95-0179
Simulation Results for The Sample Switch Algorithm

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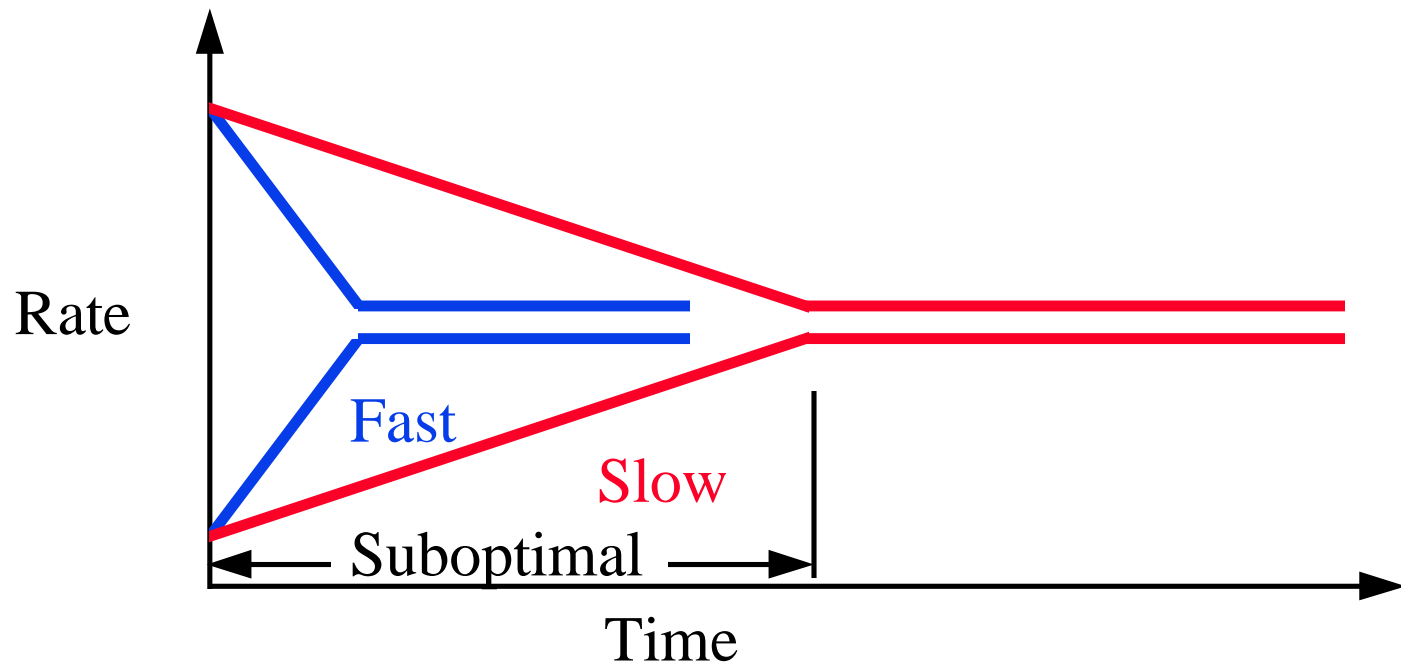Jain@cse.wustl.edu
http://www.cse.wustl.edu/~jain/

