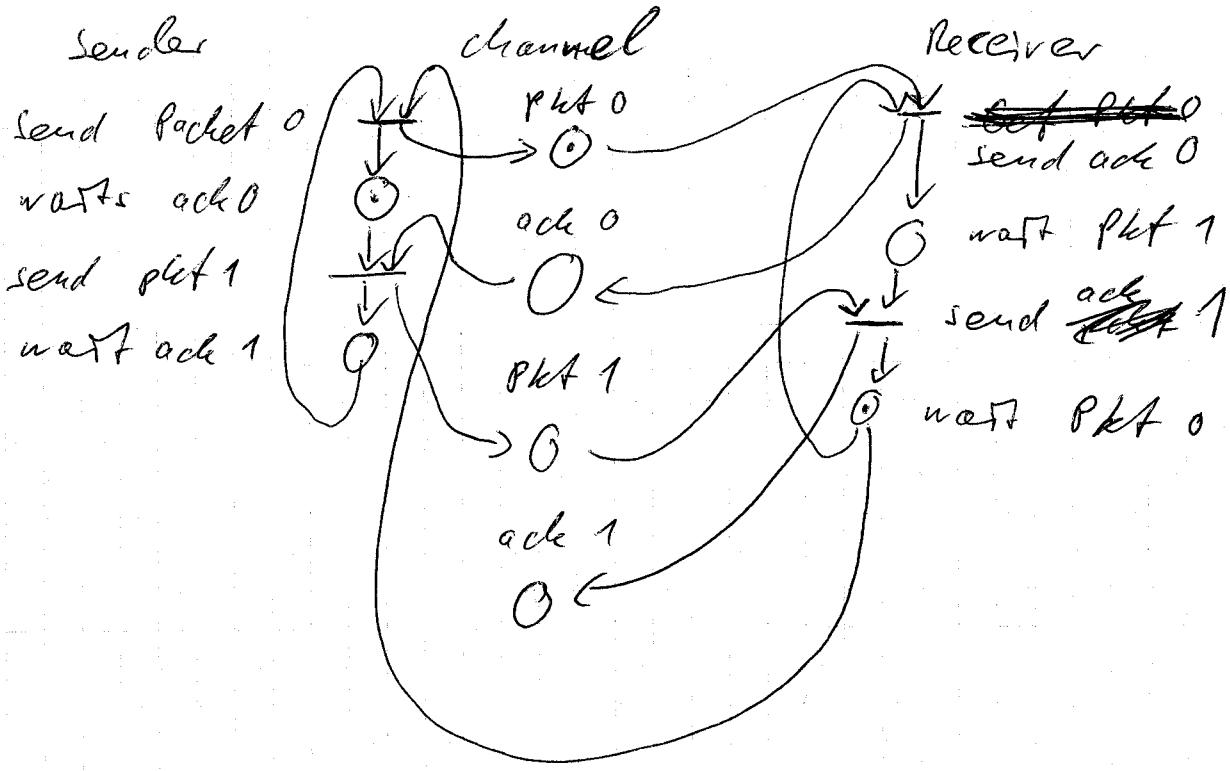
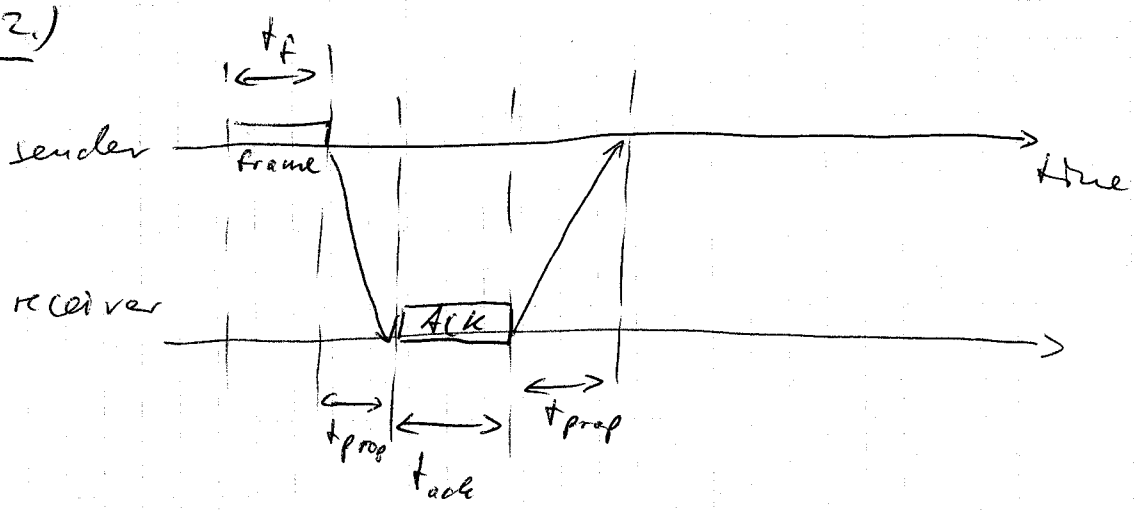
22. NOV. 2010

KN GÜ 3

1) Stop-and-Wait ARQ



2.)



