Current Issues in ATM Forum Traffic Management Group

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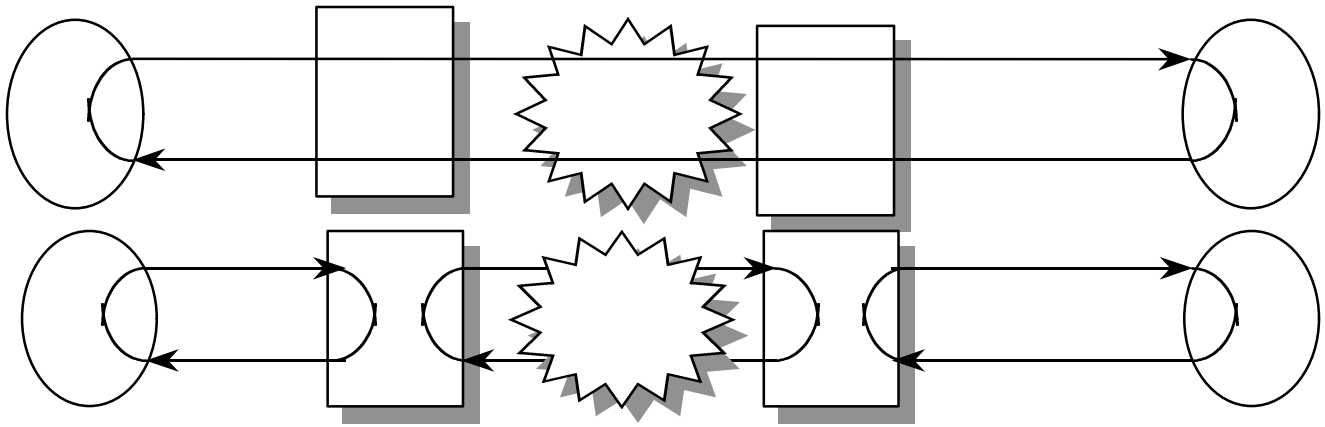
Overview

- Effect of VS/VD
- GFR
- Virtual Paths
- ITU vs ATMF
- CDV Accumulation
- CLR with EPD

Overview (Cont)

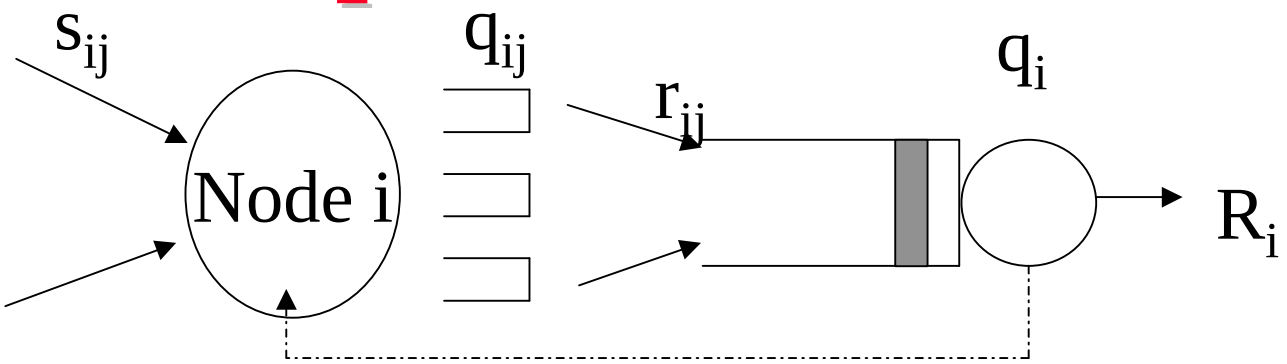
- Joint Work with other Groups
  - TM and Net Mgmt
  - ABR API
  - TM and RBB
  - TM and SAA
  - TM and Test

Virtual Source / Virtual Destination (VS / VD)



- Segments the end-to-end ABR control loop.
- Coupling between loops is implementation specific.
- VS/VD can help in buffer management across the network.
- ABR switches separated by non-ATM network could also implement VS/VD.

