QOS for Real-Time Services: Playout Delay and Application Control

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Overview

- TOMQAT
- Playout buffer adjustment
- Application control

TOMQAT

= TOtal Management of Service Quality for Multimedia Applications on IBC Infrastructure

2-year project (RACE 2116):

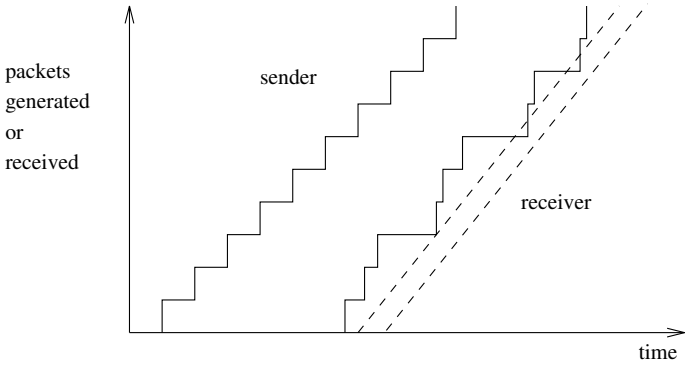
- audio and video applications over ATM networks (BALI)
- algorithms for mapping QoS parameters
- monitoring of QoS seen by multimedia applications (NM)
- user-perceived QoS
- control of multimedia applications
- …

TOMQAT Project Partners

Alpha Systems Analysis Integration	GR, Prime
Alcatel ISR	FR
Cray Communications	UK
GMD-Fokus	D
Intracom	GR
National Technical University of Athens	GR
Technical University Berlin	D
Telmat Communications	FR
Wandel & Göltermann	D

Playout Buffer Adjustment

- networks, operating systems introduce delay variations between sender and receiver (jitter)
- audio and video streams have to be resynchronized at the receiver



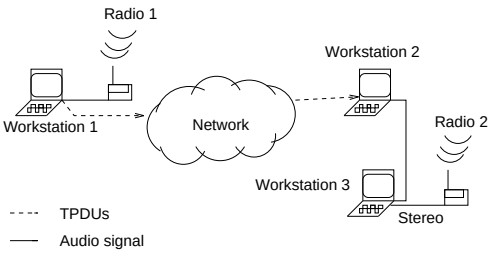
Playout Buffer Adjustment

- playout buffer introduces additional delay to compensate for delay variations
- playout delay is adjusted dynamically during talkspurts
- conference (interactive) mode: low delay, some late losses
- lecture mode: longer delay, few losses
- use simulation

→ general-purpose module for A/V applications

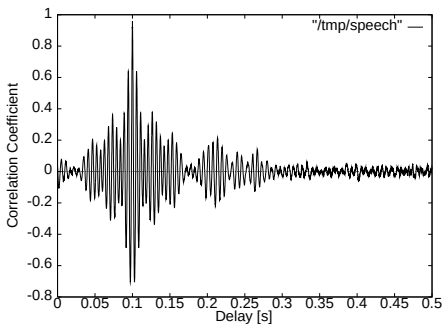
Estimation of End-End Delay

- clocks are not synchronized
- unknown delays in operating system
- → network delay measurement using cross correlation of audio signals



Estimation of End-End Delay

Cross correlation of a recorded stereo signal

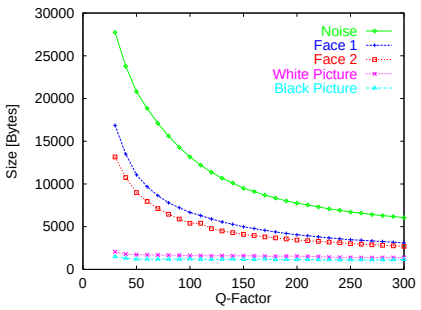


Application Control: What?

- Idea: provide service class with adjustable QOS
- used to electric tariffs for water heaters
- similar to “brownouts”
- used by electric utilities for blackout prevention
- must work for multicast
- must scale to 10^7 applications

Application Controlability

Adjust bandwidth of M-JPEG application using Q factor:



- scales linearly with frame rate, image size
- audio: encoding, number of channels, sampling rate, …
- generally: factor 2 to 3 usable range

Aside: RTP

RTP: real-time transport protocol has QOS feedback channel

- packet loss → congestion
- delay variation (jitter)
- approximate end-to-end delay

Via *IP multicast* to all session participants

Application Control: How?

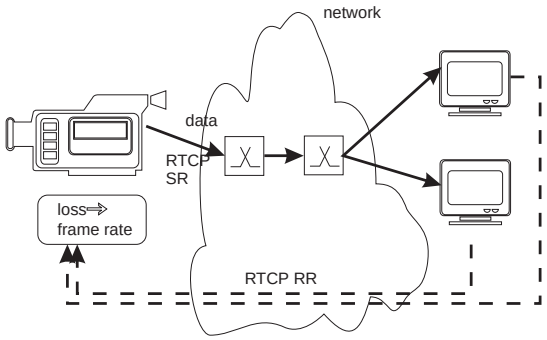
Several options:

- application → network manager
  - scales poorly
  - doesn't localize
- RTP QOS options via multicast
  - multicast for all

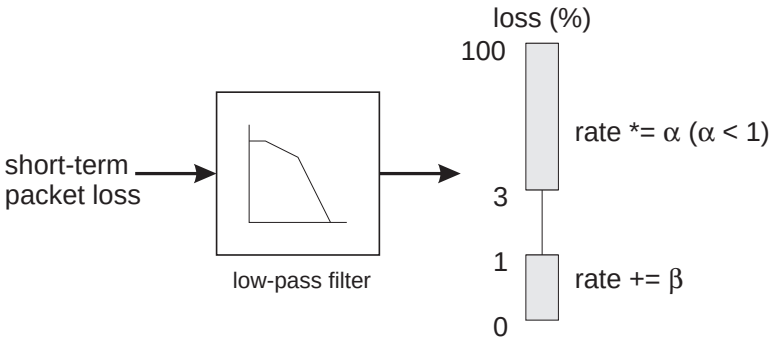
Application Control: How?

- RTP QOS (or similar) via unicast to sender
  - implemented (roughly) in ivs video tool
  - need multicast anyway to estimate group size
  - others may need network QOS for fault detection
- ATM EFCI, RM (resource management) cells
  - similar to ABR
  - maybe same mechanism in switch?
  - adjustment speed?
  - multicast?

RTP Feedback Mechanism



Control Algorithm



Conclusion

- playout delay → same application from N-ISDN to B-ISDN
- delay measurement → overall system performance
- application control → best feasible QoS
- in progress: experimental evaluation