ENSC 833-3 : NETWORK PROTOCOLS AND PERFORMANCE

FINAL PROJECT PRESENTATION

Spring 2001

ATM Traffic Control Based on Cell Loss Priority and Performance Analysis

Shim, Heung-Sub

Shim_hs@hanmail.net

Contents

- Introduction
  - Overview of ATM
  - Cell loss priority based queuing schemes
    - Push-out, partial buffer sharing, buffer separation
- Simulations
  - Implementation
  - Results
- Conclusion and discussion
- References

Introduction

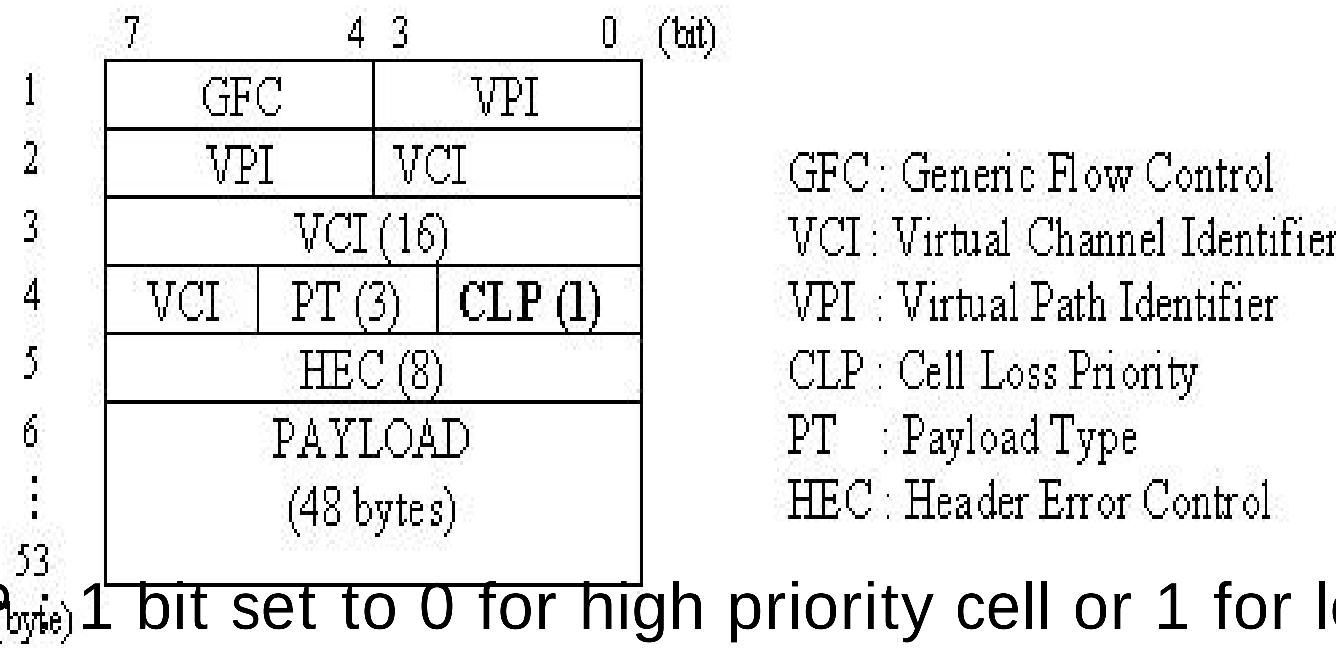
- Overview of ATM (Asynchronous Transfer Mode)
  - Ultimate solution of BISDN (Broadband ISDN)
  - Connection-oriented service
  - 53-byte fixed packet called cell
  - Transmission rate : 25Mbps ~ 2.5Gbps
  - Five service categories

    : CBR, rt-VBR, nrt-VBR, ABR, UBR
  - QoS parameters

    : Cell loss, source traffic rate, delay, delay jitter etc.

Introduction (cont.)

- ATM cell structure



- CLP : 1 bit set to 0 for high priority cell or 1 for low priority
cell, which applies to several buffer priority schemes

Introduction (cont.)

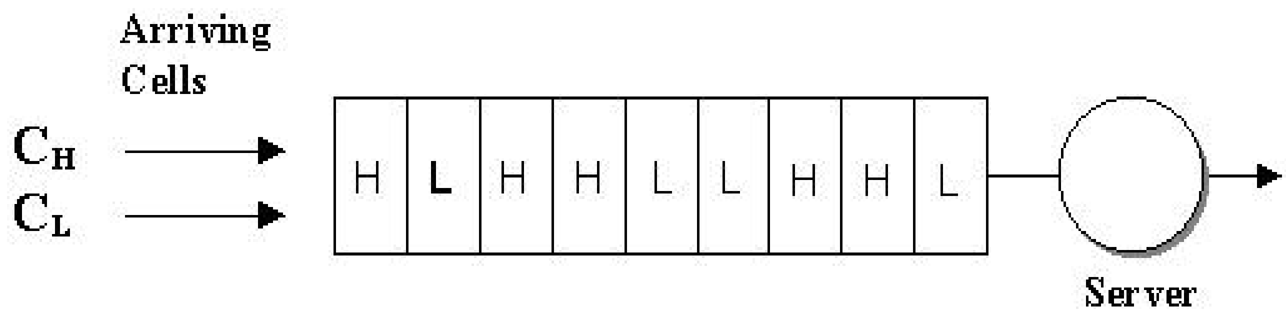
- CLP based queuing schemes
  - Priority queuing

    - Appropriate in cases where WAN (Wide Area Network) links are congested from time to time, but unnecessary otherwise because of extra processes required and performance degradations for low priority traffic.
  - Schemes

    - Push-out, partial buffer sharing, buffer separation, hybrid and so on

Introduction (cont.)

