CMPT 885-3: Special Topics: High-Performance Networks

Final Project Demo – Spring 2002

Smart Queuing: An Adaptive Approach

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Overview

- Motivation
- Queuing Schemes
- Smart Queuing
- Implementation
- Summary

Motivation

- Explosive growth of Internet
- Need to utilize network efficiently
- Control congestion & provide QoS
- Use queuing schemes
- Dynamic/chaotic Internet
- Answer: Smart Queuing

Queuing Schemes (1)

- FIFO
  - ✓ Simple and predictable
  - × Cannot provide differentiated service
- Priority Queuing
  - ✓ Provide differentiated service
  - × Starving of low priority traffic

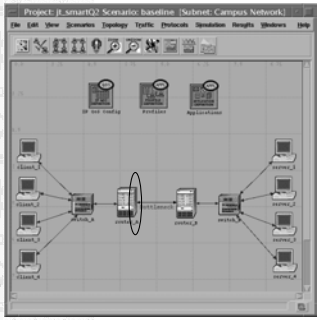
Queuing Schemes (2)

- WFQ
  - ✓Fair
  - × Complex and low-speed
- Custom Queuing (CBQ)
  - ✓Guaranteed output bandwidth for each class
  - × Problem with misbehaving user in same class

Smart Queuing

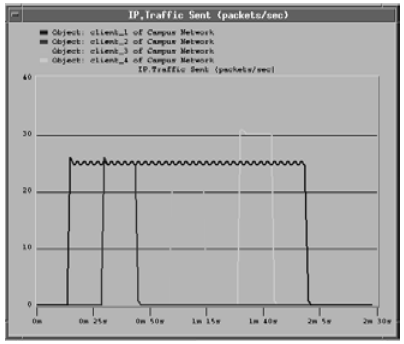
- Maintain a set of parameter
  - Number of flows
  - Quality of Service
  - Rates, packet size
- Decide which queuing is the best
  - Fairness, loss, delay
- Dynamically switch to it

Implementation (1)

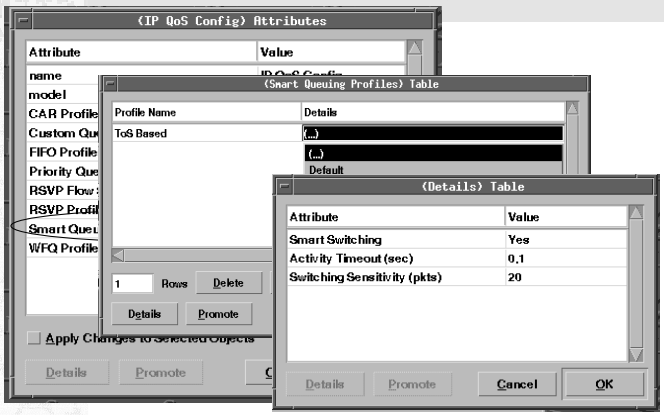


- Simple IP network
- UDP traffic with QoS
- Different characteristics
  - C1: 25 pkt/s (Hi Pr.)
  - C2: 25 pkt/s (Hi Pr.)
  - C3: 20 pkt/s (Low Pr.)
  - C4: 30 pkt/s (Hi Pr.) [misbehaving]
- Link capacity
  - 56 kbps, ~42 pkt/s

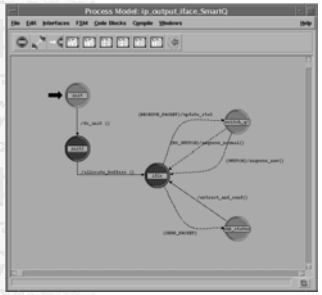
Clients Send Rates



Smart Settings

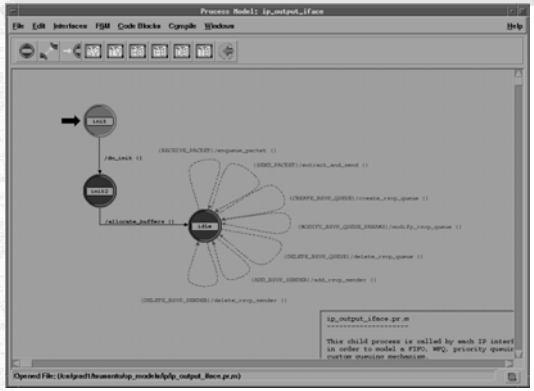


Implementation (2)

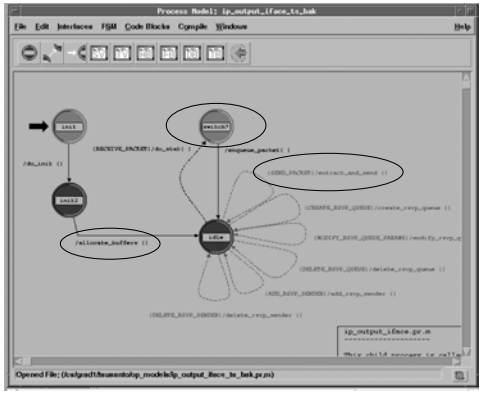


- Modify “ip_output_iface” process model
- Create multiple queuing structure (qm_info)
- Examine current traffic
- Is current method ideal?
  - No: enqueue to new method
- Synchronization issues

Original ip_output_iface



Modified ip_output_iface



Switching Module (do_stat)

- At each packet received record statistics
- if 1/(curr_pkt_time – last_pkt_time) > allow_rate then misbehave = true
- for each row, if curr_pkt_time – last_pkt_time > timeout then active = false
- Note: allow_rate is fixed according to tos

source address	tos	last pkt time	allow rate	active	misbehave

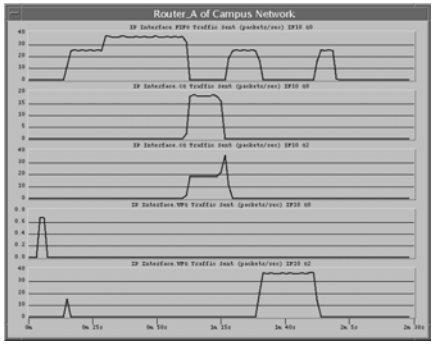
Switching Module (switch?)

