95-0179

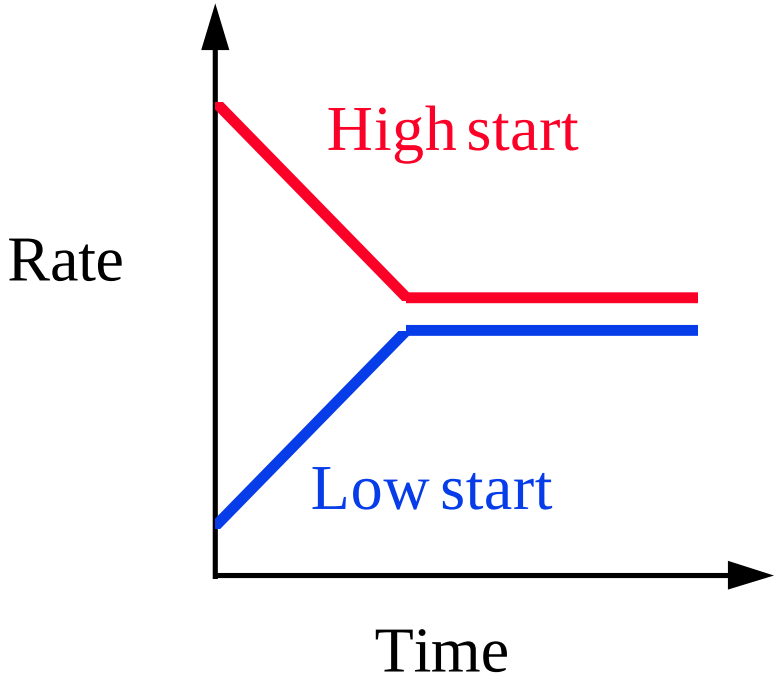
Simulation Results for The Sample Switch Algorithm

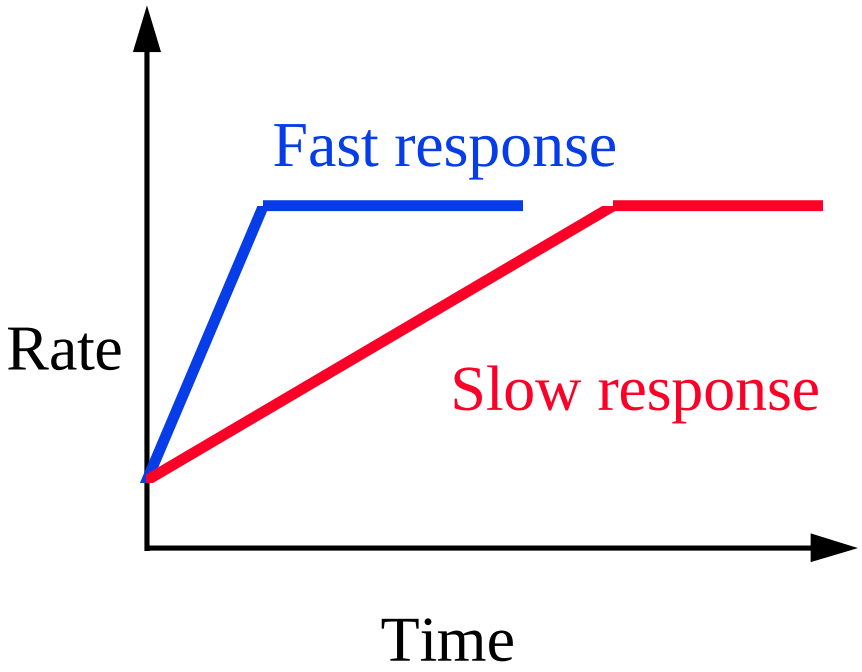
Raj Jain, Shiv Kalyanaraman, Ram Viswanathan, Rohit Goyal

