Multi Choke Point Detection

and

Virtual Destination Queuing

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Agenda

- Introduction
- Requirements
- Detailed description
- Example
- Simulation results
- Conclusion

Introduction

- Is it possible to increase link utilization while maintaining fairness?
  - Coupled with cost & complexity increase
- Possible approaches:
  - Static Weighted Fairness
  - Dynamic Weighted Fairness
  - SRP approach for Virtual Destination Queuing (VDQ)

Requirements

- **Virtual destination queues (VDQ)**.
- Multiple node **congestion information.**
  - Use of more detailed **choke** (congested) point information provides better **utilization** of network resources.
- A **scheduling policy** that utilizes multi-choke information.

Usage Packet Handling

- Each node generates usage messages to distribute the total usage value of that node
  - when a node is not congested a special message with not congested information will be generated.
- A usage packet will be removed from the ring if
  - the node which generated the usage message receives its own usage message back.

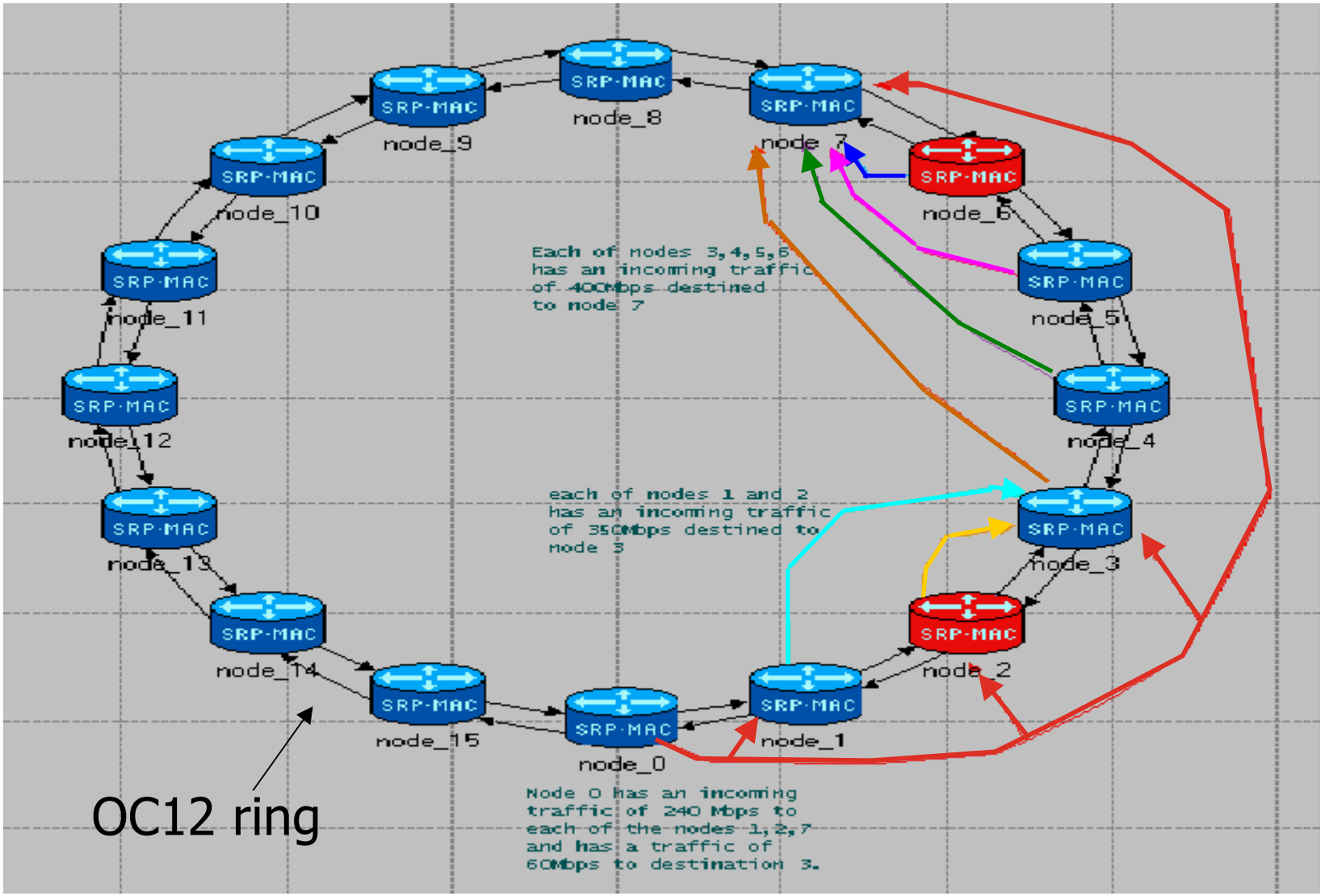
Virtual Destination Queues & Scheduling

- This approach may require as many queues as the number of nodes on the ring.
- Upon reception of usage packet node updates allowed usage information for the appropriate choke point.
- Nodes limit the amount of insertion traffic sent through the choke points.

Details

- Choke point information is passed to MAC client and MAC client does the scheduling of VDQ's.
- Usage values are accounted per VDQ basis.
- Usage values and allowed usages are decayed/incremented similar to SRP-fa.
- The number of choke points supported will determine the trade off between implementation complexity and the achievable network utilization.

A Congested Ring Scenario



Description

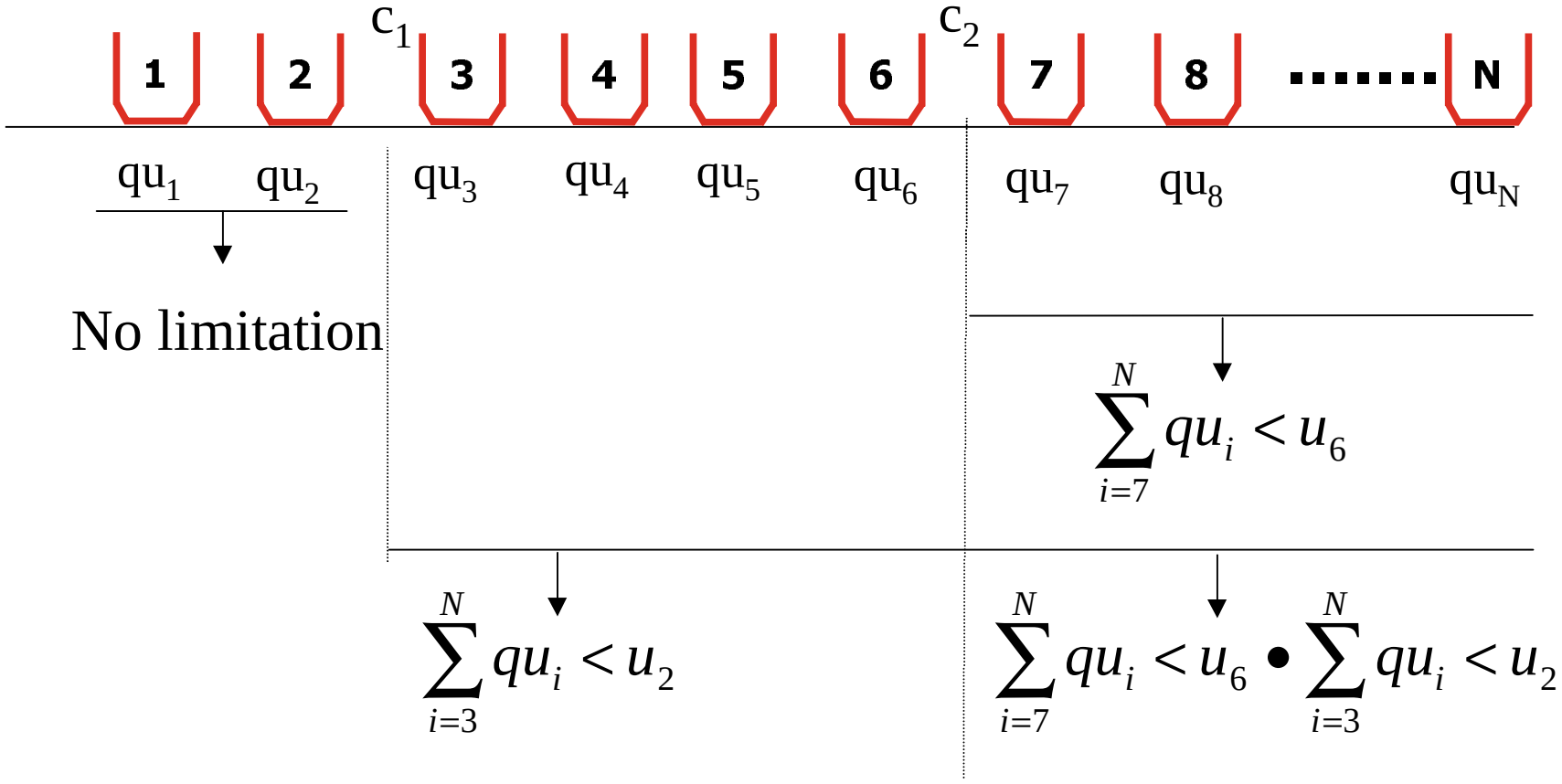
- Node 0 receives usage values u_2 and u_6 from node 2 and node 6 respectively.
- Node 0 is aware of 3 congestion domains:
  - node 1 and node 2
  - nodes between node 3 and node 6 (inclusive)
  - nodes beyond node 6

