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Straw-Vote Comments on TM4.0 R8

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- ❑ XRM Range
- ❑ ICR Initialization
- ❑ XRM Initialization
- ❑ Rule 5
- ❑ Minor Comments

XRM Range: History

On Wednesday, August 9, 1995: We presented results of two months of analysis.

- ❑ Motion was passed with **many** to 2 votes:
XRM is an integer whose size is implementation dependent.
- ❑ Motion that was specifically **not** passed:
*XRM is an integer.**
**Note: 8 bits are sufficient 24 bits are required for long-delay path.*

On Thursday, August 10, 1995: Motion was reversed without any analysis.

Six Reasons to Remove the Note

- ❑ The first format does not recommend any particular size. Eight-bit or 24-bit both are allowed. The second format tries to recommend some particular implementation.
- ❑ XRM is an internal parameter and unless we decide to signal it, there is no reason to recommend or enforce any particular value that implementors can choose themselves. Leave it to implementors. They are not dumb.
- ❑ Eight-bit XRM is inconsistent:
$$\text{XRM} = \text{CIF}/\text{Nrm}$$
$$\text{Max XRM} = (\text{Max CIF})/(\text{Min Nrm}) = 2^{24}/2 = 2^{23}$$

- Eight-bit XRM is limiting the distance and bandwidth:

$$\text{XRM} = \text{PCR} \times \text{RTT} / \text{Nrm}$$

$$\text{Max XRM} = (\text{Max PCR}) \times (\text{Max RTT}) / (\text{Min Nrm})$$

Eight-bit XRM is **not sufficient** even on 155 Mbps over North-American continent, NRM of 32 and no load:

$$\text{XRM} = 155 \text{ Mbps} \times 30 \text{ ms one way} \times 2 / 32$$

$$= 366 \text{ c/ms} \times 60 \text{ ms} / 32$$

$$= 682$$

- Users may want to use ATM networks (and your products) for longer distances, higher speeds, different Nrms, and higher loads

Motion

- ❑ On page 51 of ATMF 95-0013R8, Xrm row, column 3, delete:

Range: 0 to 255 (0 to 1677215 - See Note 2)

- ❑ Re-place the following text :

XRM is an integer. Its size is implementation dependent.

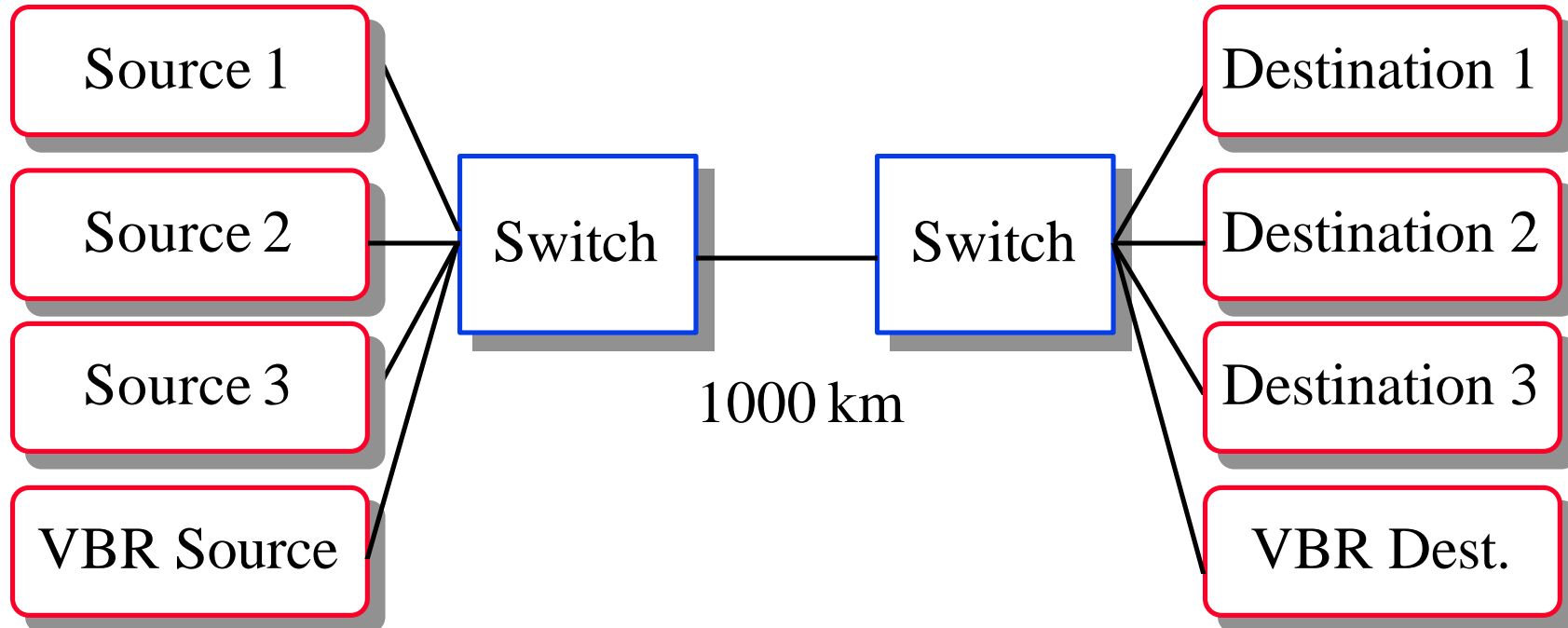
- ❑ On page 52, Delete:

