

Congestion Control for Streaming Media over Internet

Oztan Harmanci

Outline

-
-
-
-

Streaming Data

- Predictable jitter and delay
- Certain bandwidth
- Multicast/Unicast
- Efficient encoding/limited complexity
- Real time/stored
- Video/audio: precision is not vital

Why Control Congestion?

- No or little support by current coders
 - RealPlayer, windows media player, etc
- Network stalls if there is no congestion control
- Weighted round robin is not a solution

Congestion Control for Streams

- Two basic mechanisms involved
- Rate control:
 - Determines the required coding rate
- Rate shaping:
 - Adapts the rate of the stream to target rate

Source Based Rate Control

- Probe based
 - Probe the network for more bandwidth
- Model based
 - Throughput of a conformant TCP

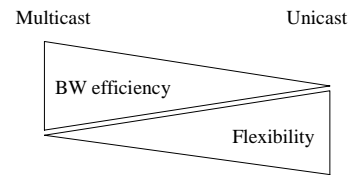
$$\lambda = \frac{1.22 \times MTU}{RTT \times \sqrt{\rho}}$$

TCP Friendliness

- TCP traffic dominates internet
- TCP users play by the rules
 - Greedy but cooperative
- What if you don't?

Source based rate control

- Efficiency vs. Bandwidth



- Receiver side rate control

Receiver Based Rate Control

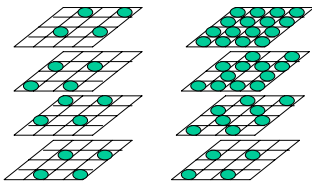
- Sender is unaware of network
- Applied to multicast
- Model based
 - Similar to sender side
 - TCP friendly
- Probe based

Receiver Side Probing

- Receiver driven layered multicast
- Sender sends layers of streams
- Two types of layers
 - Self buildable
 - Cumulative

Layers

- Example layering:

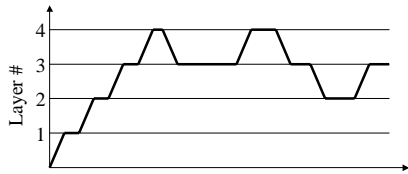


Receiver Driven Layered Multicast

- Receivers join by “experiments”
- Experiments are performed at well-chosen times
 - Join timers
- IP multicast and IGMP take care of multicasting

RDLM in Action

- Example session



RDLM Issues

- More users → more experiments → more congestion due to experiments
- Experiments effect other experiments
- Shared learning
- Quality difference

Rate Shaping

- How to adjust to target rate?
- Real time/stored video/audio
- Keep server side simple
- Soln.: Filters

Filters

- Additional processing of stream
 - Drop layers
 - Recode at target rate
 - Drop frames

Filters(ctn'd)

- End to end
 - Between application layer and transport/network layer
- Can be on routers
 - RTP already includes concept of bridges

Filter Issues

- Additional burden to routers
- Delay should be low for real time streams
- QoS

Conclusion

- ...
- ...
- ...