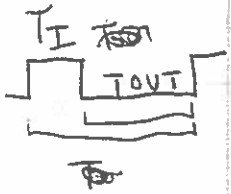
2/7/00 2/8/4 2/7/17

Efficiency for ARQ:

Stop & Wait

p = prob frame in error

$$E[\text{Transmissions}] = \frac{1}{1-p} = \Sigma 1\cdot(1-p) + 2p(1-p) + 3p^2(1-p) + \dots$$



$$Eff = \frac{T_I}{\frac{1}{1-p}(T_I + T_{out})}$$

T_{out} = $T_{round\text{-}trip} + \epsilon$

T_{out}: time out = round trip delay

T_I: packet time

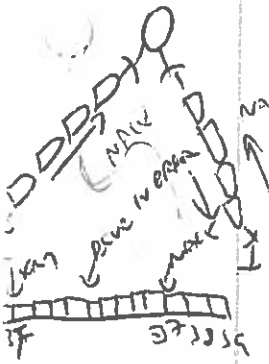
Go Back to N

τ prop delay (one way)

$$Eff = \frac{T_I}{T_I + \left(\frac{1}{1-p} - 1\right)\frac{2\tau_{prop}}{T_I}}$$

$\frac{1}{1-p} - \frac{1-p}{1-p} = \frac{p}{1-p}$ = retransmission overhead

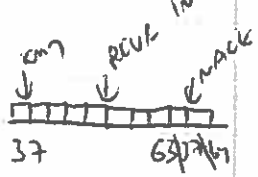
$2\tau_{prop} = T_{out}$



Selective Repeat

$$Eff = \frac{T_I}{T_I + \left(\frac{1}{1-p} - 1\right)T_I}$$

retransmission overhead



τ full channel utilization circle around

If xmsn time for all W frames $> 2\tau$ (round trip delay), channel utilization = 1 error-free, < 1 noise

examples

$p = .1$ "satellite" channel

10 kbps channel

$T_I = \underbrace{1000}_{\text{packet length}} \times .001 \frac{\text{sec}}{\text{bit}} = 1 \text{ sec}$

1 way $\tau_{prop} = .25$ sec

$T_{out} = .5$ sec $= 2\tau_{prop}$

$Eff = 15\%$

$$Eff = \frac{.1}{.1 + .1111 \times .5}$$

$= 64\%$

$$Eff = \frac{.1}{.1 + .1111 \times .1} = 90\%$$