Department of CIS
The Ohio State University
Columbus, OH 43210-1277
Jain@ACM.Org

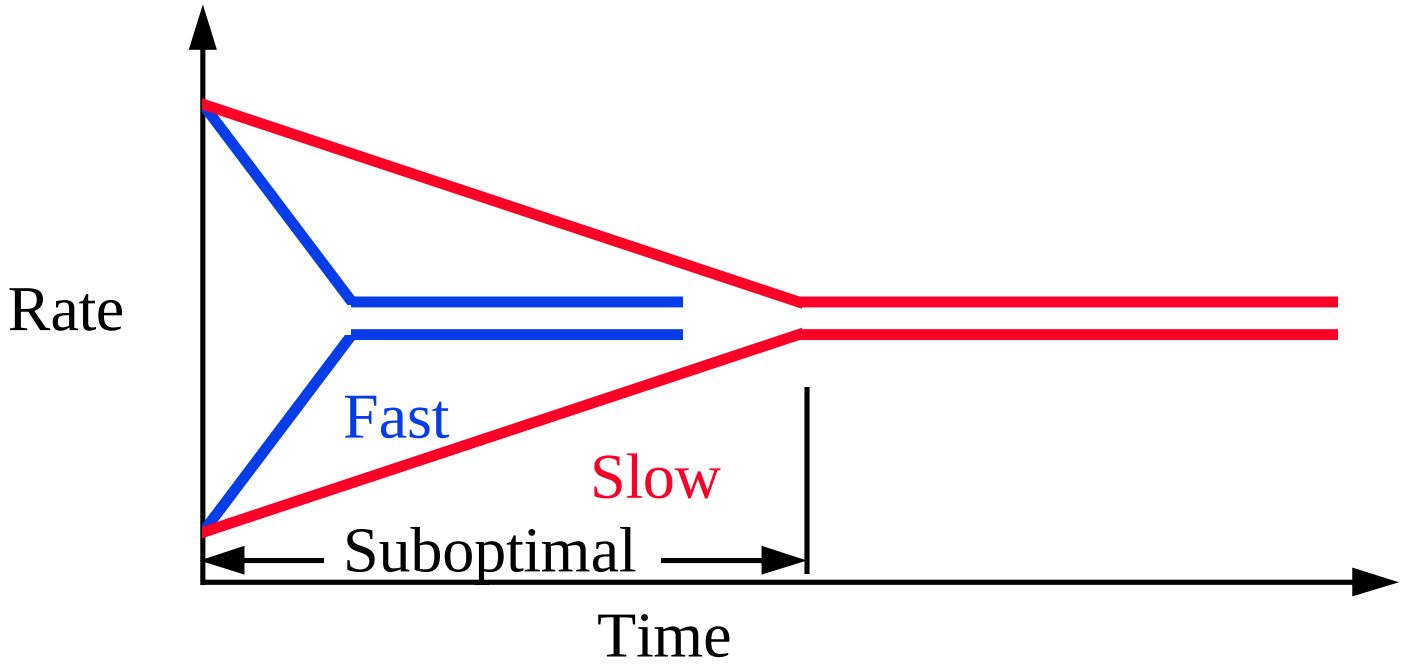
- Why worry about transient performance?
- Transient performance and bursty traffic
- Low vs High start, Slow vs Fast response
- Simulation Results
- Analytical Results

Low/High Start vs Slow/Fast Response





Is Fast Response Good for WAN?



- Yes, schemes with fast response, if designed properly, give lower queue length and better throughput than those with slow response
- With fast response, starting point doesn't matter that much.

