

**95-0179**

# **Simulation Results for The Sample Switch Algorithm**

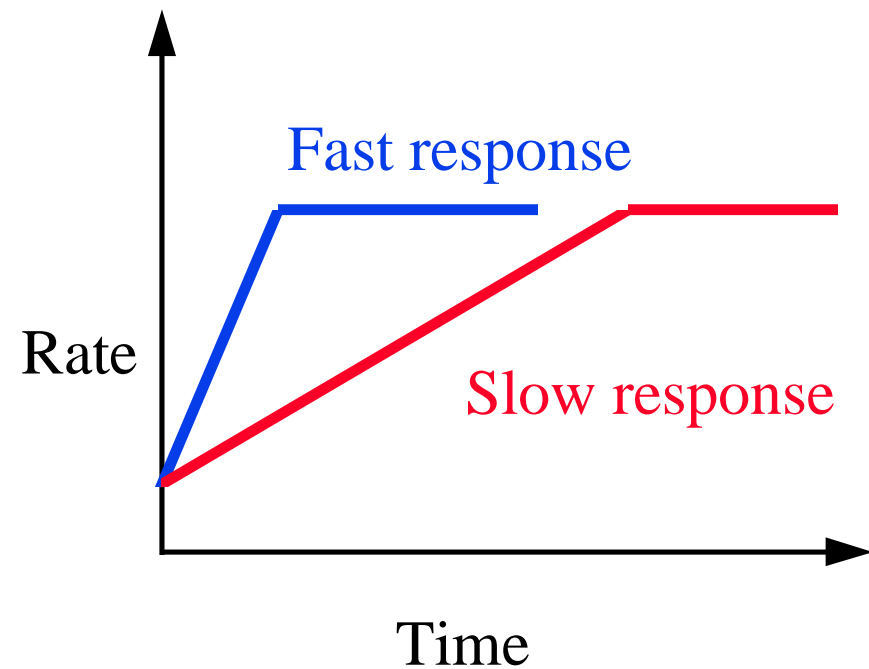
