Quality of Service

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Framework for QoS

- Define the service contract
- Setup a connection that meets the requirement
- Deliver the QoS guarantee

ATM Service Classes

- Two Types:
  - Guaranteed Traffic Classes: Uses to transport real time data. Depending on the service class, connections are guaranteed certain parameters.
  - Best Effort Traffic Classes: Used to transport best effort traffic like TCP, FTP

Service Classes over ATM

- Guaranteed Traffic Classes
  - Constant Bit Rate Traffic (CBR): Sources specify their Peak Cell Rate (PCR), which is guaranteed. This service class is used to transport audio, raw video, stock quotes, anything that has a constant bit rate.
  - Variable Bit Rate Traffic (VBR): Sources specify their PCR, Sustained Cell Rate (SCR) and Maximum Burst Size (MBS). VBR sources vary between an average sustained rate and a peak rate. VBR is used to transport compressed video.
    - Real Time Variable Bit Rate Traffic (RT-VBR): Guaranteed low delay and low delay variation as well.
    - Non Real Time variable Bit Rate Traffic (NRT-VBR): No constraints on delay or delay variation

Service Classes over ATM

- Best Effort Delivery Classes
  - Available Bit Rate Traffic (ABR): Sources specify a Minimum Cell Rate (MCR) and a Peak Cell Rate (PCR). They receive a bandwidth in between. ABR specifies a rate based flow control scheme for congestion avoidance.
  - Unspecified Bit Rate Traffic (UBR): Plain old best effort traffic

Connection Setup

- Hosts specify their traffic characteristics and initiate a connection request.
- The connection request has two components
  - Non additive link attributes
  - Additive link parameters
- Intermediate switches check to see if they have the resources to support the new connection, without breaking existing guarantees (Admission Control). If they have the resources, it is setup, else a crankback mechanism is initiated to tear down the partially created connection.
Traffic Management

- **Traffic Shaping**: Performed at the periphery of the network where hosts connect to the network. Ensures that traffic flows stay within their contracted bounds.
- **Traffic Policing**: Performed by ATM switches. Monitors for errant sources to ensure that they don’t affect conforming flows.
- Both Traffic Shaping and Policing use the leaky bucket algorithm.

Traffic Management

- **Congestion/Flow Control**
  - **Early Packet Discard (EPD)**: If ATM switch congestion levels reach a threshold, prevent new packets from entering the switch.
  - **Trailer Packet Discard (TPD)**: If EPD doesn’t work, drop tails of packets. Cluster the drops in such a way that the fewest tails are affected.
  - **Link by Link Flow control**: Per VC flow control within the network. Two mechanisms (a) Rate based flow control and (b) Credit based flow control.
  - **End to End Flow control**: ATM Switches have no flow control. Flow control occurs on an end-to-end basis.

Leaky Bucket Shaping

- Data arrives into fixed sized buffers at a variable rate.
- Data leaves the buffers at a fixed rate.
- Parameters that specify the scheme:
  - Outgoing Data Rate
  - Size of Buffer

Leaky Bucket Shaping: Questions

- What happens if data temporarily arrives at a faster rate?
- What happens if data consistently arrives at a faster rate?
- What happens if a huge amount of data is sent back to back?