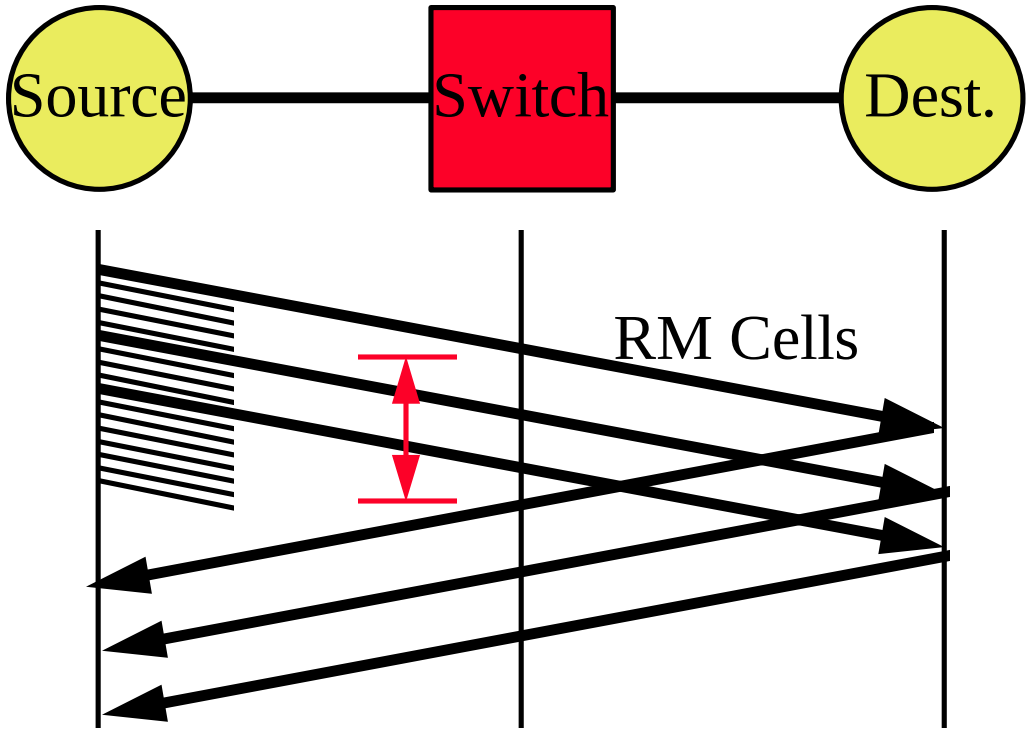
Simulation Parameters

- Source:
  Nrm = 16
  ICR = PCR/20 or PCR
  AIR = PCR
  RDF= ∞

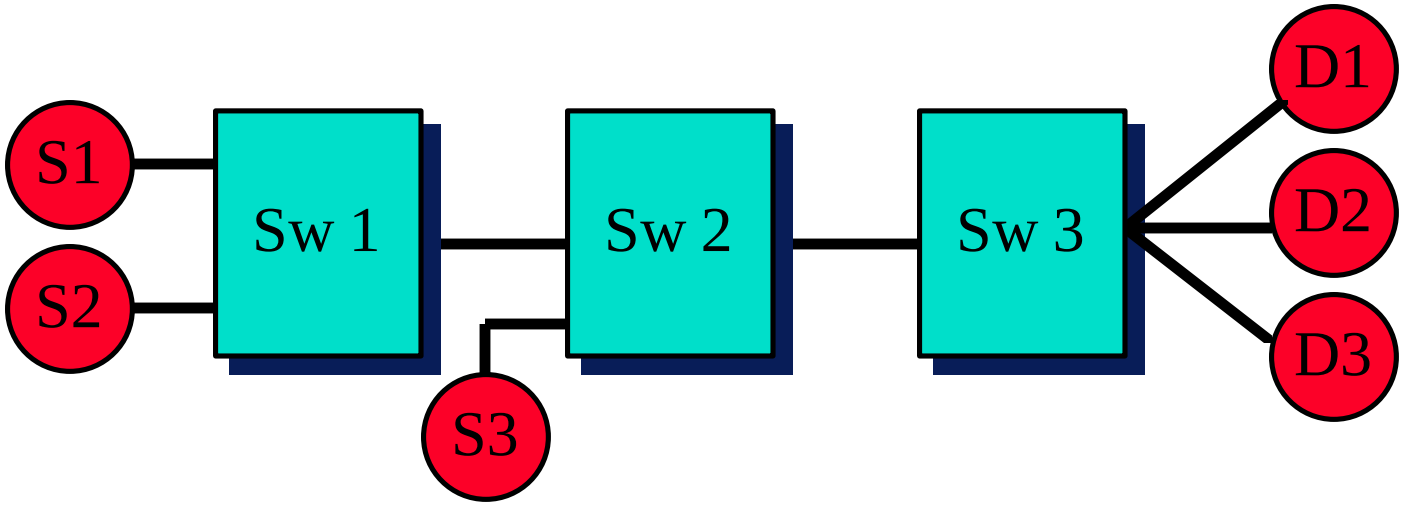
- Switch:
  Target Utilization = 95% or 90%
  Averaging interval = 30 cells
  Uses BECN option during first round-trip

