Lecture 8 - SONET

Exercise 1: Assume there are 5 million people in the Vancouver area and each creates an average of 1 Mb/s Internet traffic. What is the total Internet traffic?

Assuming optical fiber that can carry wavelengths from 1530nm to 1565nm with low loss, what is the bandwidth of one optical fibre?

Could one fibre carry the above data rate assuming 1 b/s/Hz spectral efficiency?

$$5 \times 10^6 \times 1 \times 10^6 = 5 \times 10^{12} = 5\ \text{Tb/s}$$

$$f_H = \frac{3 \times 10^8}{1.53 \times 10^{-12}} \qquad f_{Lo} = \frac{3 \times 10^8}{1.565 \times 10^{-12}}$$

$$\Delta f \approx 5 \times 10^{12} = 5\ \text{THz}$$

@ 1 b/s/Hz : 5 Tb/s

Exercise 2: What is the bit rate of an STS-1?

$$\frac{810}{\text{bytes/frame}} \times \frac{8}{\text{bit/byte}} \times \underbrace{8\ \text{kHz}}_{\frac{1}{125\mu s}\ \text{frames}} = 51.84\ \text{Mb/s}.$$

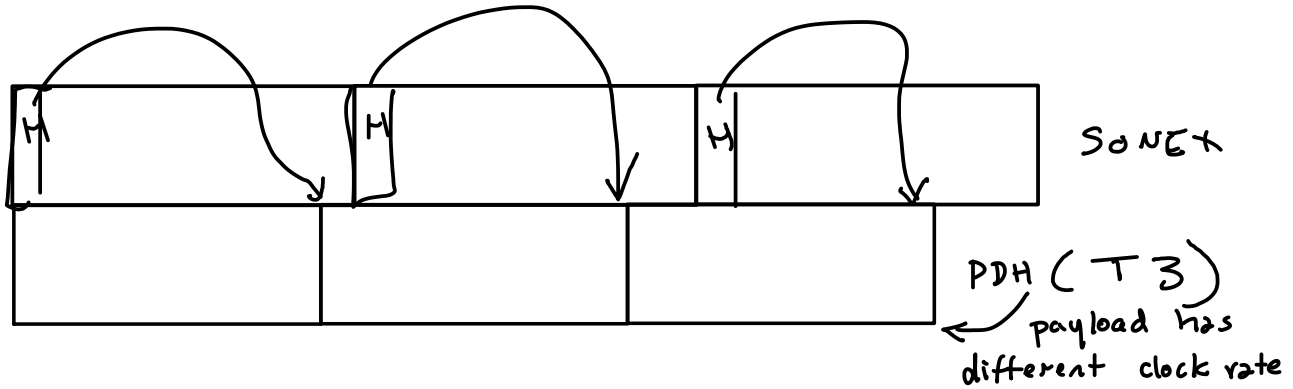
Exercise 3: What are the payload and overhead data rates for STS-1?

$$\text{overhead} = \underset{\text{bytes/row}}{3} \times \underset{\text{rows}}{9} \times \underset{\text{bits/byte}}{8} \times 8\,\text{kHz}$$

$$= 1.728\ \text{Mb/s}$$

$$\text{payload} = \underset{87}{(90-3)} \times 9 \times 8 \times 8\,\text{kHz}$$

$$= 50.112\ \text{Mb/}$$

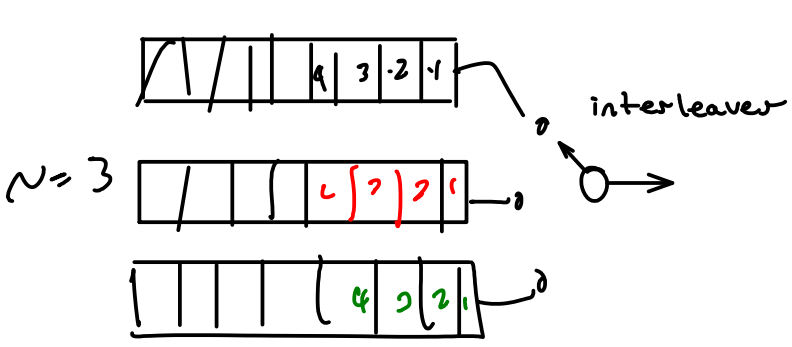


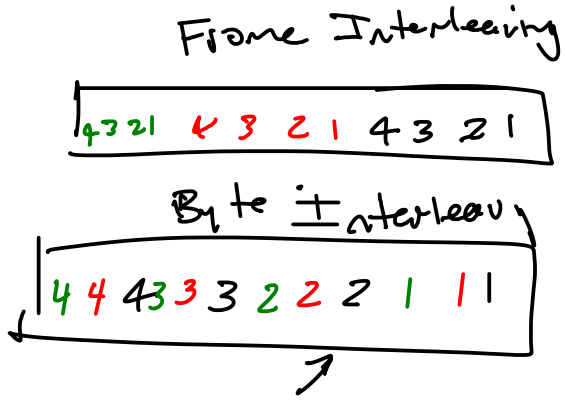
Exercise 4: What is the maximum timing variation that can be accommodated by pointer variation?

$$\frac{1\ \text{byte}}{4\ \text{frames}} = \frac{1}{810 \times 4} = \frac{1}{3240}$$

$$\approx \pm 308\ \text{ppm}$$

Exercise 5: What are two advantages of byte interleaving compared to frame interleaving?





	Frame Interleaving	Byte Interleaving
(1) less memory :	N x Frame Size	N
(2) lower delay :	input Frame duration	Byte Duration