- Push-out
  - Diagram

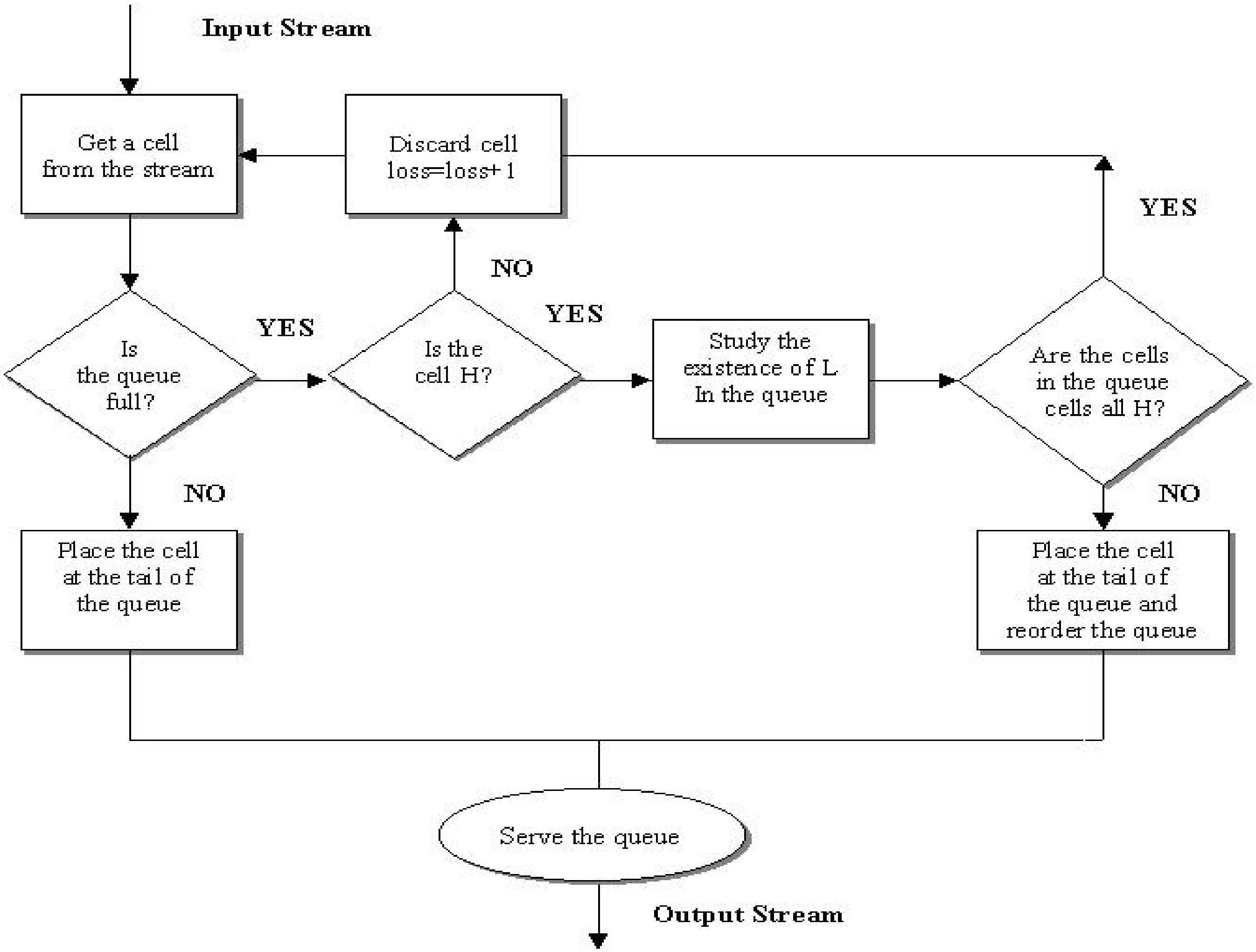


- If the buffer is full and a high priority cell (CLP = 0) arrives, the last low priority cell, which already resides in the buffer, will be pushed out and lost. All incoming low priority cells arriving during congestion will be discarded.

- Otherwise, the queue operates based on FCFS.

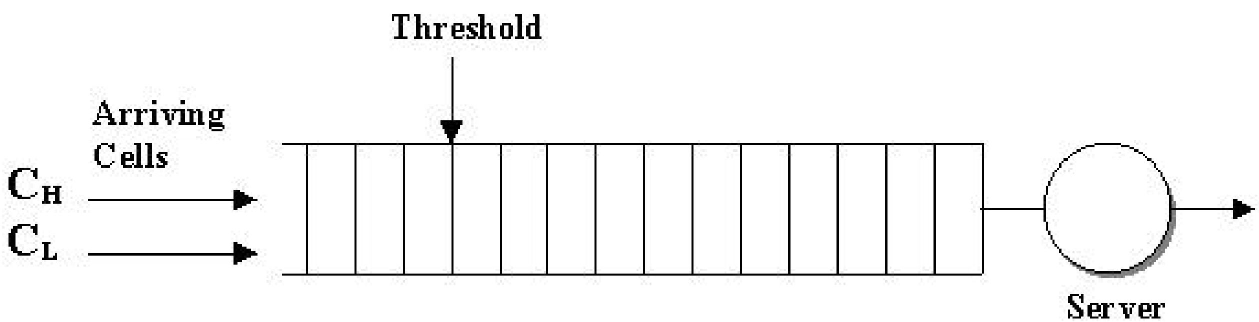
Introduction (cont.)

- Flowchart



Introduction (cont.)