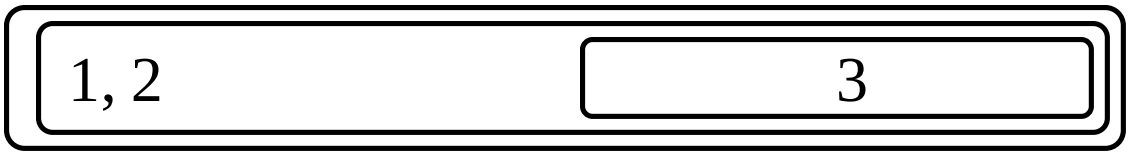
BECN Option

- Useful only if
  - WAN
  - High start
  - First round-trip of new VCs



Parking Lot Configuration



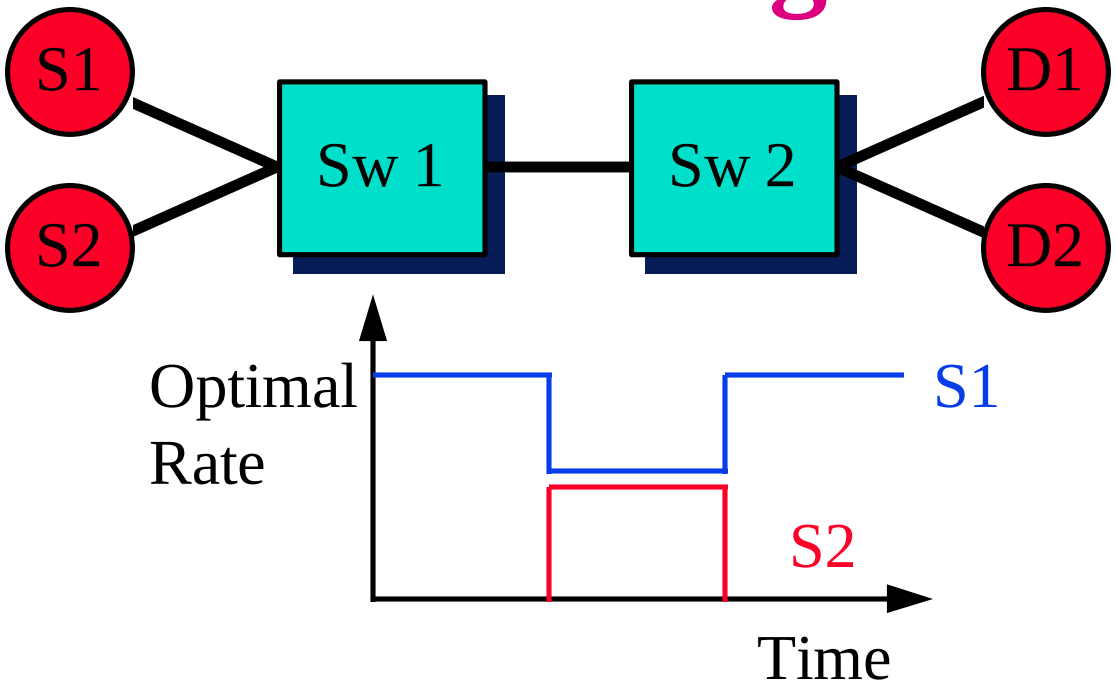


- All links 155.52 Mbps, 1 km (LAN) or 1000 km (WAN)
- Max-min optimal: 51.5, 51.5, 51.5 Mbps
- Goal: Test fairness

Configurations

- LAN Low Start: 1 km Links, ICR = 7.5 Mbps
- LAN High Start : 1 km Links, ICR = 155.52 Mbps
- WAN Low Start : 1000 km Links, ICR = 7.5 Mbps
- WAN High Start : 1000 km Links, ICR = 155.52 Mbps

Transient Configuration



- All links 155.52 Mbps
- Second source turns on during the middle part
- Goal: To check time to adapt to load changes

Simulation Results

- ERICA converges fast
- Small oscillations
- ICR does not matter in LAN cases
- Small queue lengths