Note 2: For Xrm in large delay-bandwidth product situations a 24-bit implementation may be preferable. Otherwise an 8-bit implementation is generally sufficient.

ICR Initialization

- ❑ ICR is the most influential parameter = Influential Cell Rate
- ❑ It controls the life-time performance for bursty sources
- ❑ It controls the performance when available bandwidth varies due to VBR
- ❑ $ICR = \text{Min}\{PCR, a * CIF / RTT\}$
- ❑ RTT is a random number.
95-percentiles and monthly averages are either too complex or meaningless
- ❑ On LAN's: RTT low \Rightarrow ICR = PCR
Network has practically no direct control over ICR
- ❑ Your VC's performance depends upon the time it was initialized \Rightarrow Start all you VC's at 4AM.

Three Source Configuration



- ❑ All links 155 Mbps
- ❑ Three ABR sources started at different RTTs.

Simulation Parameters

- Source: Parameters selected to maximize ACR
 - Nrm = 32
 - AIRF = 1 \Rightarrow AIR = PCR/Nrm \Rightarrow ACR is not limited by AIR
 - RDF = 512 cells
 - {TDF, PNI} = {1/8, 0} or {0, 1} \Rightarrow Rule 5 on or off
 - CIF = 512
 - RTT = Propagation delay multipliers of 1, 10 or 100
 - XDF = 1/2
- Traffic: Bi-directional
- Switch:
 - Target Utilization = 90%
 - Averaging interval = min{30 cells, 200 μ s}

Motion

- ❑ Remove:
 $ICR = \text{Min}\{PCR, a * CIF / RTT\}$
- ❑ ICR is directly negotiated between the source and the network.

XRM Initialization

$$\text{XRM} = \text{Min}\{\text{CIF}/\text{Nrm}, \text{PCR} * \text{RTT}/\text{Nrm}\}$$

- ❑ RTT is a random number
- ❑ Birth time conditions affect the life-time performance.
In this case, it is better to be born during bad times.
Birth at good time \Rightarrow Low RTT \Rightarrow 2nd term smaller
 \Rightarrow XRM Low \Rightarrow Easily triggered during congestion.
- ❑ On LANs, RTT is low.
At 155 Mbps, 3 km LAN, $\text{Nrm} = 32$
 $\text{XRM} = 0.366 \text{ cells}/\mu\text{s} * 15\mu\text{s} / 32 = 0.17$
 \Rightarrow XRM = 0 or 1
XRM triggered every 32 cells under heavy load

- The formula is based on the assumption that

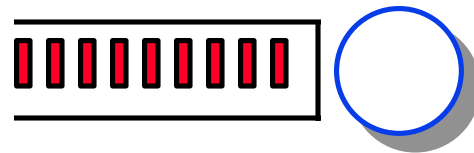
$$\text{Optimal CIF} = \text{PCR} * \text{RTT}$$

While the formula is correct, the RTT in the CIF formula should not include queueing delay. It should be pure propagation delay.

Propagation Vs Queueing Delay



- ❑ To optimally fill the pipe, number of cells in flight is proportional to the pipe size (propagation delay).



