

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

Raj Jain

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



- ❑ 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

ITU GFR

- ❑ No MFS test in F-GCRA
- ❑ No Function "f" in F-GCRA
- ❑ F-GCRA \Rightarrow QoS-F-GCRA

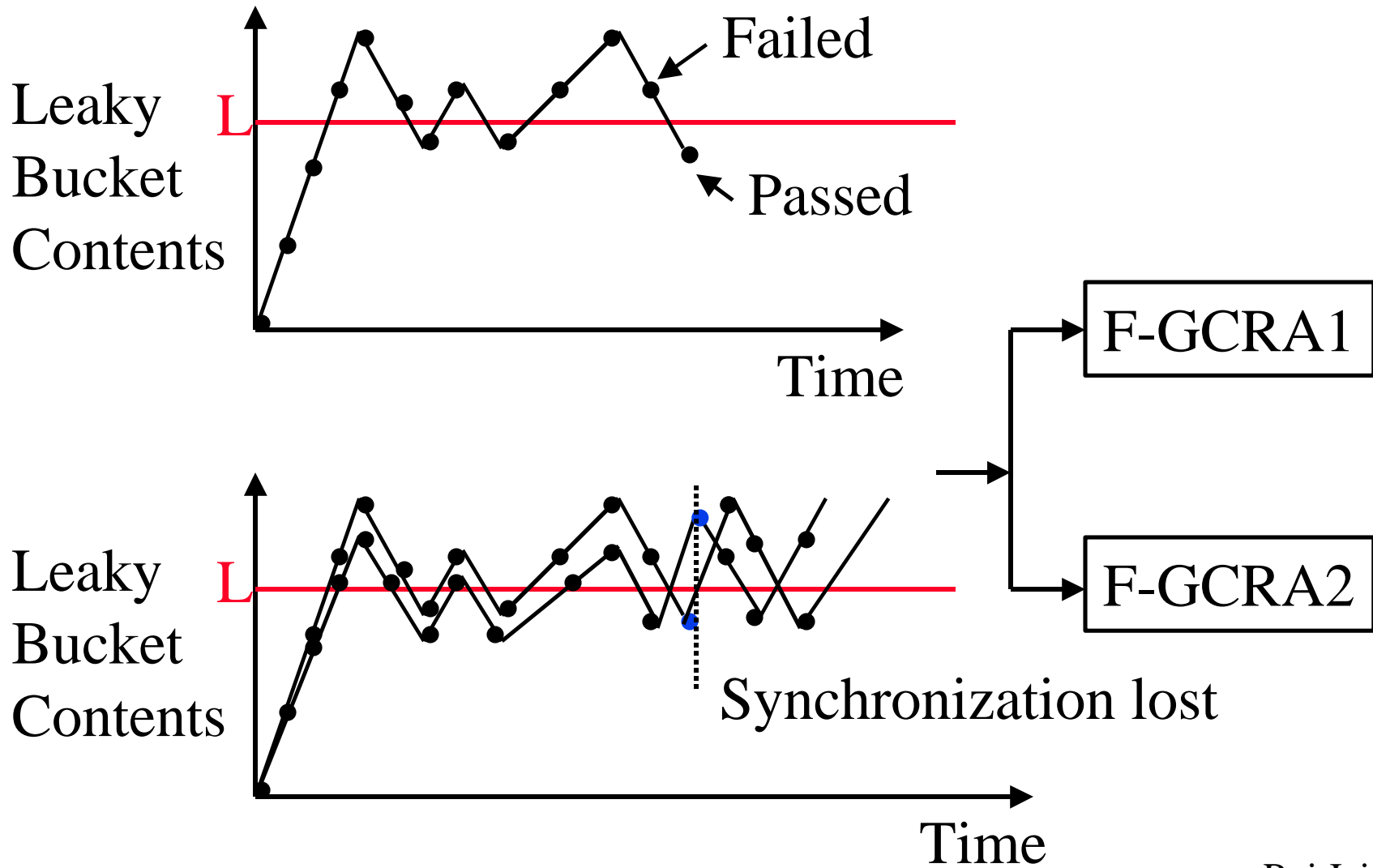
Frame Treatment in GFR

- ❑ Conforming Frames: Deliver all or none
- ❑ Non-conforming Frames: Deliver last cell if any cell delivered
- ❑ Two GFR Categories:
 - GFR.1 \Rightarrow No tagging.
 - GFR.2 \Rightarrow 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 $CLP_0 + CLP_1 \leq MCR \Rightarrow$ Deliver all
