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
- Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
- Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
- Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
- Describe the mobility support mechanism, WWW and WAPs.

UNIT 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management. Wimax

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast-retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

UNIT : 1 MAC LAYER(1)

Can we apply media access methods from fixed networks?

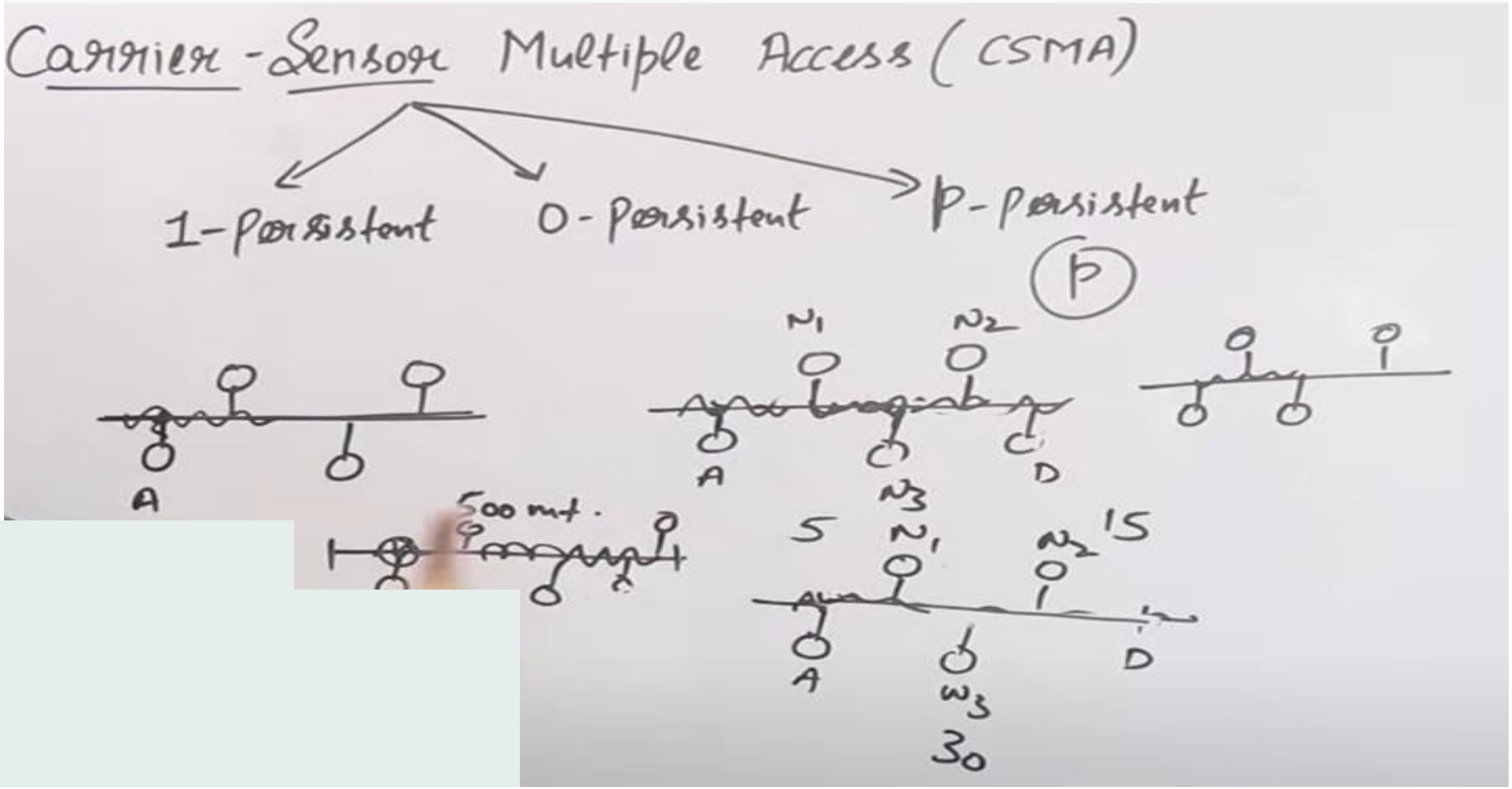
Example CSMA/CD

- **C**arrier **S**ense **M**ultiple **A**ccess with **C**ollision **D**etection
- send when medium is free, listen to medium if collision occurs (IEEE 802.3)

