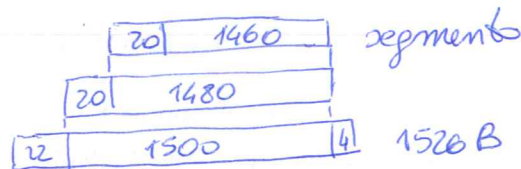


- 1) Pacchetto IP 1500 B  
 segmento 1480 B  
 trama 1526 B  $\times 8 = 12208$



- 2) stream audio 2'23" a 32 kbps  
 $143 \text{ s} \cdot 32 \text{ kbps} = 4.576.000 \text{ bit}$

$$N_{\text{segmenti}} = \frac{4.576.000}{1460 \cdot 8} = \lceil 391,78 \rceil = 392 = \text{numero di pacchetti} = \text{numero trame}$$

3)  $N = 392$

$$m_w = \frac{N}{W_s} = \frac{392}{6} = \lfloor 65,3 \rfloor = 65$$

$$m_x = N - \lfloor \frac{N}{W_s} \rfloor \cdot W_s = 392 - 390 = 2 \text{ trame}$$

$$D = 65 \cdot T_c(W_s) + T_c(2)$$

$$T_c = 2\tau + 2T_E + T_x + T_A = 0,046381 \quad \tau = \frac{d}{V_D} = \frac{4000}{4 \cdot 10^6} = 10^{-3} \text{ s}$$

$$T_c(W_s) = 2\tau + 2T_E + W_s T_x + T_A$$

$$T_c(2) = 2\tau + 2T_E + 2T_x + T_A$$

$$T_x = \frac{L}{C_{AB}} = \frac{12208}{300.000} = 0,040693 \text{ s}$$

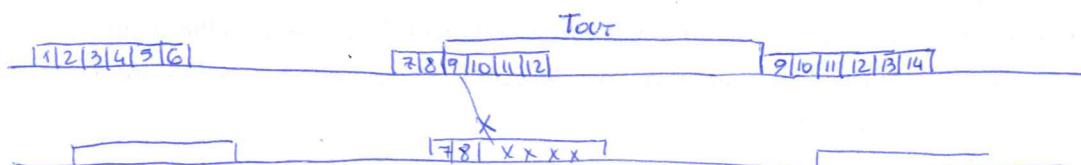
$$T_A = \frac{L_A}{C_{BA}} = \frac{84 \cdot 8^{-672}}{250.000} = 0,002688 \text{ s}$$

$$T_c(W_s) = 2 \cdot 10^{-3} + 2(5 \cdot 10^{-4}) + 6 \cdot 0,040693 + 0,002688 = 0,002 + 0,001 + 0,244158 + 0,002688 = 0,249846$$

$$T_c(2) = 2 \cdot 10^{-3} + 2(5 \cdot 10^{-4}) + 2 \cdot 0,040693 + 0,002688 = 0,003 + 0,001386 + 0,002688 = 0,007074$$

$$D = W_s \cdot T_c(W_s) + T_c(2) = 65 \cdot 0,249846 + 0,007074 = 16,23999 + 0,007074 = 16,327064$$

4)



se si perde la trama 9 anzi' inviato una finestra completa + 2 trame prima della perdita

$$D = 1T_c(W_s) + 2T_x + T_{out} + m_w T_c(W_s) + T_c(x)$$

$$m_x = 392 - (W_s + 2) = 392 - 8 = 384$$

$$m_w = \lfloor \frac{384}{6} \rfloor = 64$$

$$x = m_x - (m_w \cdot W_s) = 0$$

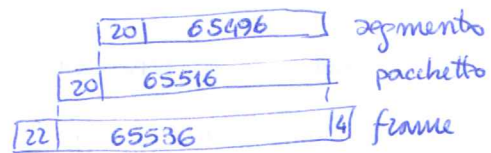
$$D = (m_w + 1)T_c(W_s) + 2T_x + T_{out} =$$

$$= 65 \cdot 0,249846 + 2 \cdot 0,040693 + (0,046381 + 0,020346) =$$

$$= 16,23999 + 0,081386 + 0,066727 = 16,388103 \text{ s}$$

- 5) Se si dovesse perdere solo il back della trama 9, essendo il protocollo con controllo cumulativo, la durata sarà uguale a quella senza perdita

