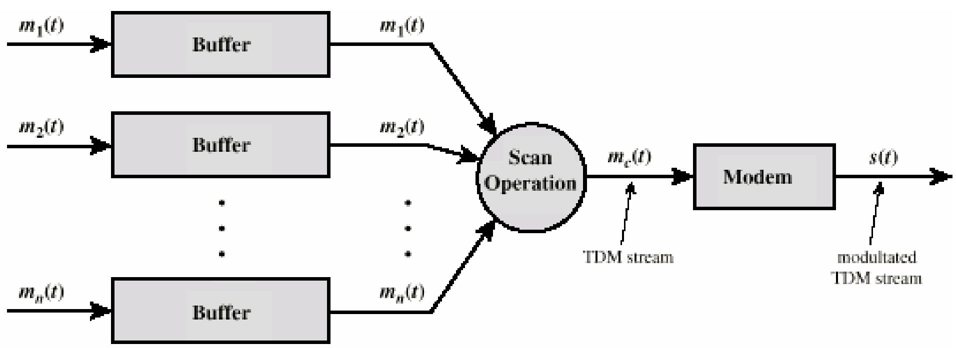
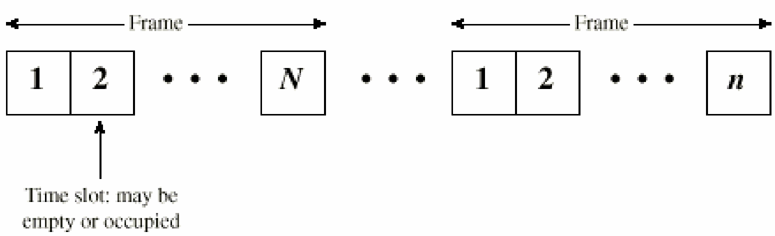
Kapil Gupta :03CS1023

Synchronous Time Division Multiplexing

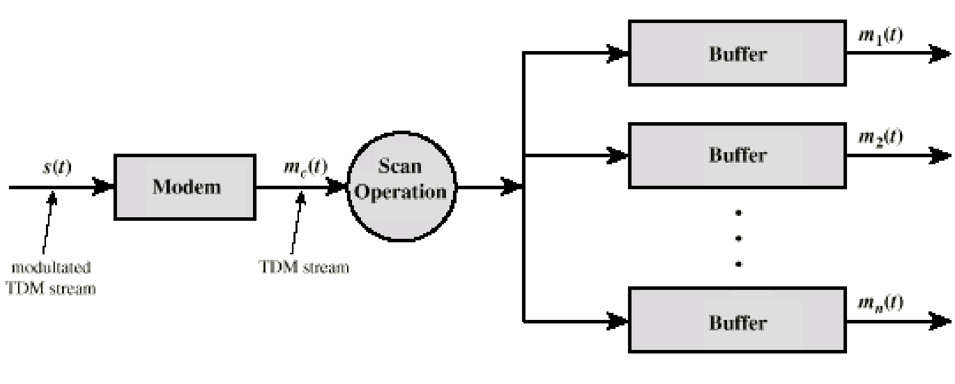
- Data rate of medium exceeds data rate of digital signal to be transmitted
- Multiple digital signals interleaved in time
- May be at bit level of blocks
- Time slots pre-assigned to sources and fixed
- Time slots allocated even if no data
- Time slots do not have to be evenly distributed amongst sources



(a) Transmitter



(b) TDM Frames



(c) Receiver

TDM Link Control

- No headers and trailers
- Data link control protocols not needed
- Flow control
    - — Data rate of multiplexed line is fixed
    - — If one channel receiver can not receive data, the others must carry on
    - — The corresponding source must be quenched
    - — This leaves empty slots
- Error control
    - — Errors are detected and handled by individual channel systems

Statistical TDM

- In Synchronous TDM many slots are wasted
- Statistical TDM allocates time slots dynamically based on demand
- Multiplexer scans input lines and collects data until frame full
- Data rate on line lower than aggregate rates of input lines