Problems in wireless networks

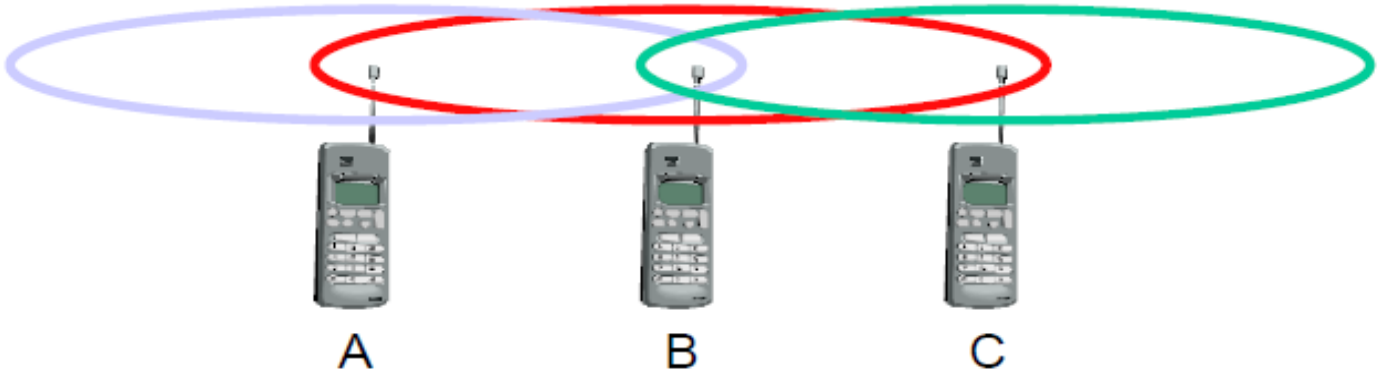
- signal strength decreases with distance
- sender applies CS and CD, but collisions happen at receiver
- sender may not “hear” collision, i.e., CD does not work
- Hidden terminal: CS might not work

UNIT : 1 MAC LAYER(2)



Hidden terminals

- A sends to B, C cannot hear A
- C wants to send to B, C senses a “free” medium (CS fails)
- Collision at B, A cannot receive the collision (CD fails)
- C is “hidden” from A

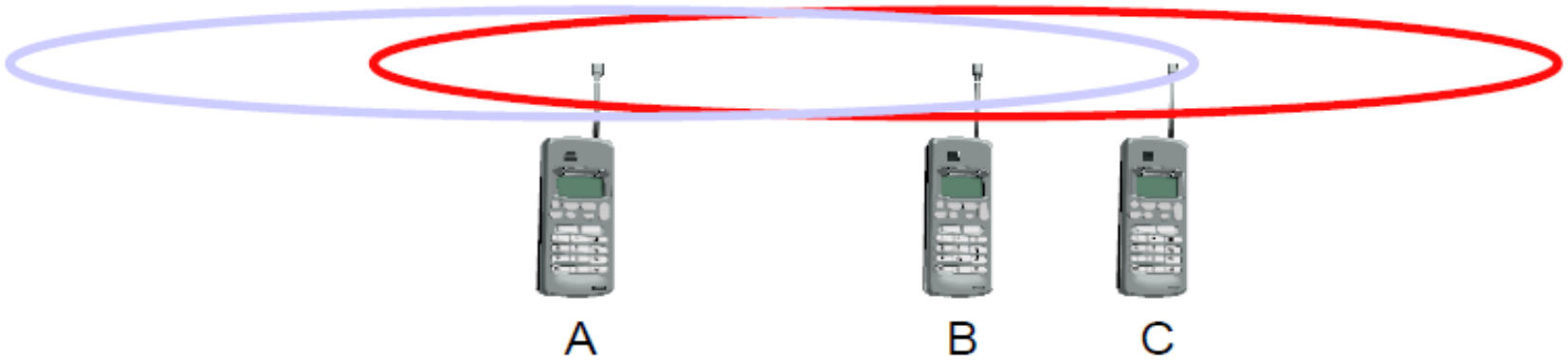


Exposed terminals

- B sends to A, C wants to send to another terminal (not A or B)
- C has to wait, CS signals a medium in use
- but A is outside radio range of C, waiting is **not** necessary
- C is “exposed” to B