- for all active users
  - if misbehave then use WFQ
  - else if users with multiple tos then use CQ
  - else use FIFO
- if need to switch
  - increment pkt_counter until it is greater than sensitivity, then switch
  - else reset pkt_counter

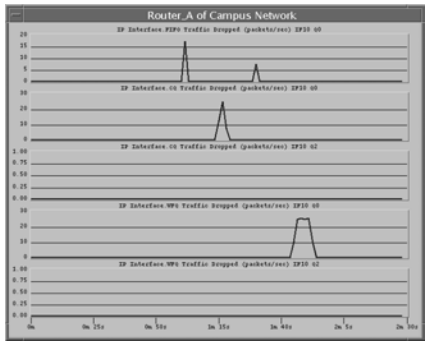
Switching Module (enqueue)

- Attempted
  - if curr_queue is not empty, put pkt to buffer
  - else if curr_queue is empty && buffer is not empty, flush buffer contents to next_queue
  - else put pkt to next_queue, set curr_queue = next_queue
- Implemented
  - if old queue is not empty, drop packet
  - else put pkt to next_queue, set curr_queue = next_queue
- dequeue: retrieve pkt from current queue and send

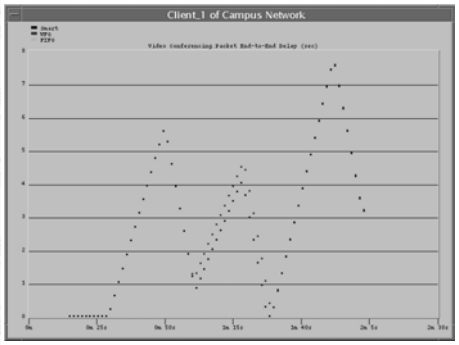
Smart Queuing In Action (1): Packets send from each queue



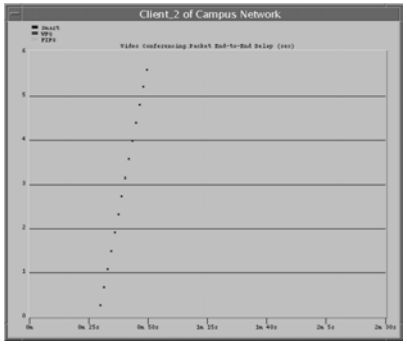
Smart Queue In Action (2): Packet dropped by each queue



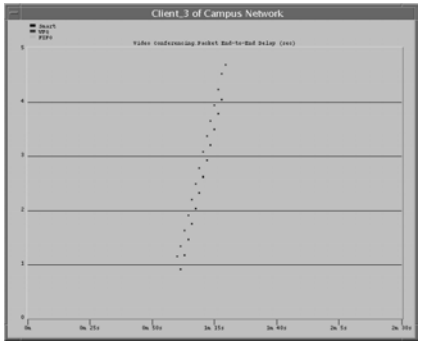
Delay Comparison: Client 1



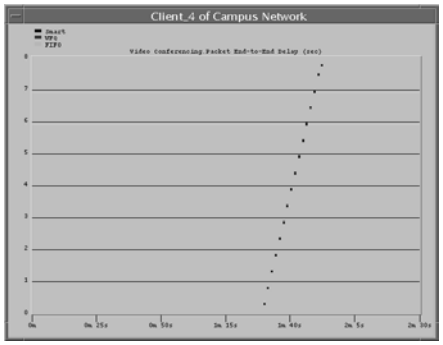
Delay Comparison: Client 2



Delay Comparison: Client 3



Delay Comparison: Client 4



Conclusion

- Is “Smart Queuing” better?
  - Yes!

Future Works

- More Verification
- Transition Buffer
- Switching:
  - Lookup tables, Pre-processing via simulation
- Traffic:
  - Incorporate TCP traffic, active queue management (RED)
- Queuing Mechanisms:
  - Incorporate other queuing schemes (i.e. DWRR, VClock)

References

- N. Alborz, and L. Trajkovic, “Implementation of VirtualClock Scheduling Algorithm in OPNET”, Proceedings of OPNETWORK 2001, Washington DC, Aug. 2001.
- Chengyu Zhu, Oliver W.W.Yang, James Aweya, Michel Ouellette, and Delfin Y.Montuno, “A Comparison of Active Queue Management Algorithms Using OPNET Modeler”, Proceedings of OPNETWORK 2001, Washington DC, Aug. 2001.
- Chuck Semeria, “Supporting Differentiated Service Classes: Queue Scheduling Disciplines”, White Paper, Juniper Networks. www.juniper.net/techcenter/techpapers/200020.html
- Costin Iancu, Anurag Acharya, “A Comparison of Feedback Based and Fair Queuing Mechanisms for Handling Unresponsive Traffic”. Proceedings of ISCC’ 2001 – Sixth IEEE Symposium on Computers and Communications, Hammamet, Tunisia, July 3-5, 2001.
- Goncalo Quadros, Antonio Alves, Edmundo Monteiro, Fernando Boavaida, “How Unfair Can Weighted Fair Queuing Be?”, Proceedings of ISCC’2000 – Fifth IEEE Symposium on Computers and Communications, Antibes, France, July 4-6, 2000.