- Partial buffer sharing
  - Diagram

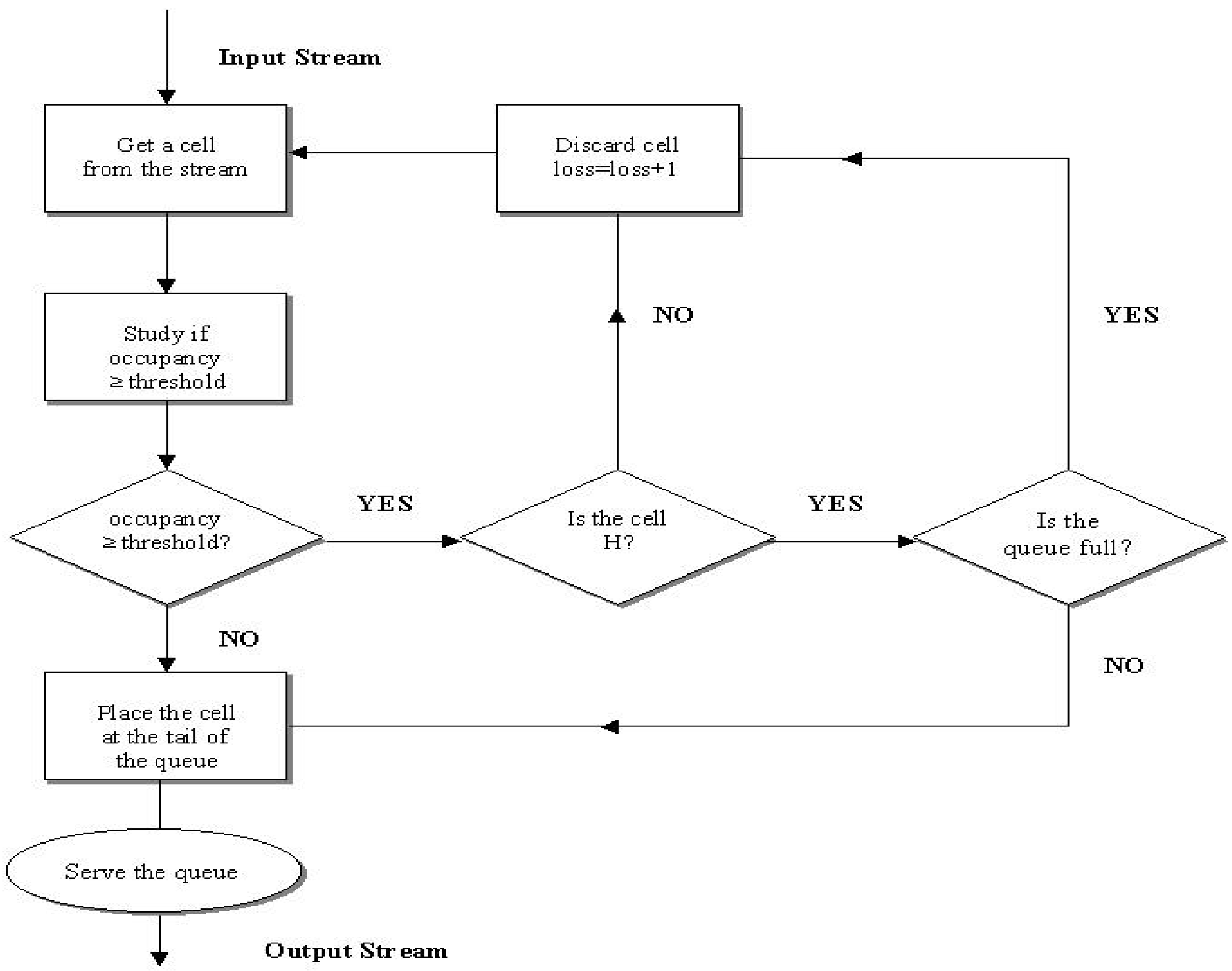


- Once the threshold is met, any incoming low priority cells are discarded. On the other hand, high priority cells can access the buffer unless it remains full.

- Otherwise, the queue operates based on FCFS.

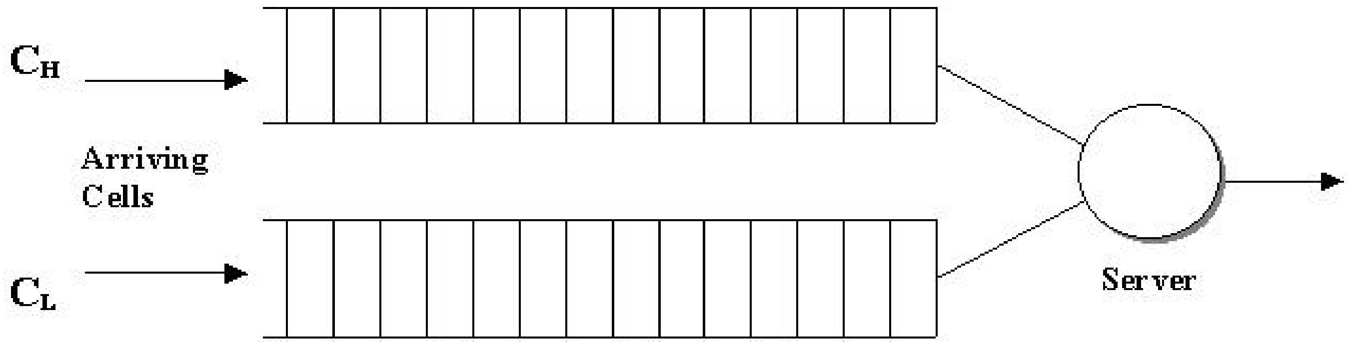
Introduction (cont.)

- Flowchart



Introduction (cont.)

