Current Issues in ATM Traffic Management

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Guaranteed Frame Rate (GFR) Service: Recent Issues

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Overview

- Overview
- Known Results
- Problems w Definition
- Wentworth GCRA Graphs: Notation
- Effect of MCR Inaccuracy
- Variable Limit Frame-GCRA
- Recent Modifications to GFR Text
- Service Guarantee Interworking

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 CLP =1
  - All frames below MCR are given CLP =0 service.
    All frames above MCR are given best effort (CLP =1) service.

Known Results

- You cannot allocate all uncommitted bandwidth in MCRs with FIFO buffering. Need per-VC Queueing.
- If you want to guarantee throughput for CLP=0 frames, you need dual threshold on queue length. CLP=0 cells are dropped after Q_{high} CLP=1 cells are dropped after Q_{low} For throughput guarantees (w/o considering CLP), one threshold is sufficient.

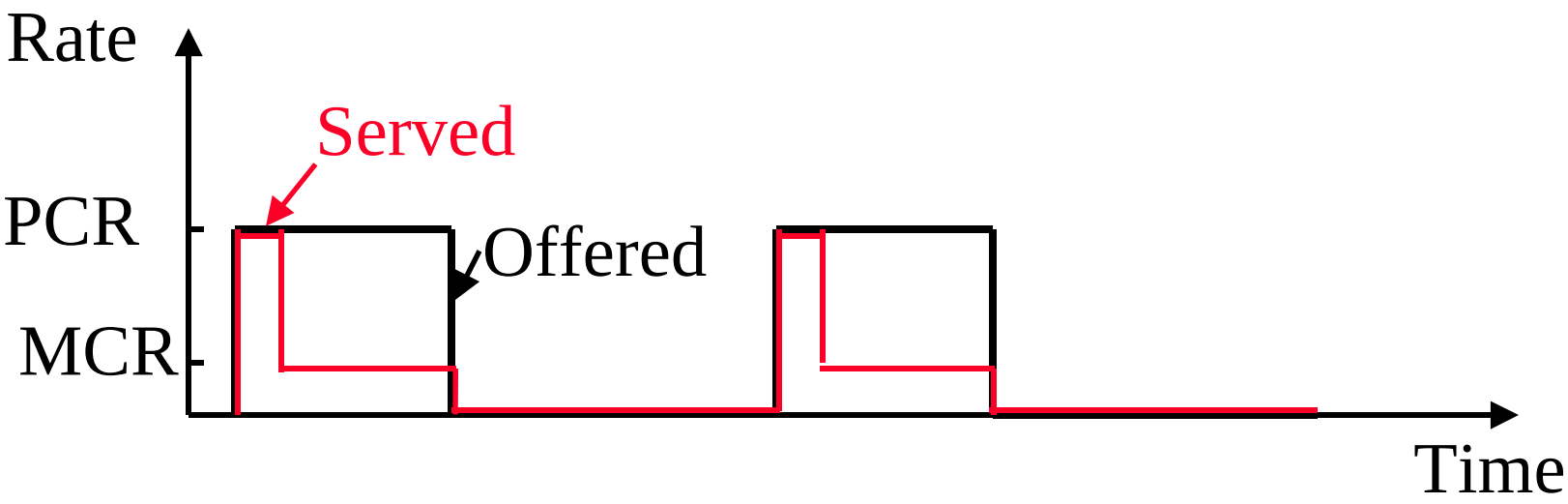
Known Results (Cont)

- With Σ MCR << Link Capacity and SACK TCP, per-VC accounting may be sufficient under certain circumstances:
  - TCP, SACK (?)
  - Σ MCRs < Uncommitted bandwidth
  - Same RTT (?), Same frame size (?)
  - No other non-TCP or higher priority traffic (?)

To be Analyzed

- Other TCP versions.
- Effect to non-adaptive (UDP) traffic
- Effect of RTT
- Effect of tagging
- Effect of frame sizes
- Parameter study
- Buffer threshold setting formula?
- How much buffer can be utilized?