Description Cont.

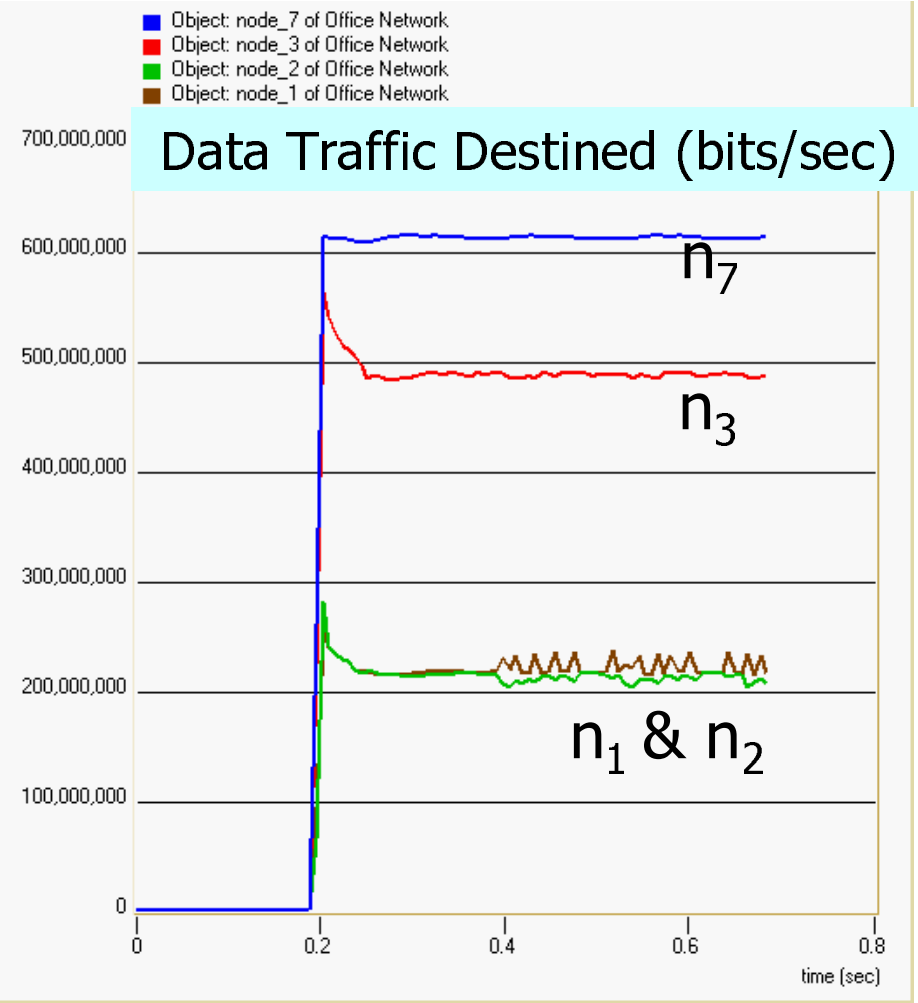
- Node 0 should obey the following constraints while scheduling its virtual destination queues:
  - Up to line rate for traffic destined to node 1 and node 2.
  - Virtual destination queues for nodes 3,4,5, and 6 can be scheduled as long as the total usage beyond VDQ_2 does not exceed u_2.
  - Virtual destination queues for nodes beyond 6 can be scheduled as long as the total usage beyond VDQ_2 does not exceed u_2 and the total usage beyond VDQ_6 does not exceed u_6.

