Traffic Management in ATM Networks

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Overview

- Trends
- Service Classes
- Traffic management functions
- Binary feedback vs explicit rate
- UBR vs ABR
Life Cycles of Technologies

Number of Problems Solved

Number of Hosts

Bytes per Hosts

Number of Networks

Time

You are here
Trends

- Industry is ahead of the academia
  Fast Ethernet, Gigabit Ethernet, ATM Traffic Mgmt
- Standardization ⇒ Can’t succeed alone
  ⇒ Innovation + Technology partnerships
- Academics must work with industrial forums.
  Publication alone is not sufficient.
  IETF, IEEE 802, ATM Forum, ...
ATM Networks: Overview

- STM = Synchronous Transfer Mode,
  ATM = Asynchronous Transfer Mode

- Allows any-speed and even variable rate connection

- ATM = Short fixed size 53-byte cells

- Connection oriented $\Rightarrow$ Virtual Channels (VC)
Classes of Service

- **UBR** (Unspecified bit rate): User sends whenever it wants. No feedback. No guarantee. Cells may be dropped during congestion.
- **CBR** (Constant bit rate): User declares required rate. Throughput, delay and delay variation guaranteed.
- **VBR** (Variable bit rate): Declare avg and max rate.
  - **rt-VBR** (Real-time): Conferencing. Max delay and delay variation guaranteed.
  - **nrt-VBR** (non-real time): Stored video. Mean delay guaranteed.
Traffic Management Functions

- Connection Admission Control (CAC): Verify that the requested bandwidth and quality of service (QoS) can be supported.
- Usage Parameter Control (UPC): Monitor and control traffic at the network entrance.
- Network Resource Management: Scheduling, Queueing, resource reservation
- Priority Control: Cell Loss Priority (CLP)
- Selective Cell Discarding: Frame Discard
- Feedback Controls: Network tells the source to increase or decrease its load.
ATM Traffic

If you throw it away, you won’t miss much.

It is flat. No variability. Just schedule it right.

It varies a lot.

Big pipe! Don’t worry about shortage.
Initial Binary Rate-based Scheme

- Explicit forward congestion indicator (EFCI) set to 0 at source
- Congested switches set EFCI to 1
- Every $n$th cell, destination sends an resource management (RM) cell to the source indicating increase amount or decrease factor
- Unfair without selective feedback
The Explicit Rate Scheme

- Sources send one **RM cell** every n cells
- The RM cells contain "**Explicit rate**"
- Destination returns the RM cell to the source
- The switches adjust the rate down
- Source adjusts to the specified rate
### ABR vs UBR

<table>
<thead>
<tr>
<th>ABR</th>
<th>UBR</th>
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<tbody>
<tr>
<td>Sources follow feedback</td>
<td>Sources send at peak rate</td>
</tr>
<tr>
<td>Switches reduce rate</td>
<td>Switches drop if congested</td>
</tr>
<tr>
<td>Small queue in the switch</td>
<td>Small queues in the source</td>
</tr>
<tr>
<td>All queues in the source</td>
<td>All queues in the network</td>
</tr>
<tr>
<td>Pushes congestion to edges</td>
<td>No backpressure</td>
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<tr>
<td>Max buffering = 4 ×RTT</td>
<td>Max Buffering = n ×RTT</td>
</tr>
<tr>
<td>Good if end-to-end ATM</td>
<td>Same end-to-end or backbone</td>
</tr>
<tr>
<td>Fair</td>
<td>Generally unfair</td>
</tr>
<tr>
<td>Good for the provider</td>
<td>Simple for user</td>
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</table>
The exponential phase of life cycle
⇒ Participate with the industrial forum

Binary feedback is too slow for high speed networks
⇒ Explicit rate feedback

ABR pushes the congestion to edges
⇒ Good for large distance-bandwidth product

UBR may be OK for slow speed or LANs
Our Papers/Contributions

All our past ATM forum contributions, papers and presentations can be obtained on-line at http://www.cis.ohio-state.edu/~jain/