- 1) Pacchetto IP 65536 B  
 segmento 65516 B  
 frame  $65562 B \times 8 = 524496 \text{ bit}$



- 2) streaming video 1 minuto e 48 secondi a 1,9 Mbps  
 $108 \cdot 1,9 M = 205.200.000 \text{ bit}$

$$N_{\text{segmenti}} = \frac{205.200.000}{65496 \cdot 8} = \lceil 391,62 \rceil = 392 = \text{numero di pacchetti} = \text{numero di frame}$$

- 3)  $N = 392$

$$m_w = \frac{N}{W_s} = \frac{392}{6} = \lfloor 65,3 \rfloor = 65 \quad m_x = N - \lfloor \frac{N}{W_s} \rfloor \cdot W_s = 392 - 390 = 2 \text{ frame}$$

$$D = 65 \cdot T_c(W_s) + T_c(2) \quad T_c = 2T + 2T_E + T_x + T_A = 0,046381 \quad T = \frac{5000}{5 \cdot 10^6} = 10^{-3} \text{ s}$$

$$T_c(W_s) = 2T + 2T_E + W_s \cdot T_x + T_A$$

$$T_c(2) = 2T + 2T_E + 2T_x + T_A$$

$$T_x = \frac{524496}{12889000} = 0,040693 \text{ s}$$

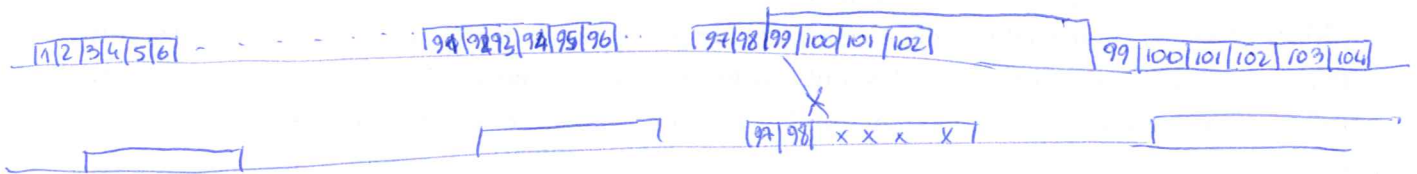
$$T_A = \frac{184 \cdot 8^{-1472}}{547689} = 0,002688 \text{ s}$$

$$T_c(W_s) = 2 \cdot 10^{-3} + 2(0,0005) + 6 \cdot 0,040693 + 0,002688 = 0,002 + 0,001 + 0,244158 + 0,002688 = 0,249846 \text{ s}$$

$$T_c(2) = 2 \cdot 10^{-3} + 2(0,0005) + 2 \cdot 0,040693 + 0,002688 = 0,087074 \text{ s}$$

$$D = W_s \cdot T_c(W_s) + T_c(2) = 65 \cdot 0,249846 + 0,087074 = 16,23999 + 0,087074 = 16,327064 \text{ s}$$

4)



se si perde la trama 99 invio' inviato 16 finestre complete + 2 trame prima della perdita.

$$D = 16 T_c(W_s) + 2 T_x + T_{out} + m_w T_c(W_s) + T_c(x)$$

$$m_x = 392 - (16 W_s + 2) = 392 - (96 + 2) = 392 - 98 = 294 \quad m_w = \lfloor \frac{294}{6} \rfloor = 49 \quad x = m_x - (m_w \cdot W_s) = 0$$

$$D = (m_w + 16) T_c(W_s) + 2 T_x + T_{out} = 65 \cdot 0,249846 + 2 \cdot 0,040693 + (\frac{3}{2} \cdot 0,046381) = 16,23999 + 0,081386 + 0,069571 = 16,390947 \text{ s}$$

- 5) Se si dovesse perdere solo il riscontro (ACK) della trama 99, essendo il protocollo con riscontro cumulativo, la durata sarà uguale a quella senza perdita.