Terminals A and B send, C receives

- signal strength decreases proportional to the square of the distance
- B's signal drowns out A's signal
- C cannot receive A



If C was an arbiter, B would drown out A

Also severe problem for CDMA-networks - precise power control needed!

Access methods SDMA/FDMA/TDMA

SDMA (Space Division Multiple Access)

- segment space into sectors, use directed antennas
- cell structure

FDMA (Frequency Division Multiple Access)

- assign a frequency to a transmission channel
- permanent (e.g., radio broadcast), slow hopping (e.g., GSM), fast hopping (FHSS, Frequency Hopping Spread Spectrum)

TDMA (Time Division Multiple Access)

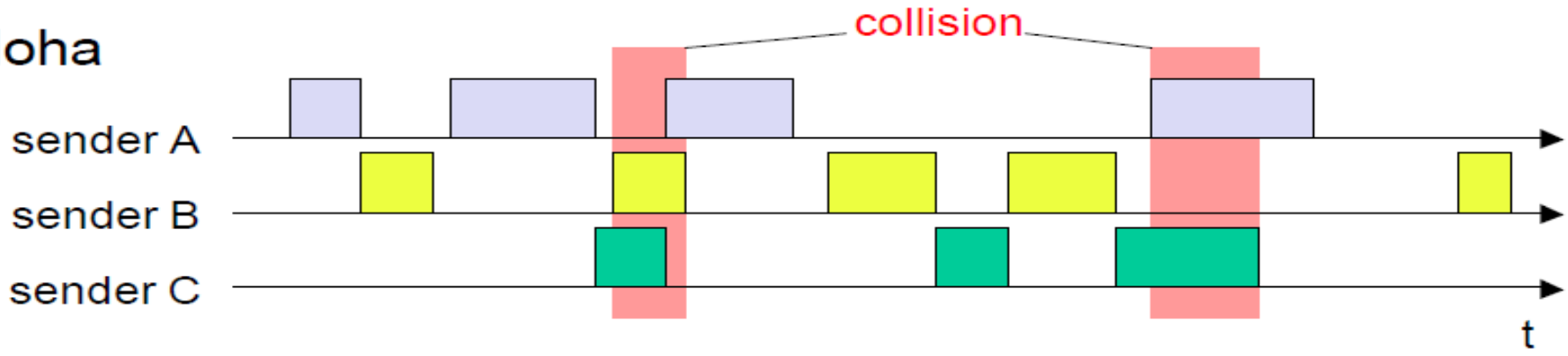
- assign the fixed sending frequency to a transmission channel between a sender and a receiver for a certain amount of time

