96-0178R1

Comments on "Use-it or Lose-it" (Annex F of TM4.0)

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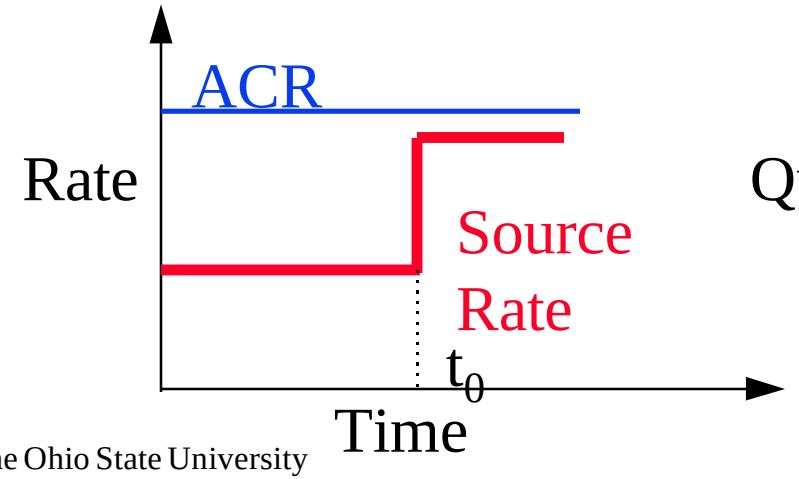
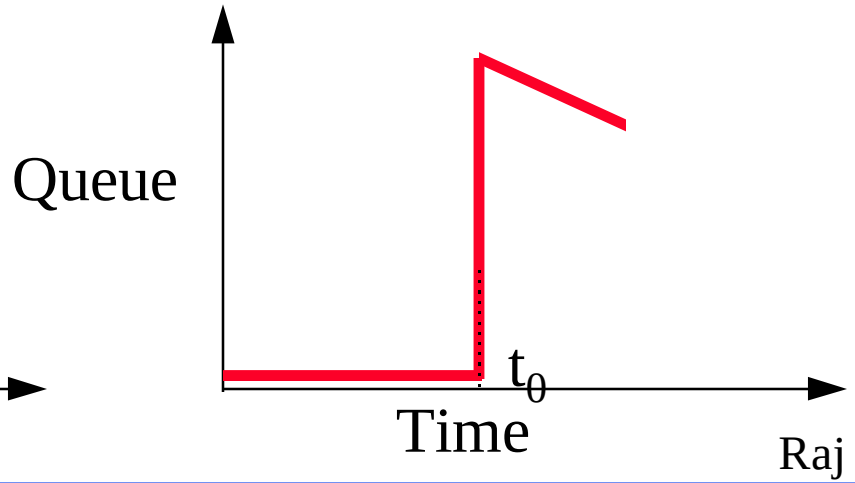
Use-it or Lose-it

- If a source does not use its allocation, the switch may give it to other sources. But if all of them start using it, there may be big queues and cell loss
- Queue growth= (ACR-Source Rate)×Feedback delay ×(Number of Sources-1)
- ACR Retention even for a small interval
  ⇒ Switches are exposed to "sudden arrivals"





Solutions

- How long can a source keep its rate allocation even though it is not using it?
  - Switch-Based: Keep ACR upto 500 ms max
  - Source-Based: Keep ACR upto next 32 cells, then 15/16th for next 32 cells, ...
- Switch-based
  ⇒ Takes one feedback delay to control
  ⇒ Switch must buffer excess traffic for one feedback delay
  ⇒ Limit overbooking
  ⇒ Under utilization
- ATM Forum has selected switch-based but NICs may optionally implement source-based policies

End-System Method 1: Forward RM Triggered

- When a in-rate forward RM is sent, if the ACR exceeds the recent transmission rate plus a fixed bound, the ACR is reduced by a multiplicative factor and the next increase inhibited. Specifically, the recent rate R, could be estimated by Nrm divided by the time since the last in-rate forward RM-cell was sent. If ACR exceeds R + ICR, the next increase is inhibited. If ACR exceeds R + ICR, the ACR could be set to the higher of ACR * 15/16 and R + ICR, and the next increase inhibited.