A Simple VS/VD Model



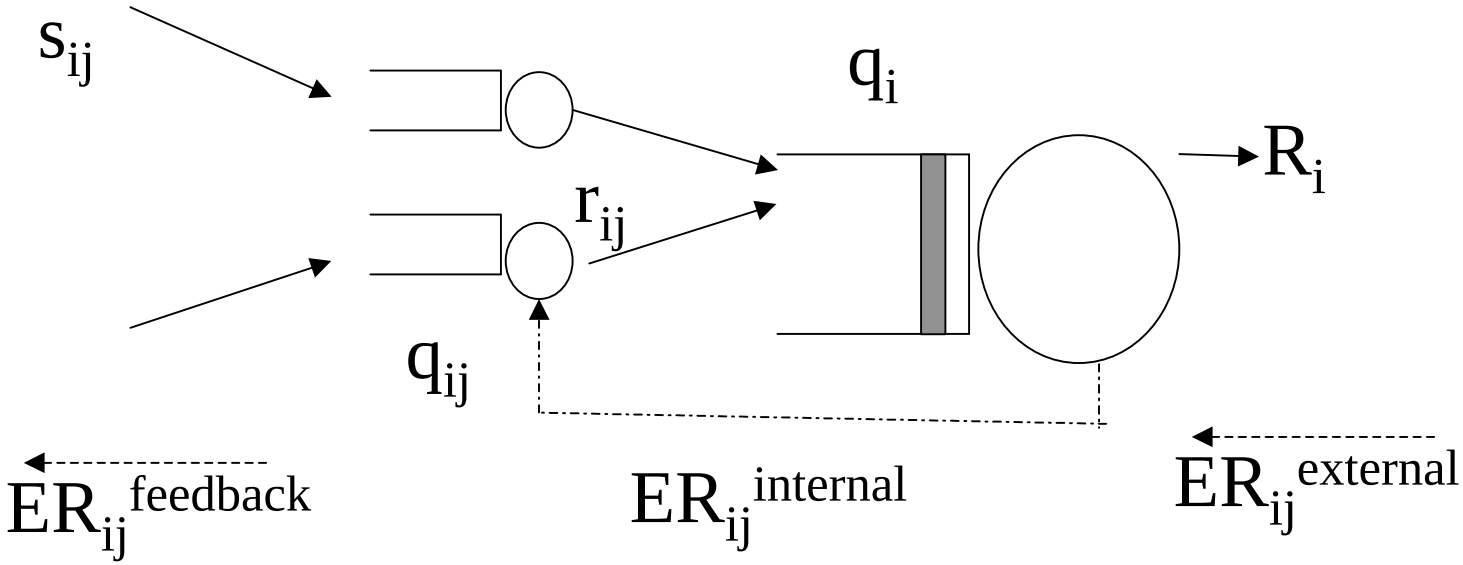
$ER_{ij}^{feedback}$ $ER_{ij}^{internal}$ $ER_{ij}^{external}$

- Internal Service Rate = f(External/Downstream Feedback, Local congestion)
- Local Congestion = $f(Q_i)$; $Q_i = q_i + \Sigma q_{ij}$
- Upstream feedback = Internal service rate
- Example: Downstream = 100 Mbps, Internal =90 Mbps = Upstream Feedback

Simple VS/VD Model

- Desired input rate to class queue is also fed back to the upstream switch.
- **Problem**:
  - Transient per-VC queues cannot drain.
    Input rate s_{ij} = Output rate r_{ij}
  - Queues that build up during open loop phase do not drain.

Correct VS/VD Model



- Internal Service Rate = f(External/Downstream Feedback, Switch algorithm using q_i)
- ACR_{ij} = f(Internal service rate, end system rules)
- Upstream feedback =f(q_{ij})ACR_{ij}
- Example: Downstream = 100, Service =90, ACR=80, Upstream feedback=70 Mbps