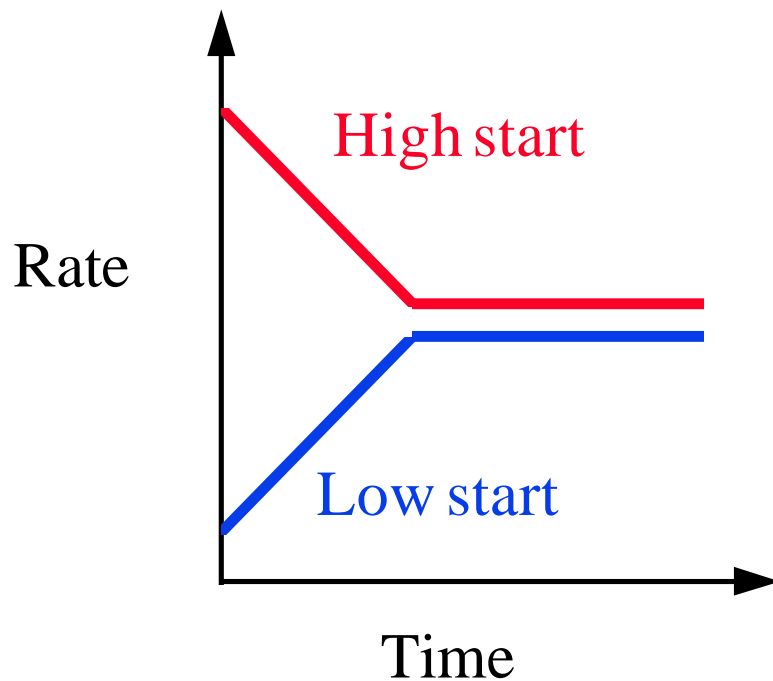
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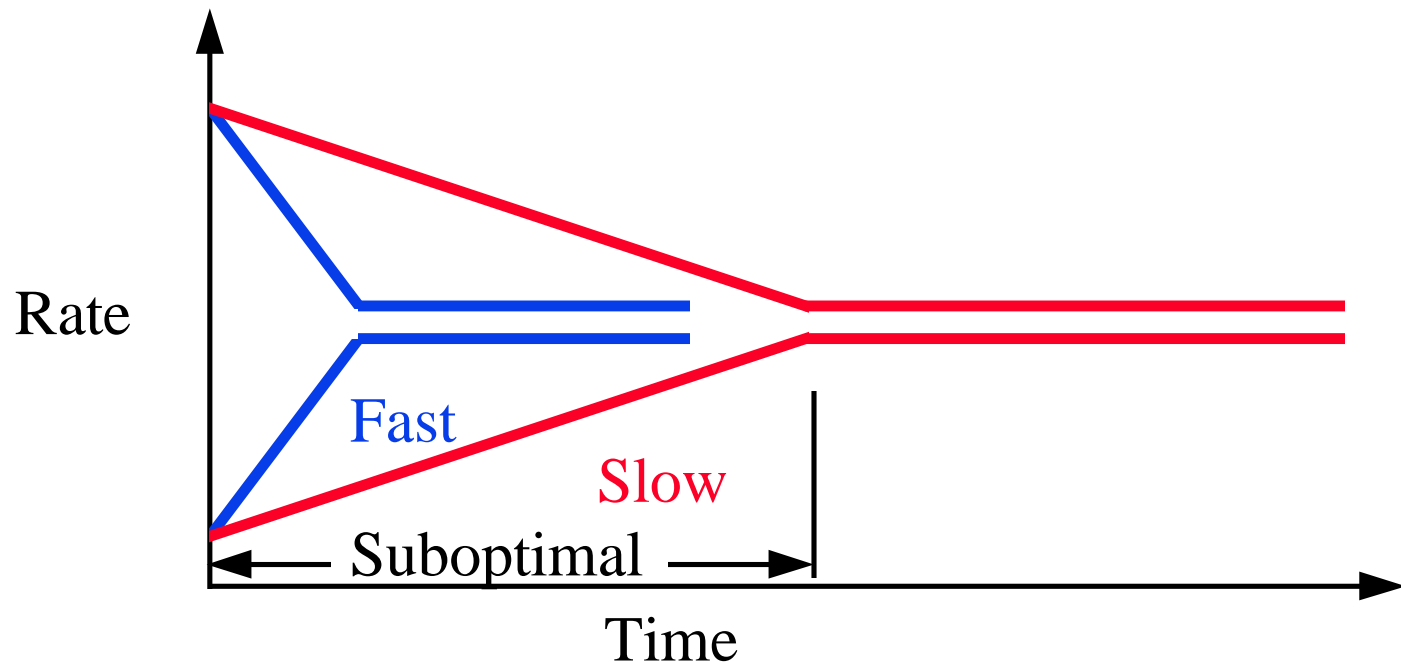