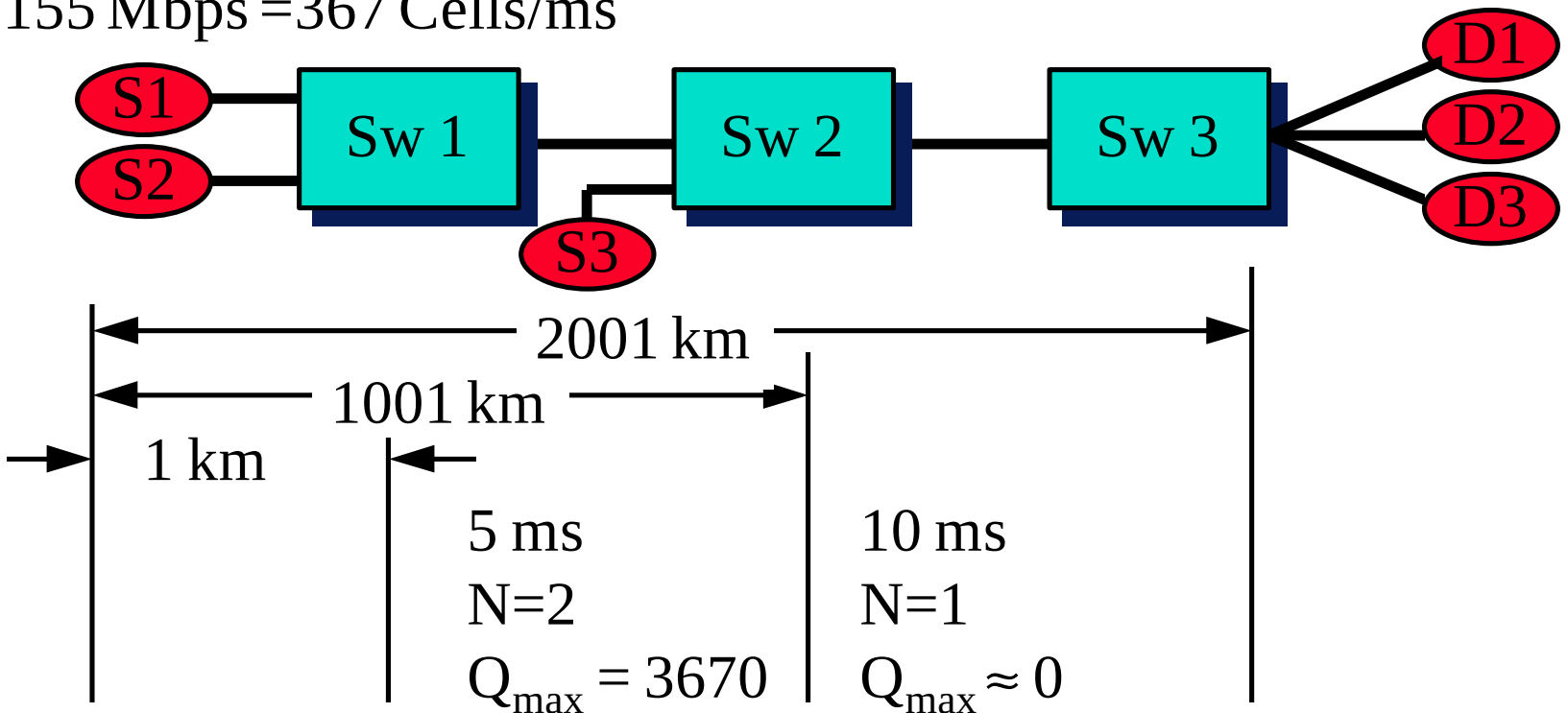
  With low start: 1-3

  With high start:

  $$\text{Qmax} \propto \text{Feedback path delay} \times (\text{Number of input links} - 1)$$

