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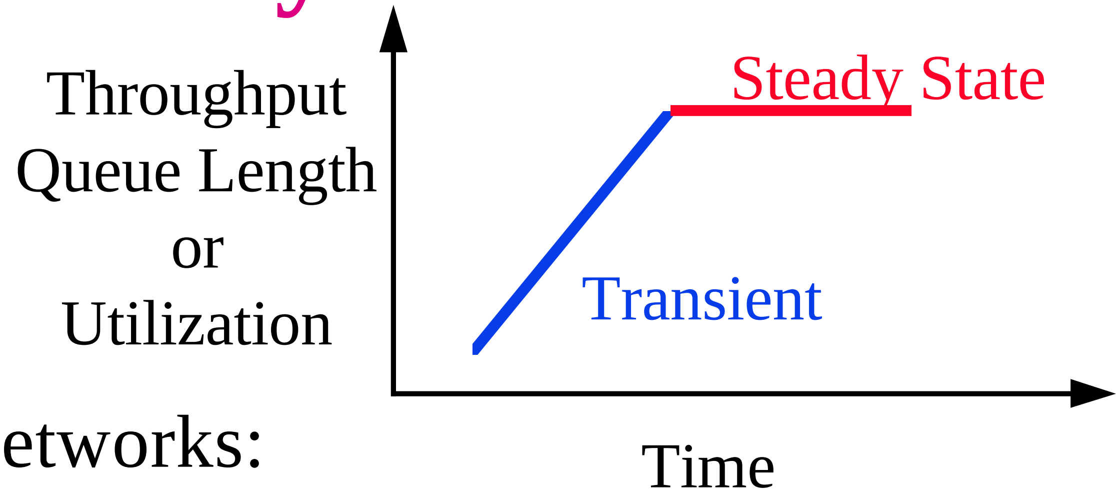
Transient Performance of EPRCA and EPRCA++

Raj Jain, Shiv Kalyanaraman, Ram Viswanathan

Raj Jain is now at
Washington University in Saint Louis
Jain@cse.wustl.edu
http://www.cse.wustl.edu/~jain/

- Why worry about transient performance?
- Transient performance and bursty traffic
- EPRCA++
- Simulation Results
- Future Improvements

Why Worry About Transients?