- ❑ Why worry about transient performance?
- ❑ Transient performance and bursty traffic
- ❑ Low vs High start, Slow vs Fast response
- ❑ Simulation Results
- ❑ Analytical Results

# 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:

$$N_{rm} = 16$$

$$ICR = PCR/20 \text{ or } PCR$$

$$AIR = PCR$$

$$RDF = \infty$$

- Switch:

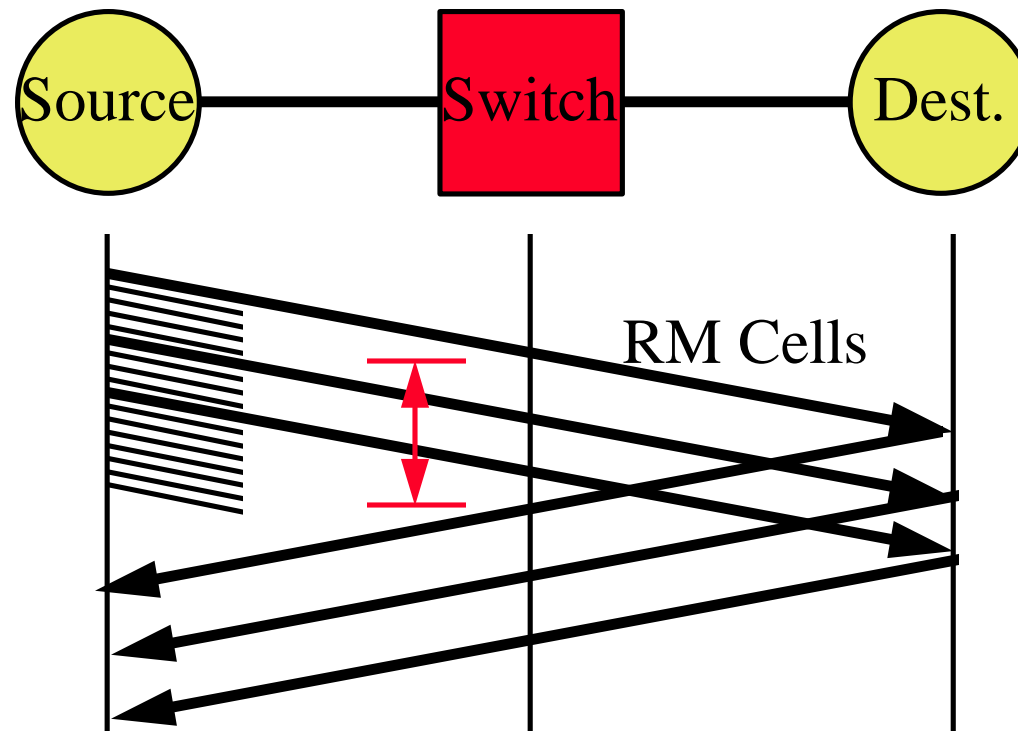
$$\text{Target Utilization} = 95\% \text{ or } 90\%$$

$$\text{Averaging interval} = 30 \text{ cells}$$

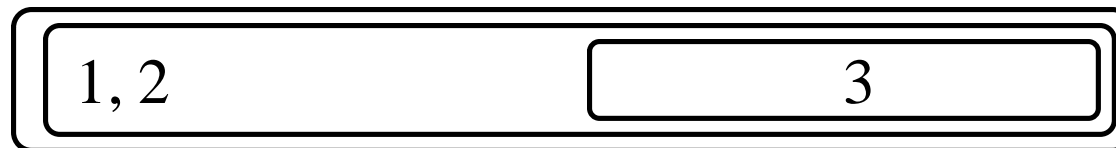
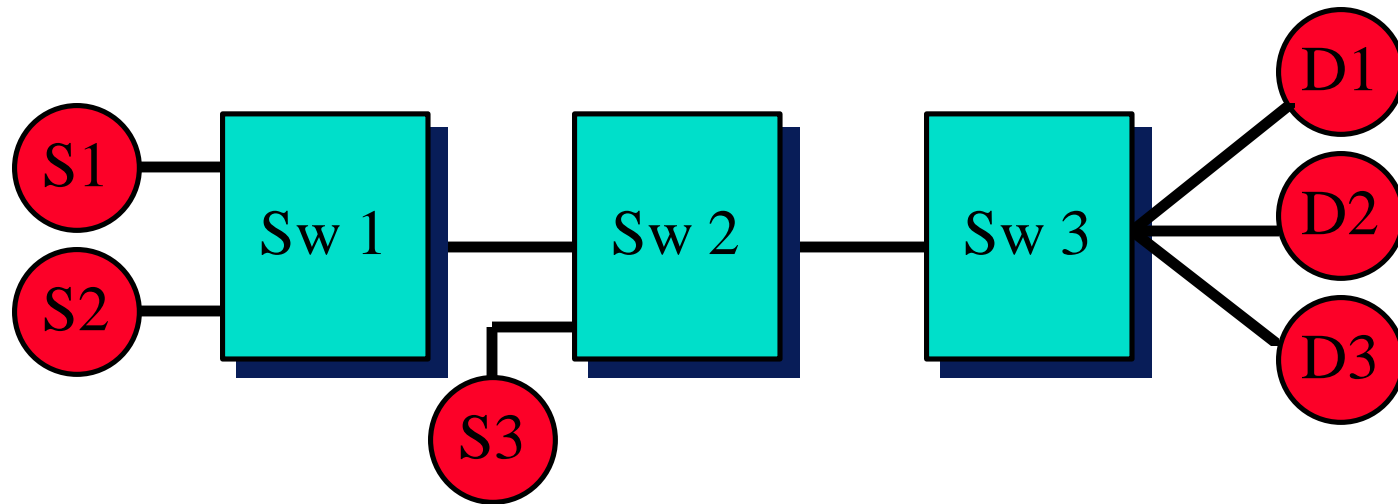
Uses BECN option during first round-trip