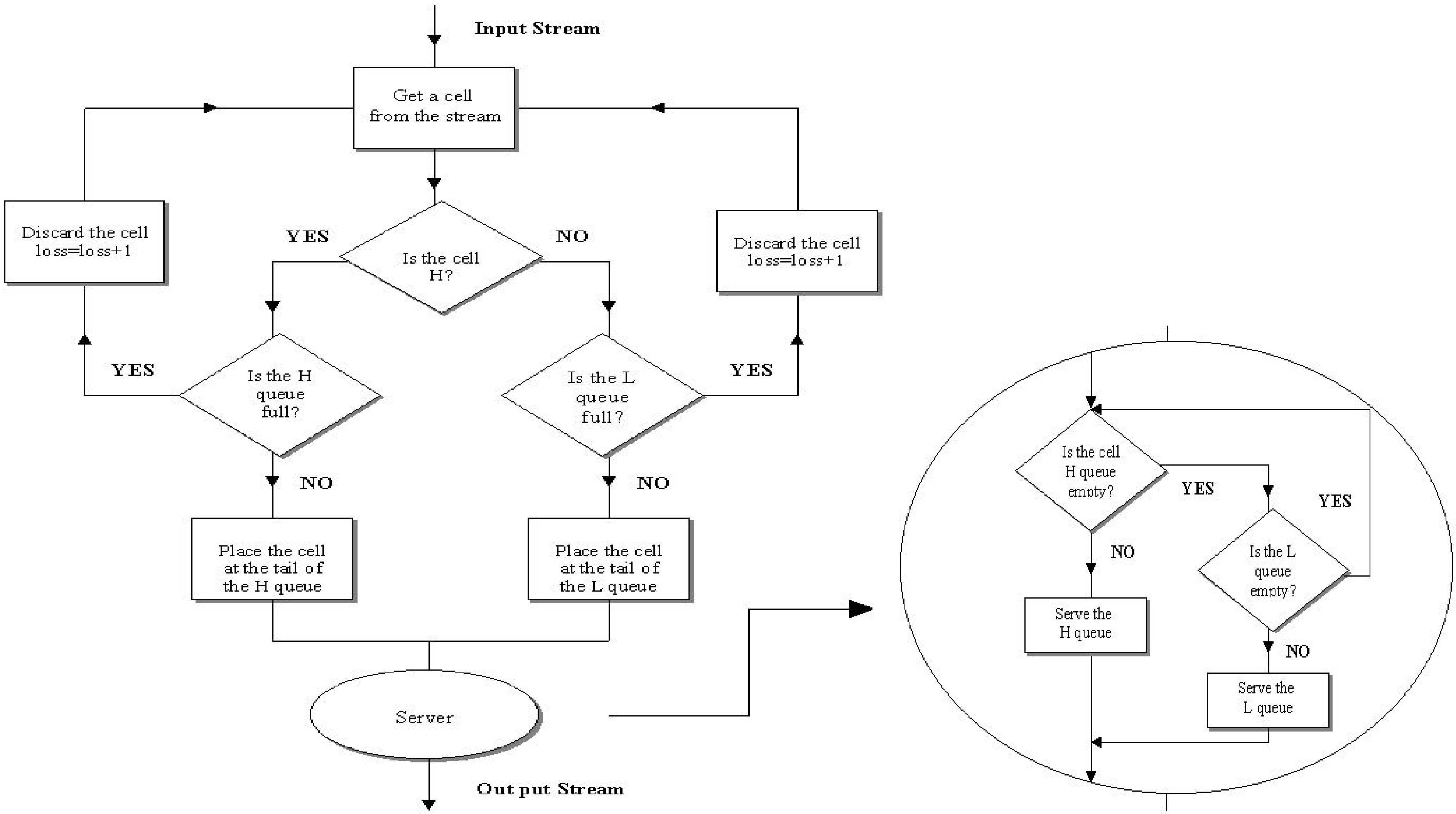
- Buffer separation
  - Diagram



- Two separate buffers, one of which is for high priority cells and the other for low priority cells.
- The high priority queue is always emptied before the low priority queue is served.

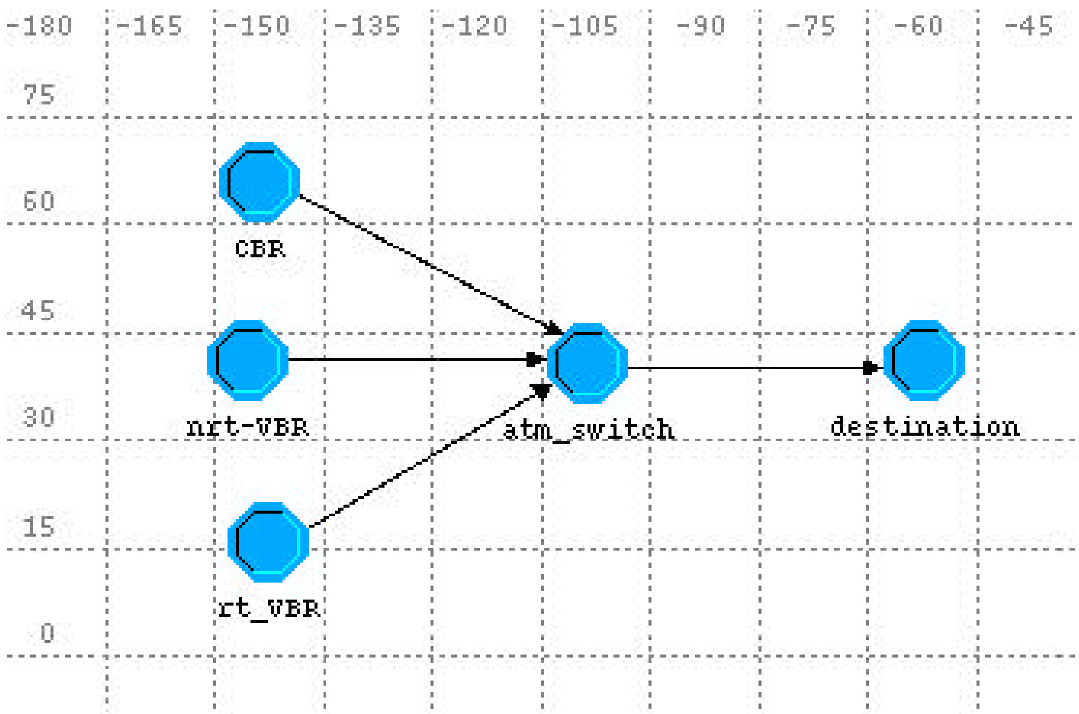
Introduction (cont.)