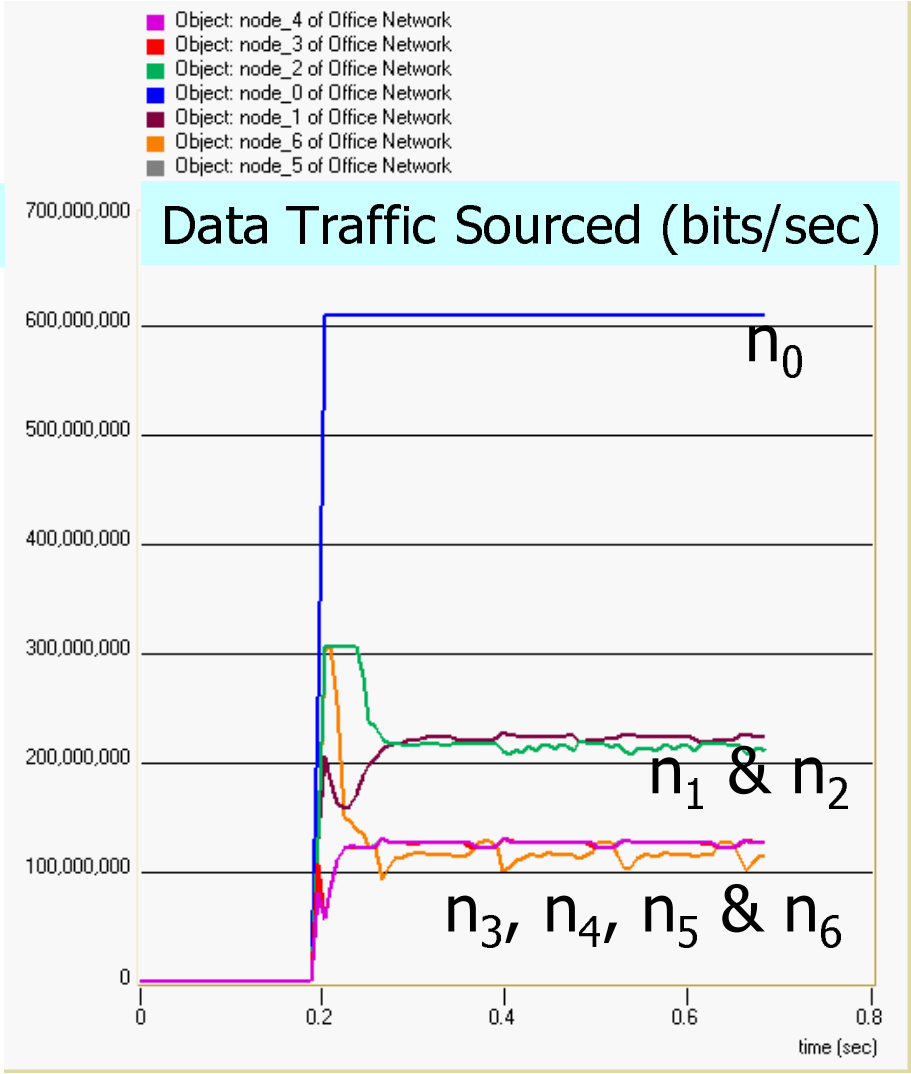
Description Cont.

