Traffic Shaping in ATM Networks
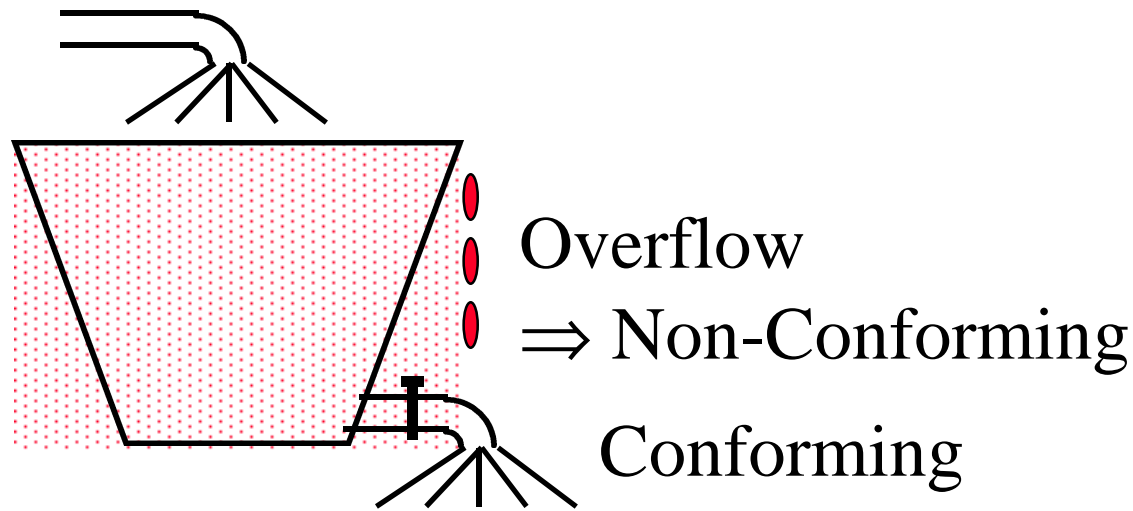
Raj Jain

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

Overview

❑ Leaky bucket

❑ Generic Cell Rate Algorithm

❑ GCRA Implementations:

