

ATM Traffic Management over Satellite Networks: Recent Issues

Raj Jain

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

TIA/CIS Meeting, July 15, 1997



1. Optimization of TCP/IP over ATM over satellite networks
2. Guaranteed Frame Rate vs Guaranteed Rate
3. Multipoint connections
4. Video background
5. Bursty WWW traffic over ATM

1. TCP over UBR Optimization

- **Past Work:** TCP over
 - UBR
 - UBR + Early Packet Discard (EPD)
 - UBR + EPD + Selective Drop
 - UBR + EPD + Fair Buffer Allocation
 - Fast Retransmit and Recovery (FRR)

Ref: Selective Acknowledgements and UBR+ Drop Policies to Improve TCP/UBR Performance over Terrestrial and Satellite Networks, ATM Forum 97-0423, April 1997.

Policies

End-System Policies

		No FRR	FRR	New Reno	SACK + New Reno	
Switch Policies	No EPD					
	EPD	Plain EPD				
		Selective Drop				
		Fair Buffer Allocation				

TCP over UBR: Results

- ❑ In LANs, switch improvements (PPD, EPD, SD, FBA) have more impact than end-system improvements (Slow start, FRR, New Reno, SACK).
- ❑ In WANs and satellite networks, end-system improvements have more impact than switch-based improvements
- ❑ FRR hurts in WANs and satellite networks.
- ❑ Fairness depends upon the switch drop policies and not on end-system policies
- ❑ Unless implemented properly, congestion window may get stuck at 256 kB

2. Guaranteed Frame Rate (GFR)

- ❑ UBR with minimum cell rate (MCR) \Rightarrow UBR+
- ❑ Frame based service
 - ❑ Complete frames are accepted or discarded in the switch
 - ❑ Traffic shaping is frame based.
All cells of the frame have CLP =0 or all cells have CLP =1
 - ❑ All frames below MCR are given CLP =0 service. All frames above MCR are given best effort (CLP =1) service.

Guaranteed Rate Service

- ❑ Guaranteed Rate (GR): Reserve a small fraction of bandwidth for UBR class.

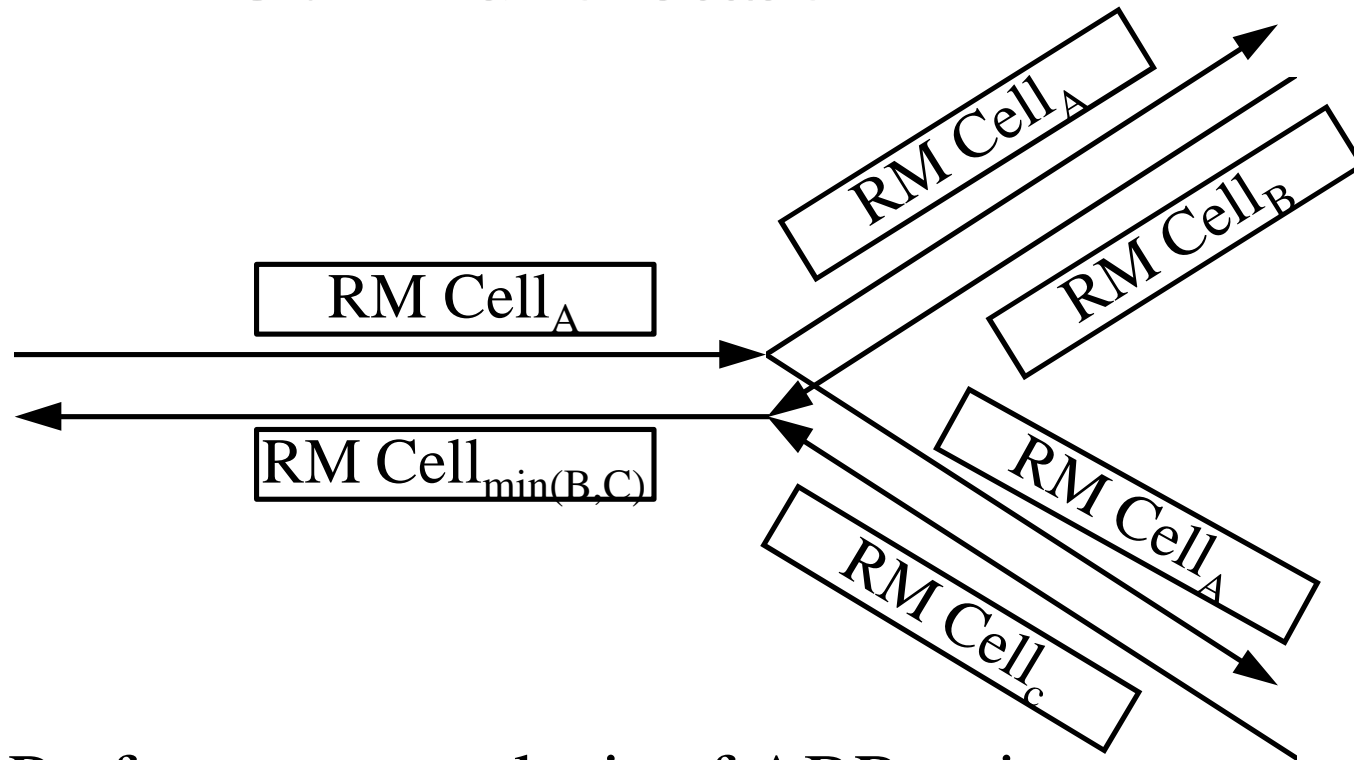
GR	GFR
per-class reservation	per-VC reservation
per-class scheduling	per-VC accounting/scheduling
No new signaling	Need new signaling
Can be done now	In TM4+