$p = 0$ (no errors)

$$v = \frac{t_f}{t_f + t_{prop} + t_{ack} + t_{prop}} = \frac{t_f}{t_f + 2t_{prop}} = \frac{1}{1+2a}$$

($t_{ack} \approx 0$)

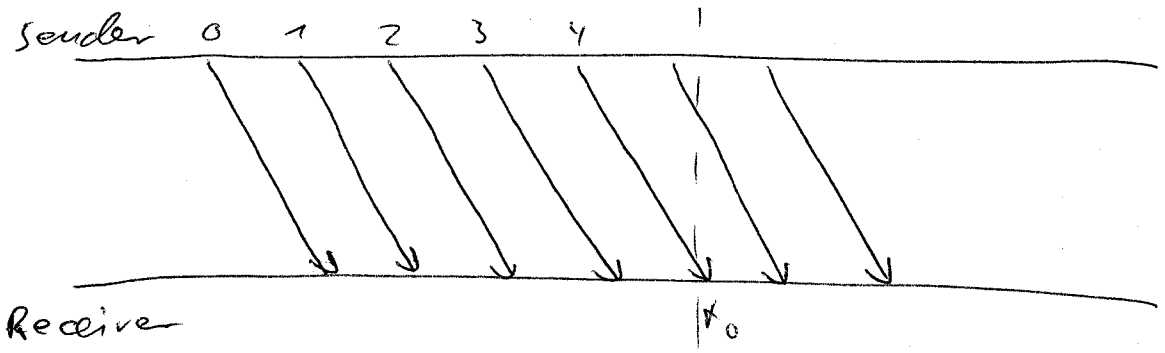
with $a = \frac{t_{prop}}{t_f}$

with $p \neq 0$, a plet is transmitted on average N times. $\left(N = \frac{1}{1-p}\right)$

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

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

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

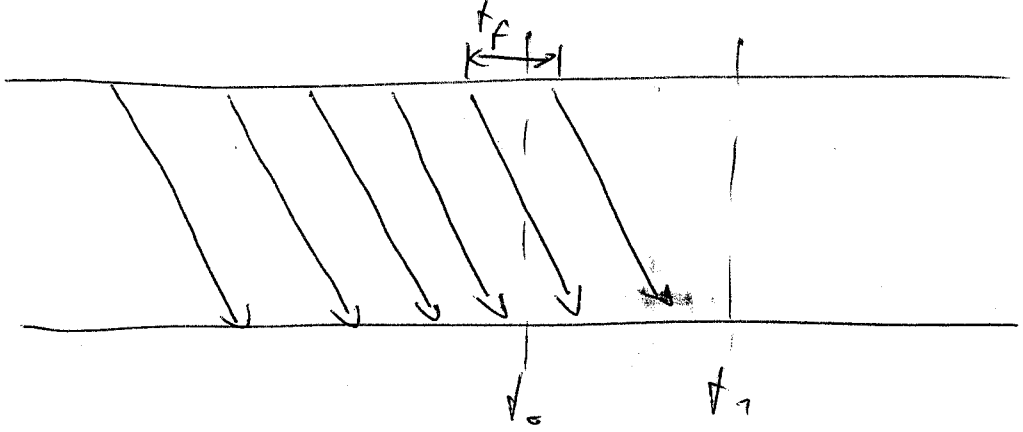


Case 1 -> The ack for frame 0 is received before t_0.

$U_{p=0} = 1$

Case 2 -> The ack for frame 0 is received at $t_1 > t_0$

$U_{p=0} < 1$



RN 6e13 22. NOV. 2010

$$v_{i=0} = \frac{k \cdot t_f}{t_1} = \frac{\text{time for transmission of } k \text{ frames}}{\text{time until ACK for frame 0 is received}}$$

$$* \quad t_1 = t_f + t_{prop} + t_{ack} + t_{prop} \simeq t_f + 2t_{prop}$$

$$\Rightarrow v_{i=0} = \frac{k \cdot t_f}{t_f + 2t_{prop}} \Rightarrow t_f = \frac{2 \cdot v \cdot t_{prop}}{k - u}$$

$$\Rightarrow t_f = 1{,}36 \cdot 10^{-6} \text{ s}$$

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

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

4.1) Selective-Repeat Protocol

$k \cdot t_f$ (time needed for transmitted k frames "window") $\geq$ (1) time needed for the ack of first frame to be received + processed, T

$$T = t_p + t_{prop} + t_{proc} + t_f + t_{prop} + t_{proc} = 0{,}64125 \text{ s}$$

(t_f: piggy-backed frame)

$$t_f = \frac{1000}{R} = 0{,}01\overline{5625} \text{ s} \qquad t_{prop} = \frac{90000 \cdot 10^3}{3 \cdot 10^8} = 0{,}3 \text{ s}$$

$$(1) \Rightarrow k \cdot t_f > T \Rightarrow k > \frac{T}{t_f} \Rightarrow k > 41{,}04 \simeq 42$$

b.) $p_f = 0{,}01$

Avg # transm. to send each frame:

$$N = \frac{1}{1-p}$$

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

$$\nu = \frac{\nu_{p=0 \to 1}}{\left(\frac{1}{1-p}\right)} = 1(0{,}99) = 0{,}99$$

$$R = 64\,000 \frac{bit}{s} = 64 \frac{pkts}{s} \Rightarrow \text{pkt. transm. rate} = 64 \cdot 0{,}99 = 63{,}36 \frac{pkts}{s}$$

for succesf. delivery