- Flowchart



Simulations

- Implementation
  - Topology



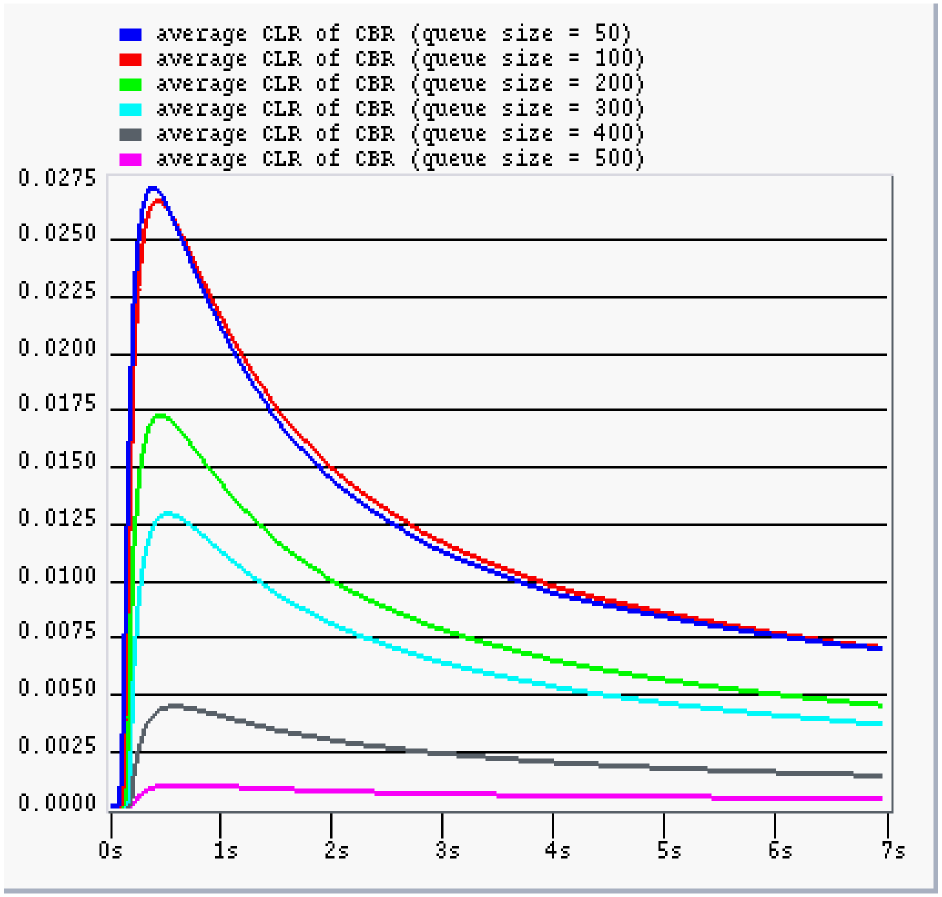
Simulations

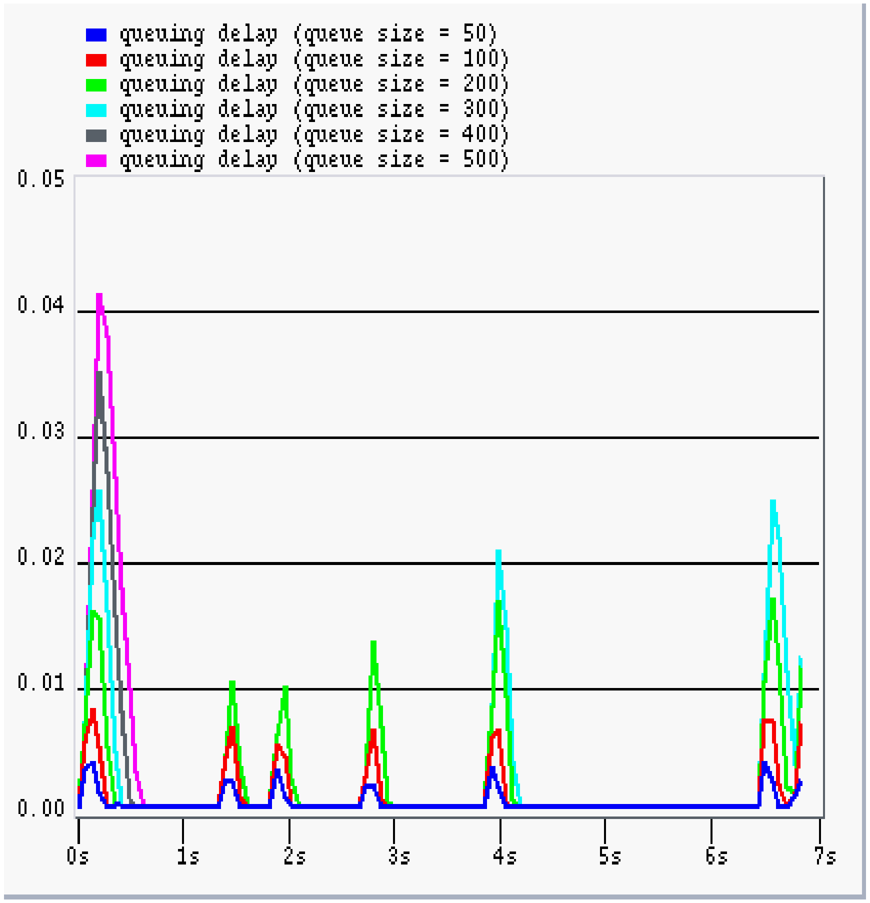
- Simulation environment

- Topology remains the same through simulations.
- Switch processes incoming cells at 10613 cells/sec (? 4.5 Mbps = 3 $\times$ DS1)
- QoS to be secured is 0.0075 for avg. CLR and 0.01 secs for max. queuing delay.
- Loads
  - Intended load
    - CBR at 3537 cells/sec (? DS1) and nrt-VBR at 3537 cells/sec (average)
    - rt-VBR at 2358 cells/sec (average) for off-duration and at 7075 cells/sec (average) for on-duration
    - Total of 70151 cells expected during a simulation
  - Actual load (collected during simulations)
    - CBR at 3537 cells/sec and nrt-VBR at 3510 cells/sec (average)
    - rt-VBR at 2355 cells/sec (average) for off-duration and at 4800 cells/sec (average) for on-duration
    - Total of 67953 cells generated during a simulation

