95-0972R1

Parameter Values for Satellite Links

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- Effect of XRM, XDF in long delay paths
  - Simulation Results
  - Analytical explanation
  - Problem: Low throughput even when no congestion
  - Proposed solution

Effect of Xrm

- XRM limits the number of cells lost if the link is broken
- Source Rule (6):
  If you not received feedback from the network after Xrm×Nrm cells, reduce your ACR:

$$ACR = \max\{MCR, ACR - ACR \times XDF\}$$

Effect of XDF

- After Xrm×Nrm cells:

$$ACR = ACR(1 - XDF)$$

- After Xrm(1 + Nrm) cells:

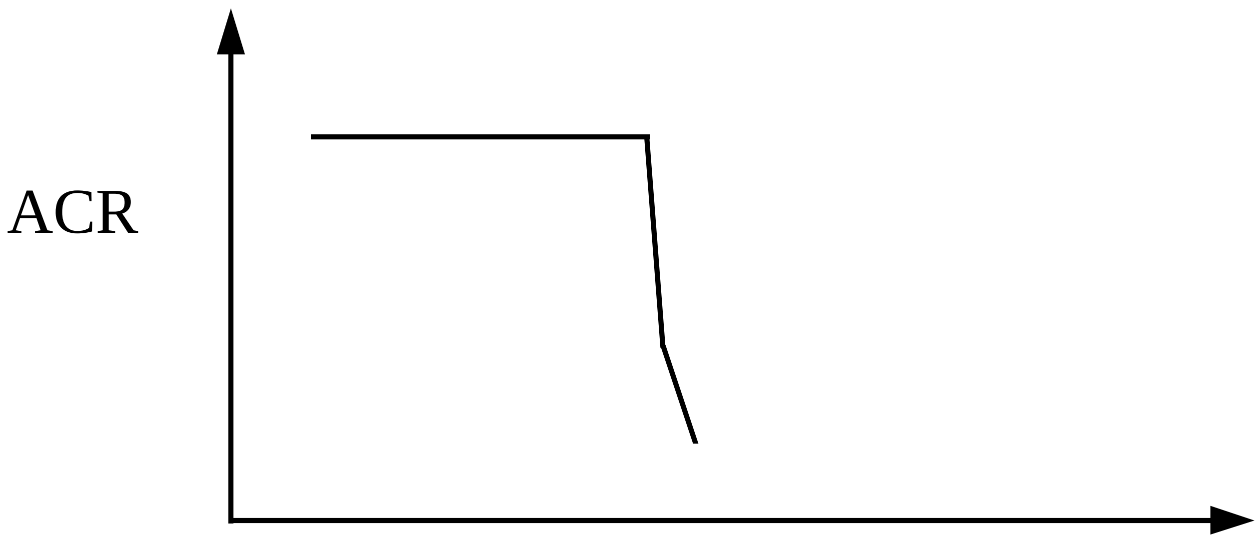
$$ACR = ACR(1 - XDF)^2$$

- After Xrm(k + Nrm) cells:

$$ACR = ACR(1 - XDF)^k$$

Effect of XDF

- There is an almost vertical drop after XRM:



- The value of XDF has very little effect
- The source becomes a "Low Rate Source"

Design Principles

- ***Abnormal operations should not be handled at extreme cost to normal operation***

$\Rightarrow$ While we don't want to lose too many cells if the link breaks,
we do not want to get 50% throughput if the link is operating.

- ***If the network is operating optimally, the control scheme should not move it to suboptimal*** $\Rightarrow$ If VCs is at the optimal rate, leave it alone or minimize oscillations.

Simulation Parameters

- Source: Parameters selected to maximize ACR
  Nrm = 32
  ICR = Optimal = 0.9×PCR/Number of VCs
  AIR = PCR/Nrm ⇒ ACR is not limited by AIR
  RDF= 256 cells
  Xrm = 32, 256, ...   XDF = 1/16
  TDFF = 0 ⇒ ACR does not go down due to TOF
- Traffic: Bidirectional, Infinite sources
- Switch:
  Target Utilization = 90%
  Averaging interval = min{30 cells, 200 μs}

Single-Source Configuration

- All links 155 Mbps, ICR = 0.9 × PCR
- Goal: If the scheme has problem with single-source, it will have problems with more complex configurations

