Medium Access Control Sublayer

Channel Allocation

– When there are two or more users trying to use a shared single channel there should be an algorithm to control this access.

- This problem occurs in broadcast networks.
- Broadcast n/ws are sometimes known as multi-access channels or random access channels.

What is MAC?

- Medium Access Control (MAC) is a sublayer of the Data-link layer.

- The protocols used to determine who goes next on a multiaccess channel belongs to a MAC sublayer.

- MAC is important in LAN which use a multiaccess channel as the basis for communication.

The Channel Allocation Problem

- There are two schemes to allocate a single channel among competing users:

1) Static Channel Allocation.

2) Dynamic Channel Allocation

Static Channel Allocation

- FDM
- TDM

Wastage of resources when some of the users are idle.

Static Channel Allocation:

- In this scheme a Frequency Division Multiplexing (FDM) is used for allocating a single channel among competing users.

- Example
  if we have N users, the bandwidth will be divided into N equal-size portions.

- ++ FDM is a simple and efficient allocation mechanism.
- - - Waste of resources when the traffic is bursty, or the channel is lightly loaded.

Dynamic Channel Allocation :

Basic assumptions

1. Station model : N independent stations. Once a frame has been generated, the station is blocked, does nothing until the frame has been successfully transmitted
2. Single Channel : A single channel is available for all communication. All channel can transmit on it and all can receive from it.

3. Collisions : when more than one station try to transmit a frame and they overlap in time, both of them are garbled and we say that a collision has occurred. Both the frames must be transmitted again.. There are no errors other than collision

Basic assumptions contd...

4. Continuous time

   Frame transmission can begin at any instant.

5. Carrier Sense

   Station can tell if the channel is in use before trying to use it. If the channel is busy, station wont send any data.

6. No carrier sense

   Stations cannot sense the channel before trying to use it. They just go ahead and transmit.

Multiple Access Protocols

ALOHA

- by Norman Abramson in 1970 to solve channel allocation problem.
- Here uncoordinated users are competing for the use of a single shared channel.
- Two versions- based on whether time is divided into discrete slots into which all frames must fit.
  - Pure ALOHA
  - Slotted ALOHA

Multiple Access Protocols

- Pure ALOHA does not require global time synchronization
- Slotted ALOHA does

PURE ALOHA

- If the frame was destroyed, the sender just waits a random amount of time, and sends it again.

- Systems in which multiple users share a common channel in a way that can lead to conflicts are widely known as **contention** systems.