Simulations

- Results
  - Push-out

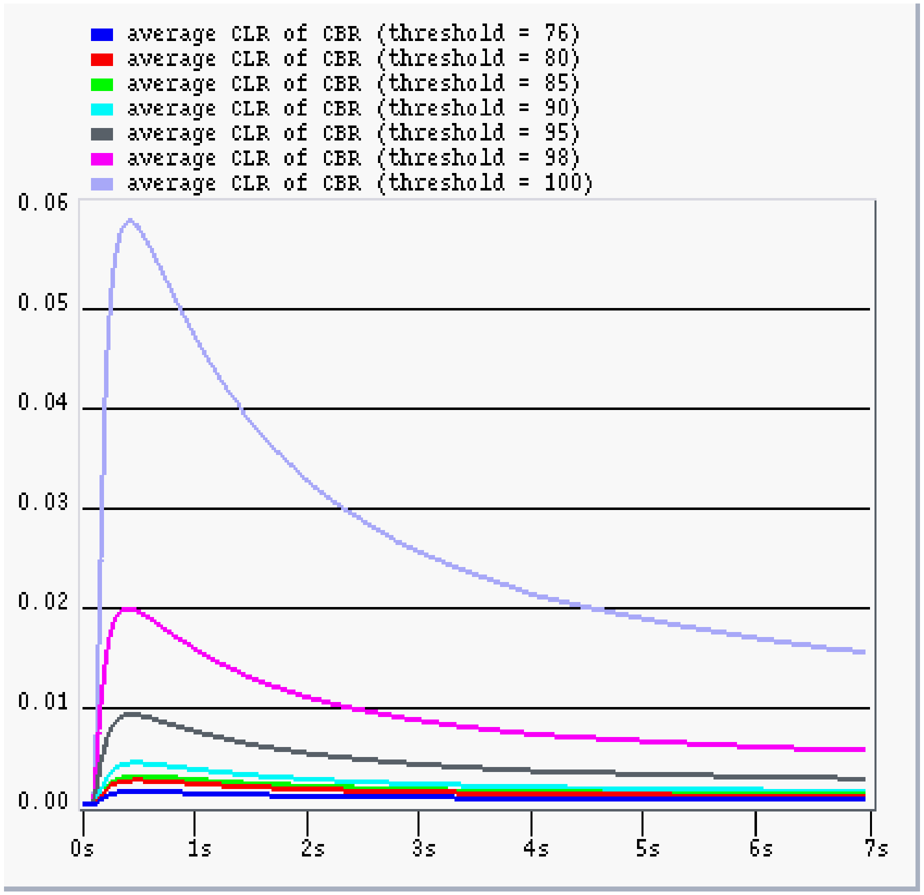


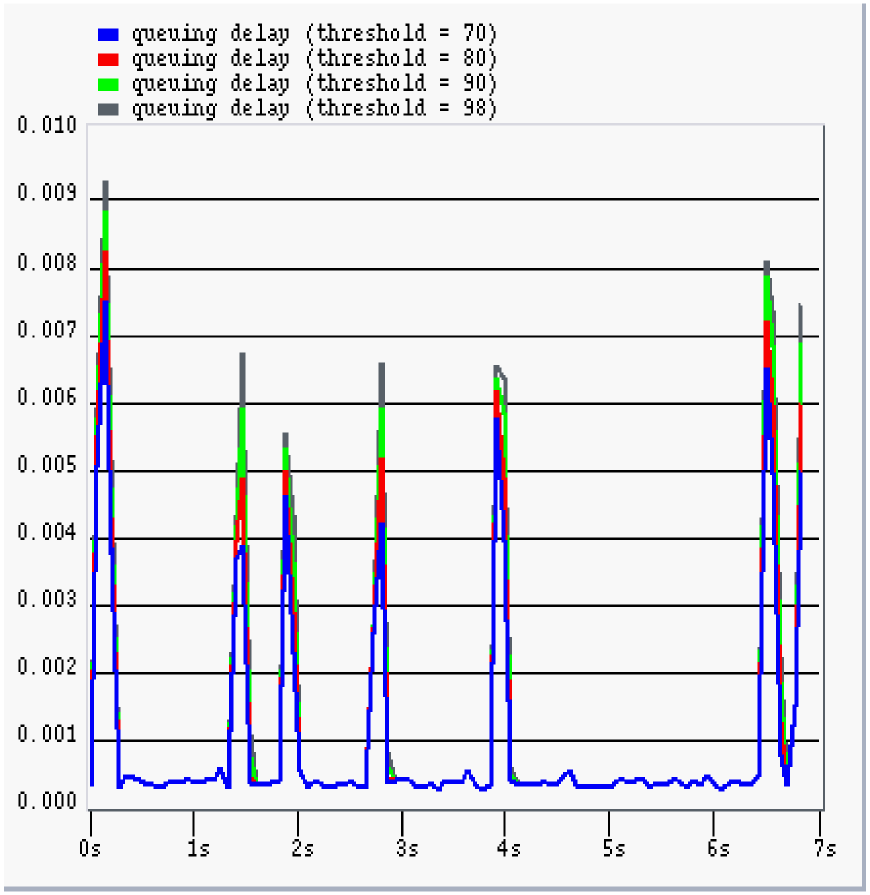


- Graphs show the CLR of CBR and the queuing delay by queue size.