Aloha/slotted aloha

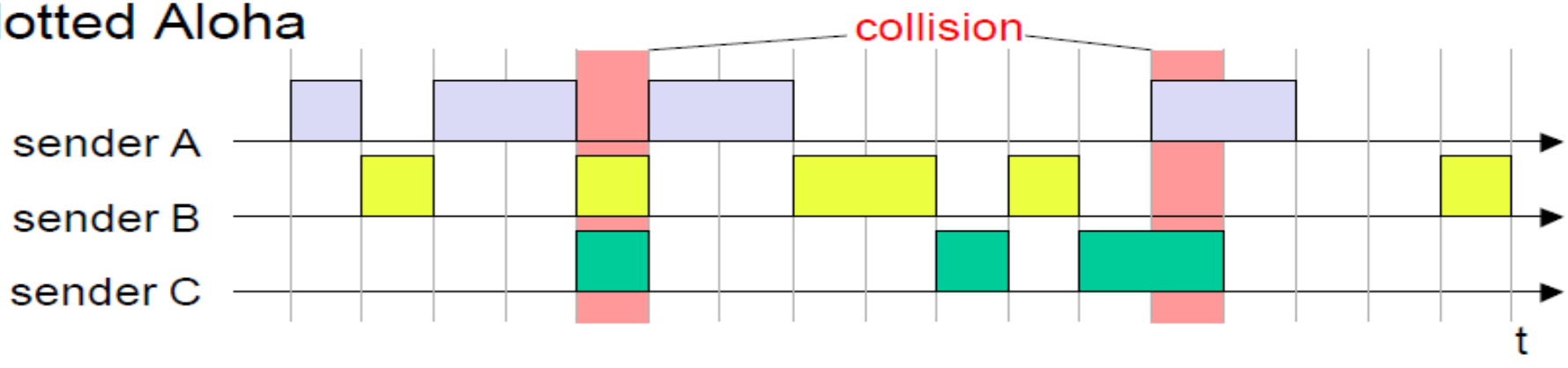
Mechanism

- random, distributed (no central arbiter), time-multiplex
- Slotted Aloha uses time-slots, sending must start at slot boundaries

Aloha



Slotted Aloha



DAMA - Demand Assigned Multiple Access

Channel efficiency only 18% for Aloha, 36% for Slotted Aloha (assuming Poisson distribution for packet arrival and packet length)

Reservation can increase efficiency to 80%

- a sender *reserves* a future time-slot
- sending within this reserved time-slot is possible without collision
- reservation also causes higher delays
- typical scheme for satellite links

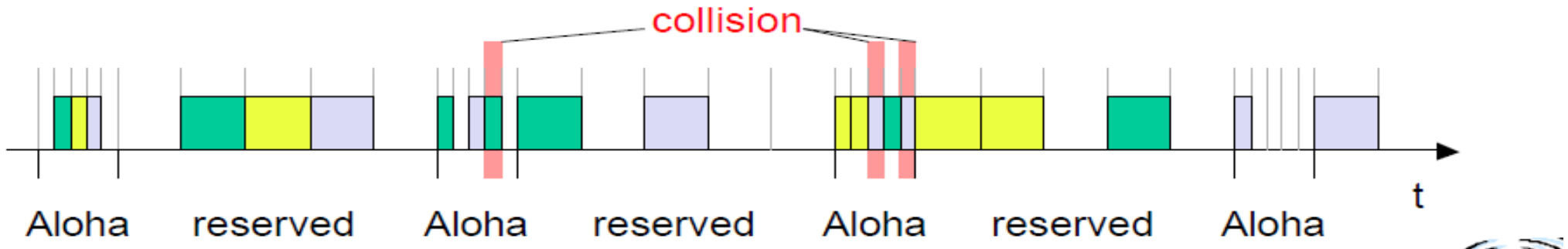
Examples for reservation algorithms:

- *Explicit Reservation according to Roberts (Reservation-ALOHA)*
- *Implicit Reservation (PRMA)*
- *Reservation-TDMA*

Access method DAMA: Explicit Reservation

Explicit Reservation (Reservation Aloha):

