Current Issues in ATM Forum Traffic Management Group: GFR and DiffServ

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Overview

- ITU GFR Alignment
- CLP Treatment in GFR
- No VLF-GCRA
- Conformance vs Eligibility
- QoS-F-GCRA
- Signaling MBS
- CLR With EPD
- DiffServ/IEEE 802.1 over ATM
No MFS test in F-GCRA
No Function "f" in F-GCRA
F-GCRA $\Rightarrow$ QoS-F-GCRA
Frame Treatment in GFR

- Conforming Frames: Deliver all or none
- Non-conforming Frames: Deliver last cell if any cell delivered
- Two GFR Categories:
  - GFR.1 ⇒ No tagging.
  - GFR.2 ⇒ Tagging.
CLP Treatment in GFR

- For each user: CLP=0 is more important than CLP=1

- Among Users:
  CLP=0 of user 1 not more important CLP=1 of user 2
  ⇒ Can't discard only CLP=1 Cells
  - IF CLP0+CLP1 ≤ MCR ⇒ Deliver all
  - IF CLP0+CLP1 ≤ MCR ⇒ Deliver CLP0+CLP1 > MCR
  - IF CLP0 ≥ MCR ⇒ Deliver CLP0 ≥ MCR

- Ref: 98-0708

- Issue: Need F-GCRA at each switch to identify excess CLP=0 cells

- Ref: 98-0823 (Status?)
GCRA Compliance

Leaky Bucket Contents

Time

Failed

Passed

F-GCRA1

F-GCRA2

Synchronization lost

The Ohio State University

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Effect of MCR Inaccuracy

- Frame size can be between 1 and MFS cells
- In the example shown:
  - Larger MCR: \( n \times \text{MFS} + 1 \) cells eligible
  - Smaller MCR: \((n+1) \times \text{MFS}\) cells eligible.
  \[ \Rightarrow \text{Larger MCR can yield smaller throughput}. \]
- Both these GCRAs are static. L is fixed.
Problem: Variable length frames
⇒ fixed F-GCRA can give lower throughput with larger tolerance

Old Solution: Variable Limit F-GCRA
Limit L is a function of time f(t)
f > BT + CDVT_{MCR}

BT = (MBS - 1)(1/MCR - 1/PCR), MBS ≥ MFS
New Solution:

\[ L = BT + CDV T_{MCR}, \]

\[ MBS \geq 1 + MFS\{\frac{PCR}{(PCR-MCR)}\}, \quad PCR > MCR \]

Ref: 98-0700 (Accepted)
Conformance

- GCRA (1/PCR, CDVT<sub>PCR</sub>)
  - Yes
  - No

- CLP same as 1st cell?
  - Yes
  - No

- Size ≤ MFS
  - Yes
  - No

- GCRA, CLP, MFS Conforming?
  - Yes, Conforming Frame
  - No. Nonconforming Frame

Ref: 98-0986 (Nortel)
Conformance vs Eligibility

- Only unmarked conforming frames are QoS eligible
- **Problem**: Conformance is known only on the last cell of the frame.
- Increase the value of X for all frames that start with CLP=0
- Undo the incrementing if frame is non-conforming
  ⇒ Store X and LCT at first cell
QoS-F-GCRA

- Number of cells passed increases with increasing tolerance or increasing MCR:
  \[ \text{QoS-F-GCRA}(T,L) < \text{QoS-F-GCRA}(T',L') \]
  If \( T' \leq T \) and \( L'/T' \geq L/T + \text{MFS} \)
  Higher MCR or sufficiently higher limit \( \Rightarrow \) More cells passed

- Any F-GCRA implementation that gives QoS to as many cells in complete unmarked frames as QoS-F-GCRA is conformant

- ATMF F-GCRA is one example of conforming implementation

- Ref: 98-0821. Not Accepted on 12/1/98.
QoS-F-GCRA Pseudocode

**On any 1st Cell:**

\[ X' = X - (t_a - LCT) \]

if \( X' > L \) or (Cell is tagged) then
  passed := false
else
  passed := true
endif

**For last cell of frames with 1st cell CLP=0:**

If (frame is not conforming) or (passed) then
  \[ X_1 := X \]
  \[ LCT_1 := LCT \]
else
  \[ X := X_1 \]
  \[ LCT := LCT_1 \]
Endif