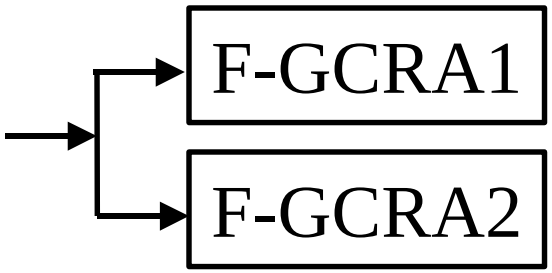
Problems w Definition



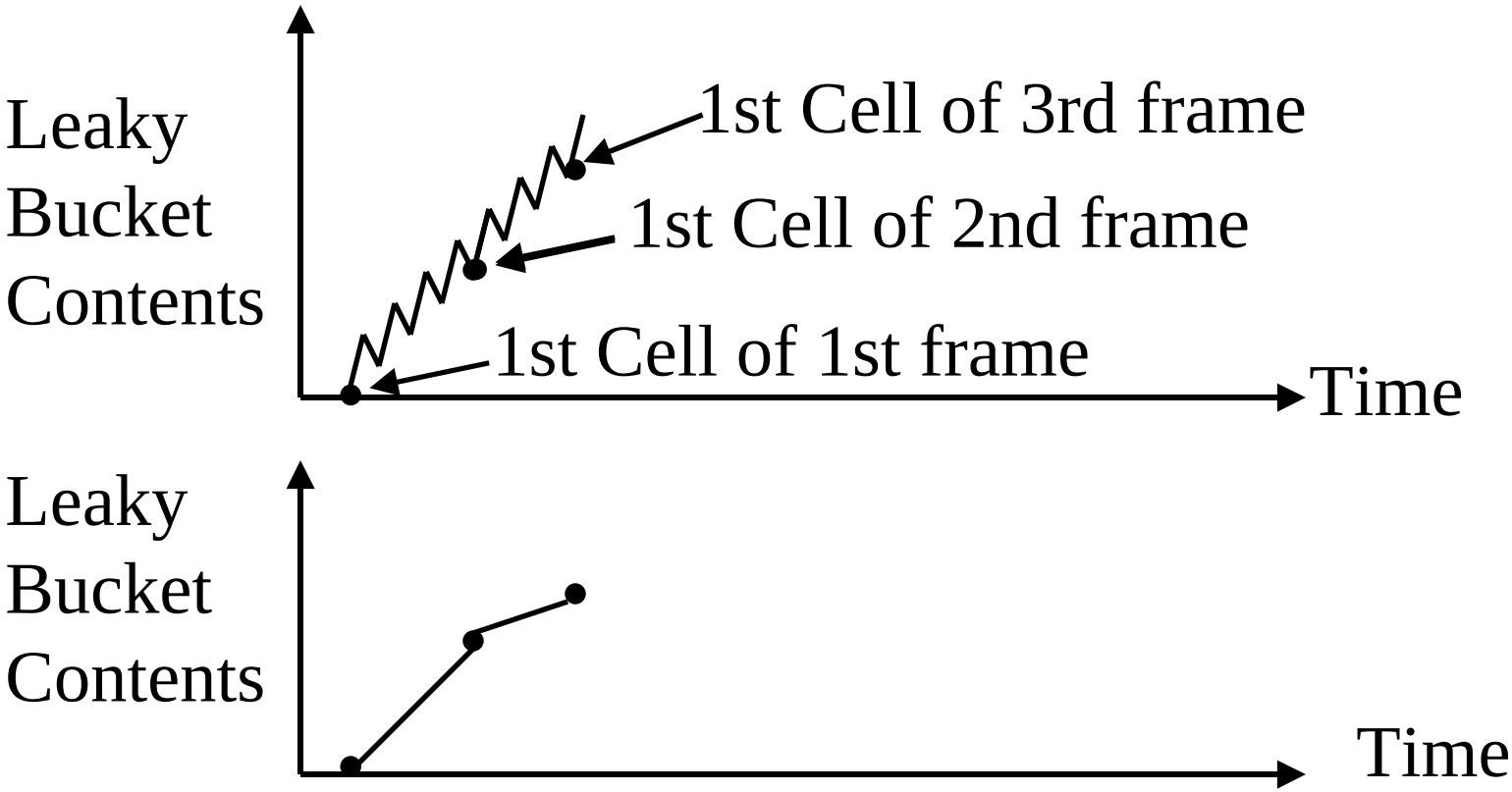
- Measure offered rate and MCR over what period
- Served rate can be much smaller even if offered rate is MCR.
- Note: Most GCRA/GFR figures are courtesy of Robert Wentworth from his ATMF Presentation.
- Ref: 97-0922*, 97-0954

Problem (Cont)

- MCR is a real number ⇒ Need tolerance
- Given a cell stream with cell/frame arrivals at t1, t2, …, tn and given a GCRA implementation and a reference GCRA, is the implementation conforming:
  - Tag/not tag the same frames?
  - Tag/not tag the same number of frames?
  - Tag/not tag at least a given number of frames?