# BECN Option

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



# Parking Lot Configuration

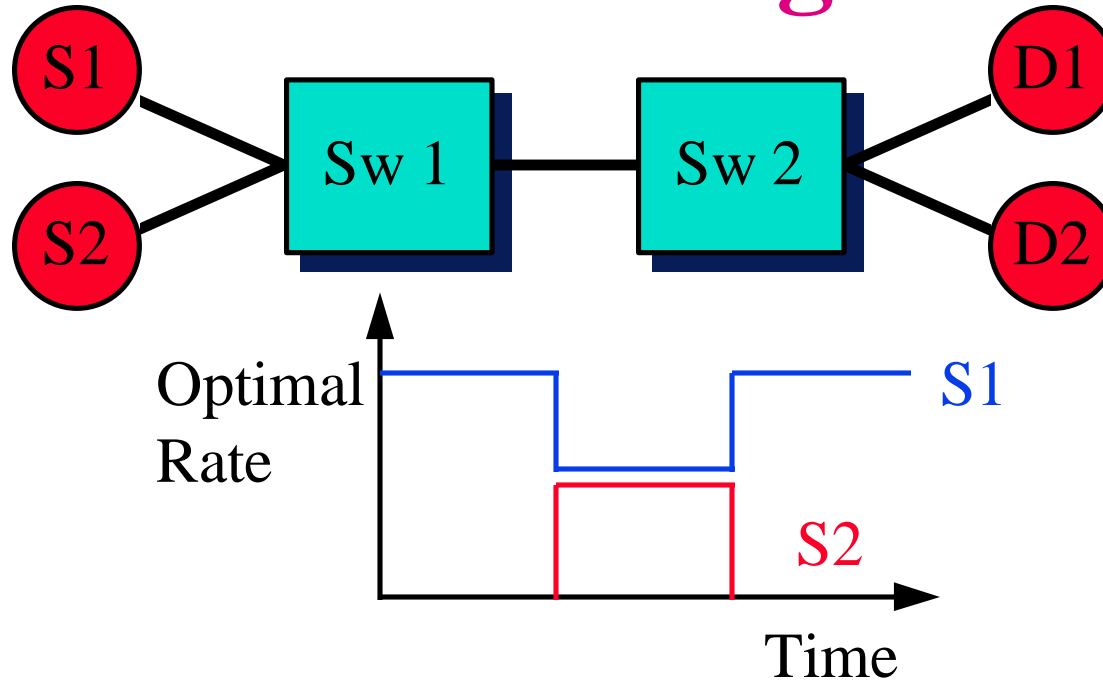


- ❑ All links 155.52 Mbps, 1 km (LAN) or 1000 km (WAN)
- ❑ Max-min optimal: 51.5, 51.5, 51.5 Mbps
- ❑ Goal: Test fairness

