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# Providing Enhanced Fairness

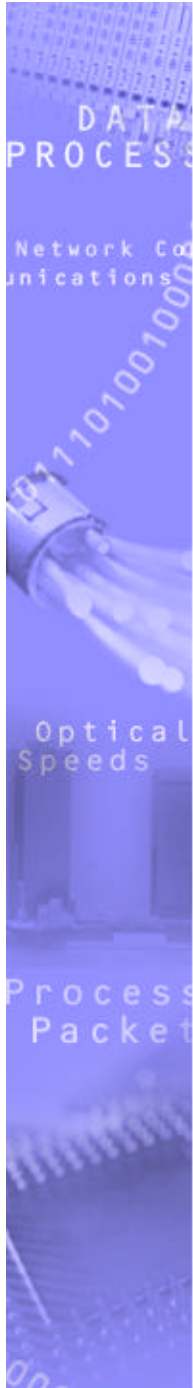
*Necdet Uzun and Mete Yilmaz*

AuroraNetics, Inc.

July 8-13, 2001

Portland, Oregon

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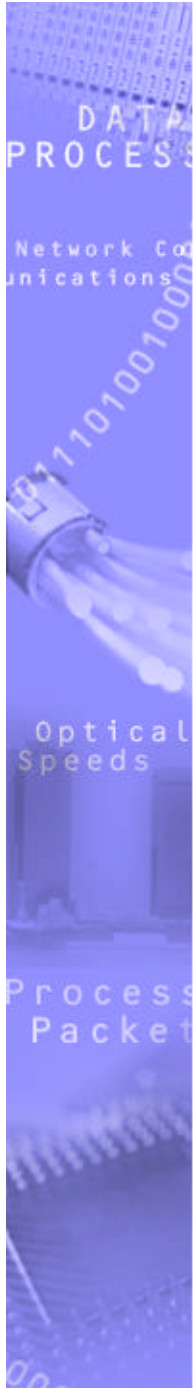


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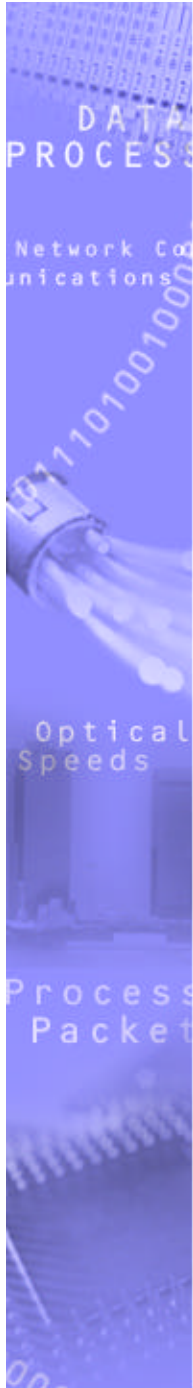


