Adaptive Playout Scheduling Using Side Information in Legacy LAN

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Feb 7, 2001
Outline

- Obtaining side information from legacy LAN
- Adaptive playout scheduling using side information
- Performance and results
- Analysis of results
Establish and terminate a TCP connection

Establish a connection: three-way handshaking

Client

- SYN
- SYN ack
- ack

Server

- FIN
- ack of FIN

Terminate a connection: four steps

Client

- FIN
- ack of FIN
- ack of FIN

Server
Side information from T2 and delay estimation

- $d_{99} = W\lambda N_0 / R$
- With $N$ active data connections, according to rule of thumb
  $d_{\text{max}} = WN / R$
- $W = \{1, 2, 4, 8, 16, 32, 64\}$ packet
- $N \geq 0$, $N_0 = 16$
- $R = 10\text{Mb/s}$
Improved playout scheduling algorithm using side information

States of number of active connections

Maintain a history of past delays for each state

State i-1: ... ...
State i: 10 | 12 | 8
State i+1: 32 | 29 | 39
State i+2: ... ...

Set initial statistics to be estimated delay, and keep updating.
Determine playout time from past statistics

Calculating percentile using order statistics

\[ E(W_r) = \frac{r}{n+1} \text{, with } W_r = \text{1-loss rate} \]
\[ r = \left\lfloor W_r(n+1) \right\rfloor \]
\[ d_{\text{estimate}} = d_r + (d_{r+1} - d_r)[(n+1)W_r - r] \]

Empirically,
\[ d_0 = d_1 - 2\sigma_d \]
\[ d_{n+1} = d_n + 2\sigma_d \]
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Performance comparison (1)

L=20%, W={4, 16, 32, 64}
Performance comparison (2)

W=16, L=\{10, 20, 30, 40\}\%
Performance analysis, $W=16$, $L=20\%$
W=32, L=40%

Side information does not help much when delay statistics weakly correlate with the # of connections

This takes place at high load, when too many TCP sources in contention
Conclusions

- In legacy LAN, performance gain is obtained using adaptive playout scheduling, even when TCP window size control is in force.
- Side information helps adaptive scheduling in general.
- Gain from side information depends on the deterministic relationship between the # of TCP connections and delay statistics.
- TCP window size control is necessary to keep sources from contending aggressively.