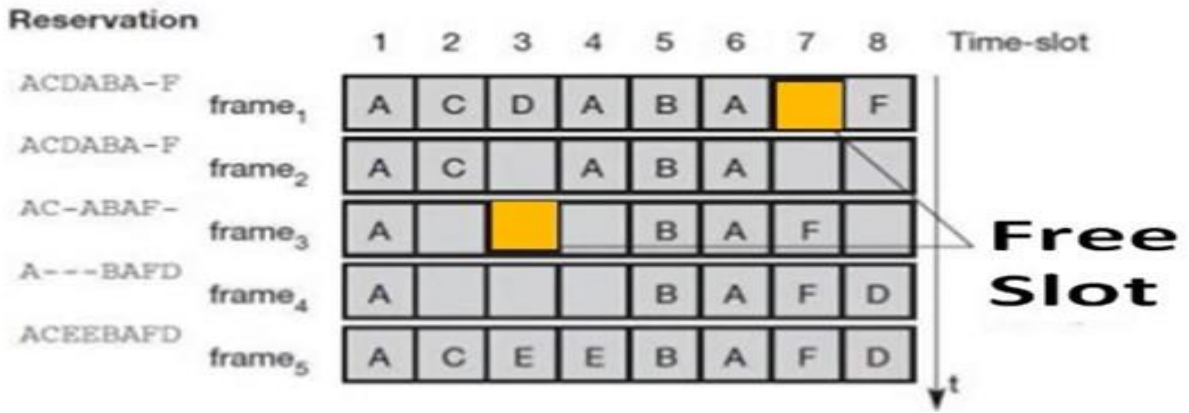
- two modes:
  - *ALOHA mode* for reservation:
    competition for small reservation slots, collisions possible
  - *reserved mode* for data transmission in reserved slots (no collisions possible)
- important for all stations to keep the reservation list consistent.
- Thus all stations have to synchronize periodically



Access method DAMA: PRMA

Packet Reservation Multiple Access (PRMA)

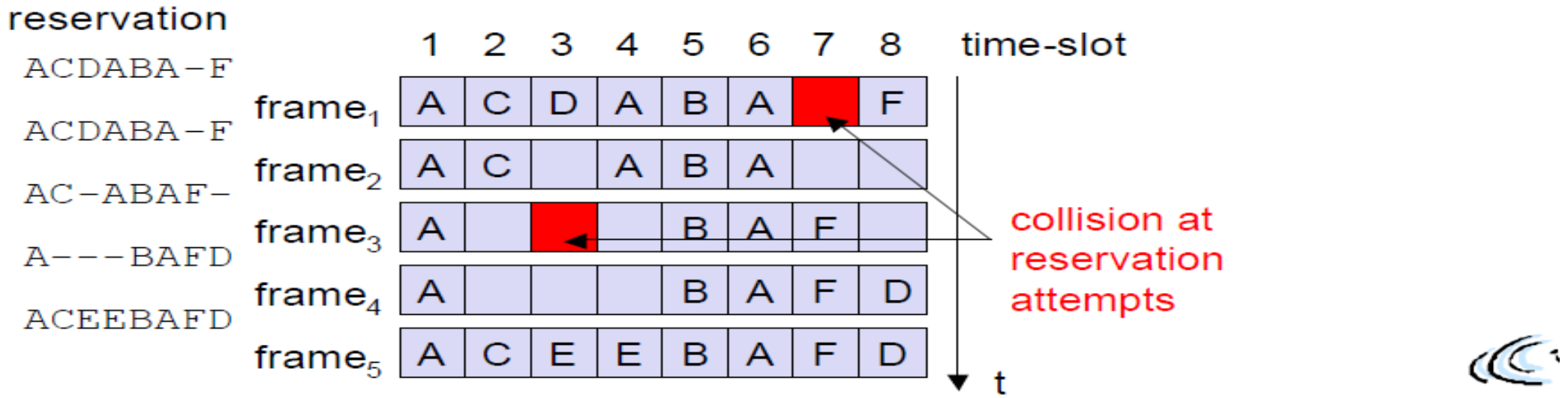
- **It is an Implicit Packet Reservation Multiple Access Scheme.**
- **In this, the slots are reserved implicitly, to transfer the packet in this slot only by many stations.**
- **Working:** In this, a base station (Satellite) broadcasts the status of each slots to all base stations, all base stations receive this status in the form of vector as shown in diagram, **this status consists of details about occupied & free slots. Now most of the stations wishing to utilize this free slots, so this is the actual problem to access this free slots by multiple stations.**



Access method DAMA: PRMA

Implicit reservation (PRMA - Packet Reservation MA):

- a certain number of slots form a frame, frames are repeated
- stations compete for empty slots using slotted aloha
- once station reserves a slot successfully, slot is assigned to this station in all following frames as long as the station has data to send
- competition for a slot starts again once slot was empty in last frame