Simulations

- Partial buffer sharing (queue size = 100)

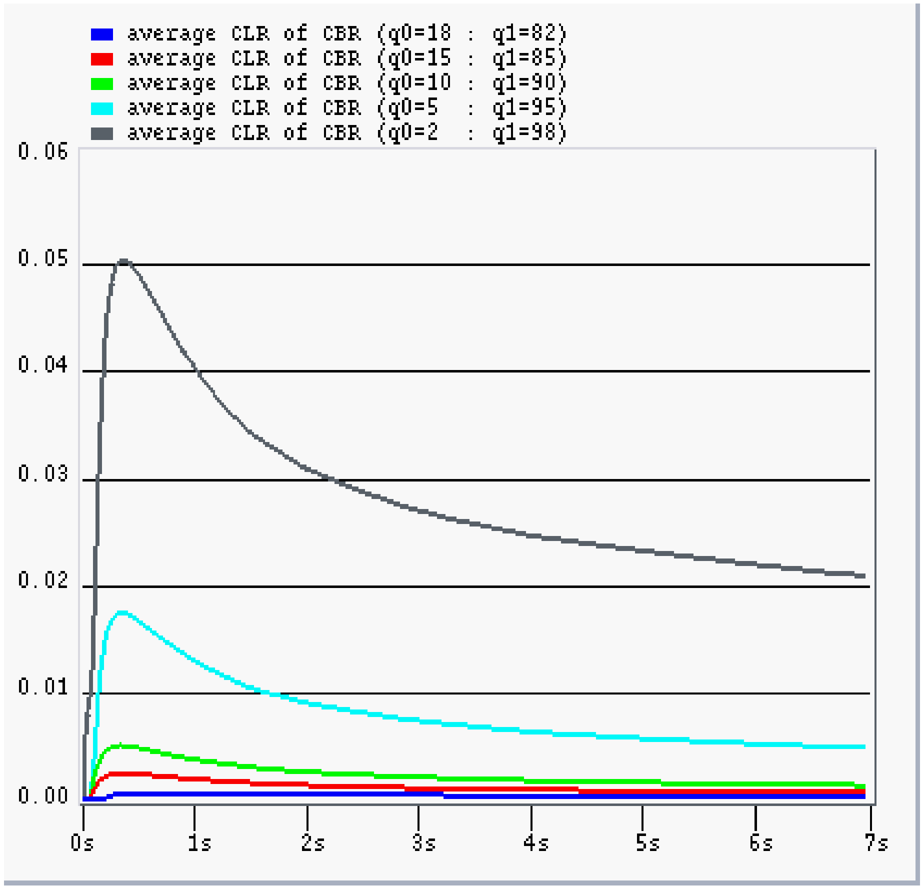


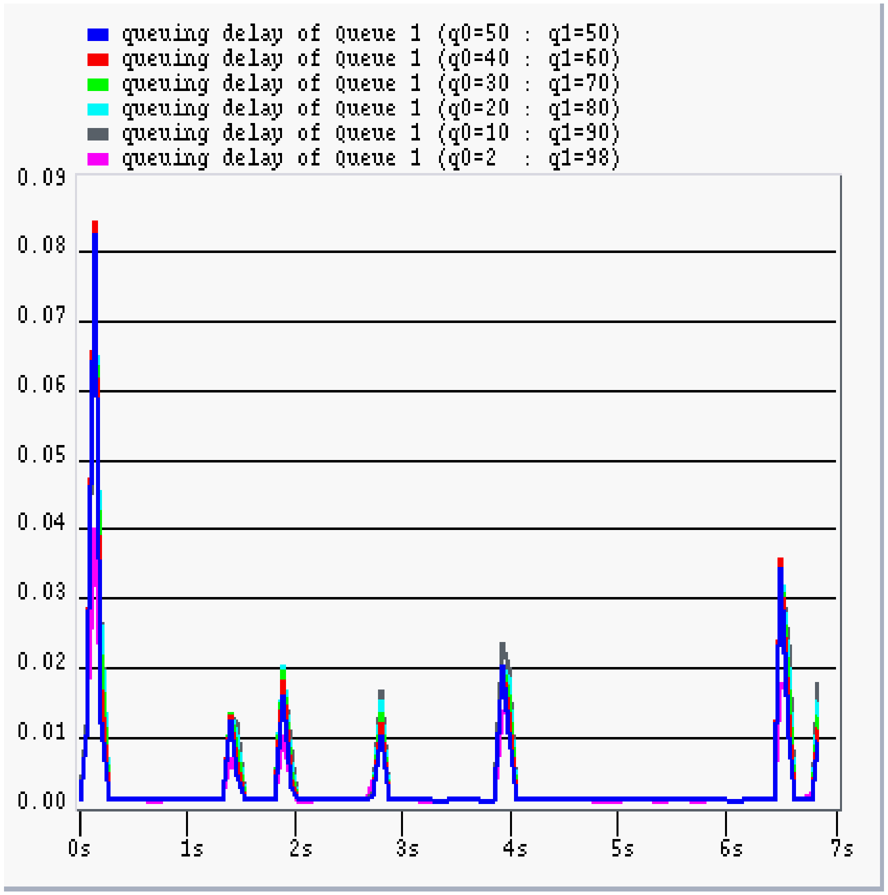


- Graphs show the CLR of CBR and the queuing delay by threshold.