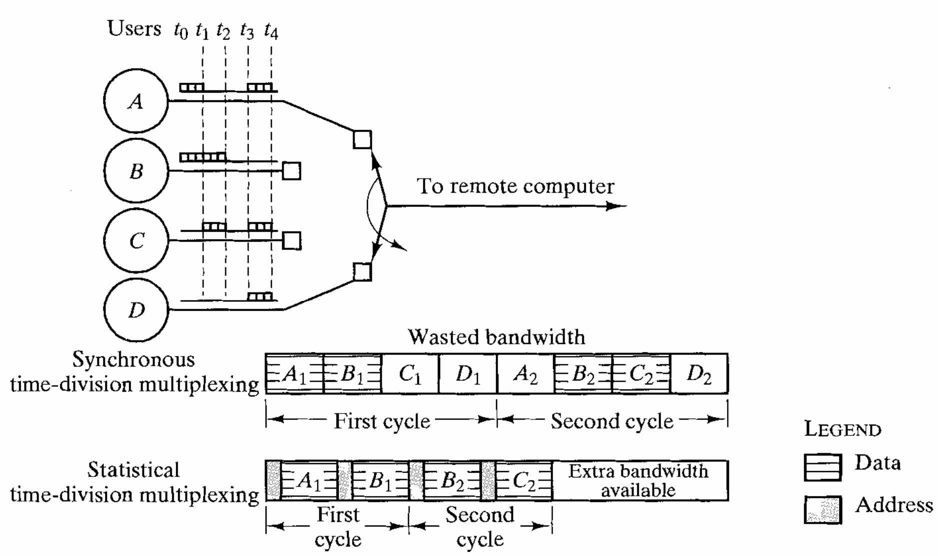
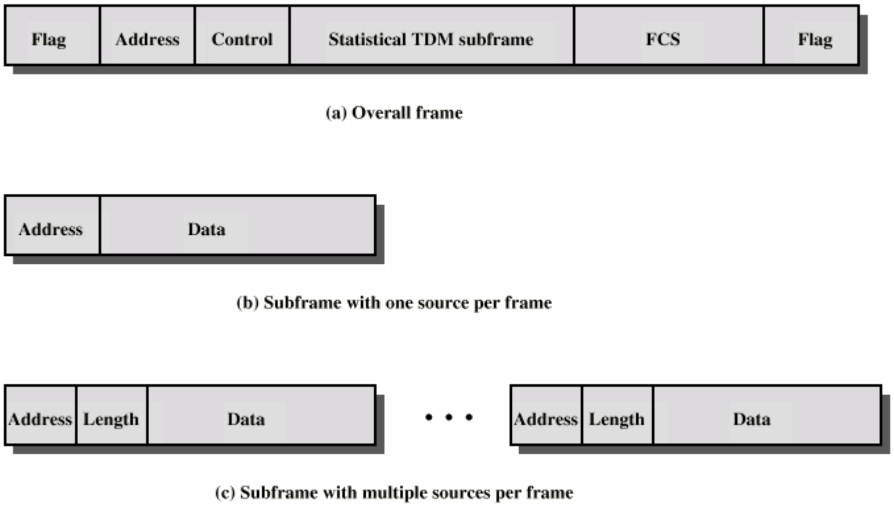


FIGURE 7.14 Synchronous TDM contrasted with statistical TDM.

Statistical TDM Frame Formats



Performance

- Output data rate less than aggregate input rates
- May cause problems during peak periods
  - — Buffer inputs
  - — Keep buffer size to minimum to reduce delay

N = number of input sources
K = data rate of each source, bps
M = effective capacity of multiplexed line, bps
a = mean fraction of time each source is transmitting, $0 < a < 1$
K = M/IR = ratio of multiplexed line capacity to total maximum input

TABLE 7.7 Single-server queues with constant service times and poisson (random) arrivals.

Parameters

λ = mean number of arrivals per second
s = service time for each arrival
ρ = utilization, fraction of time the server is busy
q = mean number of items in system (waiting and being served)
t_q = mean time an item spends in system
σq = standard deviation of q

Formulas

$$\rho = \lambda s$$

$$q = \frac{\rho^2}{2(1-\rho)} + \rho$$

$$t_q = \frac{s(2-\rho)}{2(1-\rho)}$$

$$\sigma q = \frac{1}{1-p}\sqrt{\rho - \frac{3\rho^2}{2} + \frac{5\rho^3}{6} - \frac{\rho^4}{12}}$$