  ○ Virtual Scheduling Algorithm

  ○ Leaky bucket algorithm

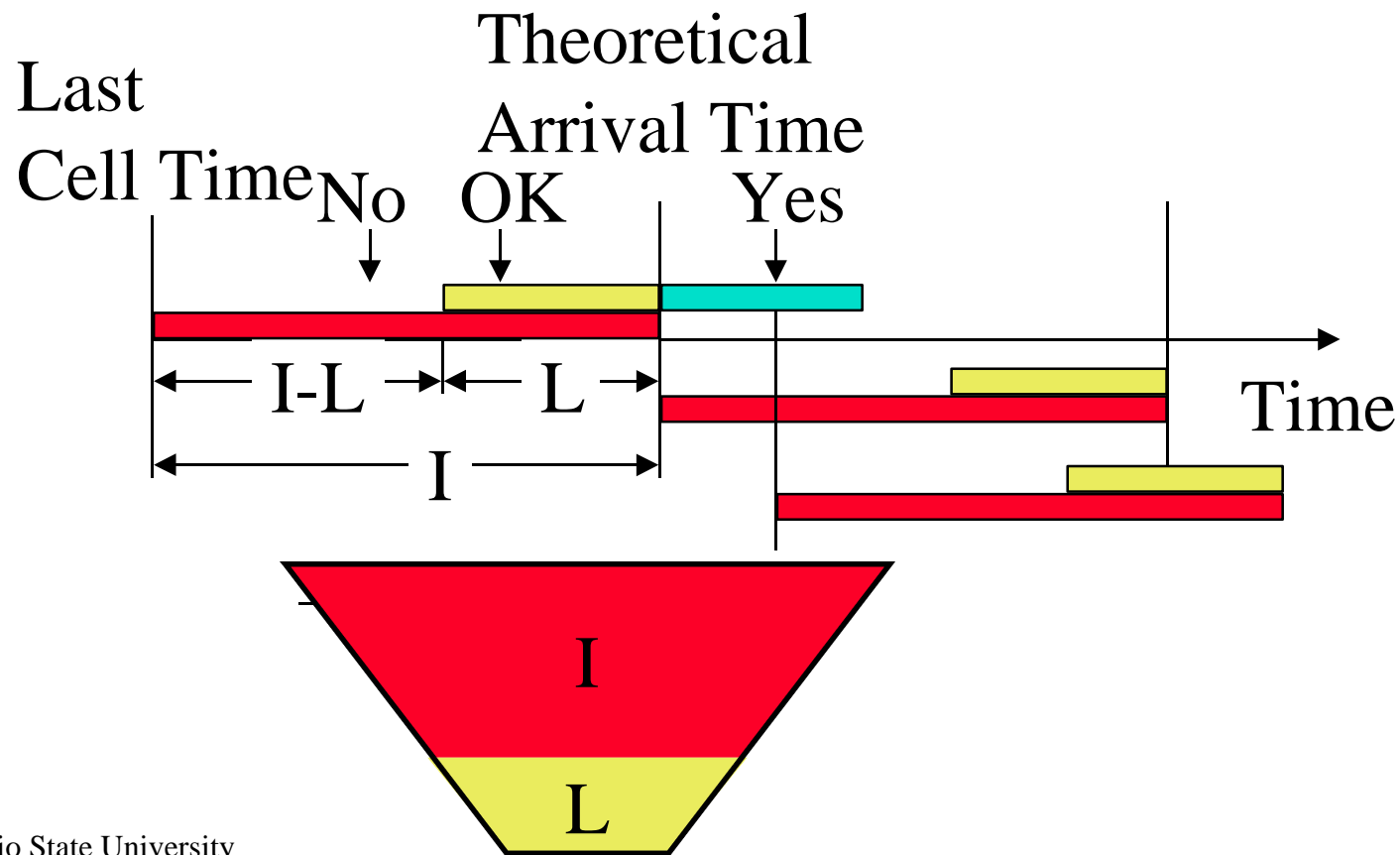❑ Examples

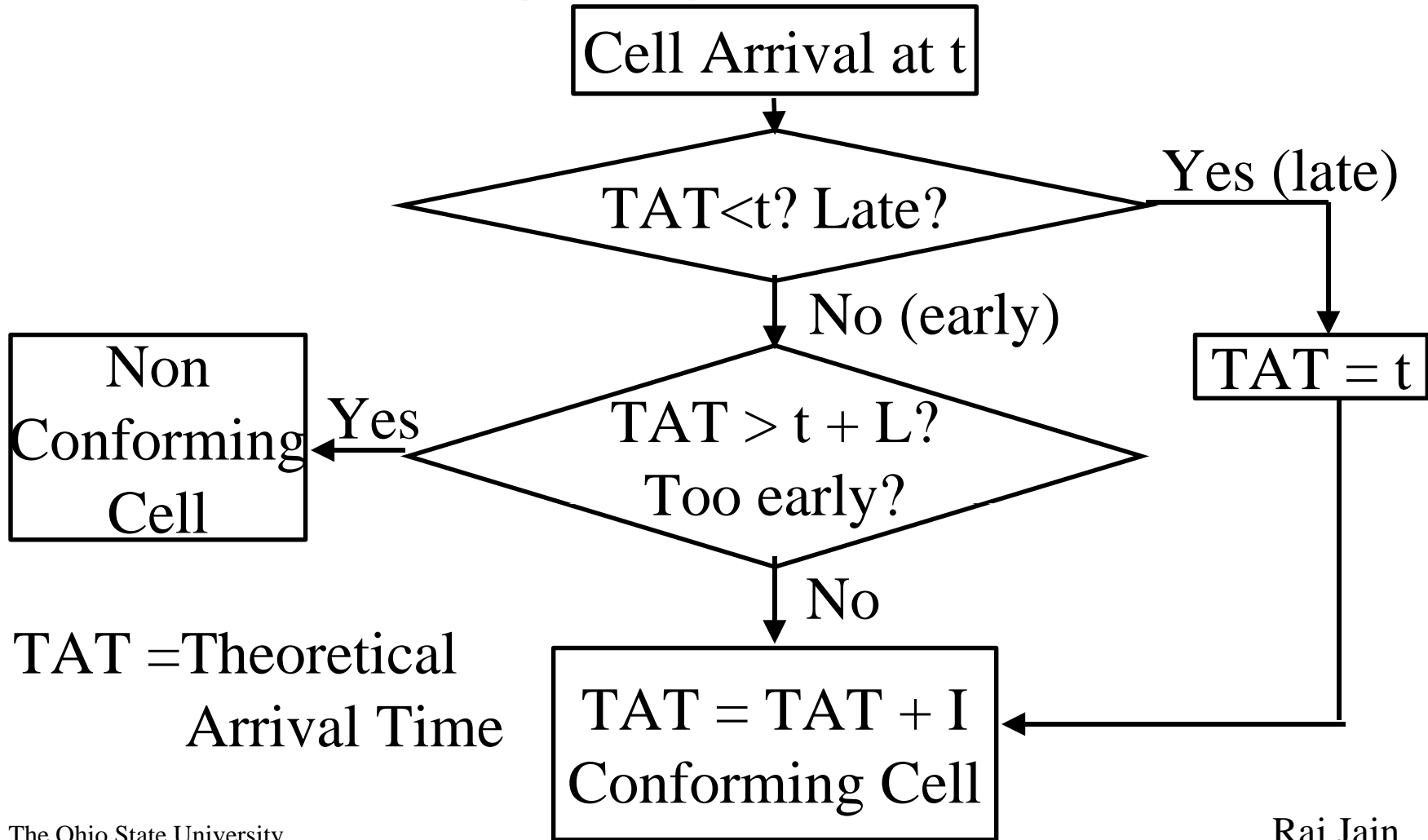# Leaky Bucket

Overflow
$\Rightarrow$ Non-Conforming

Conforming

❑ Provides traffic shaping:
Input bursty. Output rate controlled.

❑ Provides traffic policing: Ensure that users are
sending traffic within specified limits
Excess traffic discarded or admitted with CLP = 1
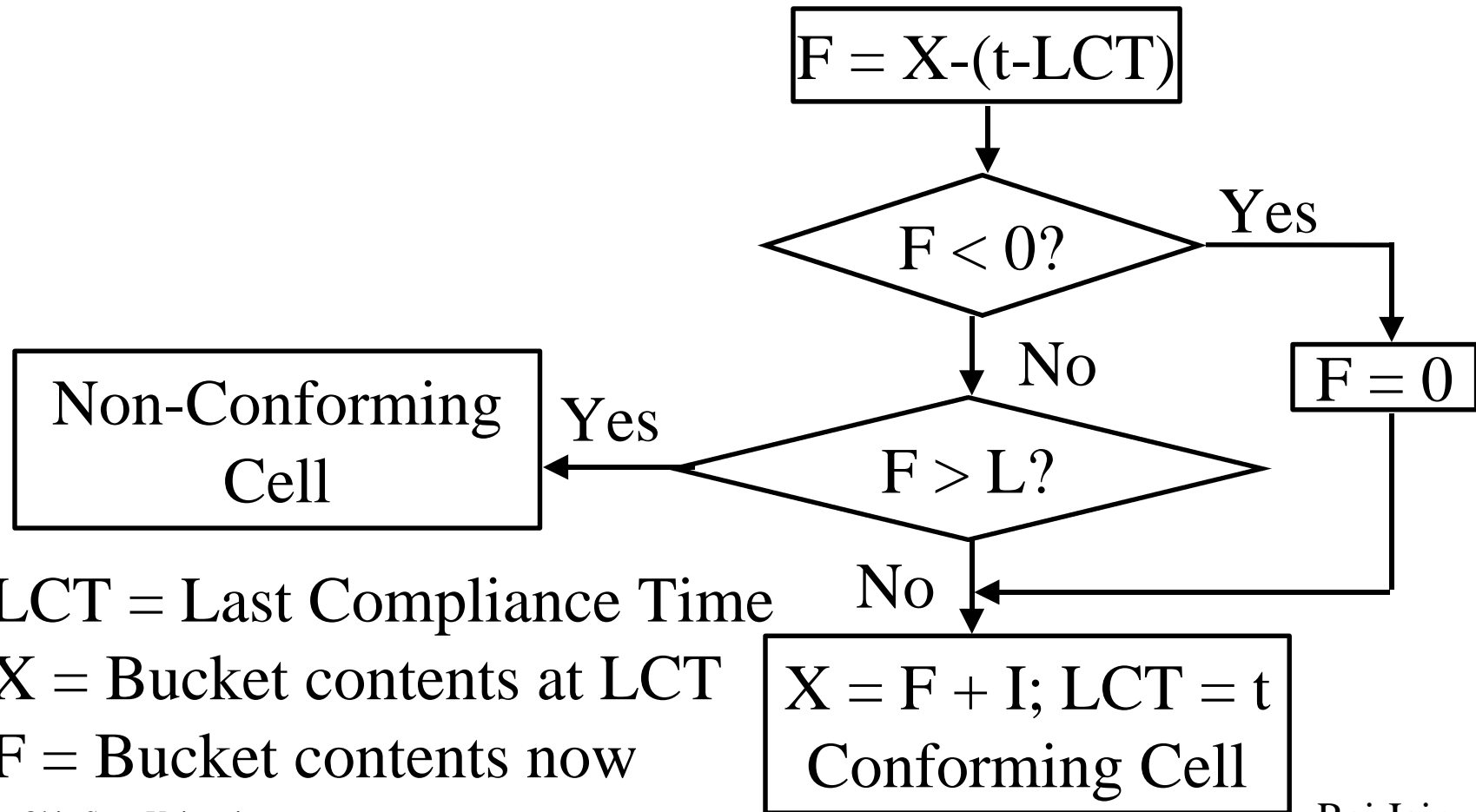
Generic Cell Rate Algorithm: GCRA(I, L)