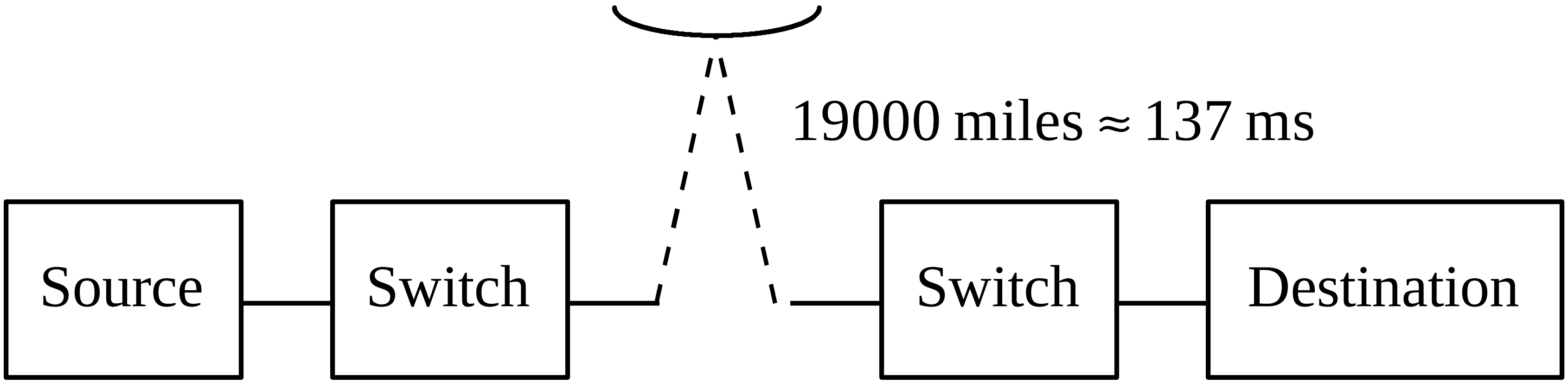
Simulation Results

- The queue lengths are small (no bottleneck)
- The rates oscillate between very low and very high even though the network feedback is consistently at ACR = 139 Mbps.
- Average throughput:
  0 for t=(0,275ms),
  32 Mbps for t=(275ms, 825ms),
  45 Mbps for t=(825ms, 1200ms)

Simulation Results (Cont)

- The results do not change much with XDF
- Percent throughput even lower for higher speed (622 Mbps) links

Satellite Links



- One-way delay = Up-down = 275 ms
- Round-trip delay = 550 ms
- Xrm = 32
  ⇒ Maximum 32×32 = 1024 cells in flight before ACR starts coming down

- Xrm = 256 (maximum allowed)
  $\Rightarrow$ 8 times more cells in flight
- Increasing Nrm is not recommended as it reduces sensitivity at lower rates
  Response time = max{feedback delay,
  Inter-RM cell time}

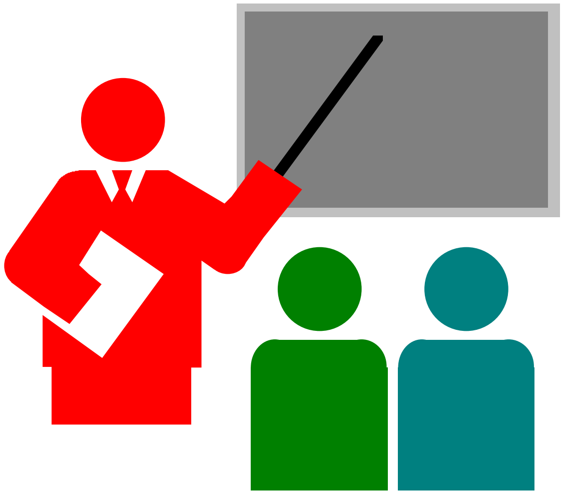
Required Xrm

- For full throughput
  $Xrm \geq RTTQ/(Nrm \times ACR)$
  Where RTTQ = Round Trip Time
  including Queueing
- For 155 Mbps, Xrm ≥ 6,144
- For 622 Mbps, Xrm ≥ 24,576
- For two satellite hops: Xrm ≥ 49,152
- For *n* satellite hops: Xrm ≥ 24,576*n*
  ⇒ Need 32 bits for Xrm

Two-Source Configuration

- All links 155 Mbps
- ICR = 0.9 × PCR/2
- Goal: To verify optimal Xrm formula

Summary



- In section 5.10.3.1 Parameter definitions and usage, replace
  "XRM is a 8 bit integer"
  with
  "XRM is a 32-bit integer"