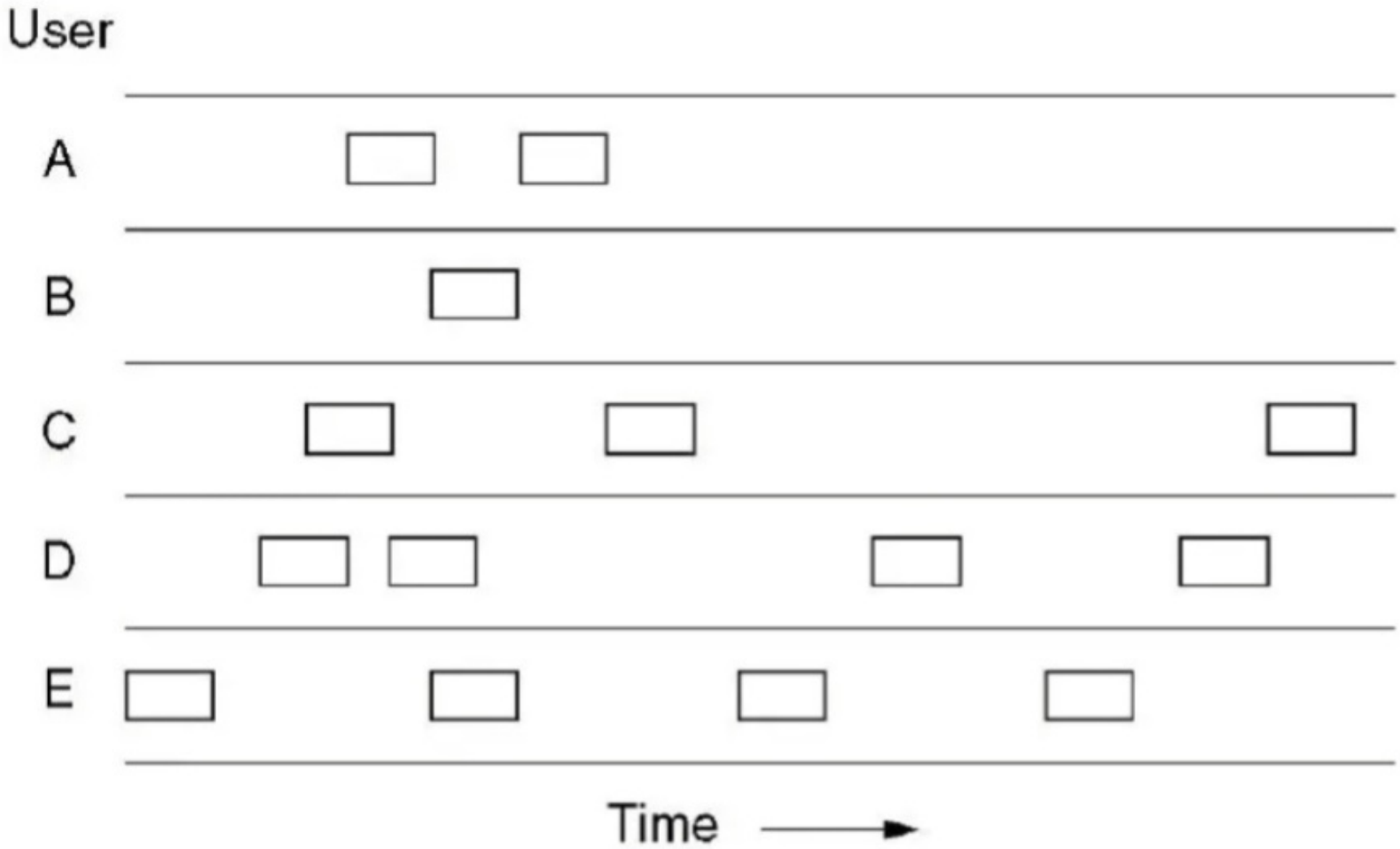
Pure ALOHA

- We assume that all the frame lengths are same because ,

  -it makes the study easier , and

  -the performance of the system is best when the frames are of fixed size.

Pure ALOHA



In pure ALOHA, frames are transmitted at completely arbitrary times.

Pure ALOHA

Frame time- amount of time needed to transmit fixed length frame

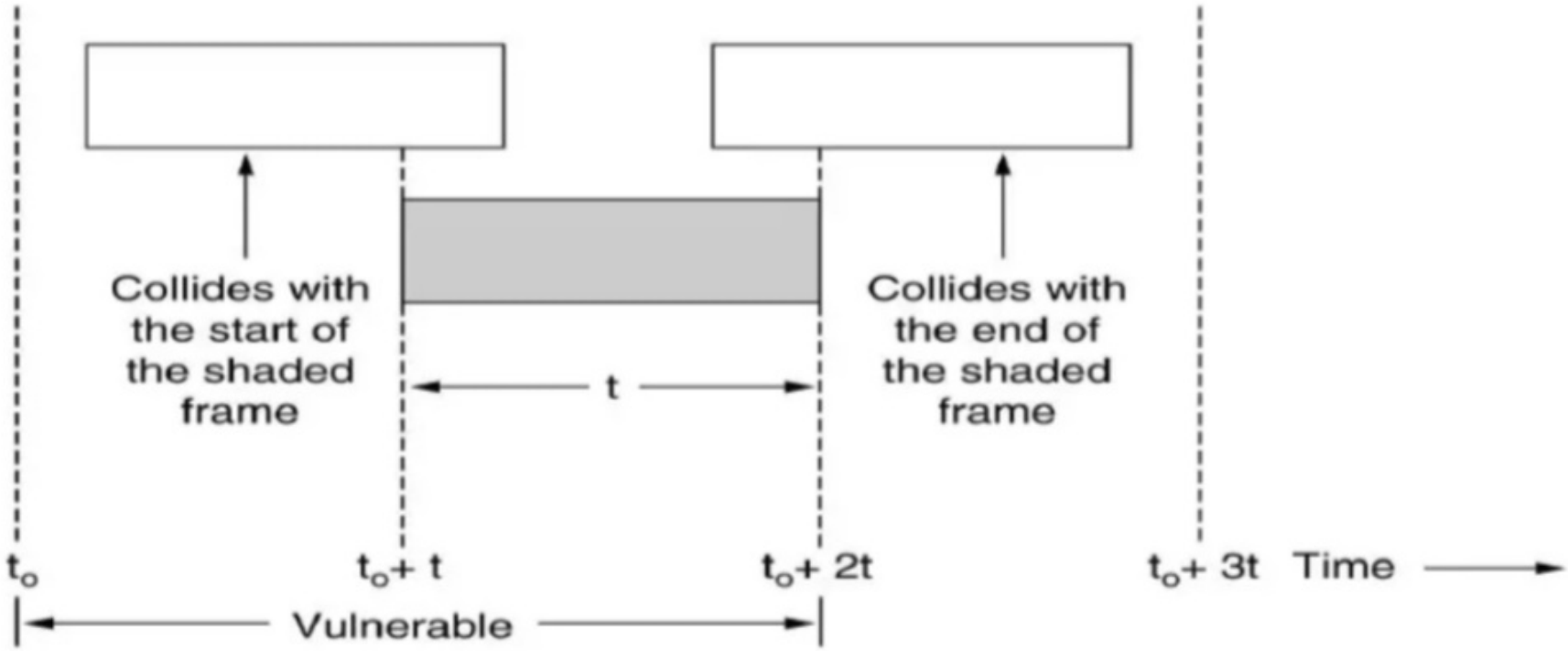
- Let N : average number of frames created per frame time
- G : average number of frames transmitted (new frames + retransmission due to collision) per frame time

- Clearlt G>=N

Pure ALOHA

- A frame will not suffer collision if no other frames are sent within one frame time of its start.
- Let t be the time required to send a frame.
- If any other user has generated a frame between time t_0 and t_0+t, the end of that frame will collide with the beginning of the shaded one.