# 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:

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

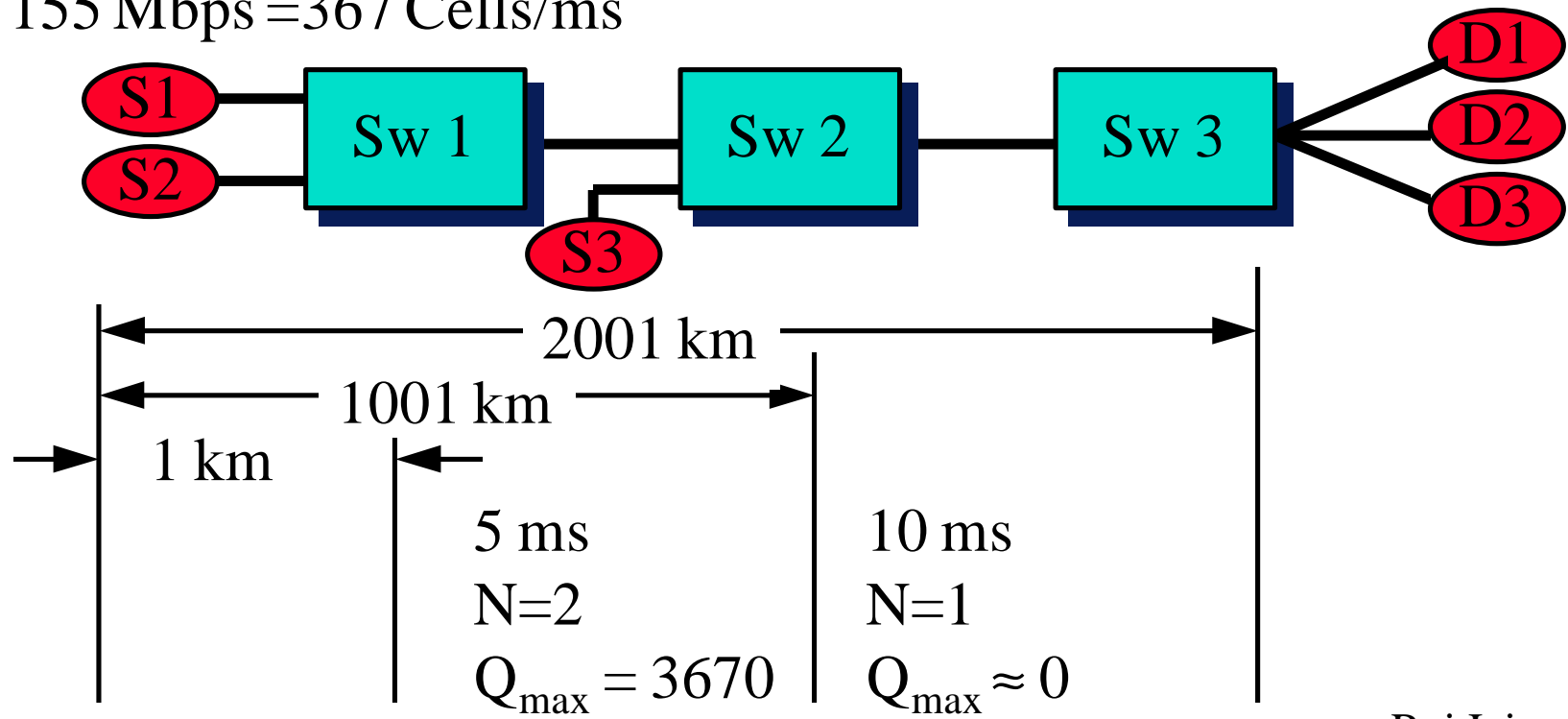
# Maximum Queue Length

- With high start + BECN:

$$Q_{\max} \leq [2 \times \text{Switch averaging interval} + \text{RM cell interval} + 2 \times \text{one-way feedback delay}] \times (N-1) \times \text{Link Cell Rate}$$