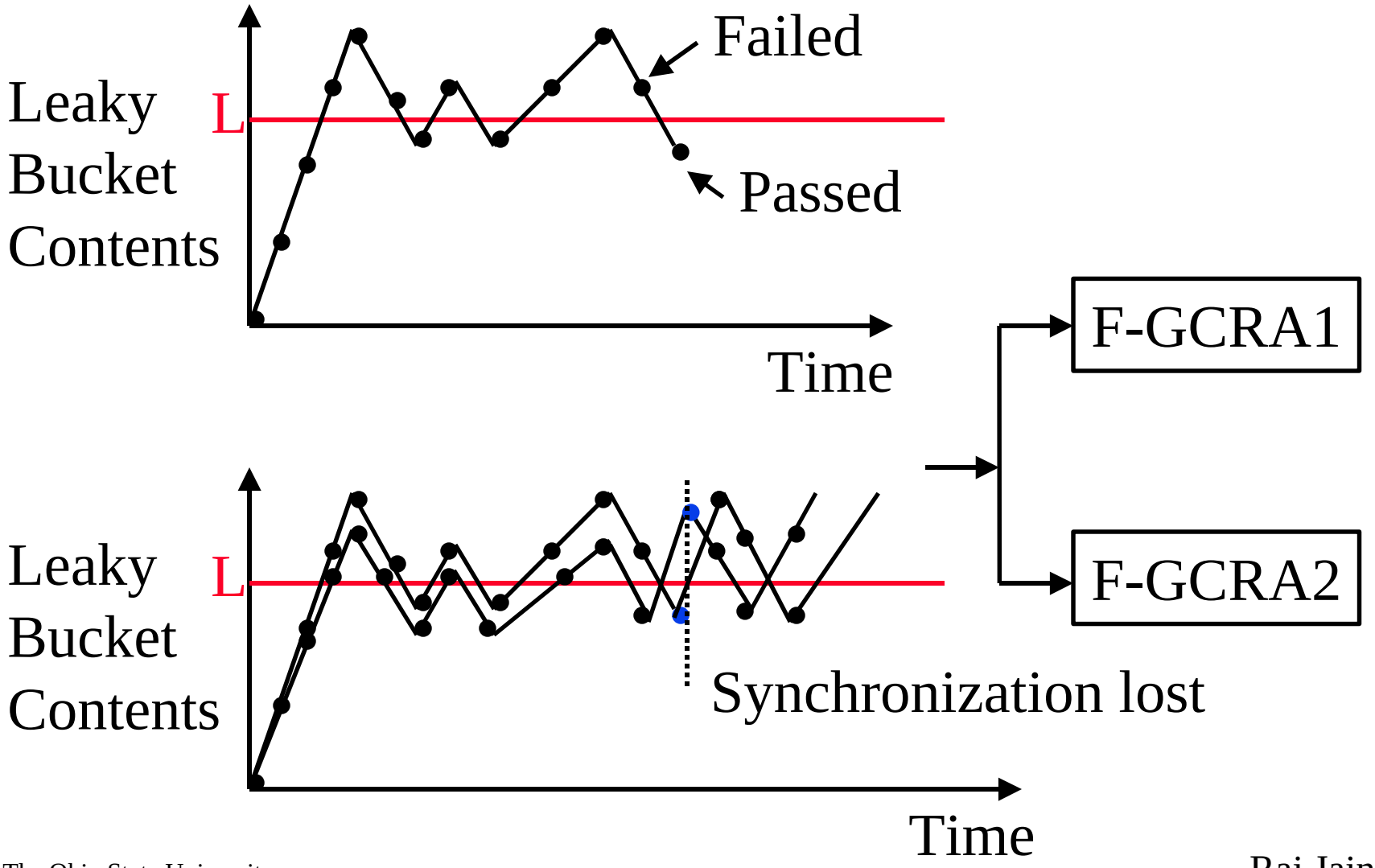


Wentworth Graphs



- Frame conformance decisions are made on 1st cell arrival ⇒ Only 1st cell arrivals are shown (dots).