Overview

❑ 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
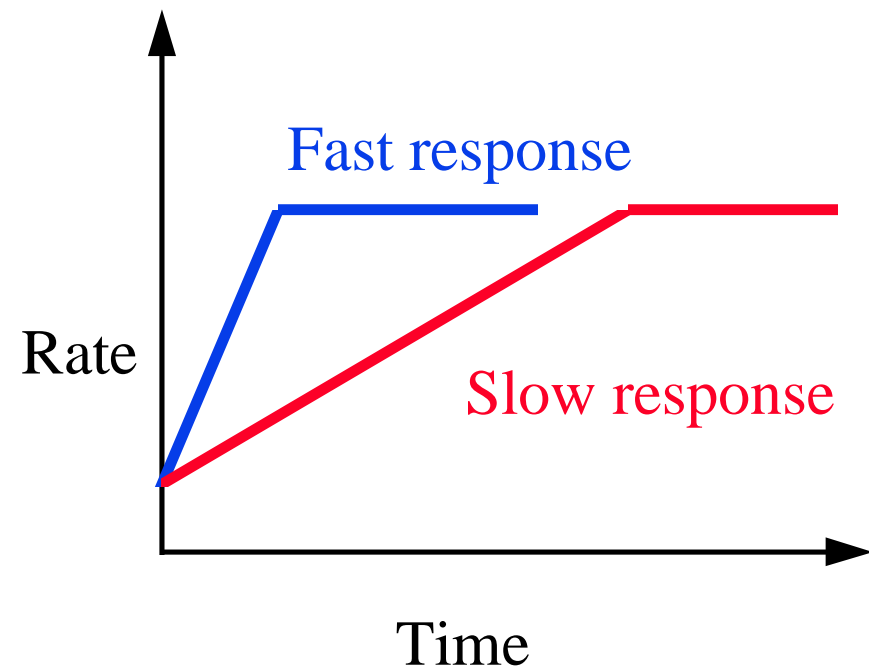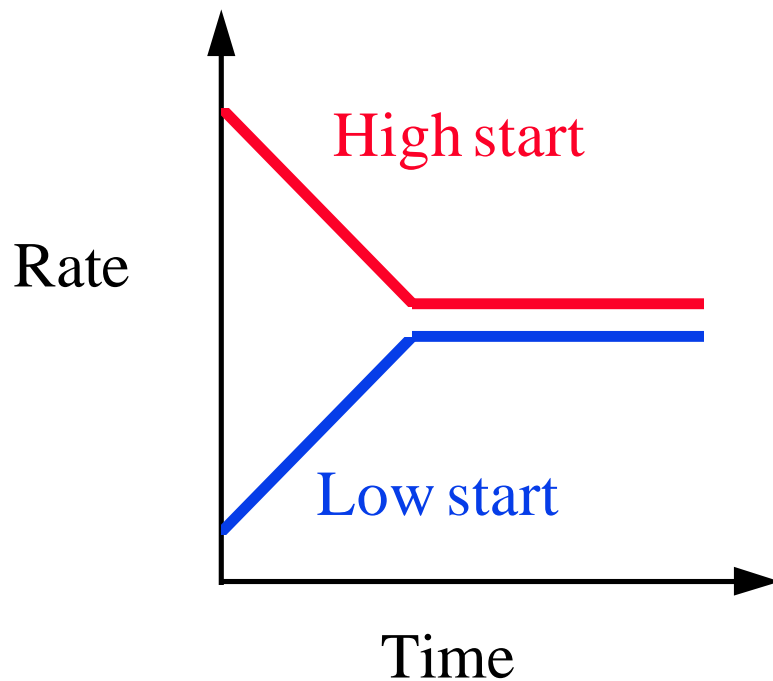
Is Fast Response Good for WAN?