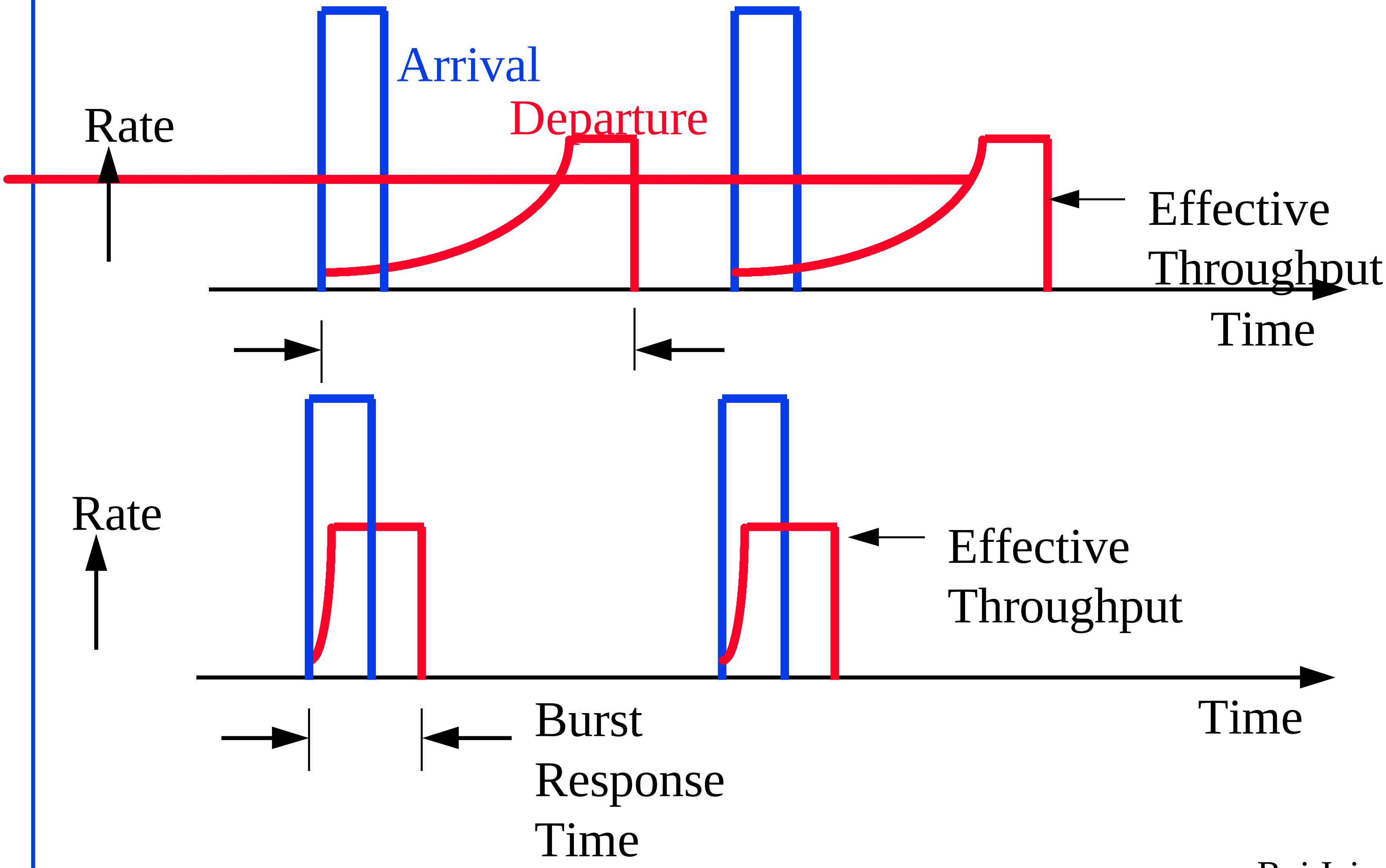


On most networks:

- There are no infinite sources.
- Sources come and go
- VCs may stay but are mostly inactive
- Traffic is highly bursty

⇒ Networks are operating in the transient region, most of the time.