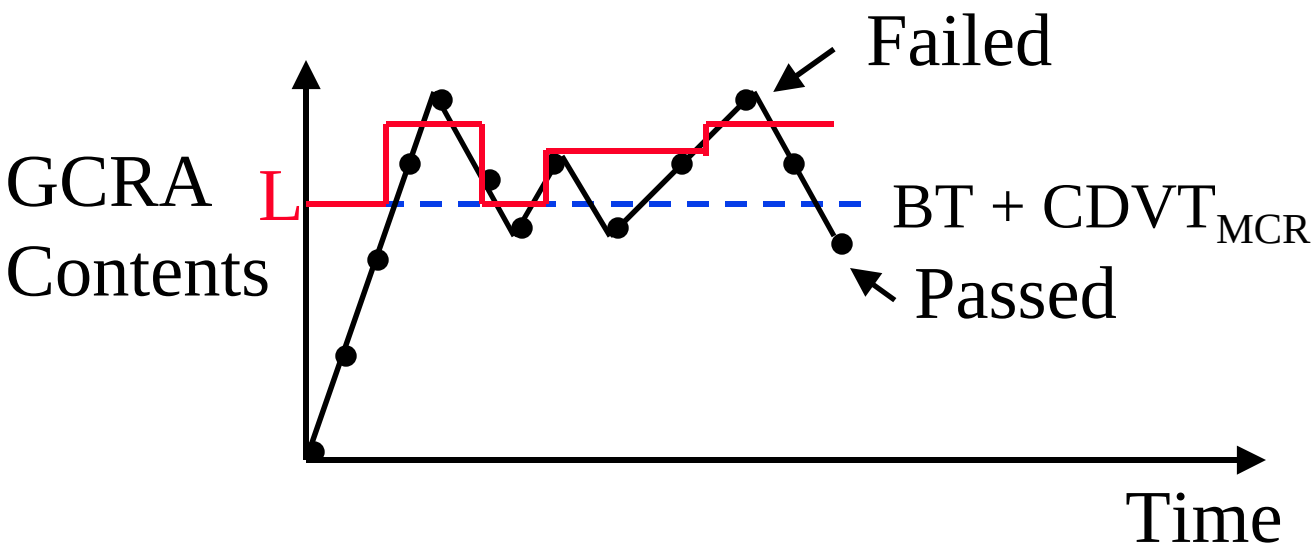
GCRA Compliance



Effect of MCR Inaccuracy

- Frame size can be between 1 and MFS cells
- In the example shown:
  Larger MCR: n×MFS+ 1 cells eligible
  Smaller MCR: (n+1)×MFS cells eligible.
  ⇒ Larger MCR can yield smaller throughput.
- Both these GCRAs are static. L is fixed.