❑ 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= ∞

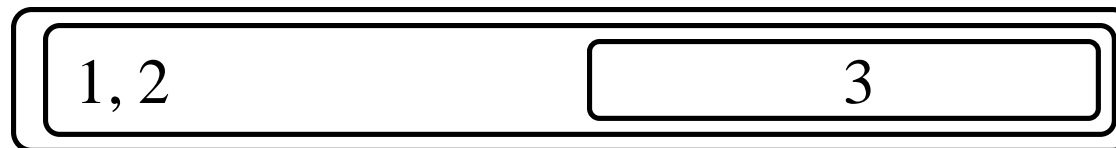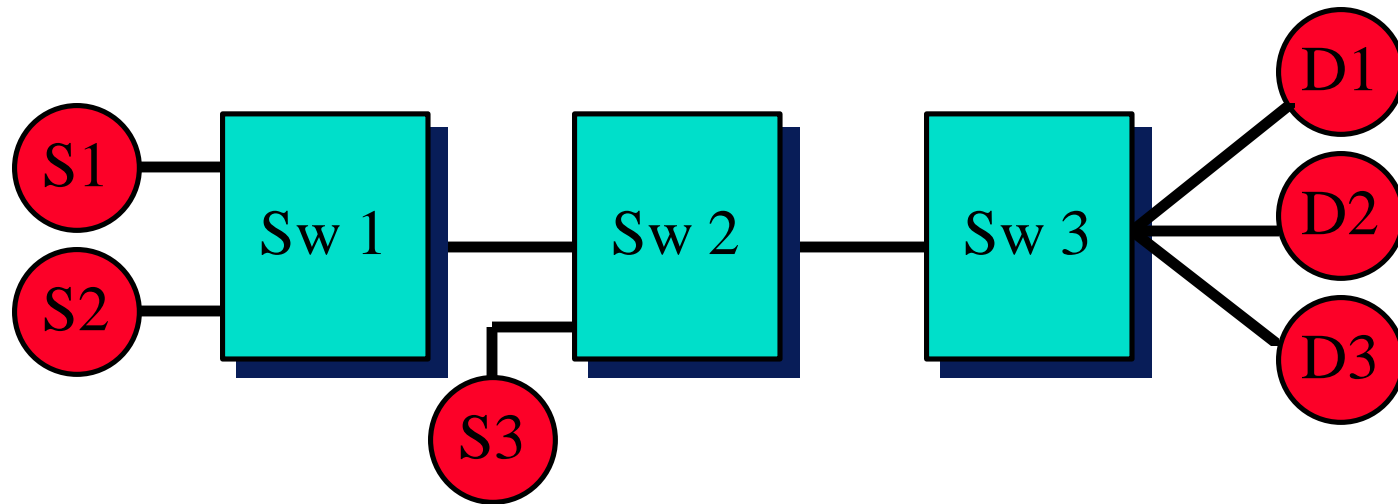❑ Switch:

