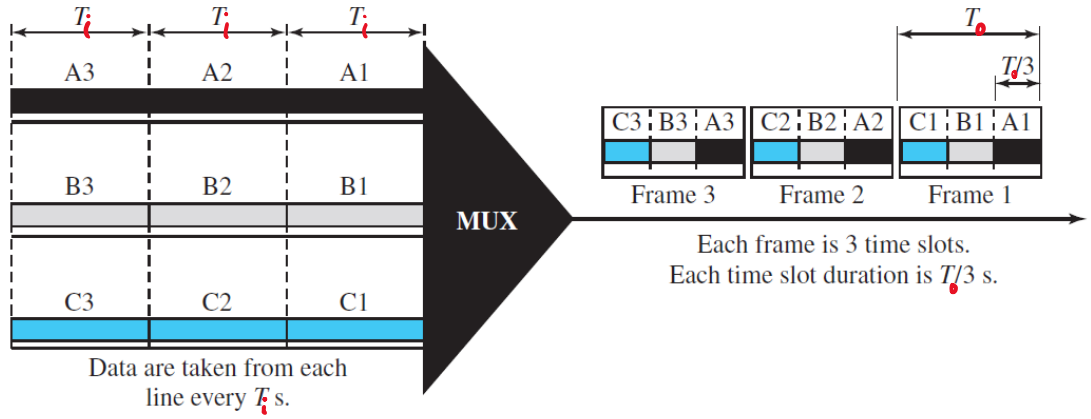
Figure 6.13 *Synchronous time-division multiplexing*



Legends for SYNCHRONOUS TDM

- Input Interval (*time taken to prepare one MUX unit*) = T_i = Output Frame Duration = T_o
- ***one MUX unit = one INTERLEAVED unit*** = $\#\ of\ bits\ in\ a\ slot$, or, $\#\ of\ bits\ taken\ in\ one\ input\ interval\ (T_i)$
- Number of Input Channel = n = number of output slots in each frame

Formula

- For any data (or bit) rate = $\frac{1}{duration}$ $or\ vice-versa$
- Input bit duration = $\frac{1}{input\ channel\ rate}$
- Input slot duration, T_i = Output Frame Duration, T_o = $MUX\ Unit * Input\ bit\ duration$
- Output Slot duration = $\frac{T_o}{n}$
- Output bit duration = $\frac{Output\ slot\ duration}{MUX\ Unit}$
- Output bit duration = $\frac{1}{Output\ data\ rate}$
- Output Frame size = $(MUX\ Unit * total\ slots) + SYNC\ bits\ (if\ any)$
- Output Frame rate = $\frac{input\ rate}{MUX\ unit}$
- Output Frame rate = $\frac{1}{frame\ duration} = \frac{1}{T_o}$
- Output **Data Rate** formula
  - No SYNC bits = $n * input\ \boldsymbol{data}\ rate$ (*This CAN'T BE applied when we have extra SYNC bits*)
  - SYNC bits = $frame\ rate * frame\ size$ (*This formula can also be applied for No SYNC bits*)

Observations

1. The output data rate must ≥ input Data Rate (*usually it's at least **n times the input data rate**)*
2. The **output frame rate must be same even if input channels are of different rates.**
3. Based on obs. (2), the MUX unit of each input channel must be adjusted. *(Chapter 6 Exercise 20, Forouzan 4th ed.)*