 - IF $CLP_0 + CLP_1 \leq MCR \Rightarrow$ Deliver $CLP_0 + CLP_1 \geq MCR$
 - IF $CLP_0 \geq MCR \Rightarrow$ Deliver $CLP_0 \geq MCR$
- ❑ Ref: 98-0708
- ❑ Issue: Need F-GCRA at each switch to identify excess CLP=0 cells
- ❑ Ref: 98-0823 (Status?)

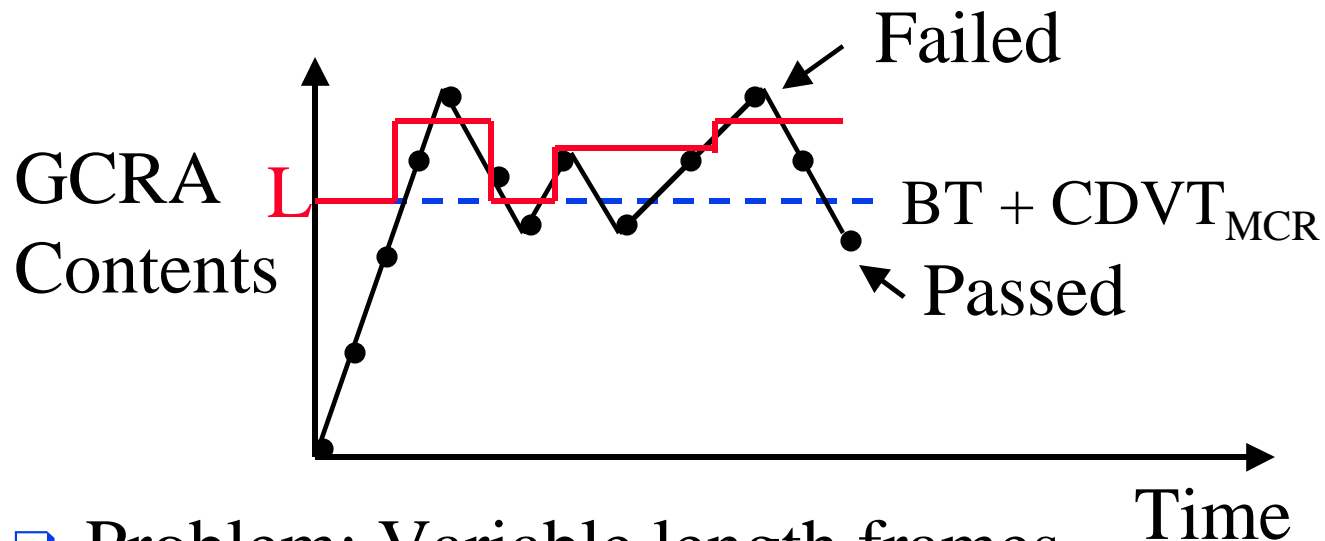
GCRA Compliance



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 Larger MCR can yield smaller throughput.
- ❑ Both these GCRAs are static. L is fixed.

VLF-GCRA



- ❑ Problem: Variable length frames
 \Rightarrow fixed F-GCRA can give lower throughput with larger tolerance