Burst Performance

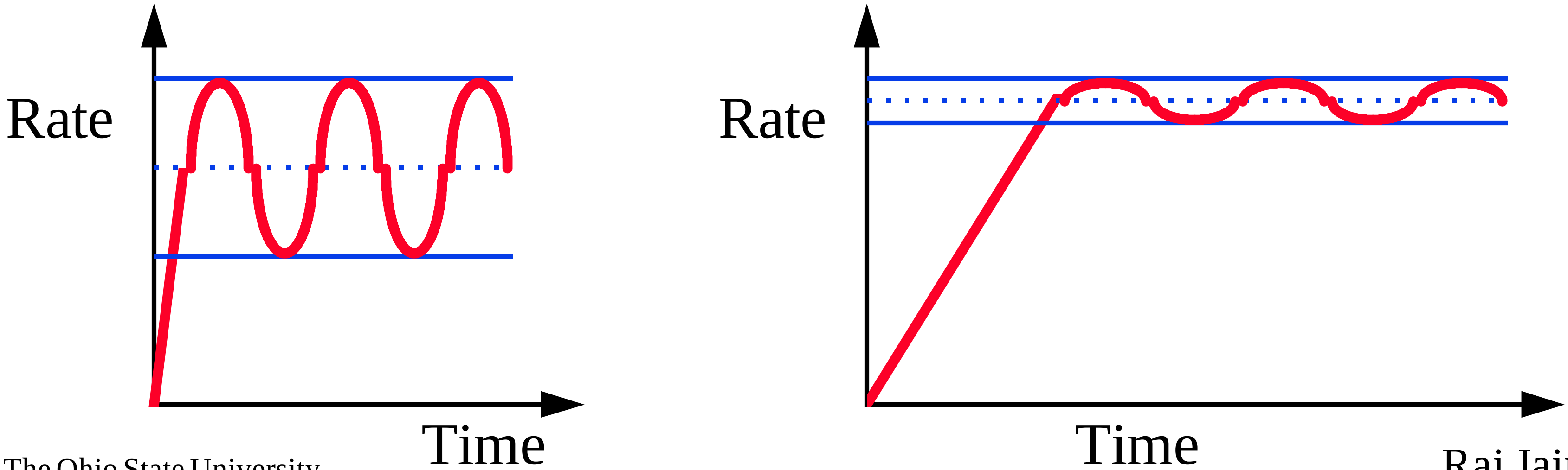


Legacy LANs vs ATM

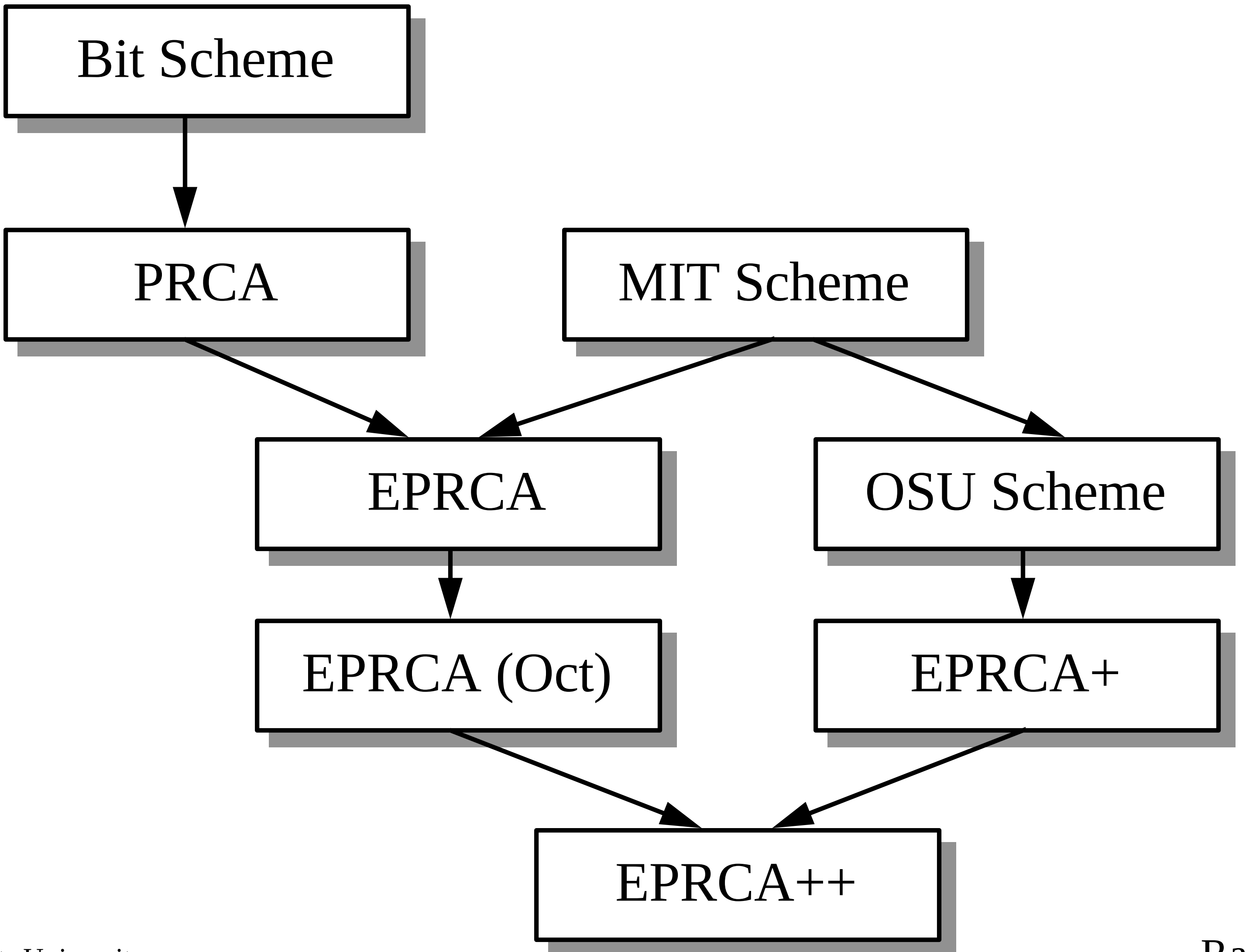
- Today's LANs have a very fast transient response. Can get to the peak rate within a few microseconds
- On ATM LANs:
  Wait for connection setup and then...
  Everytime, a burst arrives, take several milliseconds to ramp up
- Q: Given 100 Mbps Switched Ethernet and 155 Mbps ATM at the same price, which one would you buy?