Pseudo-Code

- Current:

R = Nrm/T

IF ACR > R + ICR THEN
    ACR = ACR * 15/16
    ACR-ok = FALSE

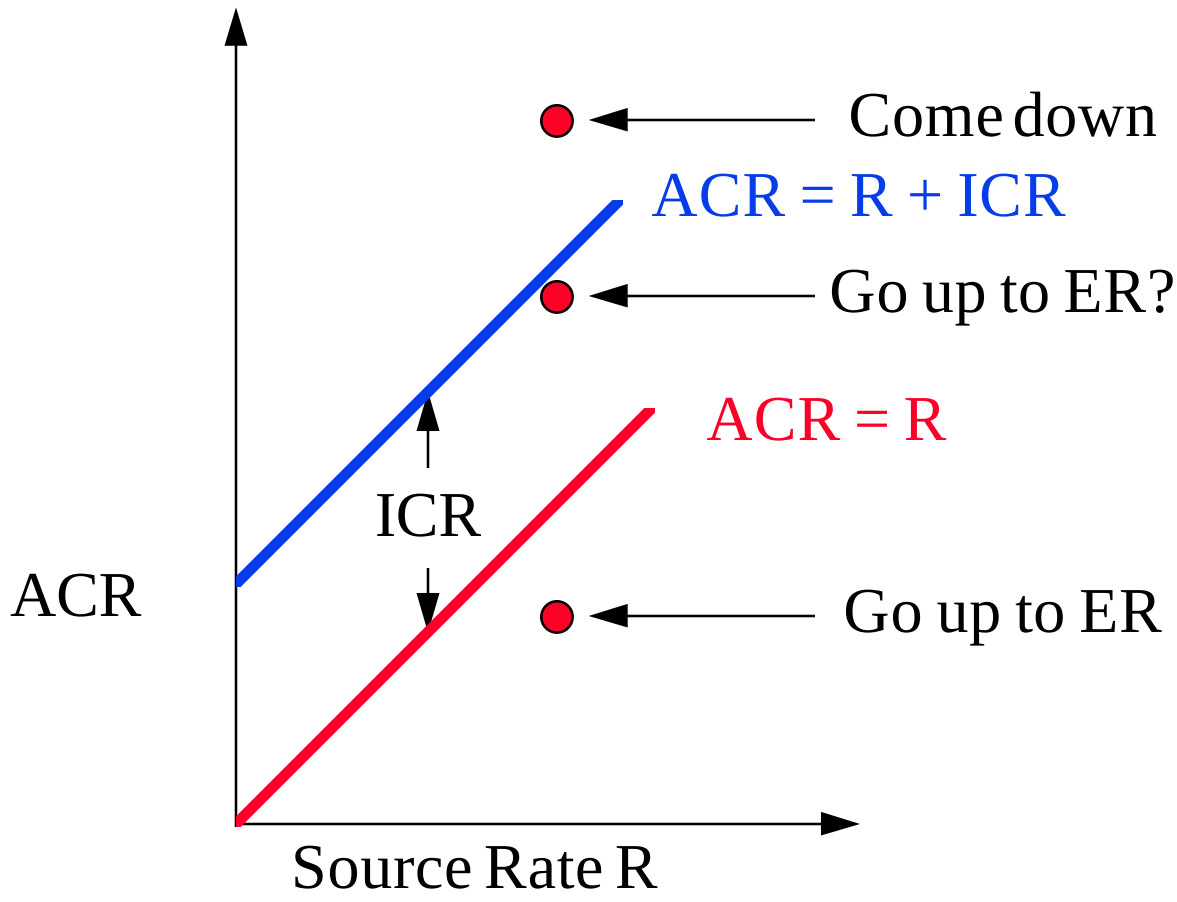
ELSE ACR-ok=TRUE;