- ❑ I = Increment = Inter-cell Time = Cell size/PCR

- ❑ L = Limit $\Rightarrow$ Leaky bucket of size I + L and rate 1

Theoretical
Arrival Time

Last
Cell Time No   OK   Yes

I-L   L

I

I

L

GCRA: Virtual Scheduling Algorithm

Cell Arrival at t

TAT<t? Late? — Yes (late)

No (early)

TAT > t + L? Too early? — Yes → Non Conforming Cell

No

TAT = t

TAT = TAT + I Conforming Cell

TAT =Theoretical Arrival Time

GCRA:
Leaky Bucket Algorithm

$$F = X-(t-LCT)$$

$$F < 0?$$ — Yes → $$F = 0$$

No

$$F > L?$$ — Yes → Non-Conforming Cell

No

$$X = F + I; LCT = t$$
Conforming Cell

LCT = Last Compliance Time
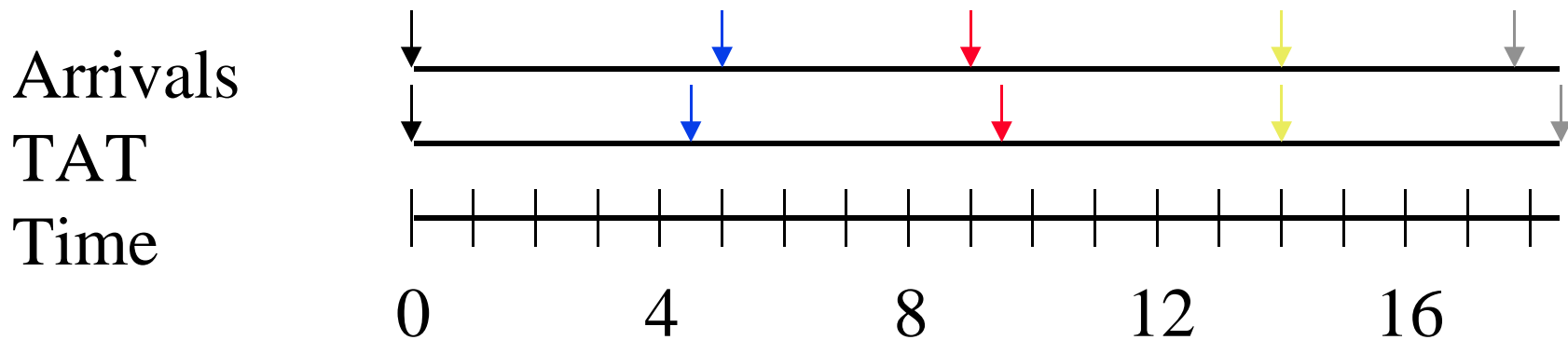X = Bucket contents at LCT
F = Bucket contents now

GCRA Examples

δ = cell time = 2.73 μs at 155 Mbps

q GCRA(4.5 δ, 0.5 δ):

Arrivals

TAT

Time

0   4   8   12   16

q GCRA(4.5 δ, 7 δ):