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

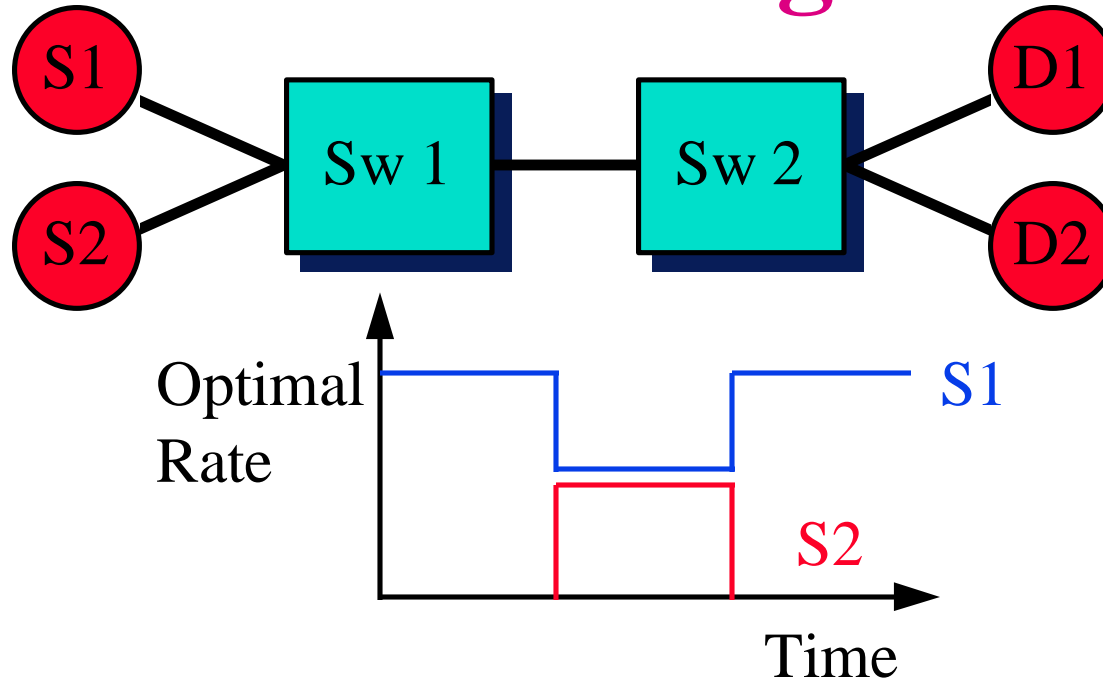**Source** —— **Switch** —— **Dest.**

RM Cells
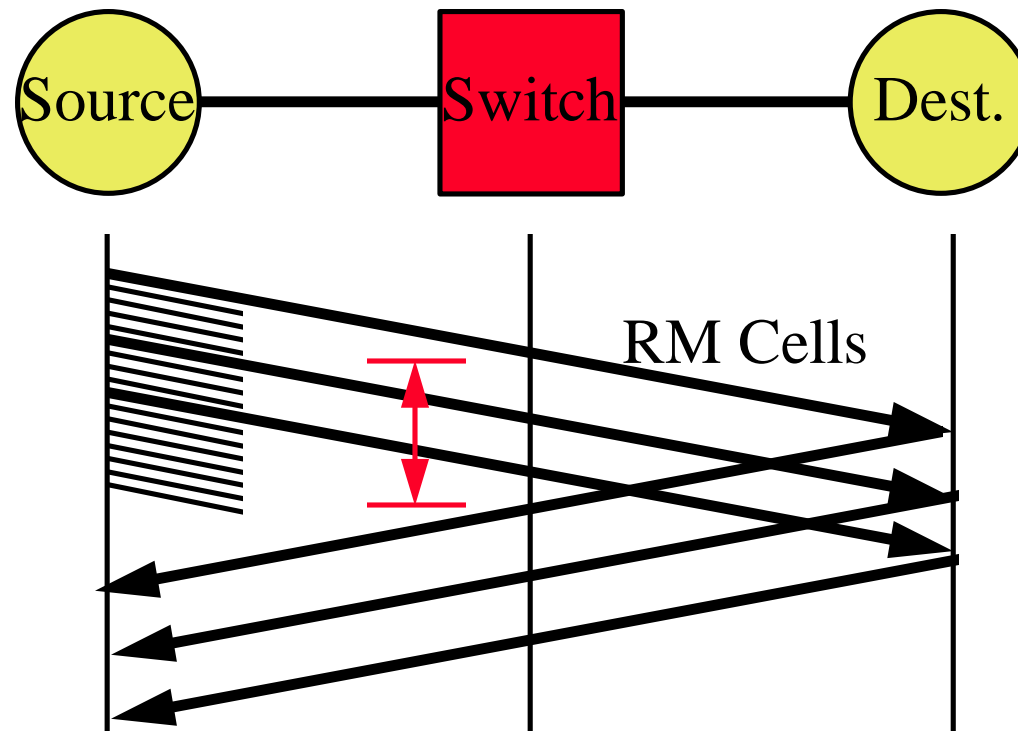