If (frame is conforming) and (passed) then
  \[ QoS\_Count := QoS\_Count + \text{Number of Cells in this frame} \]
endif

**For all cells of frames with 1st cell CLP=0:**

\[ X' := X - (t_a - LCT) \]

\[ X := \text{Max}\{0, X'\} + T \]

\[ LCT := t_a \]
Signaling MBS

- $MBS \geq 1 + MFS\{PCR/(PCR-MCR)\}$
- Sources will signal $MBS_{\text{min}}$, $MBS$, $PCR_{\text{min}}$, $PCR$, $MCR_{\text{min}}$, $MCR$
- Switches reduce $MBS$, $PCR$, $MCR$ as long as they are more than $\text{min}$
- **Issue**: Decreasing $PCR$ may increase required $MBS$
  - Fortunately, $MBS$ does not affect Buffering.
  - Buffering = $1 + MFS$
- **Solution**: Note $MBS$ in returning connect-acks.
- **Ref**: 98-0925 (Status?)
CLR With EPD

- Without EPD:
  \[ \text{CLR} = \frac{\text{Lost Cells} + \text{Corrupted Cells}}{\text{Total Emitted Cells} + \text{Lost Cells} + \text{Corrupted Cells}} \]

- With EPD:
  \[ \text{CLR} = \frac{\text{Lost Frames} + \text{Corrupted Frames}}{\text{Total Emitted Cells} + \text{Lost Frames} + \text{Corrupted Frames}} \]

- Note that lost and corrupted frames count as one cell each

- Ref: 98-0926 (Status?)
Premium Service

- Expedited Forwarding (EF)
- Virtual leased line
- Similar to CBR
- Guaranteed minimum service rate
- Policed: Arrival rate < Minimum Service Rate
- Not affected by other PHBs
  ⇒ Highest priority (if priority queueing)
- Code point: 101110
Assured Forwarding

- **PHB Group**
- **Four Classes:** Decreasing weights in WFR/WFQ
- **Three drop preference per class**
  (one rate and two bucket sizes)
DiffServ over ATM

- **DiffServe:**
  - No end-to-end guarantee
  - No call acceptance control
  - No guarantees for "microflows"

- **ATM:**
  - VC's are isolated. No relative ordering.
  - No sharing among aggregates
  - No local guarantees.
  - No Priorities.
  - No weights.
DiffServ over ATM

- Only two drop preferences. DP 2 and 3 ⇒ CLP = 1
- **Proposed Solution 1:**
  - Need a concept of "VC-bundle" = Same Src-Dest
  - Need to signal priority or weight for each VC in the bundle
  - Ref: 98-918 (Cisco, Nortel, Fore, 3COM, Telia)
- **Proposed Solution 2:**
  - Expedited Forwarding = CBR
  - Assured Forwarding = ABR or GFR with excess_i ∝ MCR_i
  - ⇒ No need to develop new services
  - Ref: 98-0931 (NewBridge)
### IEEE 802.1D Model

<table>
<thead>
<tr>
<th>Dest Addr</th>
<th>Src Addr</th>
<th>Tag Prot ID</th>
<th>Pri</th>
<th>CFI</th>
<th>VLAN ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.1Q header</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CFI = Canonical Format Indicator (Source Routing)

- **Up to eight priorities:** Strict.
  - 1 Background
  - 2 Spare
  - 0 Best Effort
  - 3 Excellent Effort
  - 4 Control load
  - 5 Video (Less than 100 ms latency and jitter)
  - 6 Voice (Less than 10 ms latency and jitter)
  - 7 Network Control
IEEE 802.1D over ATM

- Can't set PCR/SCR/BT/CDVT/MCR to get strict priorities

- Proposed Solution:
  - Allow VC bundles (multiple VCs between the same source-destination)
  - Allow signaling priority among VCs of the bundle

- Status: Unresolved.
Summary

- Can’t discriminate against CLP=1 cells of one user in favor of CLP=0 cells of another user.
- Function ‘F’ in F-GCRA has been replaced with fixed limit L. Works if MBS >> MFS.
- QoS F-GCRA in ITU allows rolling back F-GCRA for non-conforming frames
- DiffServ/802.1D over ATM require “VC-Bundle” concept (?)