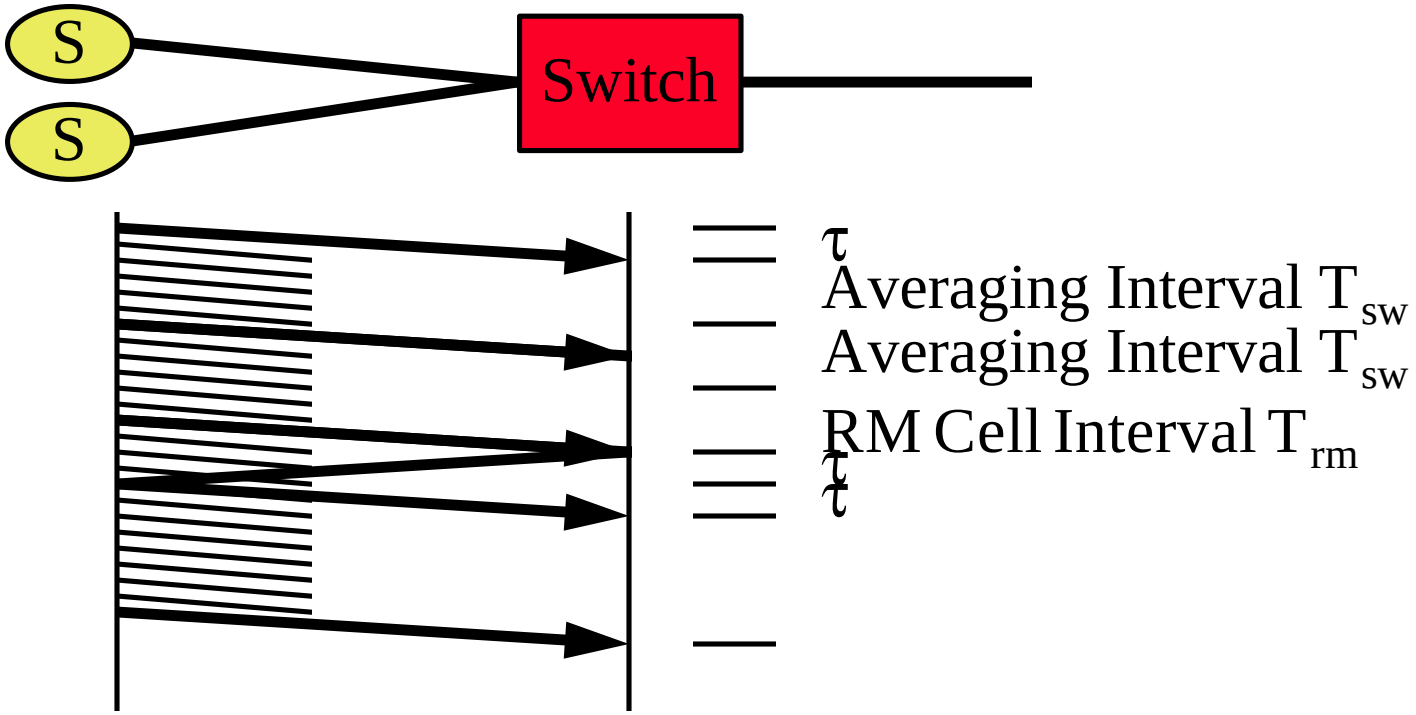
Maximum Queue Length

- With high start + BECN:
  $Q_{max} \le [2 \times$ Switch averaging interval + RM cell interval + $2 \times$ one-way feedback delay$] \times (N-1) \times$ Link Cell Rate
  Where, N = Number of input links
  155 Mbps =367 Cells/ms