Transient vs Steady State Design

- Optimistic vs pessimistic design
- You get:
  Either Fast ramp up
  Or small oscillations
  Unless you design carefully



Rate-Based Schemes



EPRCA++

- Count-based: Every Nth cell is an RM cell
  Not every ΔT interval
- AIR = PCR
- Decrease rate only if RM cell not received in k*N cells, k >> 1
- Fully compatible with current RM Cell format
- Different O(1) switch algorithm

Source Algorithm

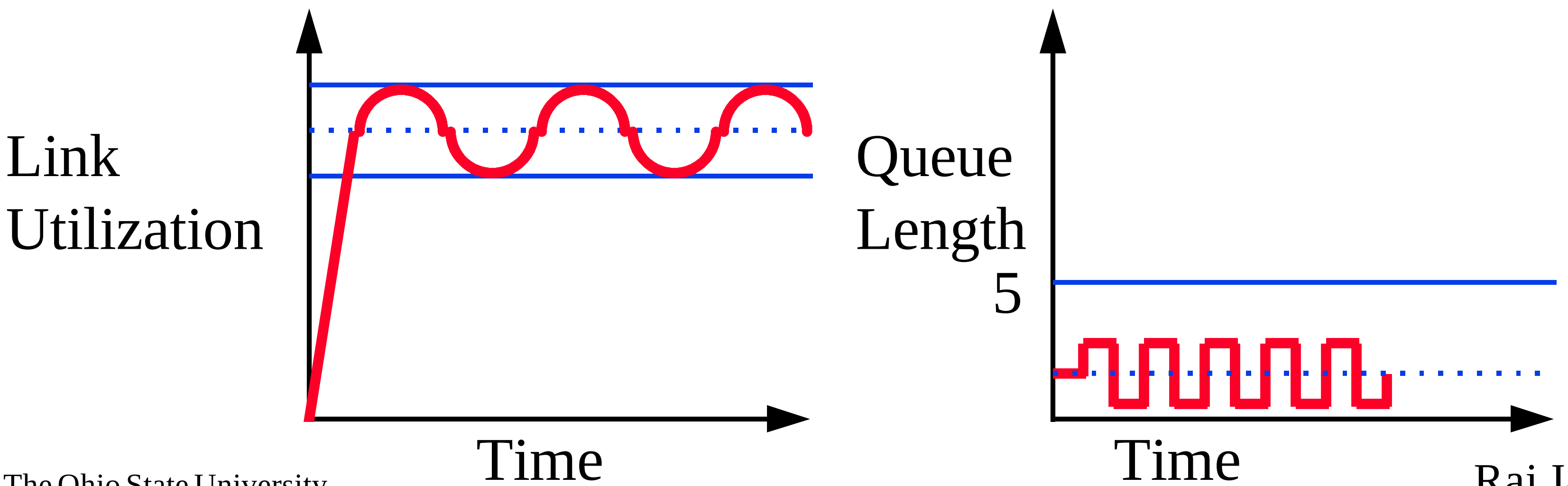
- ACR = Min(ER, ACR + AIR, PCR)