Parking Lot Configuration

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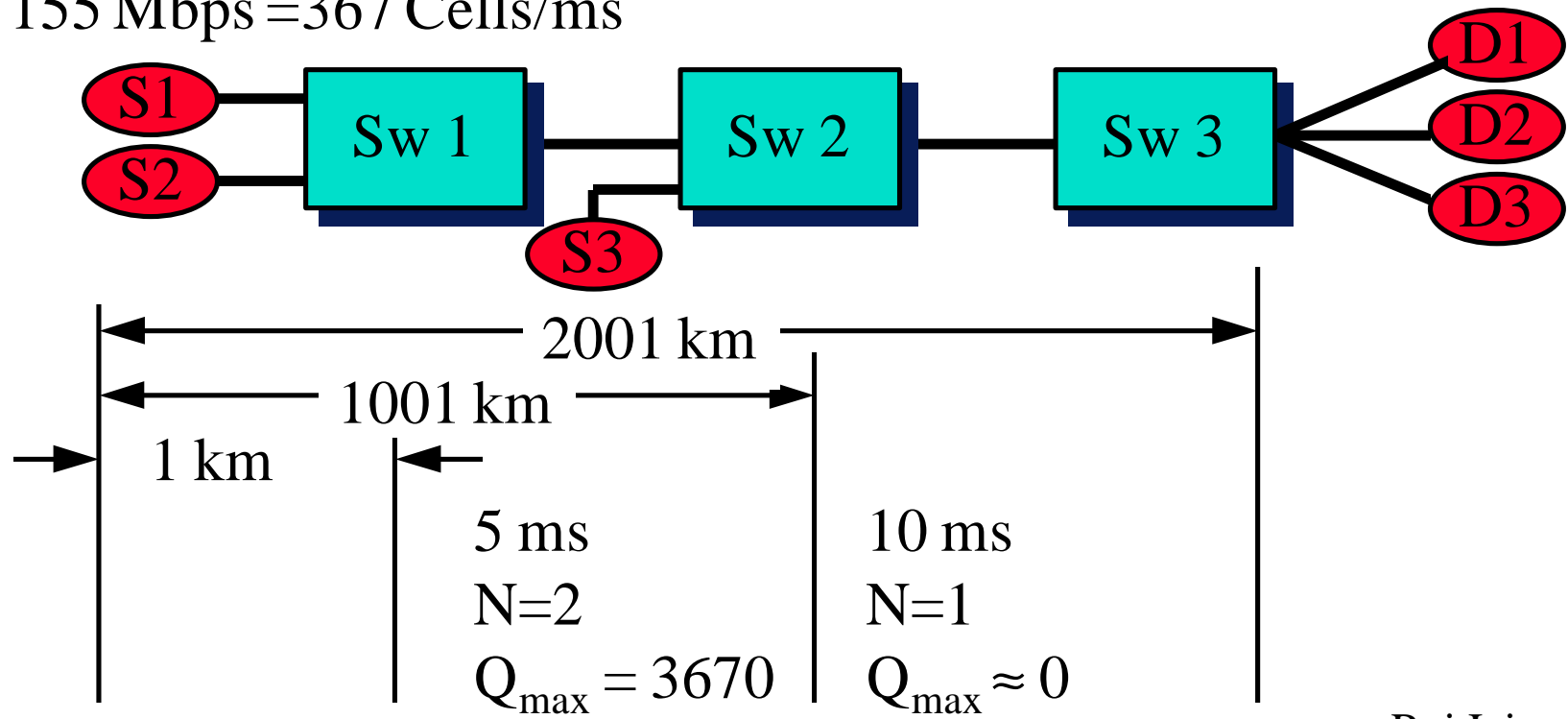$$(\text{ Number of input links-1})$$

Maximum Queue Length

❑ With high start + BECN:

$Q_{max} \leq [2 \times$ 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

2001 km

1001 km

1 km

5 ms
N=2
Q_{max} = 3670

10 ms
N=1
$Q_{max} \approx 0$

Q_{max} Derivation

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

τ
Averaging Interval T_{sw}
Averaging Interval T_{sw}
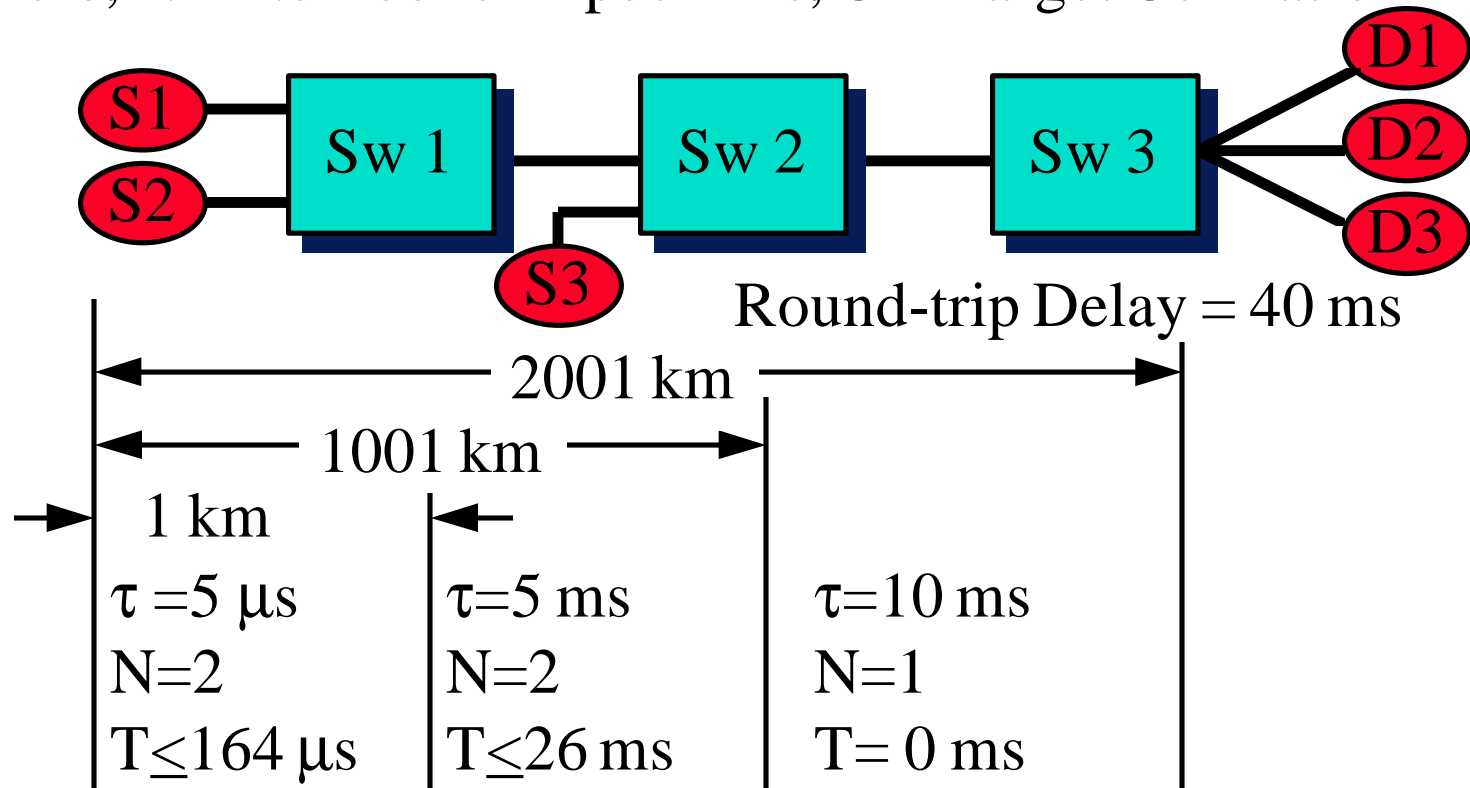RM Cell Interval T_{rm}
τ

