Approaches for a Web-based Initiation of Quality-based Communication

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Introduction

Objectives
- Simple QoS support for legacy (non QoS-aware) applications
- User should be able to influence QoS selection

Assumptions about QoS signaling
- Supports end-to-end reservations
- On a per-flow basis
- Sender-initiated
- Feasible: scalable, low setup latency

Focus
- Derive new requirements for signaling
- Determine limitations (keep signaling simple)

Based on own QoS signaling
- DMSP – Domain Manager Signaling Protocol
All QoS-aware - Reverse Path Signaling by Application

Client’s DS Domain

BB\textsubscript{C} Client

\textbf{SETUP} rtsp://…
Transport: acceptable Protocols
QoS: acceptable SSOs

RTSP/1.0 200 OK
Transport: selected Protocol
QoS: selected SSO

\textbf{PLAY} rtsp://…
Stream Data

ACK Stream Data

\textbf{SET\_PARAMETER} rtsp://…
QoS: new (reduced) QoS

Server’s DS Domain

BB\textsubscript{S} Server

\textbf{SrvEstReq}
SSOs for Downstream

\textbf{SrvEstRsp}
Handle=S1

\textbf{SrvChgReq}
Handle=C1
New SSO for Upstream

\textbf{SrvChgRsp}
Handle=C1

\textbf{SrvEstRsp}
Handle=C1

\textbf{SrvChgReq}
Handle=C1
New SSO for Upstream

\textbf{SrvChgRsp}
Handle=C1

DS: Diffserv
BB: Bandwidth Broker
Domain: Diffserv Domain (Autonomous System)
All QoS-aware – Reverse Path Signaling via DMSP

SETUP rtsp://…
Transport: acceptable Protocols
QoS: acceptable SSOs, Resp=Client

PLAY rtsp://…
Stream Data

RTSP/1.0 200 OK
Transport: selected Protocol
QoS: selected SSO
Legacy Client

Client not QoS-aware
- Upstream reservation (for feedback) must be initiated by Server

Establish reservation for reverse direction
- Domain-hop by domain-hop
  - Probably wrong path due to asymmetric routes
- End-to-end reservation for reverse direction
  - Trigger some node in receiver domain

Find/contact appropriate originator (aka BB of client domain)
- Well-known anycast address (like subnet-router anycast address)
- New DNS resource record
  - Need authorization
  - Exposed to DoS attacks
  - Might not pass firewalls
  - In case of DNS additional messages/delay for resolution process
- DMSP as transport layer (use DMSP’s User-to-User Information)
  - Slower due to hop-by-hop communication
  - Increased signaling load on intermediate nodes
Only Server QoS-aware – DMSP as Transport Layer

Client's DS Domain

\[ B_B^C \]

Client

Server's DS Domain

\[ B_B^S \]

Server

**RTSP**/1.0 200 OK
Transport: selected Protocol

**PLAY** rtsp://…

Stream Data

ACK Stream Data

** SETUP rtsp://…**
Transport: acceptable Protocols

**SrvEstReq**
SSOs for Upstream

**SrvEstRsp**
SSO Down, Handle=S1
U2U: SSO Up, Handle=C1

**SrvEstReq**
SSOs for Downstream
U2U: SSOs for Upstream
Legacy Client & Server - Web-based initiation

Neither Client nor Server are QoS-aware
- Reservations must be initiated by a third party
- User should be able to control QoS

Web-based service initiation
- Many sessions are initiated via the ubiquitous Web interface
  - „Misuse“ this start phase for QoS
- Extend Content Negotiation to cover QoS
  - Web Server provides Information about document
  - Browser provides user preferences
- Agent-driven
  - Hyperlinks accompanied by HTML/XML Tags describing their QoS requirements
  - Selection algorithms to be executed by browser
  - Browser selects QoS and triggers signaling
- Server-driven
  - Browser generates HTTP extension headers according to user preferences
  - Web server selects QoS and triggers signaling
Problems

Ephemeral ports & transport protocol negotiation
- No knowledge of port number unless involved in data communication
- Ways to obtain knowledge
  - Application specific proxy
    - not general
  - Watch client’s socket(s)
  - Wrapper library intercepting client’s socket operations
    - nasty
- Control legacy application to use a given port, i.e., command line

End of Reservation
- Reservation termination (by originator/responder only)
  - Obtain information about end of communication between sender & receiver
    - Wait for process termination
    - Watch socket
- Reservation abort (by any node involved)
  - Garbage collection by first hop router
    - No data packets during a certain period of time
    - In case of soft-state originator/responder: when refreshes are missing
    - Both waste resources for some time
Legacy Client & Server - Web-initiated Reservation

Browser's DS Domain

Client

BB_C

Browser

GET http://www/...

QoS: Dst=Client
Service=SSOs

invoke with rtsp://...
specify transport & ports

SETUP

PLAY

watch client's socket

1a. command line

1b. watch socket/wrapper library

1c. application specific proxy

Browser's DS Domain

Server's DS Domain

WWW

BB_S

Server

SrvChgReq
both directions
SrvChgRsp

SrvChgReq
both directions
SrvChgRsp

SrvChgReq
both directions
SrvChgRsp

SrvTrmReq
both directions
SrvTrmRsp

SrvTrmReq
both directions
SrvTrmRsp

SrvAbtReq
downstream

SrvAbtReq
downstream

want for
RTSP Transport-Header

look for RTSP Transport:Header

data stream

1a-1c: alternatives for obtaining ports
2a-2b: teardown alternatives

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http://www.tm.uka.de/
Conclusions - Outlook

Benefits

- Only two modified applications needed: browser and web server
  - Alternatively modified proxy instead of modified browser
- QoS support independent of target application
- Possible migration strategy from no QoS to full QoS

Limitations

- General support for ephemeral ports is costly/requires ugly measures
- Transport not adopted to QoS
  - Application might wrongly reduce rate in case of packet loss

Requirements to QoS signaling

- Support third party initiated reservations (possibly limited to same domain)
- Work as “transport protocol” (for those third party initiations)

Future Work

- Implement QoS-aware browser and web server
  - Mozilla and Apache
- Support for ephemeral ports
  - Selected applications for A/V-streaming
- Testbed with DSDM prototype
  - Latency and user perception