- Proposed:

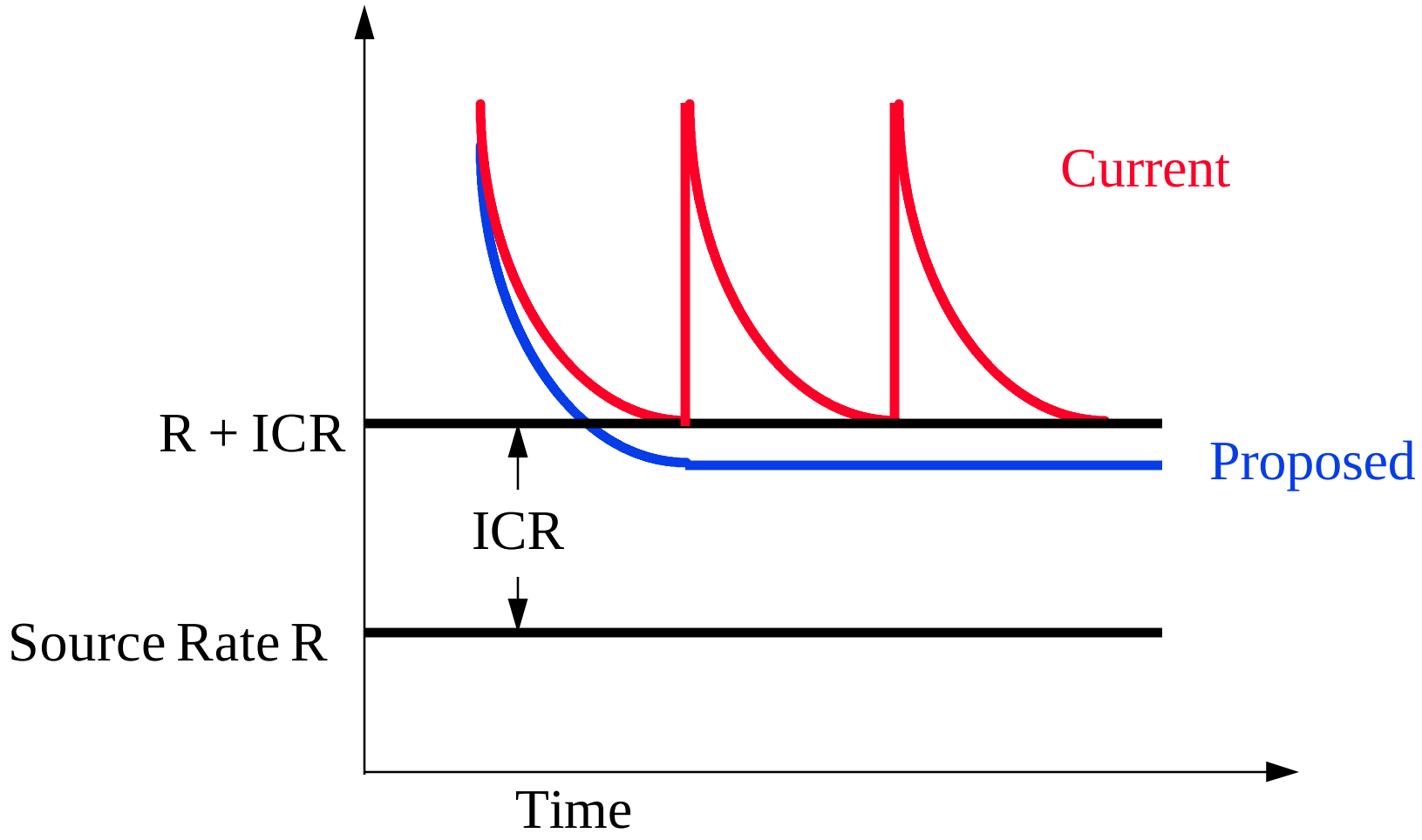
R = Nrm/T

ACR-ok = ACR $\leq$ R

IF ACR > R + ICR THEN
    ACR = ACR * 15/16;