Simulations

- Buffer separation (queue size = 100)

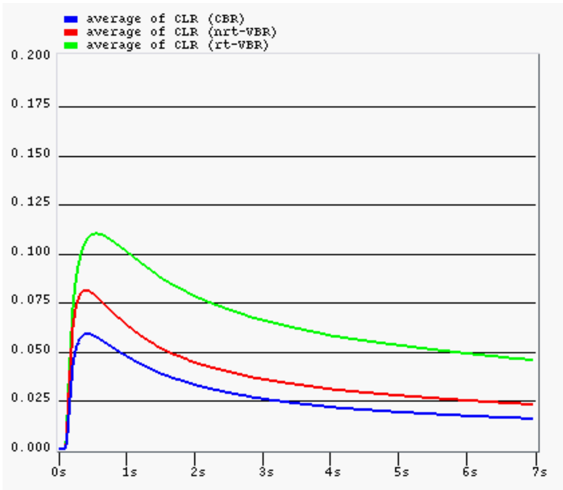




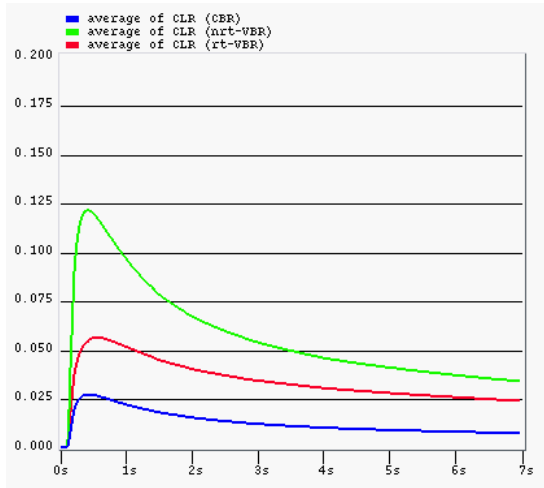
- Graphs show the CLR of CBR and the queuing delay by queue size ratio.

Simulations

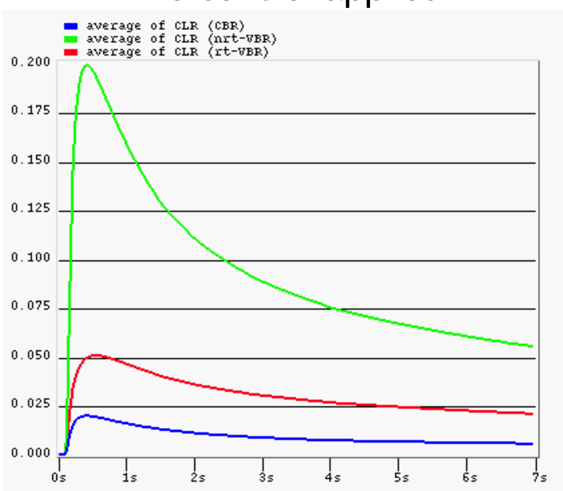
- Graphs for performance comparison (queue size = 100)



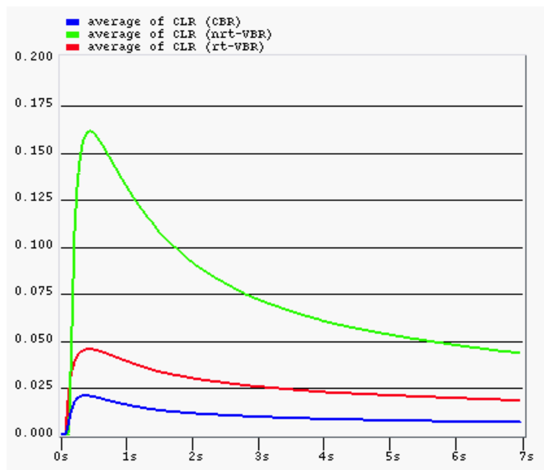
- No control applied



- Push-out



- Partial buffer sharing (threshold = 98)



- Buffer separation (queue size ratio = 4:96)

Simulations

- Table for cell loss comparison (queue size = 100, total load = 67953)

Traffic type	CBR	rt-VBR	nrt-VBR	Total
[illegible]	208	502	279	989
[illegible]	90	242	435	767
[illegible]	86	221	690	997
[illegible]	93	209	482	784

Conclusion and Discussion

- Conclusion
  - As expected, all the three implemented schemes improve the CLR of the high priority traffic by sacrificing the low priority traffic.
  - Some queuing schemes may bring an improvement in the CLR of the whole traffic.
  - Queuing delay could vary with queuing schemes used though the queue size is fixed (especially in partial buffer sharing).
- Discussion
  - Difficulties

  - Time-consuming OPNET debugging process, determination of simulation scale for better comparison, clear understanding of relevant existing models required to create user-defined models or attributes

References

[1] P.S. Neelakanta, “ATM Telecommunications”, 2000

[2] Dominique Gaiti and Guy Pujolle, “Performance Management Issues in ATM Networks: Traffic Congestion Control”, IEEE/ACM Transactions on Networking, Vol. 4, No. 2, April 1996

[3] Sridhar Ramesh, Gatherine Rosenberg and Anurag Kumar, "Revenue Maximization in ATM Networks Using the CLP Capability and Buffer Priority Management", IEEE/ACM Transactions on Networking, Vol. 4, No. 6, December 1996

[4] Ness B. Shroff and Mischa Schwartz, "Improved Loss Calculations at an ATM Multiplexer", IEEE/ACM Transactions on Networking, Vol. 6, No. 4, August 1998

[5] Todd Lizambri, Fernando Duran and Shukri Wakid, "Priority Scheduling and Buffer Management for ATM Traffic Shaping". http://w3.antd.nist.gov/Hsntg/publications/Papers/lizambri_1299.pdf

[6] Viet L. Do and Kenneth Y. Yun, "A Scalable Priority Queue Manager Architecture for Output-Buffered ATM Switches". http://paradise.ucsd.edu/PAPERS/ICCCN-99-PQM.pdf

[7] Space Priority Algorithms. http://www.dur.ac.uk/~des0www3/space/space2.html

[8] CISCO, “Optimizing Your Network Design”.
http://www.cisco.com/cpress/cc/td/cpress/design/topdown/td0512.htm