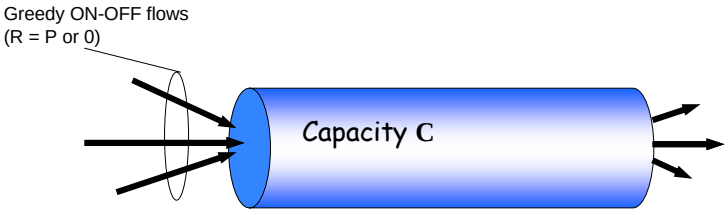
Bufferless multiplexer

Bufferless Multiplexer

- Number of flows $= N$

  $C = 100\ Mbps$



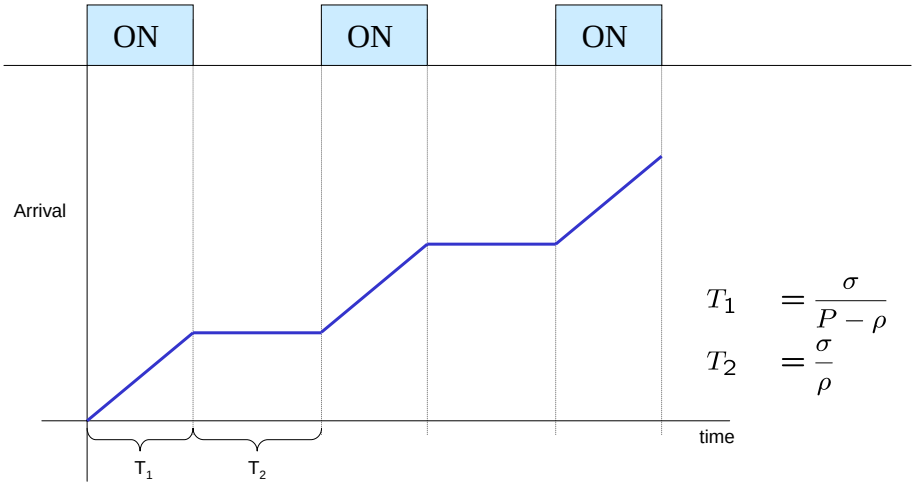
What is the Prob. That the rate from all flows exceeds capacity?

= What is $P_{loss} = P(\sum_{j=1}^{N} R_j > C)$?

Greedy ON-OFF Source

- ON-OFF source that is constrained by a leaky bucket with parameters *P*, σ and ρ:
  - **ON Phase**:
    - Send at rate P (until leaky bucket is empty)
  - **OFF Phase:**
    - Do not send (until leaky bucket is full)