- Our proposal introduces a "hystersis zone" to avoid continuous oscillations between ACR-retention and non-retention

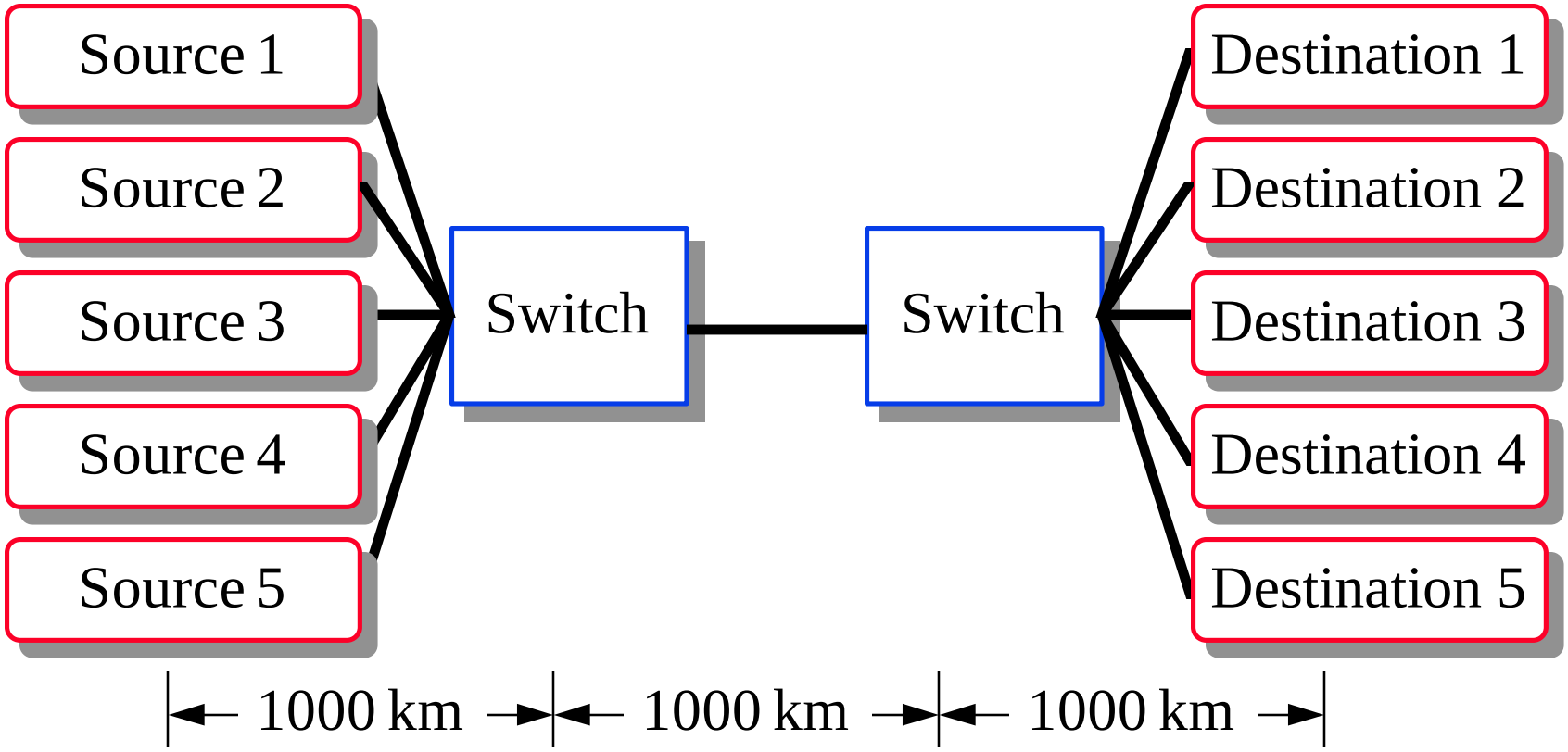

Current
R + ICR
Proposed
ICR
Source Rate R
Time

Motion 1

- Change the text to:

