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?