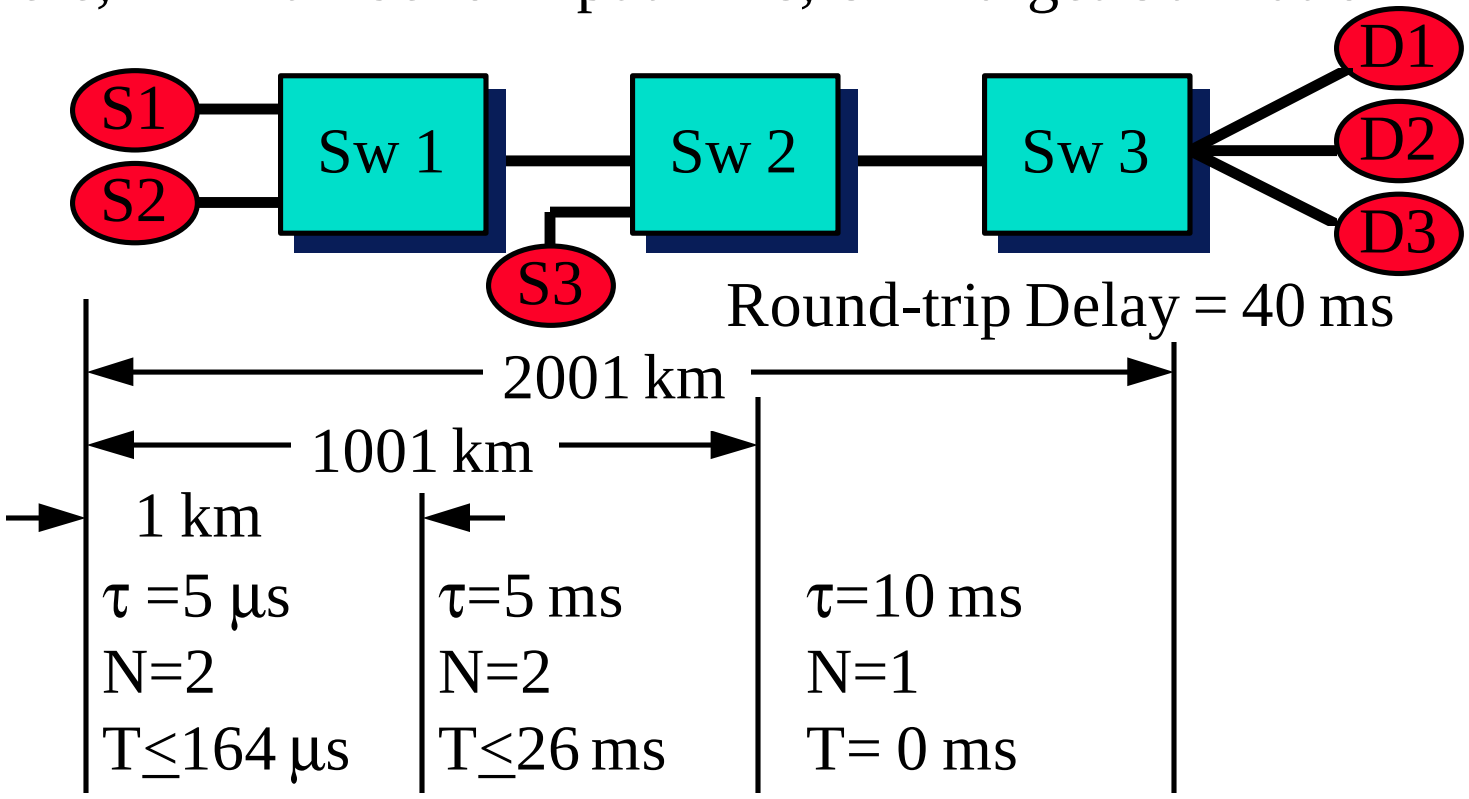
Q_{max} Derivation

- With high start +BECN: Qmax ≤ $[2T_{sw}+T_{rm}+2\tau]\times[(NR-R)]$
  $Q_{max} \le [2 \times$ Switch averaging interval + RM cell interval + $2 \times$ one-way feedback delay$]$ (N-1) $\times$ Link Cell Rate
  Where, N = Number of input links