Switch Algorithm

- Monitor:
  Overload = Input rate/Target Utilization
  Fair Share= fn(Available rate, # of active VCs)
- This VC's Share = fn(CCR, Overload)
- ER = Max(Fair Share, This VC's Share)
  ER in Cell = Min(ER in Cell, ER)
- A few other minor details

Features

- Congestion Avoidance
  - High throughput, Low delay
  - Small queues
- Bounded oscillations $\Rightarrow$ Good for Video traffic
- Parameters: Few, insensitive, easy



EPRCA++ Parameters

- Source:
  Nrm = 16
  ICR = PCR/20
- Switch:
  Target Utilization = 95%
  Averaging interval = 30 cells

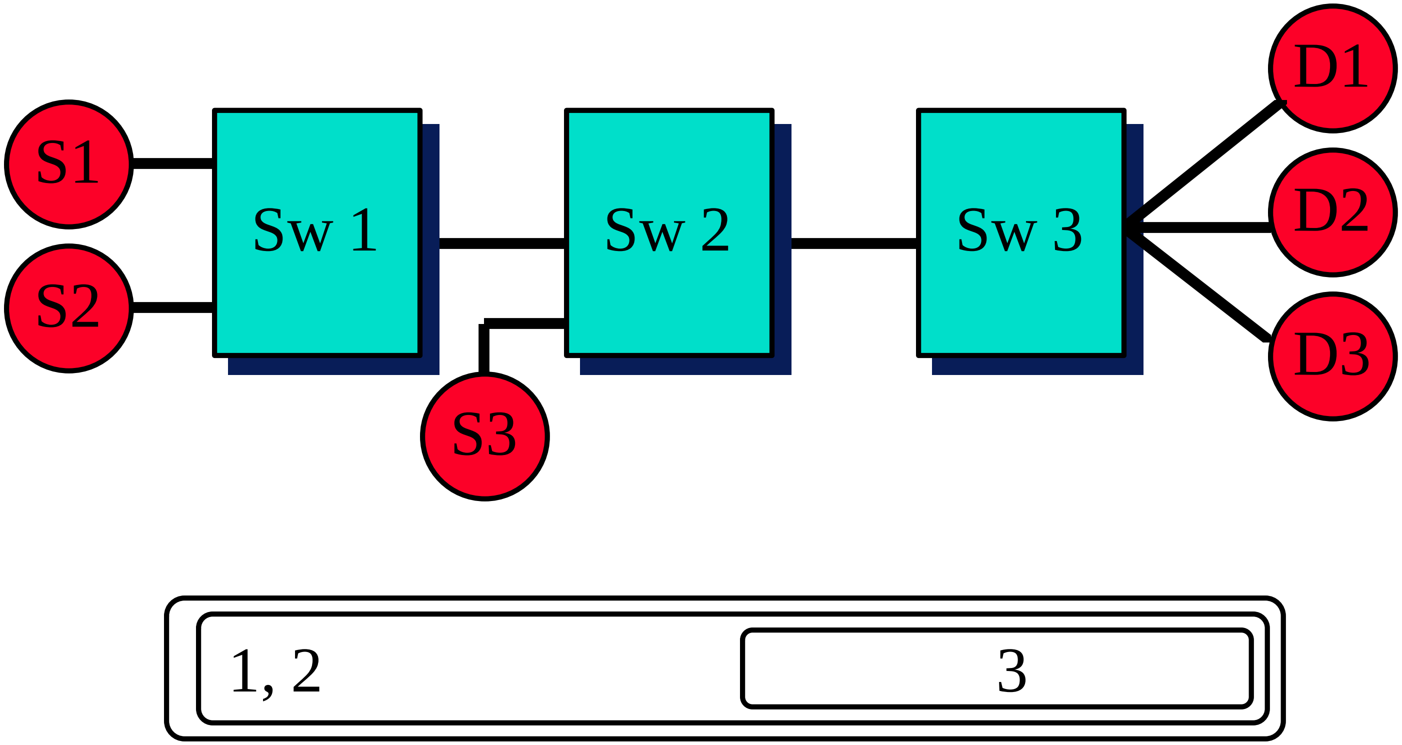
EPRCA Parameters

[AF-TM 94-0735R1]