Raj Jain
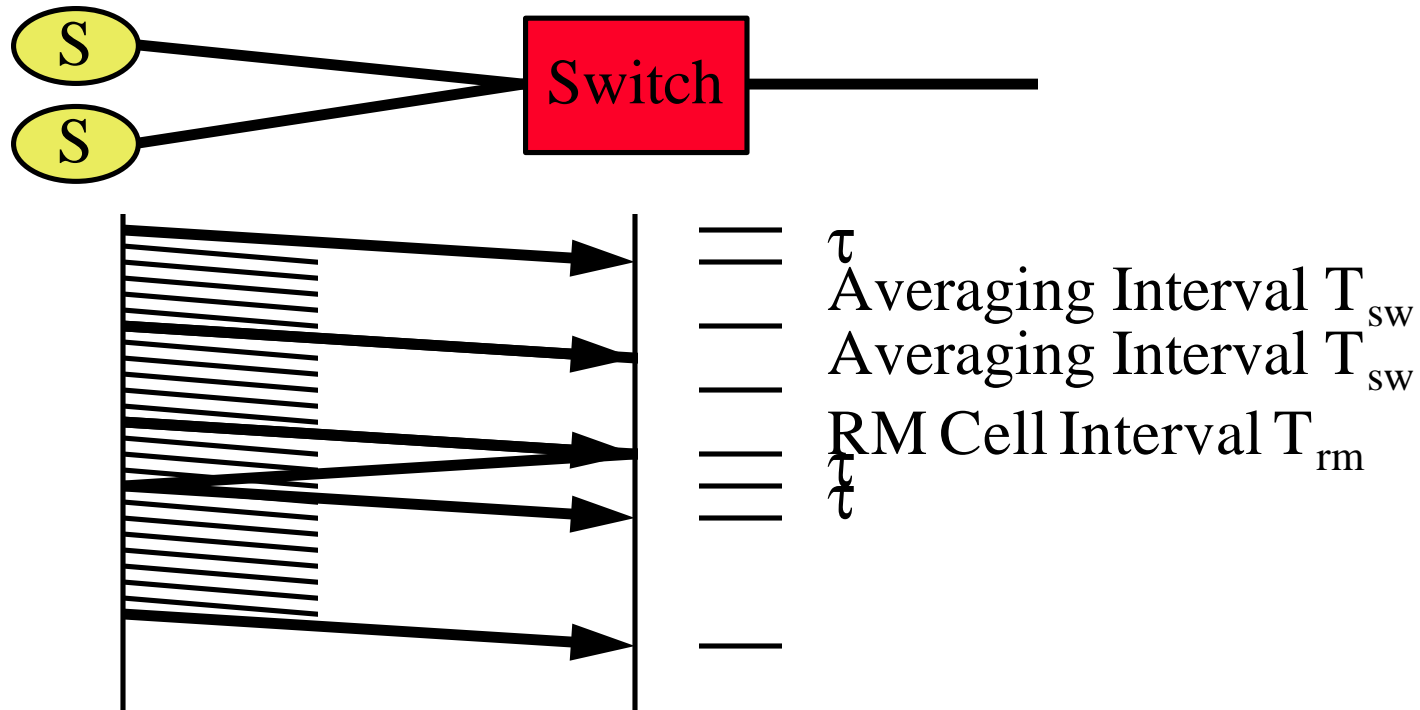
Convergence Time

❑ With high start + BECN:

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

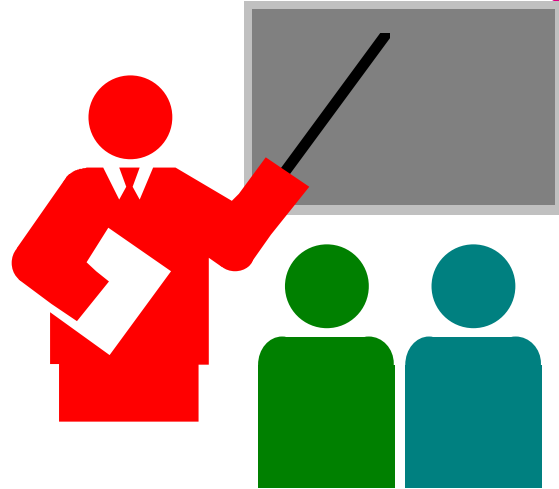Where, N = Number of input links, U = Target Utilization