Arrivals

TAT

Time

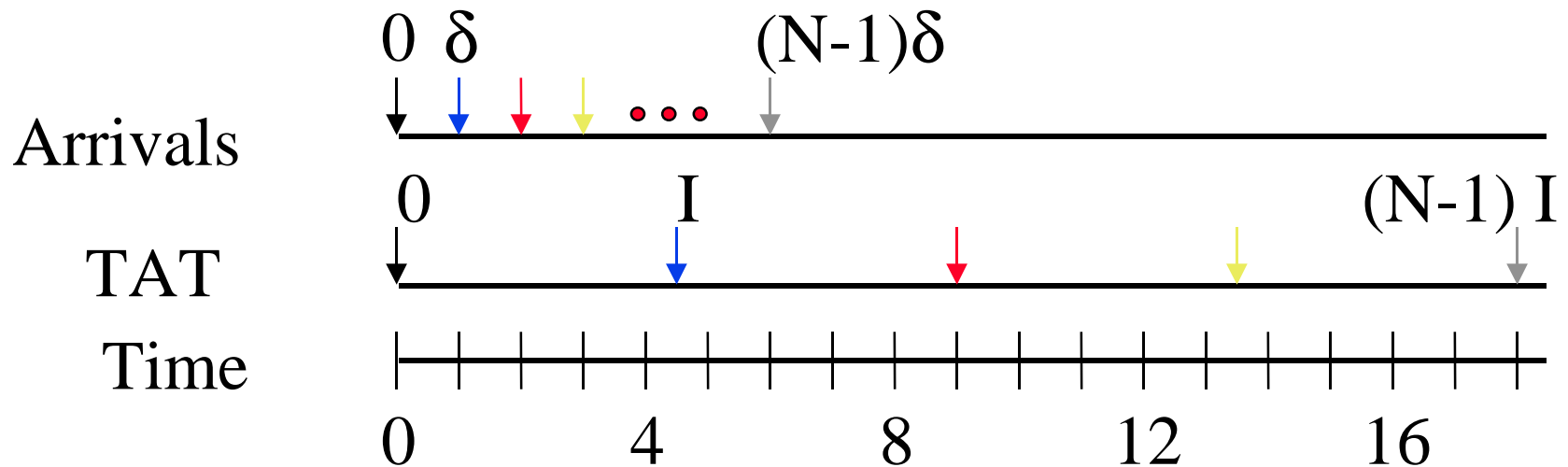0   4   8   12   16
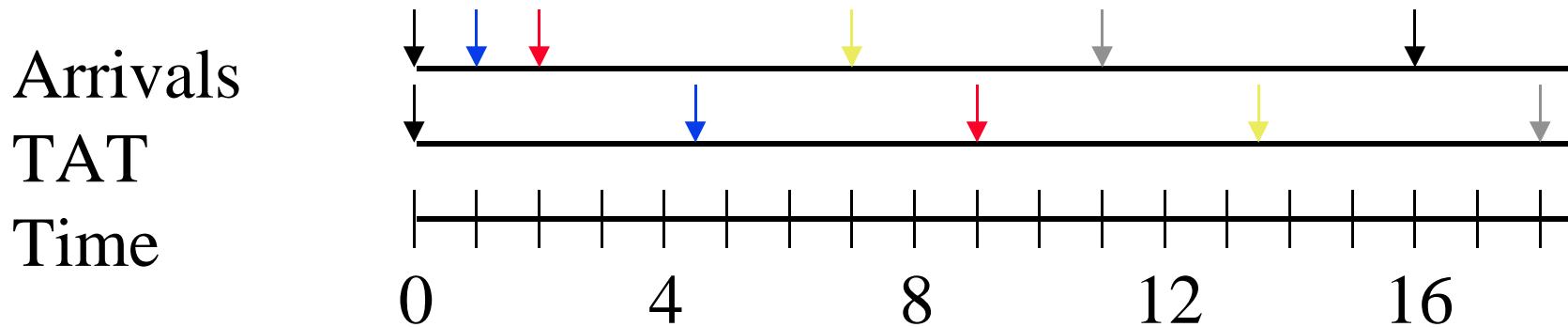
Maximum Burst Size

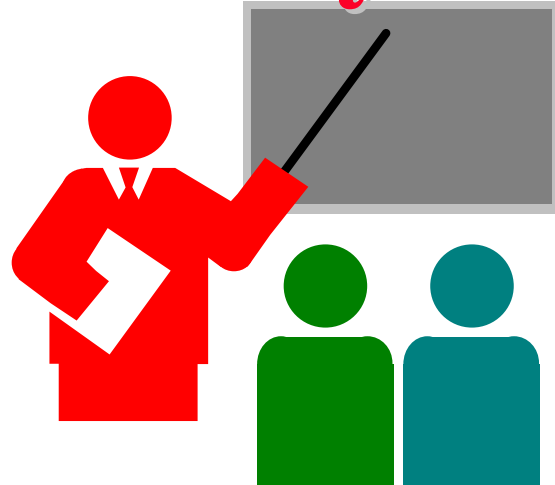δ = cell time at PCR, I = cell time at SCR, L=Limit

N = Maximum burst size

GCRA(I , L):

$$(N-1) I - (N-1)\delta < L$$

$$MBS = N = Int[1 + L/(I - \delta)]$$

$$L = (MBS-1)(I - \delta)$$

Summary

❑ Leaky bucket is used to smooth bursty arrivals

❑ GCRA requires increment (inter-cell arrival time) and limit (on earlyness)

❑ Two implementations: Virtual scheduling and leaky bucket

Homework

❏ Read pages 240-243 of Black's Emerging Technologies book 2nd edition.
(Or Read pages 505-513 of Stallings' ISDN and Broadband ISDN with Frame Relay and ATM)

❏ Conduct Lab exercise 1