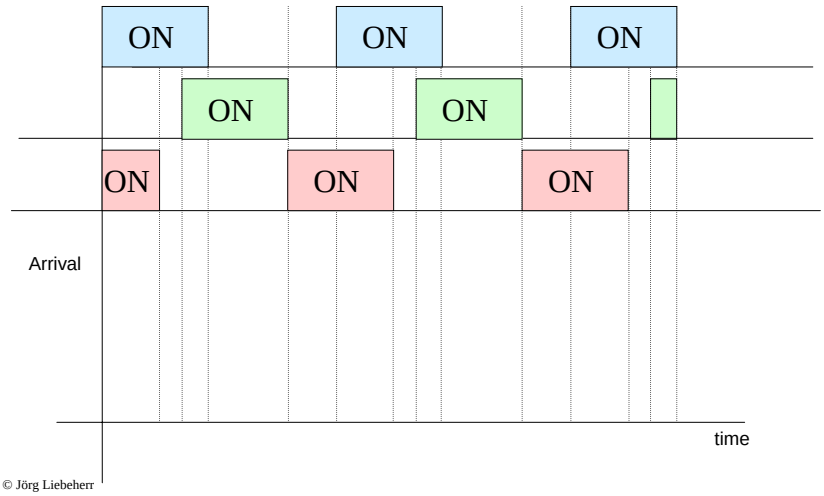
Greedy ON-OFF Source



$$T_1 = \frac{\sigma}{P-\rho}$$

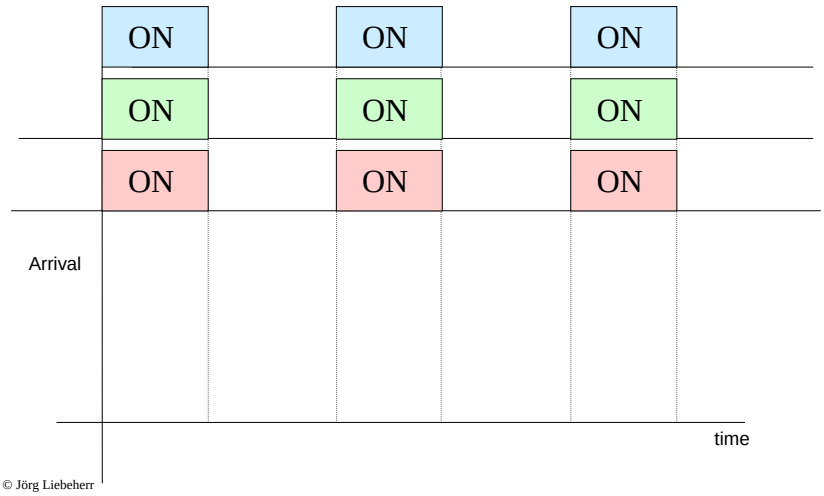
$$T_2 = \frac{\sigma}{\rho}$$

Multiple Greedy ON-OFF Sources



Multiple Greedy ON-OFF Sources

- Worst-case



CLT:

$$P_{loss} = Pr(\sum_{j=1}^{N} R_j > C) \approx 1 - \Phi(\frac{C - N\rho}{\sqrt{N(P\rho - \rho^2)}})$$

Number of flows $= N$

$C = 100\ Mbps$

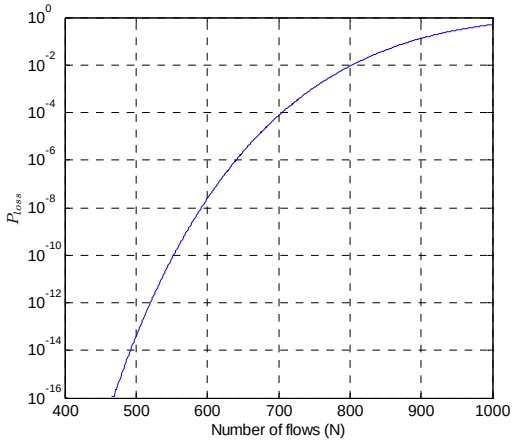
$P = 1\ Mbps$

$\rho = 0.1\ Mbps$

$\sigma = 100,000\ bit$

$E[R] = \rho$

$Var[R] = P\rho - \rho^2$



Chernoff Bound:

$$P_{loss} = P(\sum_{j=1}^{N} R_j > C) < e^{-Nl(C/N)}$$

$$l(a) = a/P \cdot \ln(\frac{a}{\rho}\frac{P-\rho}{P-a}) - \ln\frac{P-\rho}{P-a}$$

Number of flows $= N$

$C = 100\ Mbps$

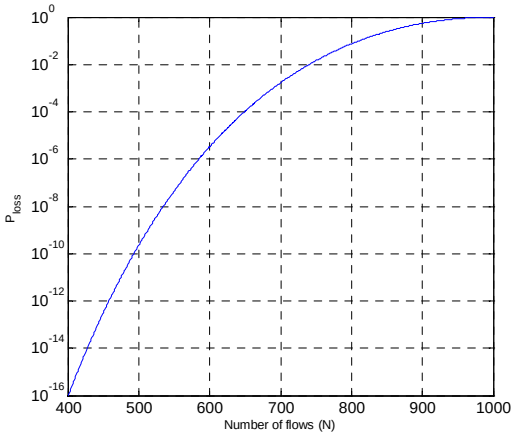
$P = 1\ Mbps$

$\rho = 0.1\ Mbps$

$\sigma = 100,000\ bit$

$E[R] = \rho$

$Var[R] = P\rho - \rho^2$



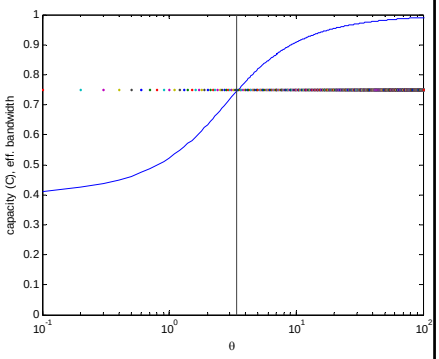
Effective bandwidth

- Slotted system
- Single source:
  - In each slot, source transmits with Prob. p
  - If source transmits, it sends at rate R
- B_k={0,R} transmission in slot k
- A_n are the transmissions in timer interval [0,n]

$$A_n = \sum_{k=1}^{n} B_k$$

$$E[e^{\theta B_k}] = 1 - p + pe^{R\theta}$$

$$\alpha_A(\theta) = \frac{1}{\theta} ln(1 - p + pe^{R\theta})$$



$$R = 1\ Mbps$$
$$C = 0.75\ Mbps$$
$$p = 0.4$$