Ref: Guaranteed Rate for Improving TCP Performance on UBR+ over Terrestrial and Satellite Networks, ATM Forum 97-0424, April 1997

Guaranteed Rate: Results

- ❑ Guaranteed rate is helpful in WANs.
- ❑ For WANs, the effect of reserving 10% bandwidth for UBR is more than that obtained by EPD, SD, or FBA
- ❑ For LANs, guaranteed rate is not so helpful. Drop policies are more important.
- ❑ For Satellites, end-system policies seem more important.

3. Multicast ABR



Ref: Performance analysis of ABR point-to-multipoint connections for bursty and non-bursty traffic with and without VBR background, ATM Forum 97-0422, April 1997

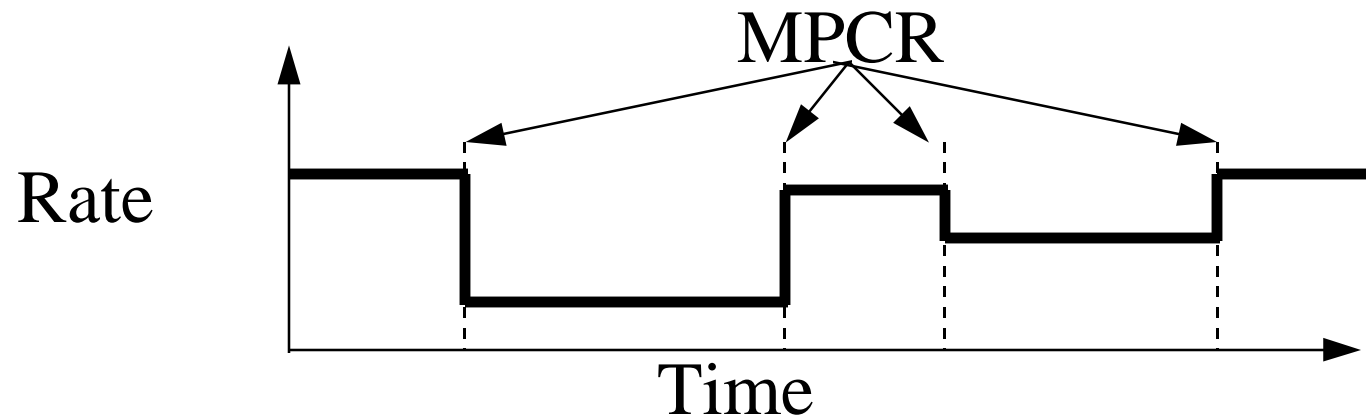
Multipoint Connections: Issues

- ❑ Minimum of ER from branches is sent upstream
Should we wait for all branches?
- ❑ If you send BRM on every FRM, you may give feedback without receiving any
⇒ Need to ensure that at least one feedback has been received before sending a BRM.
Otherwise, you may give PCR
- ❑ Not all downstream feedbacks in an upstream feedback
⇒ Consolidation noise

Multipoint: Results

- ❑ ABR with ERICA (extended for multipoint) work ok
- ❑ Efficiency, fairness, responsiveness is maintained
- ❑ Consolidation noise due to asynchronous arrival of feedback from different leaves appears as oscillations
- ❑ Additional delay due to FRM wait and BRM consolidation
⇒ slower transient response than point-to-point
- ❑ Minimum of all paths is allocated
⇒ some links are underutilized
- ❑ Queue control (ERICA+) is required for stability

4. Data + Video over ATM



□ MPEG2 VBR Video: Piecewise CBR

Ref: Performance of TCP over ABR with Long-Range Dependent VBR Background Traffic Over Terrestrial and Satellite ATM Networks, ATM Forum 97-0177, April 1997.

Data + Video over ATM : Results

- ❑ MPEG2 compressed video = piecewise CBR, long-range dependent rate, random inter-MPCR intervals
- ❑ ABR with appropriate switch algorithm can handle the randomness in ABR capacity
- ❑ With ERICA+ and Infinite TCP Traffic:
 - ❑ Queue lengths $< 3 \times$ Feedback delay
 - ❑ Efficiency close to the maximum possible.
 - ❑ Queues are similar to those with deterministic VBR

5. WWW (Bursty) Traffic over ABR

- ❑ Large number of sources
- ❑ SPECweb'96 benchmark
- ❑ Results: ABR is stable.

- ❑ **Ref:** Performance of Bursty
World Wide Web (WWW) Sources over ABR,
ATM Forum 97-0425, April 1997

Summary



- ❑ For satellite networks, end-system policies (SACK) have more impact than switch policies (EPD).
- ❑ Reserving a small fraction for UBR helps it a lot in satellite networks
- ❑ ABR works OK
 - ❑ In multipoint VCs
 - ❑ In presence of video background
 - ❑ Even with large # of WWW sources

Our Contributions and Papers

All our contributions and papers are available **on-line** at <http://www.cis.ohio-state.edu/~jain/>

□ See [Recent Hot Papers](#) for tutorials.