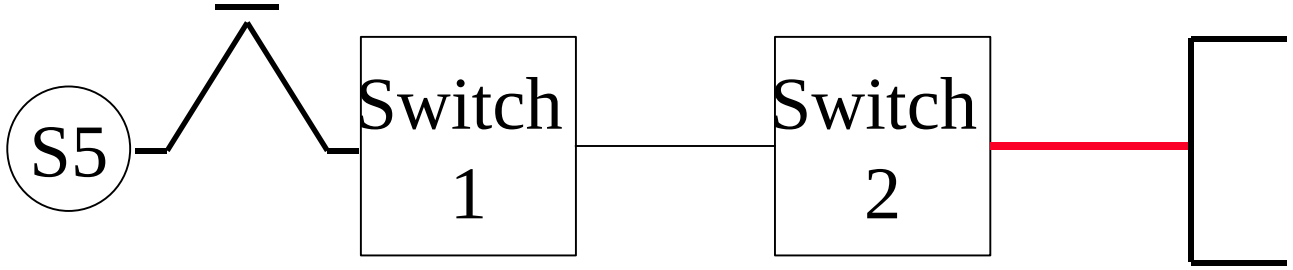
Per-VC ERICA+

- BRM received :
  - $ER_{ij}^{external}$:= ER in RM cell
- FRM received :
  - ER in RM := $ER_{ij}^{feedback}$
- At the end of each averaging interval :
  - $ER_{ij}^{internal}$
    := Min{ Max (r_{ij}/Overload, $g(q_i)R_i/N$), $ER_{ij}^{external}$}
  - Output rate
    $ACR_{ij} = r_{ij}$:= fn{$ER_{ij}^{internal}$, end system rules}
  - $ER_{ij}^{feedback}$:= $g(q_{ij})r_{ij}$

VSVD Results

- VS/VD switch architecture:
  - Per-VC queues drain at an ACR based only on the external congestion and class Q
  - Feedback to upstream queue must include external congestion, class Q, and per-VC Q.
  - Each queue must monitor its input and output rate.
- Action (Feb'98): Added a sample VS/VD scheme to baseline text

Results (Cont)



- With correct implementation of VS/VD:
  Maximum queue at each switch
  $\leq$ Bandwidth delay product of the previous loop
  $\Rightarrow$ Can help isolate long-delay hops from short-delay hops.
- Workgroup switches on satellite paths will not need buffering proportional to round-trip even if they are the bottleneck.

VS/VD: Other Issues

- Effect on ABR parameters
- Ref: 96-1639

GFR

- Status of Feb'98 Meeting
- Signaling Parameter for GFR
  - PCR_{0+1}
  - MCR_0
  - MBS
  - MFS = Min{CPCS PDU Size, MBS}
  - Tagging
  - Best Effort
- Attempt to replace GFR with VBR.4 failed
- Attempt to include flow charts for conformance was tabled.