Pure ALOHA


Collides with the start of the shaded frame
Collides with the end of the shaded frame
t
t_o
t_o+ t
t_o+ 2t
t_o+ 3t
Time
Vulnerable

Contd..

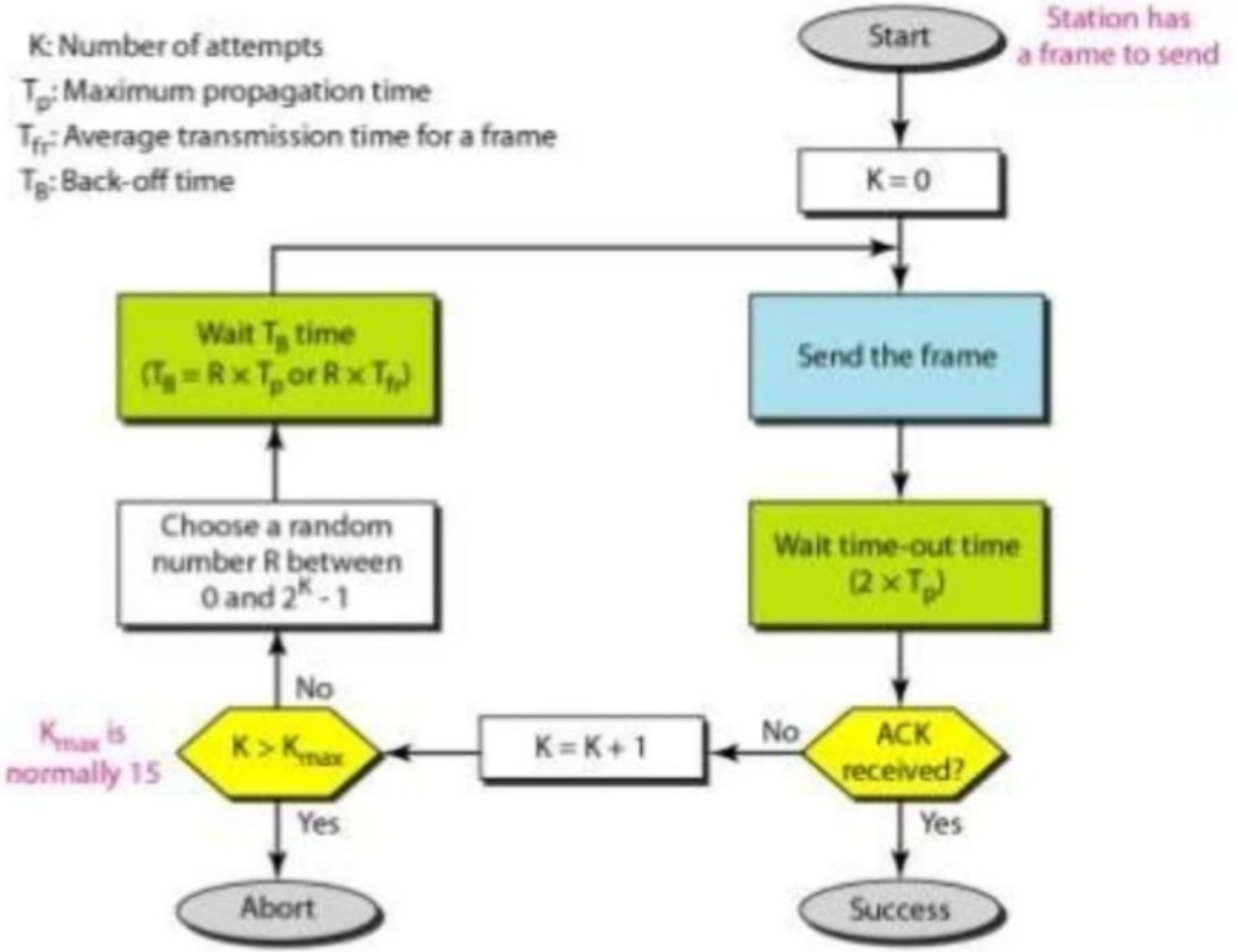
- The frames that collide with the shaded frame are generated in the intervals to – to+t and to+t – to + 2t.
-
- Average number of frames generated in these two time intervals is 2G.

Pure ALOHA

The main disadvantage of Pure ALOHA is a low channel utilization.

This is expected due to the feature that all users transmit whenever they want.

Figure *Procedure for pure ALOHA protocol*



Slotted ALOHA

- In this method the proposal was to divide the time into discrete intervals each interval corresponding to one frame.
- In Slotted ALOHA, a computer can not send anytime, instead it is required to wait for the beginning of the time slot.
- The big advantage of Slotted ALOHA is the increase in channel utilization.

Slotted ALOHA

- Pure ALOHA is continuous and slotted ALOHA is discrete.
- To reduce the chance of collisions the station should be able to detect what other stations are doing.

ALOHA system