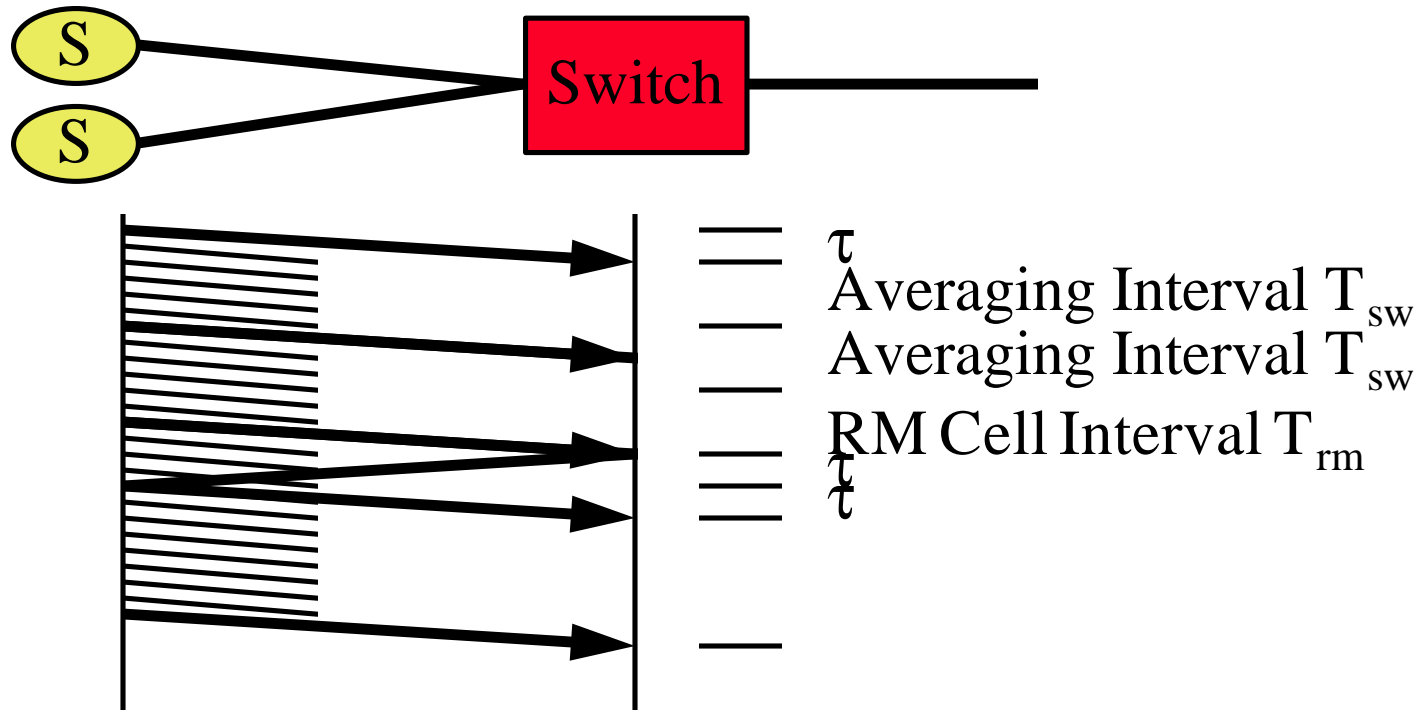
Where,  $N$  = Number of **input links**

