Why is it needed?

- Real time services require guarantees for bounds on Cell Transfer Delay (CTD) and Cell Loss Ratio (CLR)
- Network is obligated to provide these for the connection lifetime along the complete path
- Measurement of QoS being provided is required for CAC, routing, congestion management algorithms
- Data is used to analyze trends and take proactive/reactive control measures
ITU-T Standard I.610

- Performance monitoring OAM cells can be inserted at path/channel level either as end-to-end or segment flow
- Each cell monitors a fixed block of user cells
- Capable of detecting errored blocks and the difference in number of cells transmitted and received
- Optional time-stamp field to measure round trip delays
- Cannot measure the one way delay and identify bottleneck links/nodes
- No algorithm specified as to how frequently the measurements should be made
Measuring CTD

- Delay can be measured accurately by pre-computing the fixed propagation delay and the switches providing the measurements of their queuing delays.

- Demands new processing capabilities at switches; the ability to timestamp cells at ingress and egress.

- Can also measure by estimating the parameters of remote clock using linear regression and correcting remote time-stamps.

- Convergence may be very slow and possibly inaccurate.
Estimating CLR

- CLR at a node can be estimated using a fuzzy system given the initial and asymptotic behavior.

- Algorithm sensitive to the choice of some initial parameters.

- Another way to estimate at a single buffer is to use measurements from small pseudo buffers to fit regression. The best source model is identified and the estimate is extrapolated to the real buffer size.

- Both do not address the issue of estimating the CLR end-to-end and identifying the bottlenecks.
Technical Approach

- Our experiment consists of two Cell Protocol Processor modules of the HP Broadband Series Test System, a delay and loss simulator and three ATM switches connected by fiber.

- One module is used as a source/sink for traffic and another as a front end for one of the switches.

- Future work involves
  - designing adaptive OAM cell strategies
  - investigate sending programs rather than cells to nodes
  - design simplest possible schemes for accurate monitoring of delay and loss