Round-trip Delay = 40 ms

2001 km

1001 km

1 km

$\tau = 5\ \mu s$	$\tau = 5$ ms	$\tau = 10$ ms
N=2	N=2	N=1
$T \leq 164\ \mu s$	$T \leq 26$ ms	T = 0 ms

Convergence Time: Derivation

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

S

S

Switch

τ

Averaging Interval T_{sw}

Averaging Interval T_{sw}

RM Cell Interval T_{rm}

τ

T
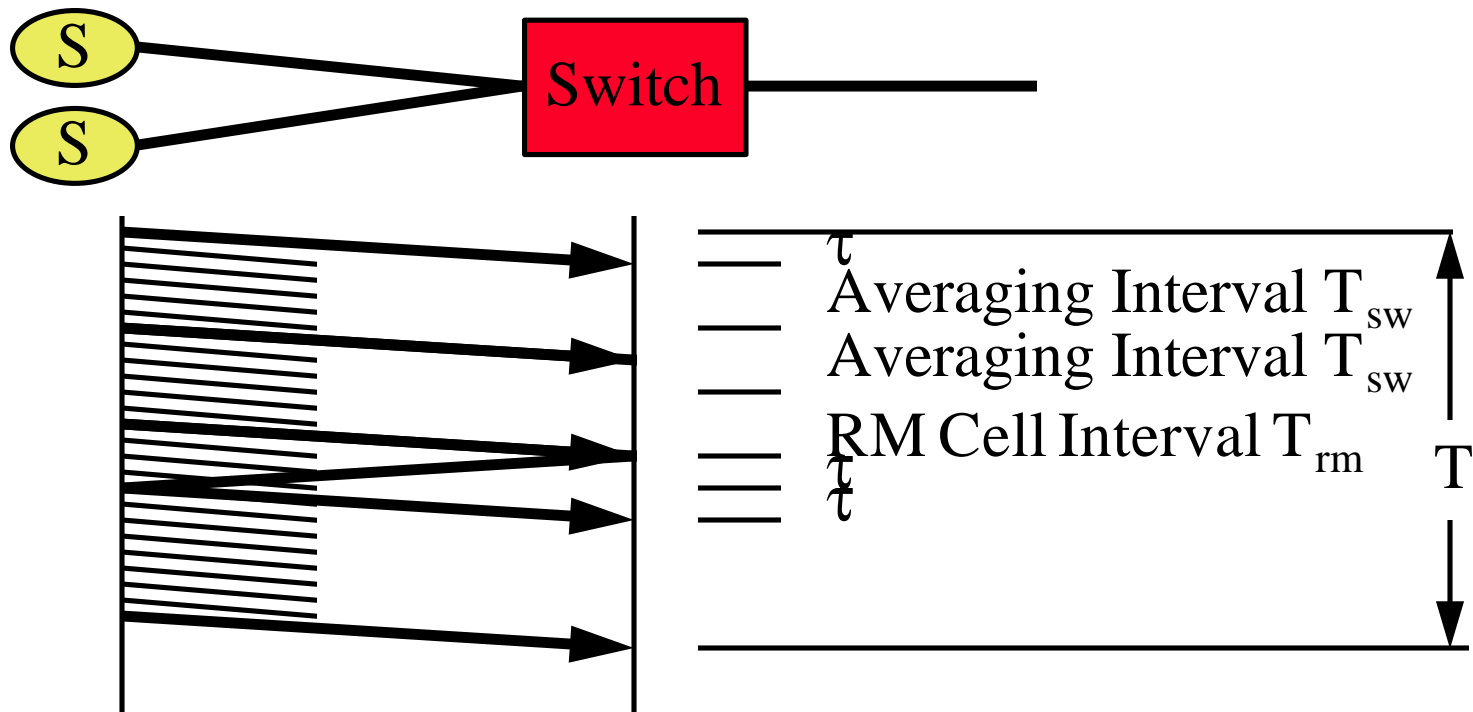
Summary

- ❏ 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