155 Mbps = 367 Cells/ms



# $Q_{\max}$ Derivation

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

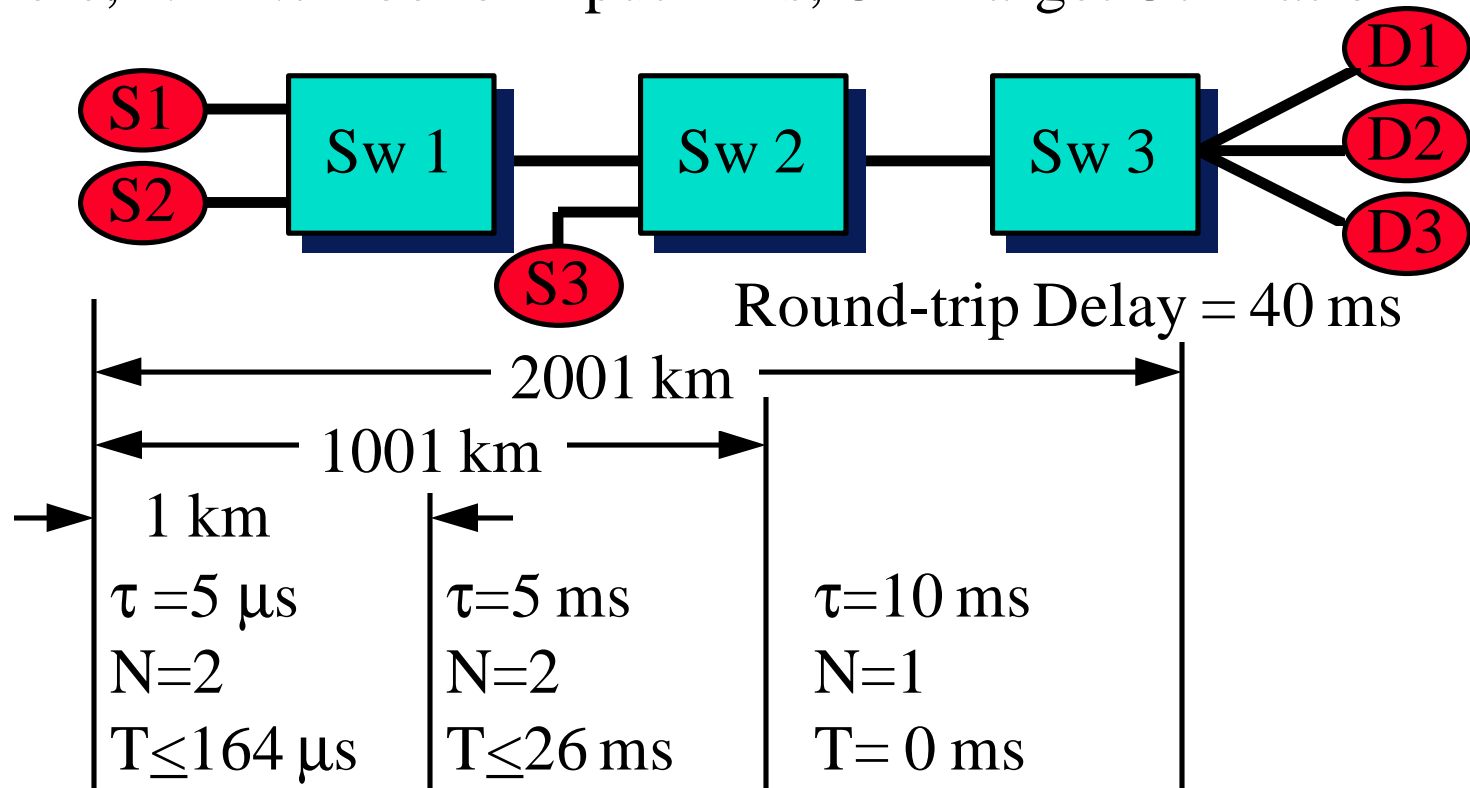


# Convergence Time

- With high start + BECN:

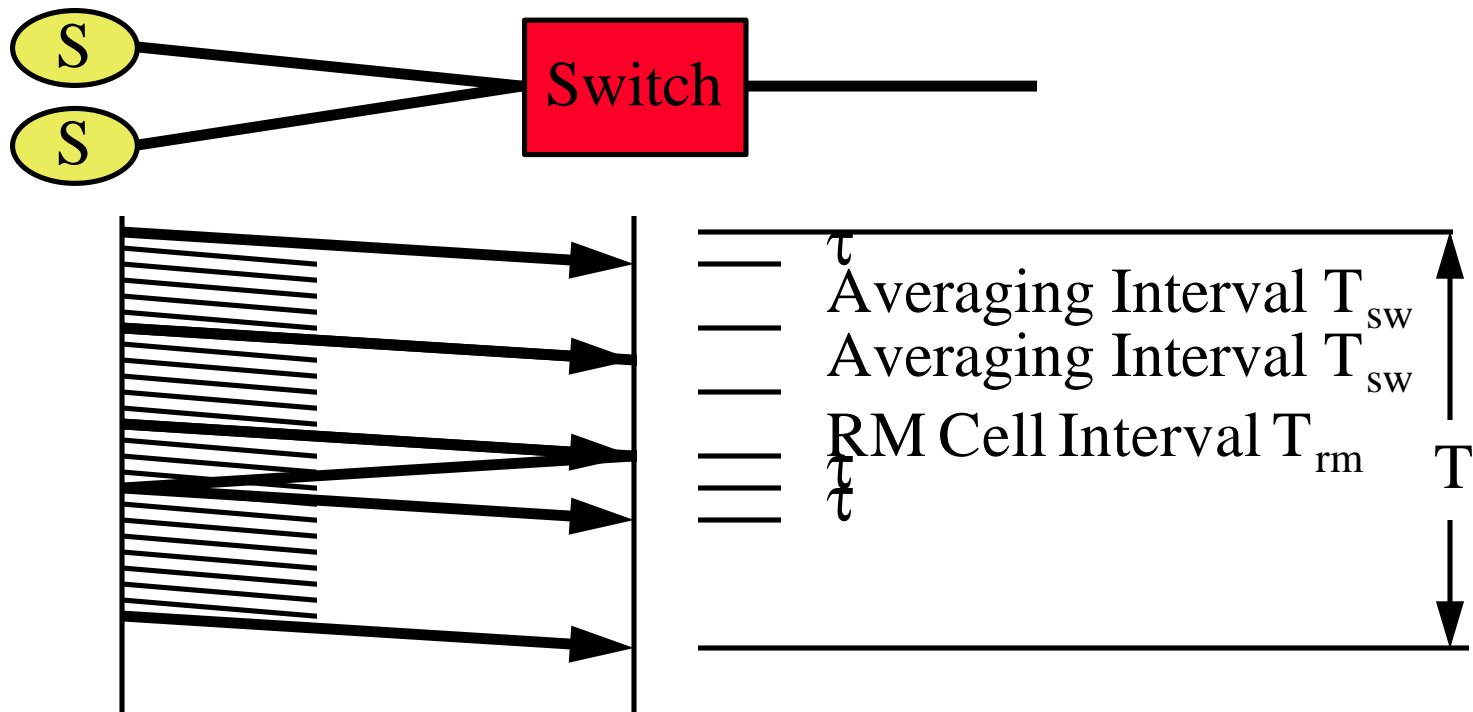
Convergence time  $\approx [3 + 2(N-1)/(1-U)] \times$  one-way feedback delay +  $2 \times$  Switch averaging interval + RM cell interval

Where,  $N$  = Number of input links,  $U$  = Target Utilization

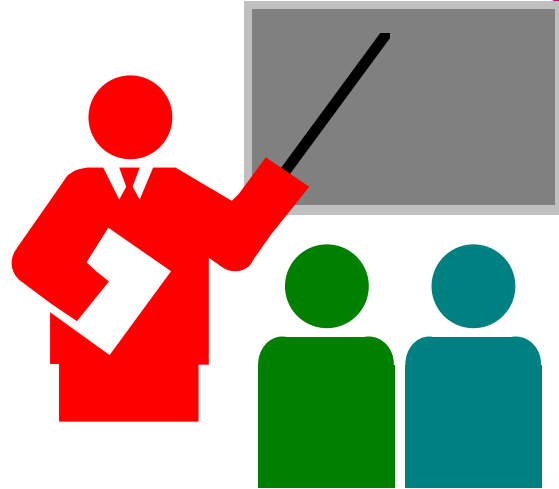


# Convergence Time: Derivation

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



# 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