  When a in-rate forward RM is sent, if the ACR exceeds the recent transmission rate the next increase is inhibited. Further, if the ACR exceeds the recent transmission rate plus a fixed bound, the ACR is reduced by a multiplicative factor. Specifically, the recent rate R, could be estimated by Nrm divided by the time since the last in-rate forward RM-cell was sent. If ACR exceeds R, the next increase is inhibited. If ACR exceeds R + ICR, the ACR is set to the higher of ACR * 15/16 and R + ICR.

Five Source Configuration



- All links 155 Mbps
- All source bottlenecked at 10 Mbps upto 200 ms
  At t = 200 ms, the sources are able to use their full ACR

Simulation Parameters

- Source: Parameters selected to maximize ACR
  ICR = 1 Mbps
  TBE = 4096 ⇒ Rule 6 disabled
  CRM (Xrm) = TBE/Nrm
  PCR = 155.52 Mbps, MCR= 0, RIF (AIR) = 1, Nrm = 32,
  Mrm = 2, RDF = 1/512, Trm = 100ms, CDF (XDF) = 0,
  TCR = 10 c/s
- Traffic: Bi-directional, infinite. Source bottlenecked initially.
- Switch: ERICA
  Target Utilization = 90%
  Averaging interval = min{30 cells, 200 μs}

Conclusions

- It is possible to have ACR retention for 500 ms.
  The switch is vulnerable to "sudden arrivals" during this time
- Ignoring feedback just once causes oscillations.
  Network is susceptible to large queues during oscillations.
  Our proposal eliminates such oscillations.
- **Current**:
  Ignore once.
  As soon as you enter the allowed zone, you can go up
- **Our proposal**:
  You should not go up as long as you have ACR retention

Pseudo-Code: Current

```
ACR-ok  A flag indicating that the ACR passed the "TOF" test
ACR-ok = time <= TOF * Nrm / ACR              ! S5
    If not ACR-ok and ACR > ICR               ! ACR is too high
       ACR = ACR - ACR * time * TDF           ! S5a: idle adjust
       ACR = max(ACR, ICR)

    if receive RM(DIR = backward, CCR, ER, CI, NI, BN) ! S8: adjust ACR
     if  CI = 1
        ACR = ACR - ACR * RDF                  ! do MD
    else if NI = 0 and (ACR-ok or PNI)        ! S5b
        ACR = ACR + Nrm * AIR                  ! do AI
       ACR = min(ACR, PCR)
     ACR = min(ACR, ER)                        ! S9
     ACR = Max(ACR, MCR)                       ! S9
     ACR-ok = true                             ! S5b
```

Pseudo-Code: Proposed

```
ACR-ok  An optional flag indicating that source has no ACR retention
    R = Nrm/T                                  ! Current rate
    ACR-ok = (ACR <= R)                        ! No retention
    if (ACR > R + ICR)                         ! ACR is too high
      ACR = Max(R + ICR, ACR * 15/16) ! Optional adjustment

   if receive RM(DIR = backward, CCR, ER, CI, NI, BN) ! S8: adjust ACR
    if  CI = 1
      ACR = ACR - ACR * RDF                    ! Do multiplicative decrease
    else if NI = 0 and ACR-ok                  ! Don't inhibit increase
       ACR = ACR + AIR                         ! Additive increase
      ACR = min(ACR, PCR)
    ACR = min(ACR, ER)                         ! S9
    ACR = Max(ACR, MCR)                        ! S9
```

Motion 2

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Change pseudo-code as proposed.