Multisource Receiver-driven Layered Multicast

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1. Outline of talk

- Research: streaming (=watching) multiple videos over IP network (e.g., in distance monitoring, etc)
- Problem: cooperative rate-control
- Contribution: Priority-based Autonomous Control (PAC)
2. Streaming & IP Multicast

- **IP Multicast**
  
  **Sender**: send data to a group address
  
  **Receiver**: subscribe to (=join) the group
  
  **Router**: forward data to the subscribers

  Rate controlled by sender
3. RLM & layered coding

- **Receiver-driven Layered Multicast**
  - Sender: send layered-coded data to groups (one layer, one group)
  - Receiver: select groups (=layers) to join

sender controls rate

layered data

IP network

OK

OK

OK

receivers
4. Previous studies on RLM

- McCanne et al., ACM SIGCOMM 96
- Rate-control: w/o subjective consideration, w/o receiver feedback, TCP-friendly, CPU-load based, ...

basic join-experiment (McCanne et al.)
5. Multisource RLM

- Applications
  - distance monitoring/caring
  - multi-point conferencing
  - multi-camera based live streaming

- IP network

- Senders

- Receiver
6. Cooperative rate-control

- P1: timing to join/leave
- P2: priority-based rate-control
7. Solving P1 (previous study)

- Wait for a random time, or
- Try joining or leaving in turn

![Diagram showing the relationship between number of groups and time with steps indicating join and leave intervals in turn.](Image)
8. Solving P2 (this study)

- Priority-based Autonomous Control
- Priorities are given to all videos.
- Resource = network bandwidth
- Control try-interval for each video & start from video with longer interval.
9. Overview of PAC

- Control thread (determine try-intervals)
- Run/pause
- Priorities given by user
- Report packet loss

- IP network
- Autonomous RLM

- Video 1
- Video 2
- Video n

- Thread 1
- Thread 2
- Thread n
10. Simulation test

- \#video = 3, priority = 5, 3, 2 (all)
- \#layer = 6, rate = 300Kbps (all)
- $T = 30s$ (control period)
- Join: if packet loss rate $\leq 1\%$
- Leave: if packet loss rate $\geq 5\%$

Sender: Cisco 2501, 4Mbps buffer FIFO, mode PIM Dense

Receiver: Cisco 2514
11. Simulation result

- Wrpt priority
- Bad join (#2)
- #2 is less stable
- Congestion
12. Conclusion

- Works as expected for most time.
- Unstable in some cases.
13. Future work

- More detailed study (by software emulator such as the NS)

Problem with router's buffering method
14. Other remarks

- Easy if resource is the CPU load.
- Congestion may be not for all.
- Should consider TCP streams too.
- Real IP Multicast is not easy :-( ...
15. Simulation details

- Java based program
- Raw data only (no special codec)