1 a)

$W \ll \frac{N_s}{2} \Rightarrow N_s \geq 2W$

b) $t_{Max} = 60\ s$ $\qquad \frac{t_{Max}}{t_p} = 3\ 750\ 000$

$t_p = \frac{1000 \times 8}{500\ M/s} = 16\ \mu s$

c) $N_w\ t_p \geq t_p + RTt$

$N_w \geq \frac{20\ ms + 16\ \mu s}{16\ \mu s} \approx 1250$

2 $C = 16\ Mbit/s$

$RTt = 100\ ms$

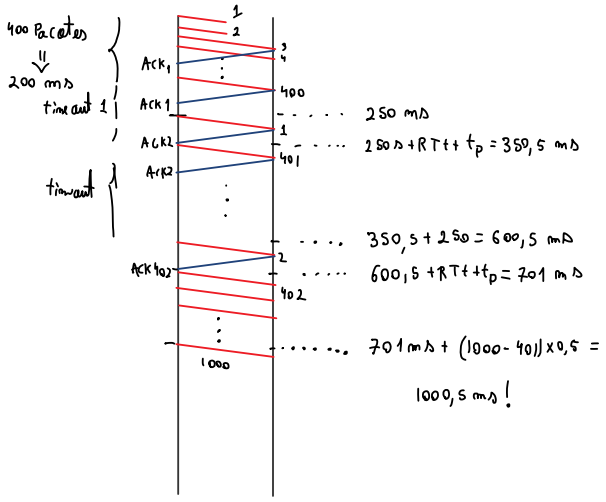
$W = 400$

$P = 1KB$

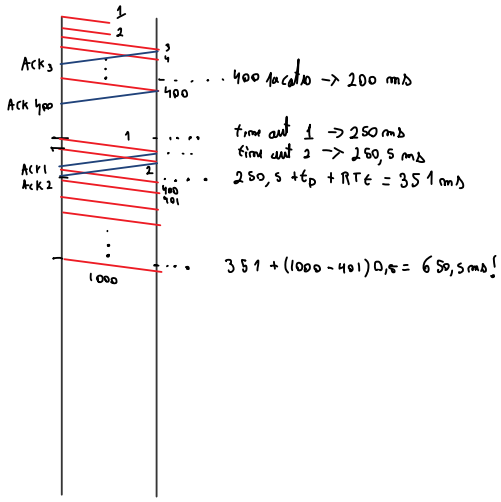
$F = 1000P$

$t_p = \frac{1000 \times 8}{16M} = 0{,}5\ ms$

a)



b)



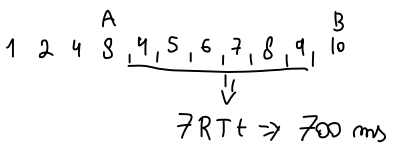
3 $ACK = 1000 + 1500 = 2500$

$RCWIN = 2000 + 1200 - 1500 = 1700$

4 a) Alguma perda

b) $\frac{12K}{1500} = 8 \Rightarrow (1+2+4+8) \times 1500 = 22500\ bytes$

c)



d)

T_1-A : $1+2+4+8 = 15$ $\quad (3\ RTt)$

A-B : $4+5+6+7+8+9+10 = 49$ $\quad (10\ RTt)$

B-C : $5+6+7+8+9+10+11+12+13+14+15+16 = 126$ $\quad (22\ RTt)$

C-T_f : $1+2+4+8+9+10 = 34$ $\quad (28\ RTt)$

$\frac{15+49+126+34}{28\ RTt} = 8\ Seg/RTt$

$\frac{8 \times 1600}{100\ ms} = 120\ KB/s$ //

(ou $960\ Kbit/s$)

5 a) $40\,Mbit \cdot 2 \cdot 20\,ms = 1\,600\,000$ bytes $\Rightarrow$ 200 KB

b) $200\,KB + 300\,KB = 500\,KB$

c) 40 Mbit/s

d) Pretendo aumentar $\Rightarrow$ $w_{1\,novo} = \frac{w_1}{2}$ e $w_{2\,novo} = \frac{w_2}{2}$ Logo $w_1 - w_2 = 150KB$

$(w_1 - w_2)_{novo} = 75KB$