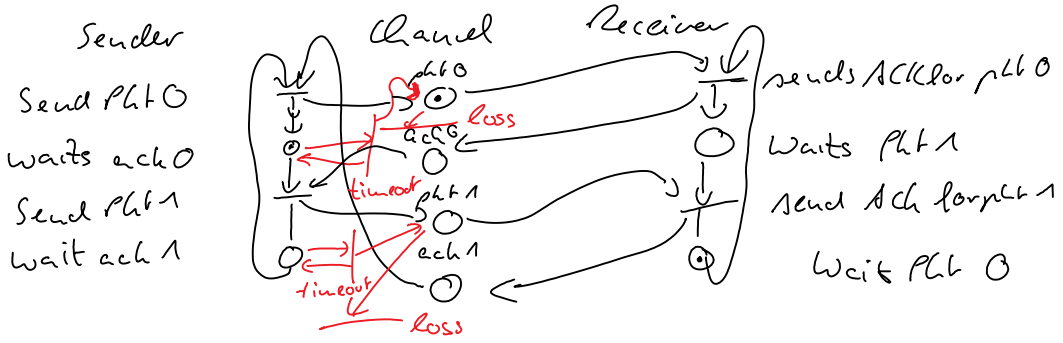
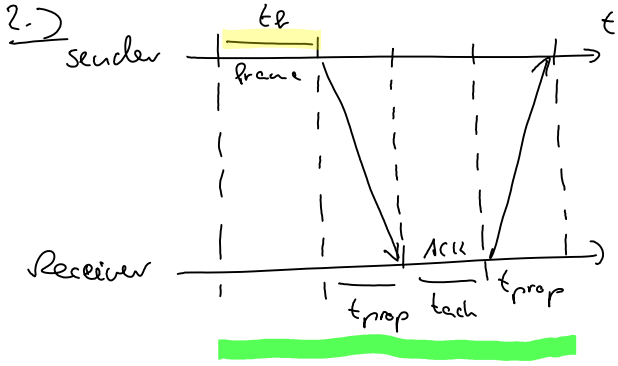
GGÜ 3

Montag, 22. November 2010
11:43

1.) Stop-and-Wait ARQ, Packet 0, 1



2.)



with $P = 0$ ($\Rightarrow$ no errors)

$$D_{P=0} = \frac{t_f}{t_f + t_{prop} + \underbrace{t_{ack} + t_{error}}_{\approx 0}} = \frac{t_f}{t_f + 2t_{prop}}$$

$$= \frac{1}{1 + 2a} \quad \text{with } a = \frac{t_{prop}}{t_f}$$

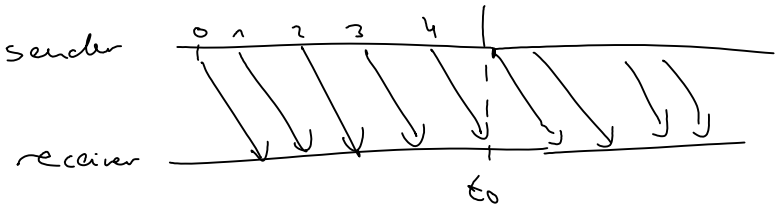
with $P \neq 0$, a pkt is transmitted on average N times

$$N = \left(\frac{1}{1-P}\right)$$

$$D = \frac{t_f}{(N-1)\underbrace{(t_f + t_{ack\_timeout})}_{2 \times t_{prop}} + (t_f + 2t_{prop})}$$

$$= \frac{t_f}{N(t_f + 2t_{prop})} = \frac{1-P}{1+2a}$$

3.) $P = 0$ (no errors)

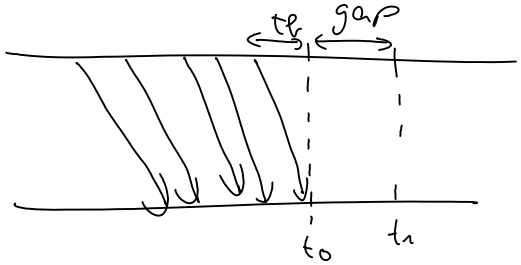


$K = 5$

Case 1

→ ACK frame 0 is received before t_0

$U_{P=0} = 1$



Case 2

→ the ACK for frame 0 is received at $t_1 > t_0$

$U_{P=0} < 1$

$$U_{P=0} = \frac{K t_f}{t_1} = \frac{\text{time for transm. } K \text{ frames}}{\text{time until ack for frame 0 is received}}$$

$t_n = t_f + t_{prop} + t_{ack} + t_{prop} \approx t_f + 2t_{prop}$

$\Rightarrow U_{p=0} = \frac{K t_f}{t_f + 2t_{prop}} \Rightarrow t_f = \frac{2U\, t_{prop}}{K-U} \Rightarrow t_f = 1{,}36 \cdot 10^{-6}\,\text{sec}$

with $t_{prop} = \frac{1500}{3\times 10^8} = 5\mu s$

$t_f = \frac{L}{R} \Rightarrow L = (1{,}36 \cdot 10^{-6})(10 \times 10^{-6}) = 13{,}63\,\text{bits} \approx 14\,\text{bits}$

4.) a) selective-Reject Protocol $t_f = \frac{1000}{R} = 0{,}015625\,s$ $t_{prop} = \frac{90.000 \times 10^3}{3\times 10^8} = 0{,}3\,s$

$\underbrace{Kt_f}_{\text{time needed for transmitting } K \text{ frames}} \overset{(a)}{>}$ time needed for the ack of first frame to be received + processed, T

$T = \underbrace{t_f}_{} + t_{prop} + t_{proc} + t_f + t_{prop} + t_{proc}$

$= 0{,}641125\,s$

$(a) \Rightarrow KT_f > T \Rightarrow K > \frac{T}{t_f} \Rightarrow K > 41{,}04 \approx 42$

5) $P_f = 0{,}01$

Avg. # transm. to send each frame $= N = \frac{1}{1-p}$

$\Rightarrow$ time to deliver a frame $t_f\left(\frac{1}{1-p}\right)$

$U = \frac{U_{p=0}}{\left(\frac{1}{1-p}\right)} = 1 \cdot (0{,}99) = 0{,}99$

$R = 64.000\,\frac{bit}{sec} = 64\,\frac{kbits}{sec} \Rightarrow$ (bit transm. rate for succesf. deliver) $= 64.099 = 63{,}36\,\frac{kbits}{s}$

↑ bit rate for succesfull and not succ. trans.