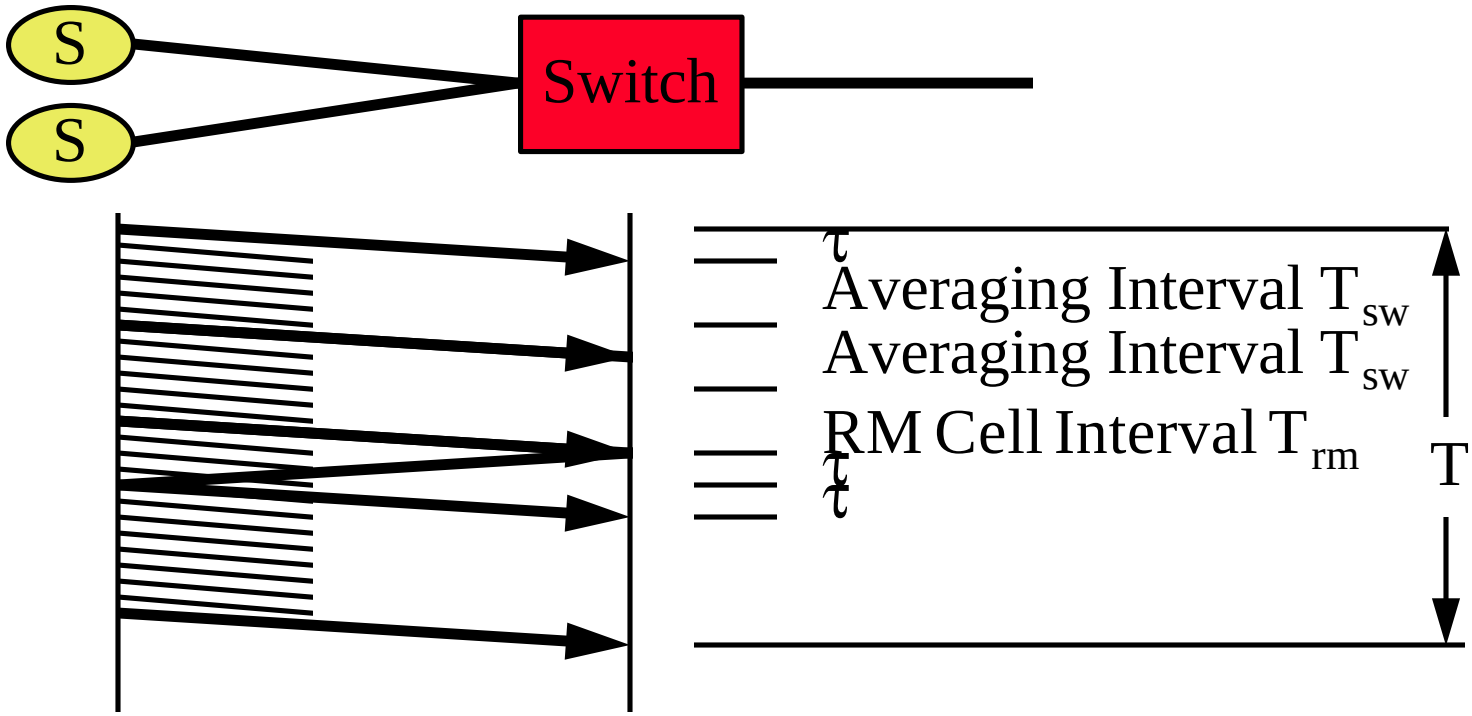
Convergence Time

- With high start + BECN:
  Convergence time ≈ [3 + 2(N-1)/(1-U)] × one-way feedback delay + 2 × Switch averaging interval + RM cell interval
  Where, N = Number of input links, U = Target Utilization

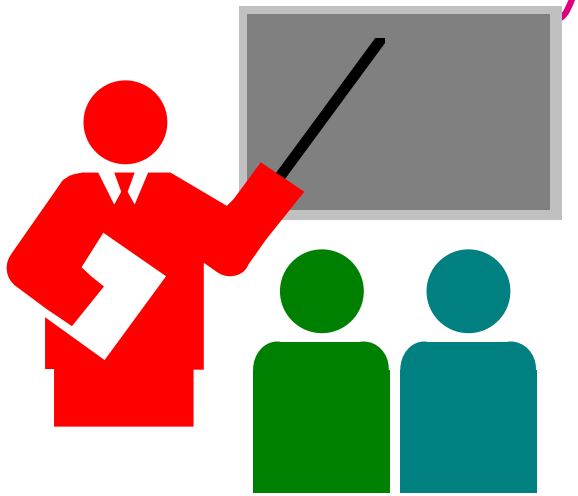


Convergence Time: Derivation

- $(2\tau+2T_{sw}+T_{rm})NR- (T-3\tau-2T_{sw}-T_{rm})UR = (T-\tau)R$
- $T = [3+2(N-1)/(1-U)]\tau + 2T_{sw} + T_{rm}$



Summary



- ERICA provides high-throughput
  Low queue length, Low delay
- Provides quick response to transients
- Is relatively insensitive to initial cell rate
- High starts possible in LAN environments