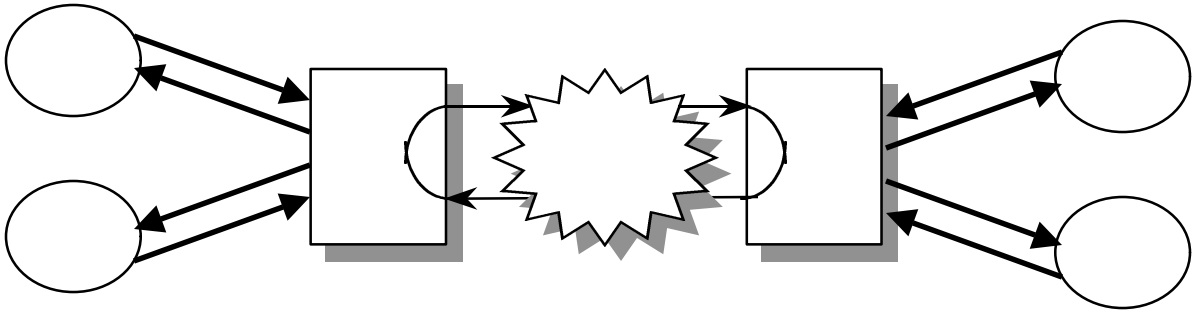
Virtual Paths

- VC to VP Aggregation
- EFCI State

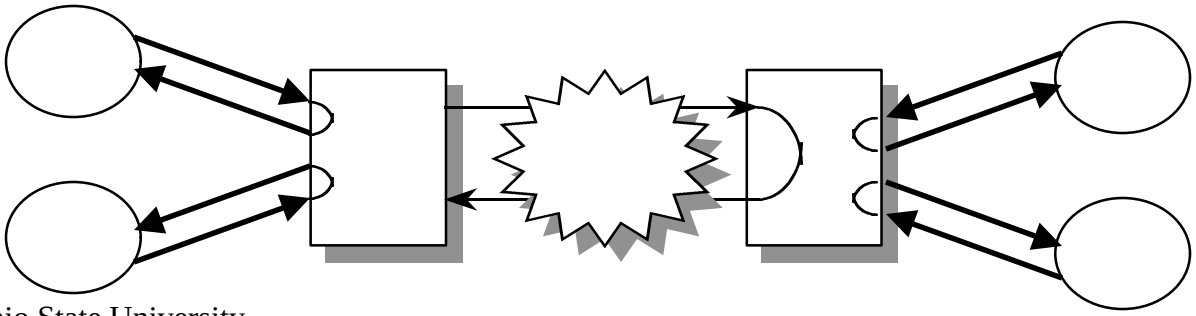
VC to VP Aggregation

- VP = Σ VCs
- VP Traffic contract ≠ Σ VC traffic contracts
- QoS of VP = QoS of most demanding VC?
- An appendix has been added to TM5.0 describing the problem (Feb'98). No known general solution.
- Ref: 97-0714, 97-0624, 97-0168R2, 95-1519

EFCI State



- VP sources should not reset EFCI
- Solution 1: Use VS/VD at VP ends
- Solution 2: Only reflect EFCI at VP source. Not full VD.
- Ref: 97-0386



ITU vs ATMF

- ATMF vs ITU Classes
- QoS Parameters

ATMF VBR Definitions

- VBR.1 ⇒ Non-conforming cells are discarded
- VBR.2 ⇒ CLP=0 that overflow SCR bucket are dropped, CLP=1 that pass PCR bucket are eligible
- VBR.3 ⇒ CLP=0 that overflow SCR bucket are tagged and then eligible for best effort service

ITU QoS Classes

- High priority cell vs aggregate stream
  CLR_0 vs CLR_{0+1}
- I.356 applies only to public networks
  - Class 1: Delay & CLR_{0+1}
  - Class 2: CLR_{0+1}
  - Class 3: CLR_0
  - Unspecified Class