- ❑ Old Solution: Variable Limit F-GCRA
 Limit L is a function of time $f(t)$

$$f > BT + CDVT_{MCR}$$

$$BT = (MBS - 1)(1/MCR - 1/PCR), MBS \geq MFS$$

F-GCRA

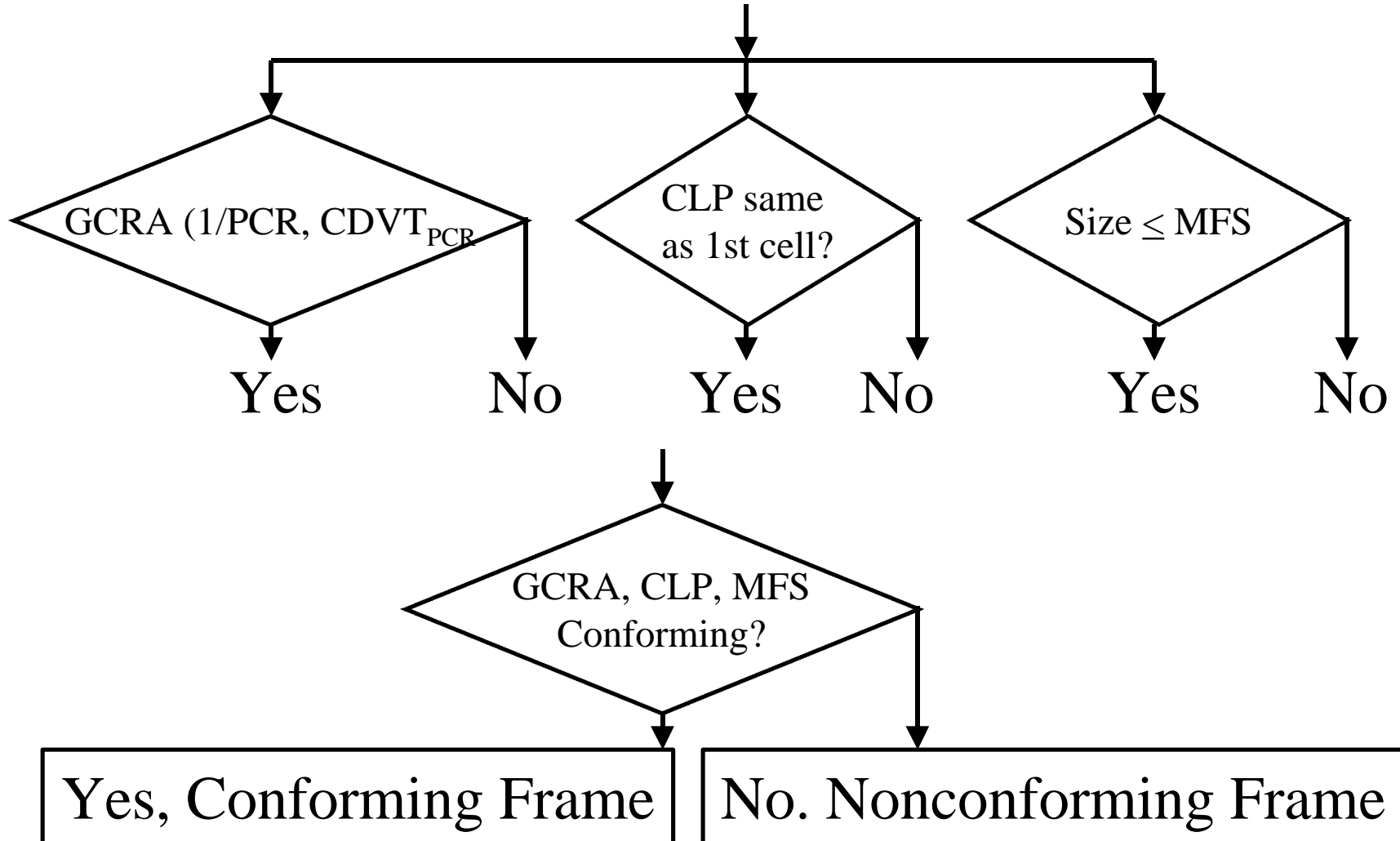
- New Solution:

$$L = BT + CDVT_{MCR},$$

$$MBS \geq 1 + MFS \{PCR / (PCR - MCR)\}, PCR > MCR$$

- Ref: 98-0700 (Accepted)