- AIR = Additive increase rate = 0.212 Mbps
- MDF = Multiplicative decrease factor = 2^8 (Adjusted for Nrm)
- Nrm = RM cell interval = 16
- SW_HT = High threshold = 50
- SW_LT = Low threshold = 45
- SW_DQT = Very congested threhold = 100
- SW_IMR = Initial rate for MACR = PCR/100 = 1.49
- SW_VCS = VC Separator = $1-2^{-3}$
- SW_AV = Exponential averaging factor = 2^{-4}
- SW_MRF = Major reduction factor = 2^{-1} for WAN, 2^{-2} for LAN
- SW_DPF = Down pressure factor = $1-2^{-3}$
- SW_ERF = Explicit reduction factor = $1-2^{-4}$

The SW_* parameters have been removed in EPRCA++

Parking Lot Configuration

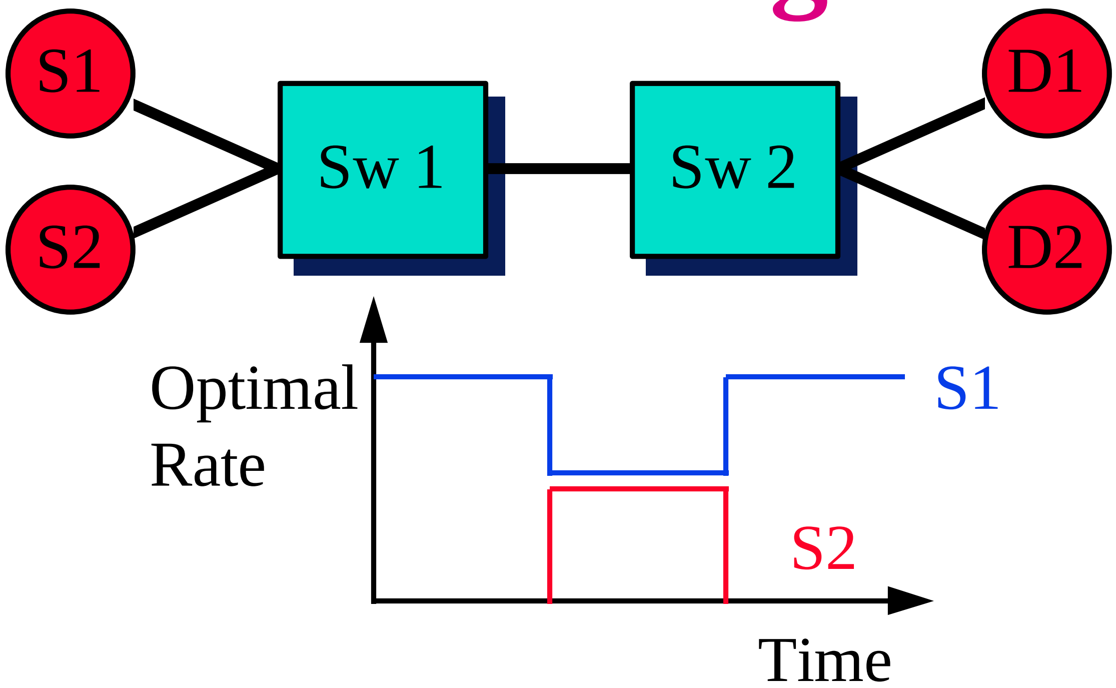


- All links 155 Mbps, 1 km
- Max-min optimal: 51.3, 51.3, 51.3 Mbps
- Goal: Test fairness

Simulation Results

- EPRCA++ takes shorter time to converge
  = Max (RM Cell Interval, Round trip delay)
- Smaller oscillations
- Considerably smaller queue lengths:
  1-3 in EPRCA++
  50-60 in EPRCA
  Cell delay for Q = 50 for T1 or small ABR bandwidth may be considered large.
- This applies to most configurations