- ❑ To optimally fill the queue, number of cells is exactly one. Every extra cell is adding to the CTD without increasing the throughput
- ❑ Longer queues \neq Put more of your cells in the queue. If done, repeatedly, the system will become unstable.
- ❑ **Conclusion:** The RTT in the formula should be propagation delay only.

Motion

- The RTT in XRM formula should be propagation delay only.

Minor Comments

- $XRM = \text{Min}\{CIF/N_{rm}, PCR * RTT/N_{rm}\}$
The right hand side is a floating point number.
Should it be rounded up or down?

Rule 5

- ❑ Designed to avoid “ACR retention”
Also known as “Use it or loose it” policy
Source rate much below ACR \Rightarrow Decrease ACR
- ❑ Source Rate = Average rate over the last Nrm cells
 $= \text{Nrm}/T$, where T = time since the last RM sent
- ❑ Undesirable effects:
 - ❑ Unnecessarily triggered on network directed ACR increases
 - ❑ Current formula and parameter values \Rightarrow ACR \leftarrow ICR
 - ❑ Gaps between bursts \Rightarrow Rule 5 easily triggered
 - ❑ The decrease is proportional to $T \propto 1/\text{source rate}$

- May not trigger for sources with ACR retention (high ICR) and may trigger for sources without ACR retention problem (normal increase):

- The rule is ineffective for VCs born during good times or high CIF.

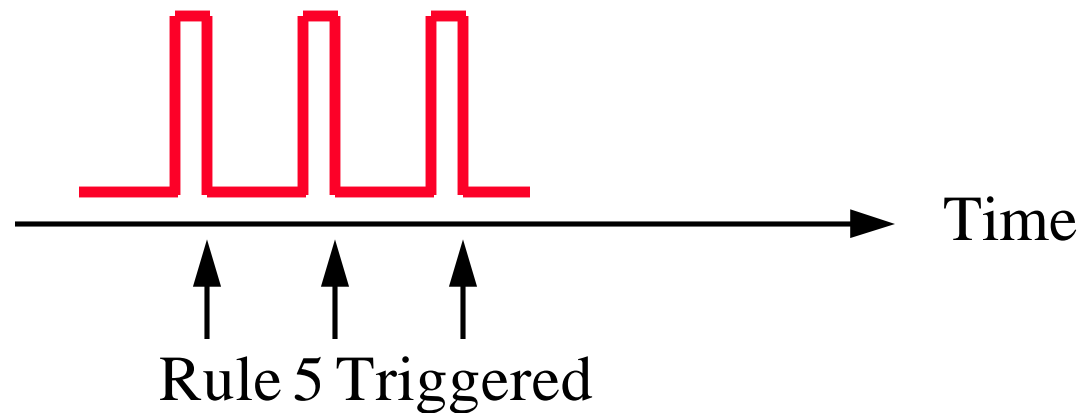
$$\text{ICR} = \text{Min}\{\text{PCR}, a * \text{CIF} / \text{RTT}\}$$

Low RTT at birth time \Rightarrow High ICR = PCR

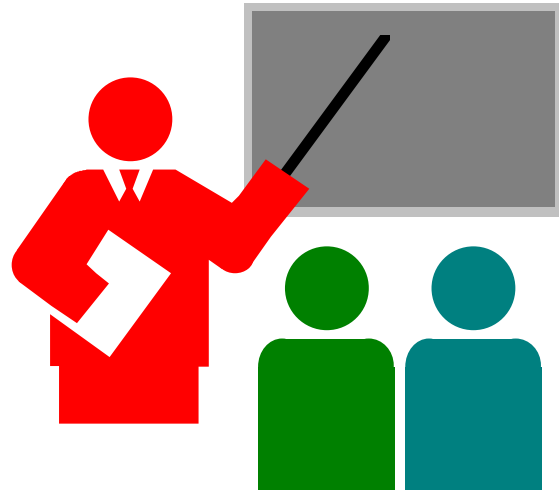
These VC's are automatically exempt from Rule 5.

Similarly VC's allowed large CIF are exempt from Rule 5.

- The rule may be repeatedly triggered unnecessarily:



Summary



- ❑ $XRM = 256$ is insufficient even for North-America
- ❑ ICR should be directly negotiated
- ❑ Round trip delay with queueing is highly random
Network performance is unpredictable
Remove round-trip from ICR and XRM formulae.
- ❑ Rule 5 should be fixed.