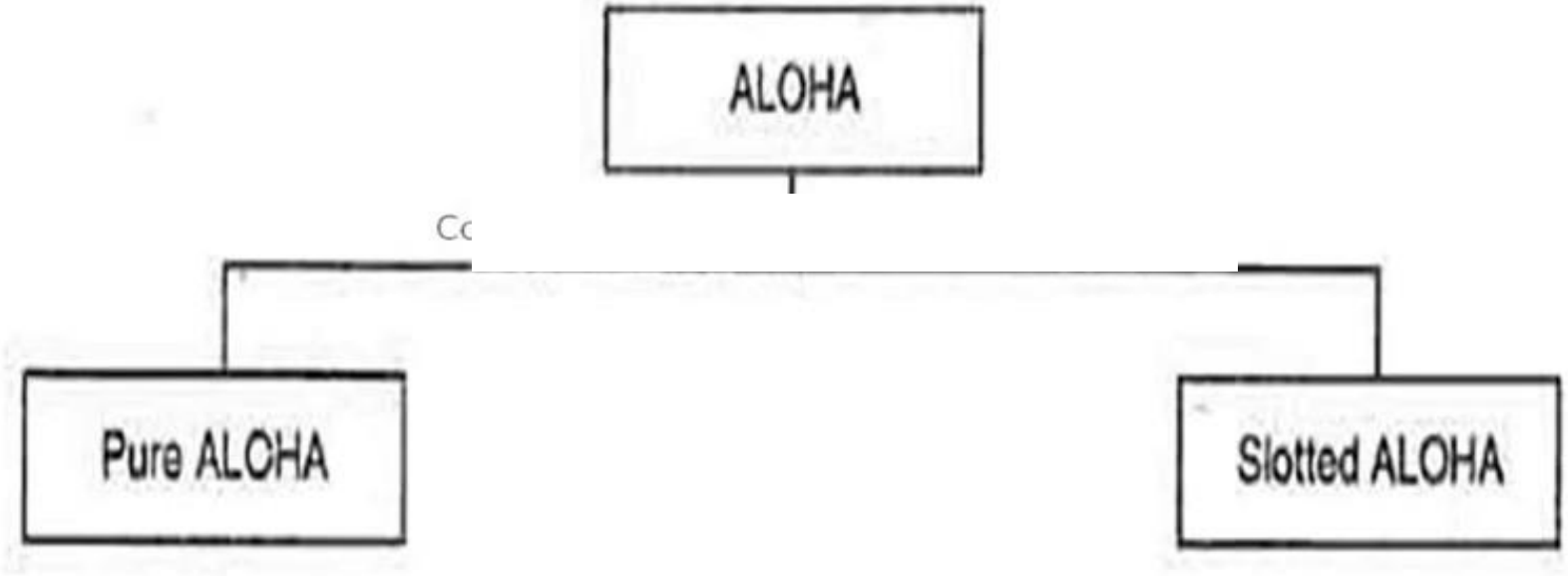


Access method DAMA: PRMA

Cont..

Solution: This problem is solved by the ALOHA concept.

ALOHA: ALOHA is a system for coordinating and arbitrating access to a shared communication Networks channel.



UNIT : 1 MAC LAYER(12)

POLLING:- Used when one Station wants to be heard by all others.

↳ BLUETOOTH (WAN)

↳ Strictly Centralized:

→ One master and Several Slaves

→ Master Can Poll the Slaves by many Schemes.

↳ Round Robin

→ Random

→ As per Reservation

List of all stn Transmit

↳ POLLING

↓

decision when a node Should Transmit

Advanced Mobile Phone Service (AMPS)

ISMA:- Inhibit Sense Multiple Access.

↳ Used for Packet Data transmission in AMPS mobile Phone System.

→ Also Called DSMA (Digital Sense multiple access).

↳ BS (Base Stⁿ) only sends BUSY/IDLE Signal and BUSY Tone on downlink.

→ After BUSY Tone stops, accessing Uplink is not Coordinated any further.

→ BS acknowledges Successful transmission.

THANKS