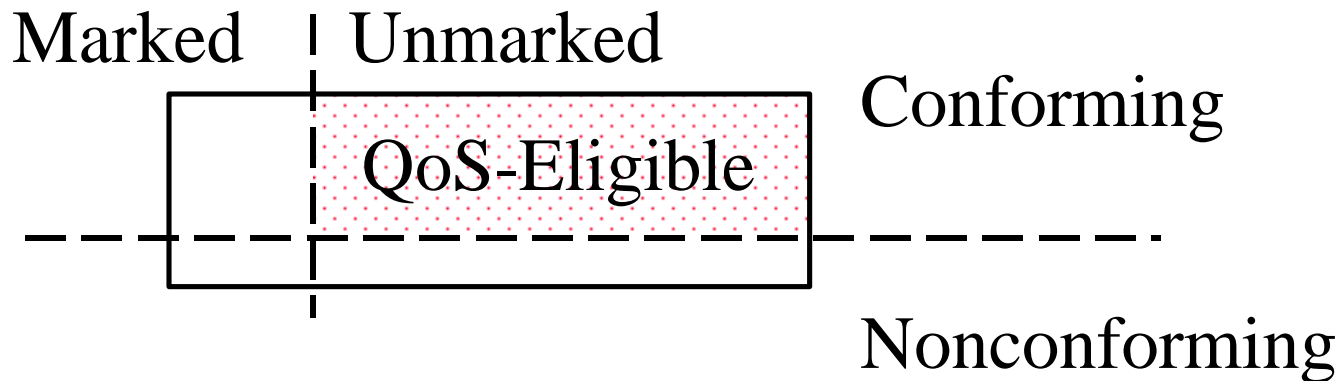
Conformance



□ Ref: 98-0986 (Nortel)
The Ohio State University

Raj Jain

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:

$$QoS-F-GCRA(T,L) \leq QoS-F-GCRA(T',L')$$

If $T' \leq T$ and $L'/T' \geq L/T + MFS$

Higher MCR or sufficiently higher limit

⇒ 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 - (ta-LCT)
if(X' > L) or (Cell is tagged) then
    passed := false
else
    passed := true
endif
```



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

```
X' := X - (ta-LCT)
X := Max{0, X'} + T
LCT := ta
```



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 + Number of Cells in this frame
endif
```

Signaling MBS

- ❑ $MBS \geq 1 + MFS \{PCR / (PCR - MCR)\}$
- ❑ Sources will signal MBS_{min} , MBS, PCR_{min} , PCR, MCR_{min} , MCR
- ❑ Switches reduce MBS, PCR, MCR as long as they are more than 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?)