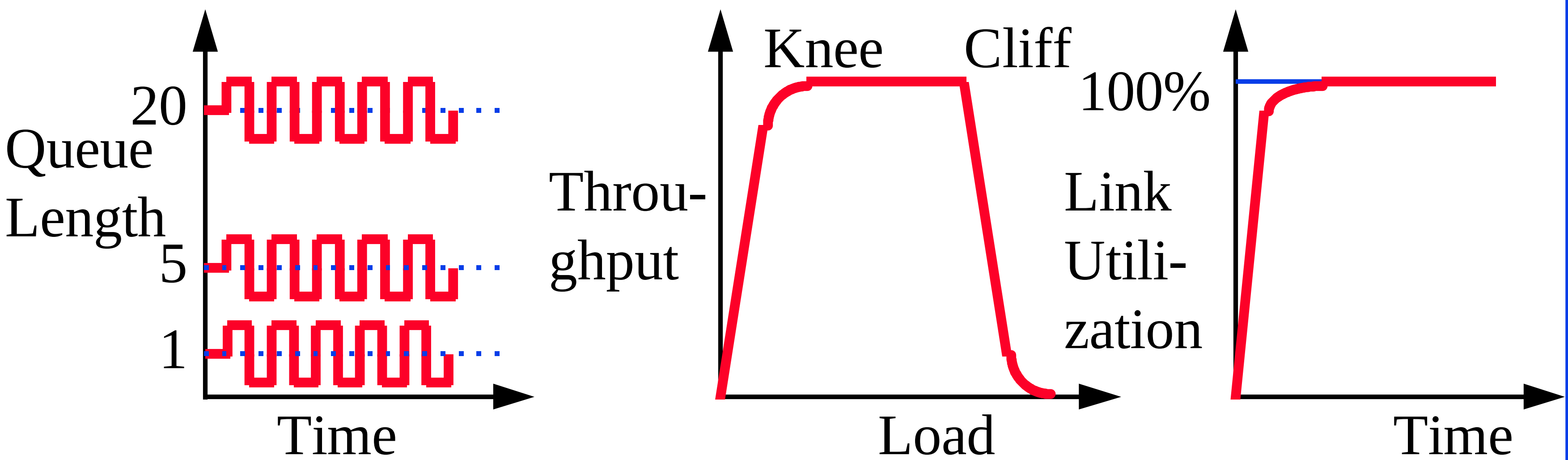
Transient Configuration



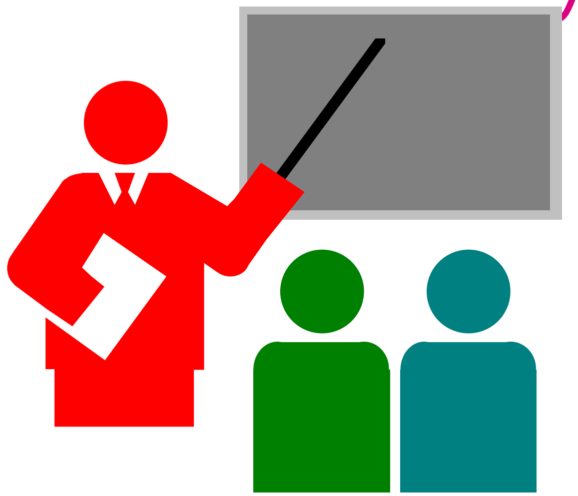
- All links 155 Mbps, 1 km
- Second source at 5 ms, transmits 0.7 Mb
- Goal: To check time to adapt to load changes

Other Options: Queue Control

- Allows setting queue goal at any desired value
- Allows operation at any point between the knee and the cliff
- Allows utilization of all available capacity
- Useful when available bit rate varies widely.



Summary



- Real networks are mostly in transient state
  $\Rightarrow$ Transient performance is important
- Slow transient $\Rightarrow$ poor burst performance
- Fast transient and good steady state is possible