Channel Allocation Problem

- Static Allocation
- Dynamic Allocation

Static Allocation

- Static allocation of bandwidth may be done using TDM or FDM
  - Divide the available bandwidth into some number of channels,
  - Hence there will be no interference between users.
- Problems
  - The division of bandwidth is static.
    - We may have unused channels, when too few users,
    - Or we may have starving users, when more users than channels,
    - As the number of users changes we would like the allocation to change. However, the channel division is static.
  - Traffic is generally not constant. Hence some of the channel capacity may be unused.

Static Allocation

- Consider the mean time delay (T) for a channel

$$T = \frac{1}{\mu C - \lambda}$$

  - $1/\mu$ mean frame length, bits/frame
  - λ frame arrival rate, frames/sec
  - C channel capacity, bits/sec
- Now consider dividing the channel into N sub-channels

$$T_{FDM} = \frac{1}{\mu(C/N) - (\lambda/N)} = \frac{N}{\mu C - \lambda}$$

  - The mean time delay T_{FDM} becomes N times worse, N*T

Dynamic Allocation

Five key concepts of dynamic channel allocation:

1. Station Model.
   - N independent stations each generating frames,
   - Probability of frame being generated in a time interval Δt is $\lambda\Delta t$
   - Once a frame is generated the station blocks until the frame is transmitted.
2. Single Channel Assumption
   - A single channel is available for all communication and all stations receive from it and transmit to it.
3. Collision Assumption
   - If two stations transmit simultaneously the resulting signal is garbled,
   - All stations can detect the collision.

Dynamic Allocation

4. (a) Continuous Time: Frame transmission can start at any time – no master clock,
   or (b) Slotted Time: Frame transmission can start only at the start of a slot. Each slot will either be empty, have a single frame in it or contain a collision.

5. (a) Carrier Sense: Stations can tell if the channel is in use,
   or (b) No Carrier Sense: Stations cannot sense whether the channel is busy.