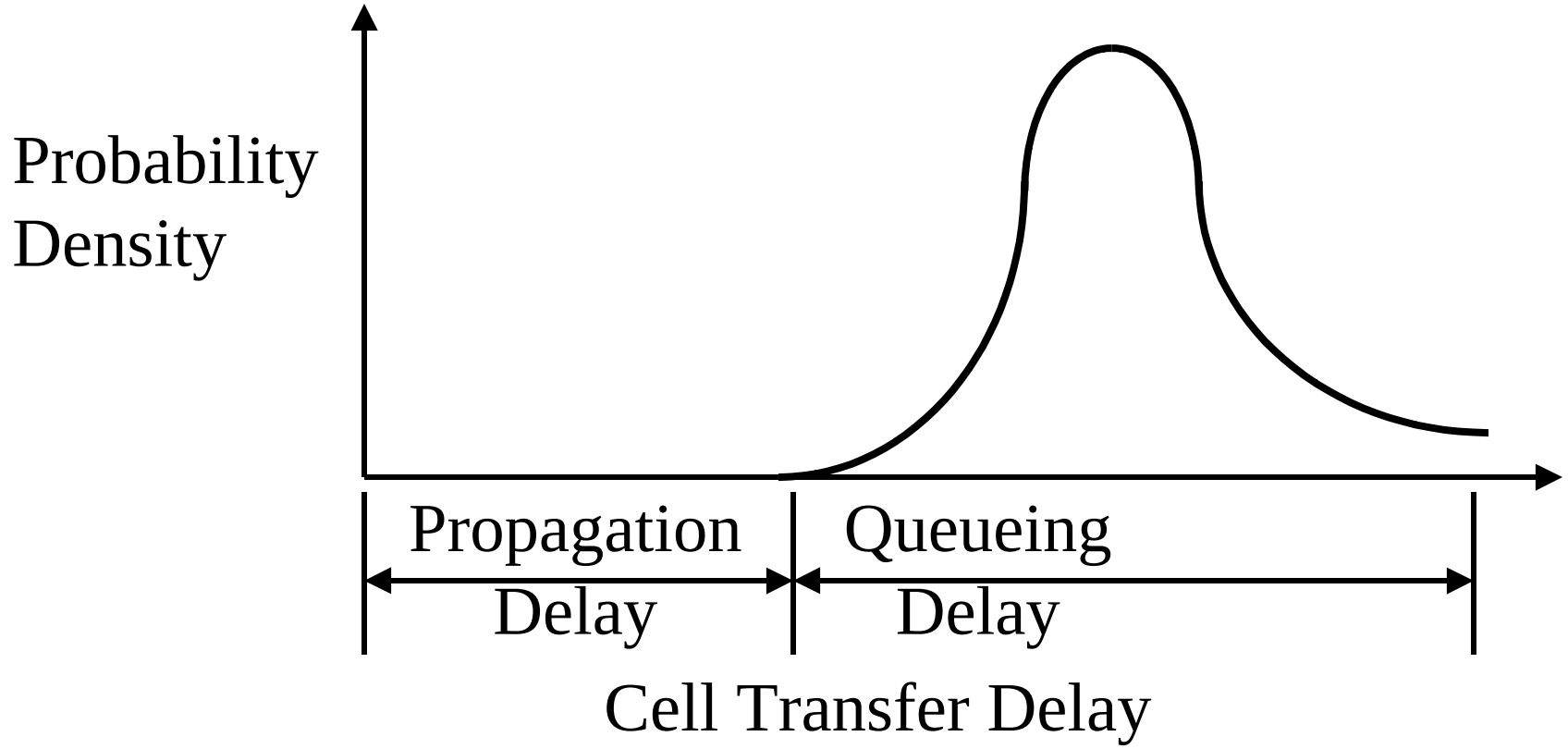
ATMF vs ITU Classes

- Five Service Categories vs four QoS Classes
- CBR = Class 1
- rt-VBR.1 = Class 1
- rt-VBR.2 = ?
- rt-VBR.3 = ?
- nrt-VBR.1 = 2
- nrt-VBR.2 = 3
- nrt-VBR.3 = 3
- ABR = 3,U
- UBR = U

QoS Parameters

- ATM Forum uses maxCTD and peak-to-peak CDV
- ITU uses meanCTD and 2-pt CDV
- MaxCTD = $CTD_{1-\alpha}$
- MeanCTD = $1/n \Sigma$ CTD
- Peak-to-peak CDV = $CTD_{1-\alpha}$ - CTD_{fixed}
- 2-pt CDV = $CTD_{1-\alpha/2}$ - $CTD_{\alpha/2}$
- Ref: 97-0895, 97-0290, 97-0562, 97-0427, 97-0404, 96-0369

CDV Accumulation



- TM4.0 uses Mean, variance, discrepancy
- Discrepancy = Measured CDV(α) - CDV(α) from Gaussian distribution

CDV (Cont)

- Worst case $\Rightarrow$ Overestimate
  $\Rightarrow$ Underutilization, Blocking
- Suggest using Chernoff method or Markovian Inequality
- Assumes local delays at switches are independent.
- Assumes delays at each switch are gamma distributed.
  Switch Delay pdf: $f(t) = \lambda^r t^{r-1} e^{-\lambda t}/\Gamma r$
  λ = scale parameter of the switch delay
  r = shape parameter of the switch delay

CDV Algorithm

- $s_i = \min_{1<j\leq i} \lambda_j/c$, $c>1$
- If s_i is less than requested end-to-end CDV, accumulate $r_i \log(\lambda_i/(\lambda_i - s_i))$
- How do you select c? Need more guidance.
- Ref: 97-0293