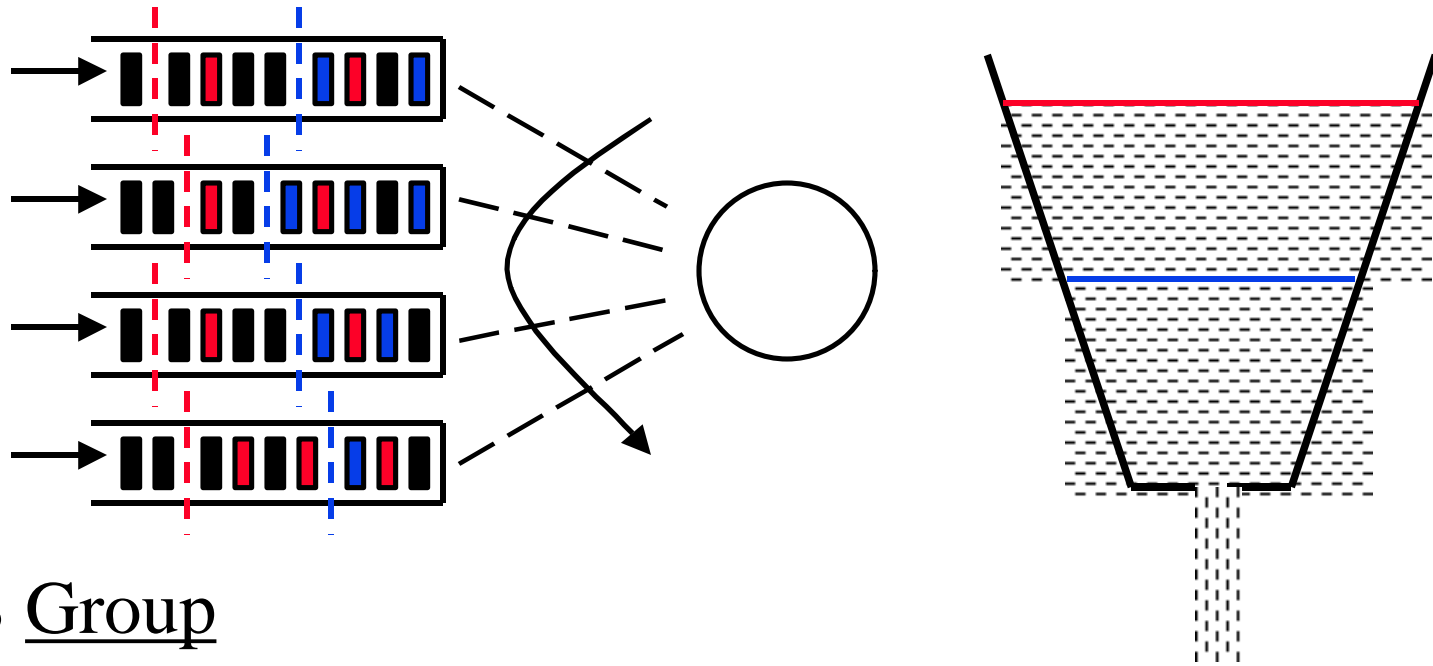
CLR With EPD

- ❑ Without EPD:
 - $CLR = \frac{\text{Lost Cells} + \text{Corrupted Cells}}{\text{Total Emitted Cells} + \text{Lost Cells} + \text{Corrupted Cells}}$
- ❑ With EPD:
 - $CLR = \frac{\text{Lost Frames} + \text{Corrupted Frames}}{\text{Total Emitted Cells} + \text{Lost Frames} + \text{Corrupted Frames}}$
- ❑ 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)

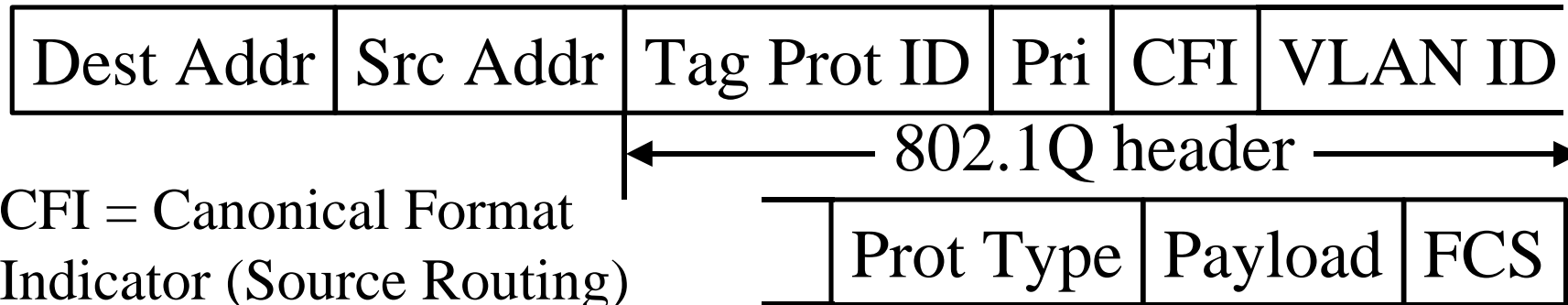
DiffServ over ATM

- 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 \Rightarrow 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 $\text{excess}_i \propto \text{MCR}_i$
 \Rightarrow No need to develop new services
 - Ref: 98-0931 (NewBridge)

IEEE 802.1D Model



□ **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)

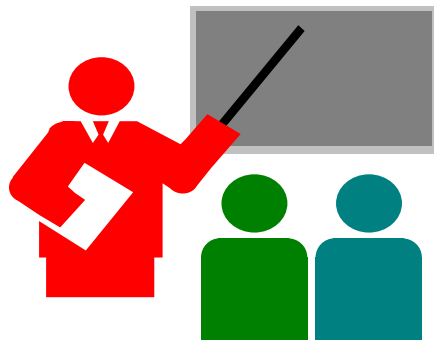
6 Voice (Less than 10 ms latency and jitter)

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 $MBS \gg MFS$.
- ❑ QoS F-GCRA in ITU allows rolling back F-GCRA for non-conforming frames
- ❑ DiffServ/802.1D over ATM require "VC-Bundle" concept (?)