- 1 picture worth 1000 words:

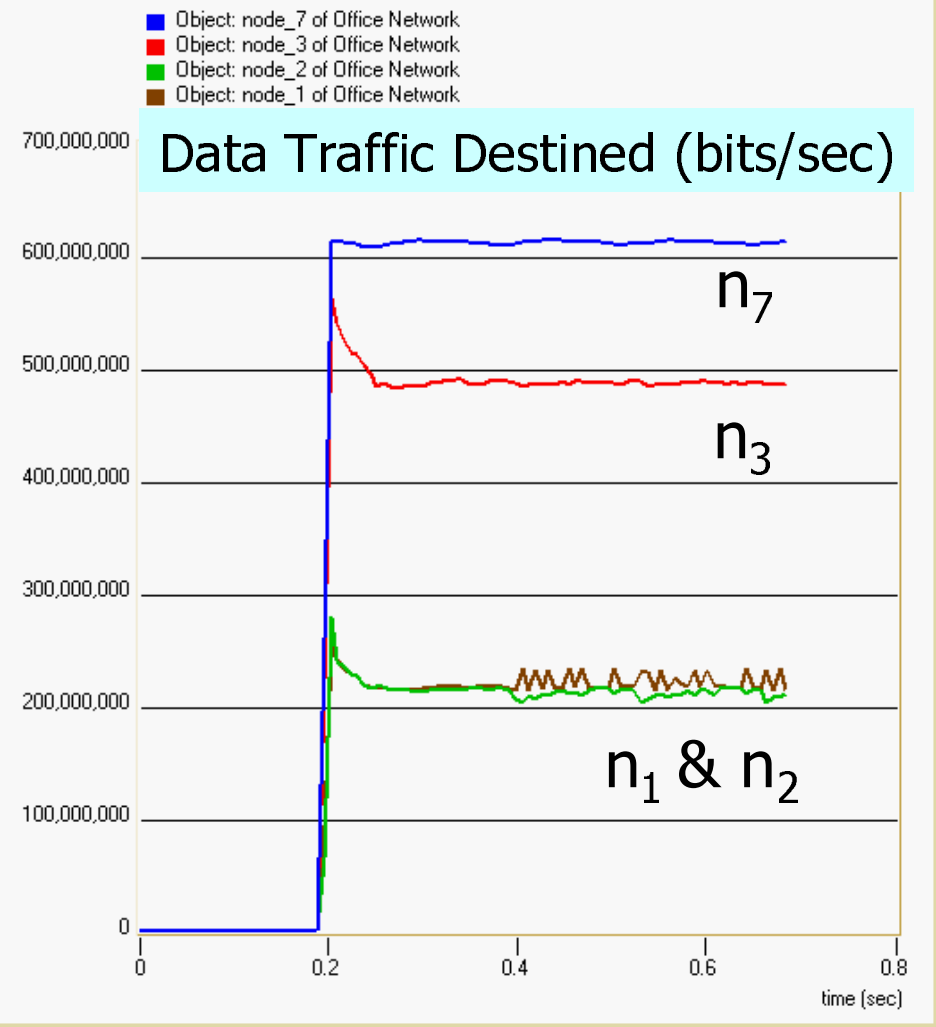


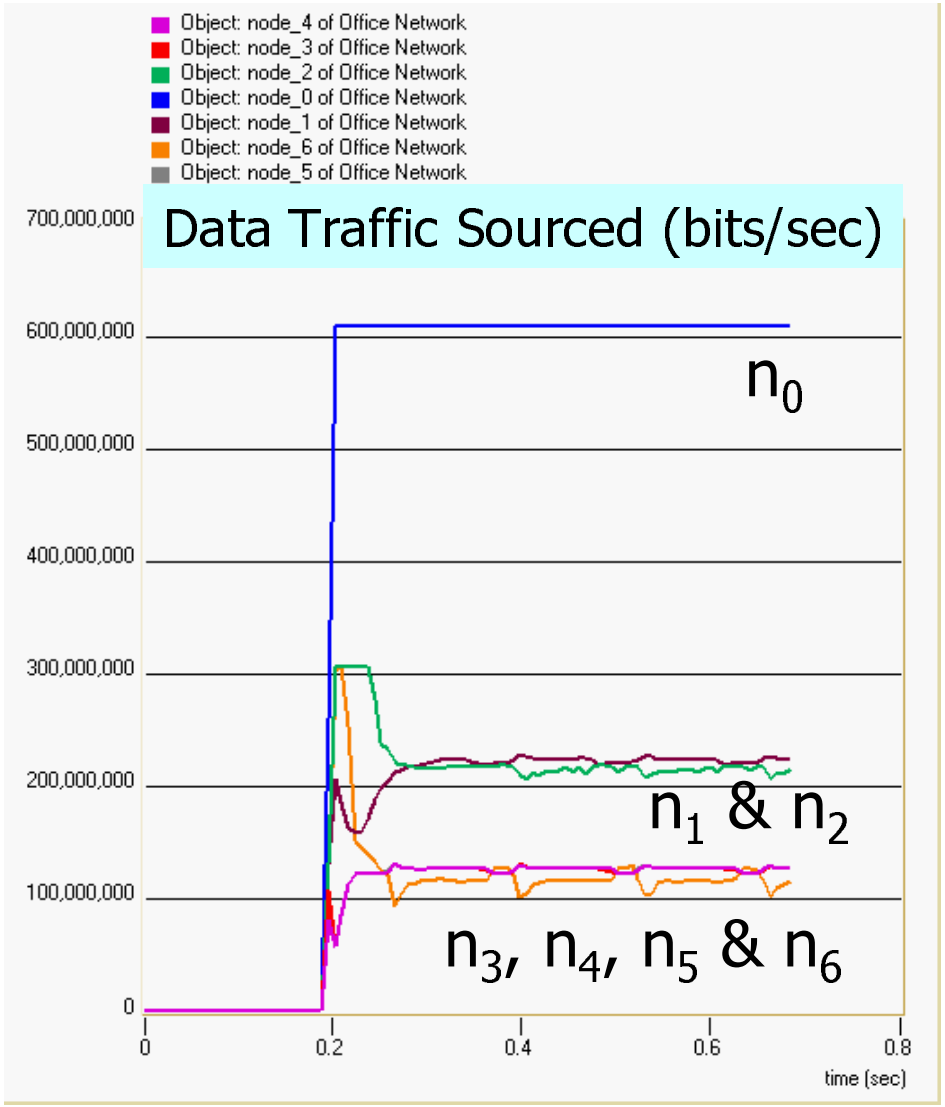
Simulation I (VDQ, max choke point =4)





Simulation II (VDQ, max choke point =1)





Conclusion

- VDQ increases the total cost of the network.
- In most cases the gain may not be worth the cost increases incurred compared to SRP.
- The number of nodes on the ring will be limited by the number of VDQ's that can be supported.
- One choke point will be sufficient for many scenarios.