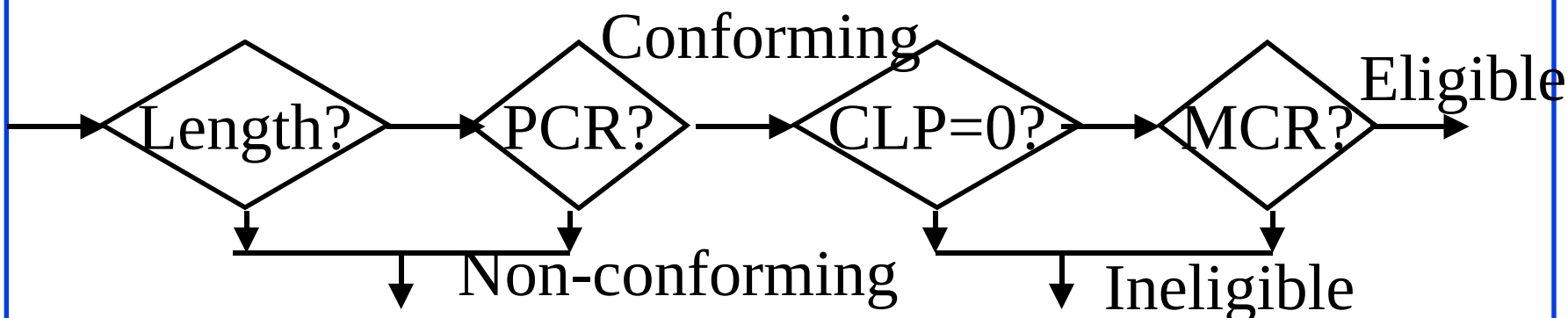
VLF-GCRA



- Variable Limit F-GCRA
- Limit L is a function of time L(t)
- L(t) > BT + CDVT$_{MCR}$

Recent Modifications

- MFS and MBS decoupled
- Marked vs Tagged (User vs Network)
- Network tagging allowed only if requested by the user
- Service eligible vs conforming
  ⇒ Changed "if" conditions in F-GCRA pseudocode



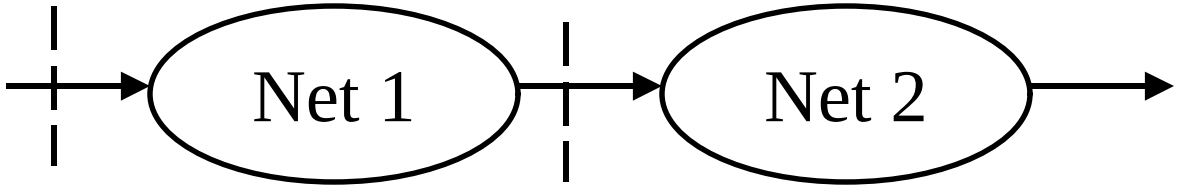
Recent Mod. (Cont)

- MCR ≠ Guaranteed Service rate
  MCR = Maximum eligibility rate
- New text says nothing about service
  ⇒ Networks can store and deliver later
  Networks can drop all non-eligible frames
  Such nets are compliant but "undesirable"
- $CDVT_{PCR}$ and $CDVT_{MCR}$
- GCRA(1/PCR, $CDVT_{PCR}$), F-GCRA(1/MCR, f)
  Conformance and eligibility
- $f \geq BT + CDVT_{MCR}$
  BT = (MBS-1)*(1/MCR - 1/PCR)

Recent Mod. (Cont)

- f can be a time-varying function.
  VLF-GCRA is allowed.
- Non-conforming CLP=0 cells: pass unchanged, discard, or tag if allowed
- Last cell is not discarded if any cells of the frame have gone through. Last cell is discarded if all cells of the frame have been discarded.
- CLR applies only to eligible CLP=0 cells
- Fairness is implementation dependent
- Conformance when passing between networks

Service Guarantee Interworking

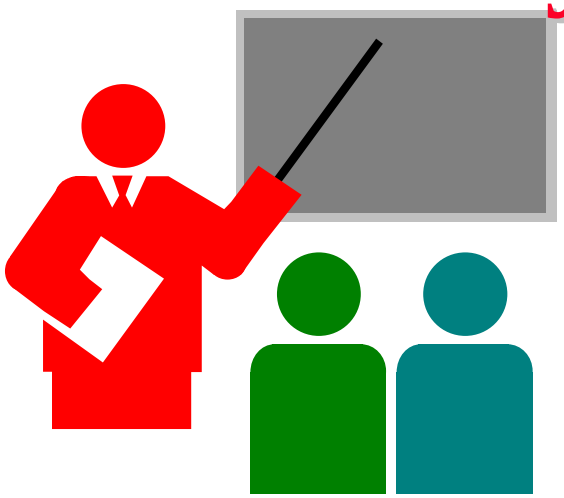


- Traffic contracts at successive networks
- Conforming traffic may become non-conforming
- Particularly important for GFR
- Need: How to calculate exit traffic characteristics? Still an open issue.
- Ref: 97-0954R1

TM 5.0

- 1st Straw (Jul 98)
- Final (Dec 98)
- Will include GFR

Summary



- GFR Conformance is a complex issue
- MCR tolerance and Frame level guarantees are not trivial to specify
- TM5.0 will specify GFR