CLR with EPD

- Cells dropped due to EPD be not counted in CLR

Joint Work with Other Groups

- TM and Net Mgmt
- ABR API
- TM and RBB
- TM and SAA
- TM and Test

TM and Net Mgmt

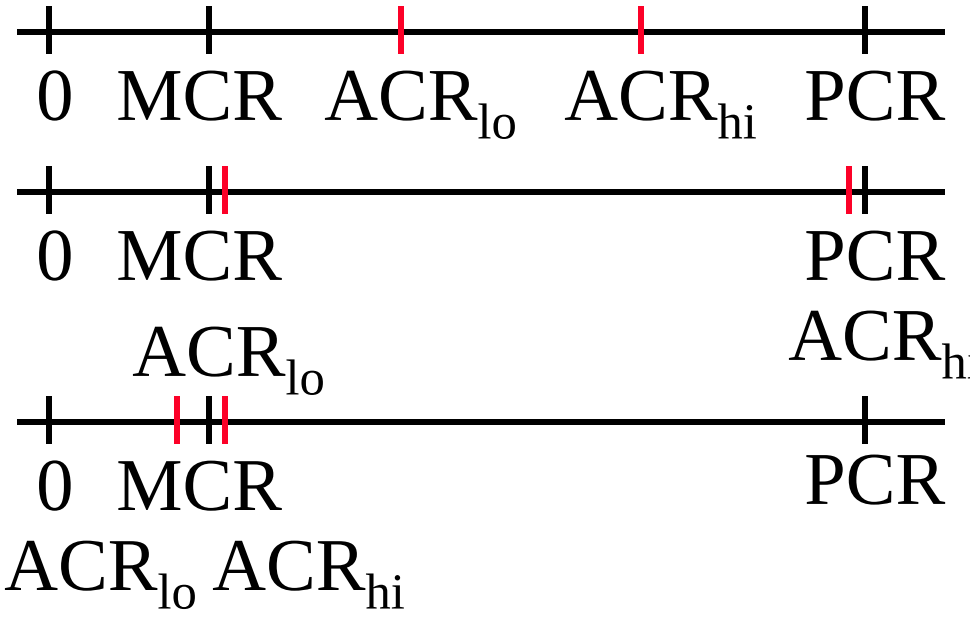
- Management of ABR Service
- Count invalid RM cells, valid RM cells
- Invalid: BN=1 and DIR=0, ER>PCR, ...
- Ref: 97-0478R2
- Traffic Descriptors for CBR, VBR, ABR, UBR
- CBR Traffic Descriptor: PCR, SCR, MBS, CDVT, p-to-p CDV, max CTD CLR
- Ref: 97-0923
- Accumulative Parameters: FRTT, maxCTD, peak-to-peak CDV

ABR API

- Query and Set: PCR, MCR, ICR, RIF, RDF, MCRmin
- Query: FRTT, TBE
- Set: ER (<PCR), MCR
- Query: ACR
- Ref: 97-0999*, 97-1020*, 97-1100*

Querying ACR

- When should the applications be notified of ACR change?
- Suggestion: two threshold crossing
- Ref: 97-1020*



TM and RBB

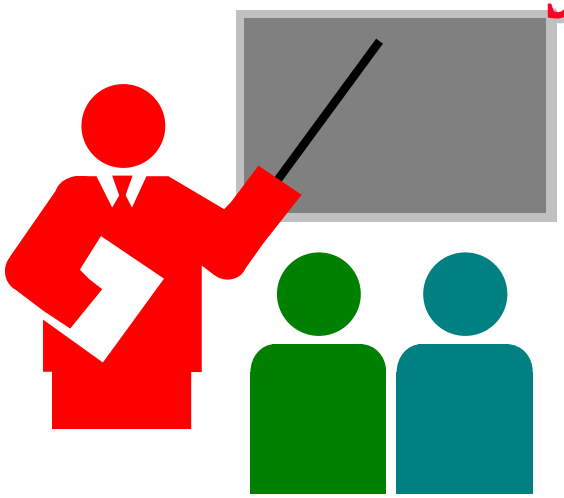
- RBB: Shared access over cable, asymmetric links
- Simplification of traffic parameters for residential users
- Effect of dual delays in cable modems
- Ref: 97-1081

TM and SAA

VBR Video

- Given mean, PCR of a video stream, how does one request SCR, MBS, ...
- Effective BW = (1-α)Mean+ α PCR
- Higher Effective BW ⇒ Lower MBS
- Ref: 97-0756*, 97-0733, 97-0797
- Service Category for Video: CBR, VBR, ABR, ABT

Summary



- Effect of VS/VD: Buffers = previous hop
- GFR: Signaling parameters.
- Virtual Paths: Not easy to compute QoS
- ITU classes vs ATMF service categories
- CDV Accumulation: Chernoff Inequality

Future Issues

- ABR Policing
- Multipoint
- ABR Fairness and Pricing
- Effective Number of Active Sources
- Varying Phy Bandwidth
- TCP/IP over ATM
- FUNI Conformance