# Problem Definition

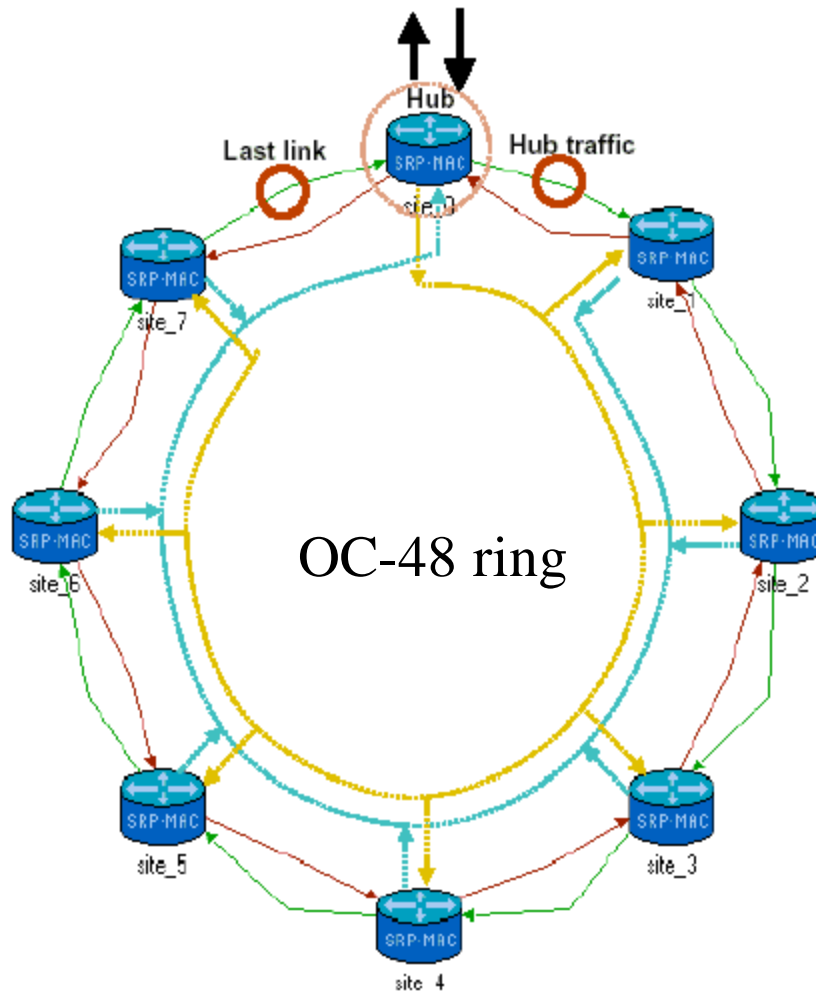


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- In a RPR ring, hub or server nodes will send much more traffic than other nodes.
- Some congestion mechanisms will enforce (equal) fairness across nodes in the congestion domain, including hub nodes.
- This may limit the amount of local reuse by overly throttling hub nodes and the links on the ring may not be utilized optimally.



# Example 1 (Lantern's Scenario)

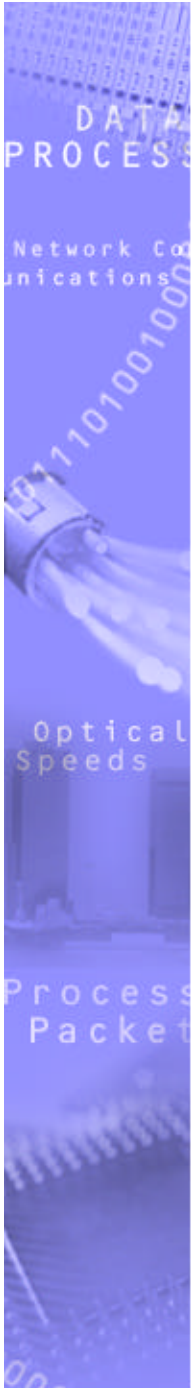


## Traffic Pattern

All nodes send traffic to the hub.

Hub sends 100Mbps to each node.

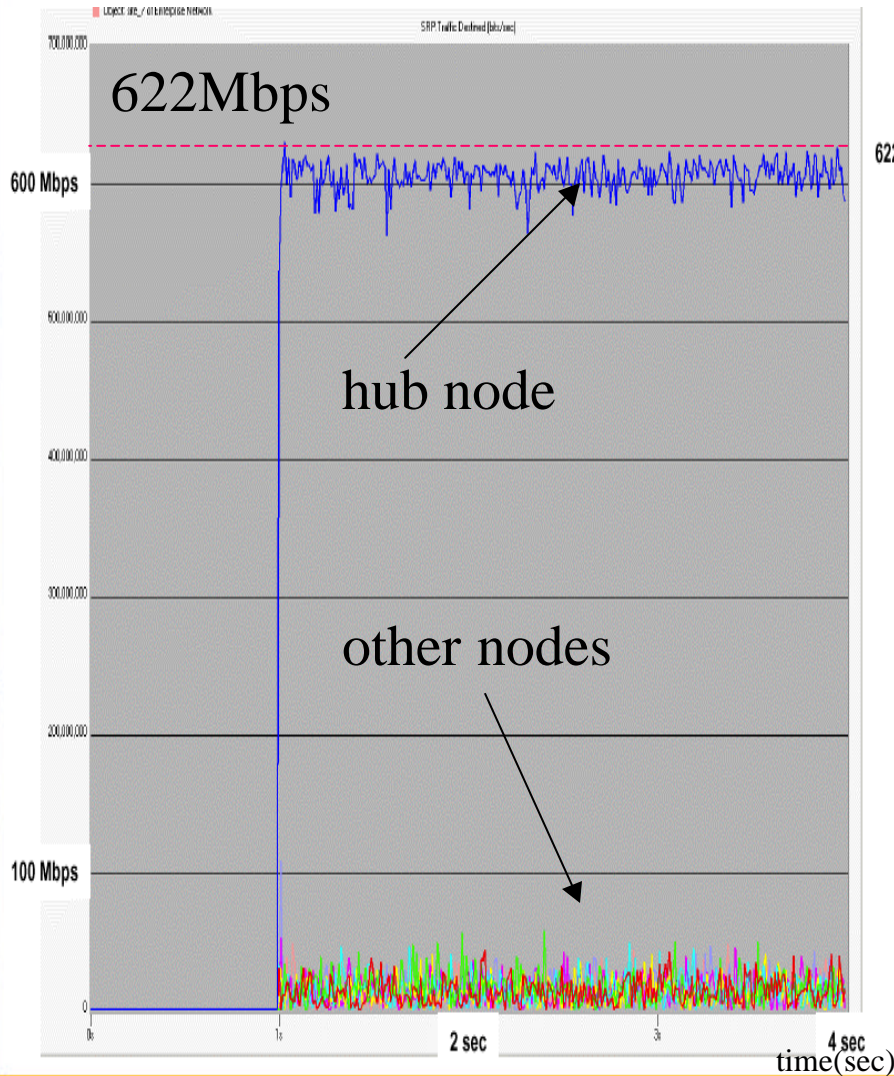
300Mbps ingress traffic at each node.



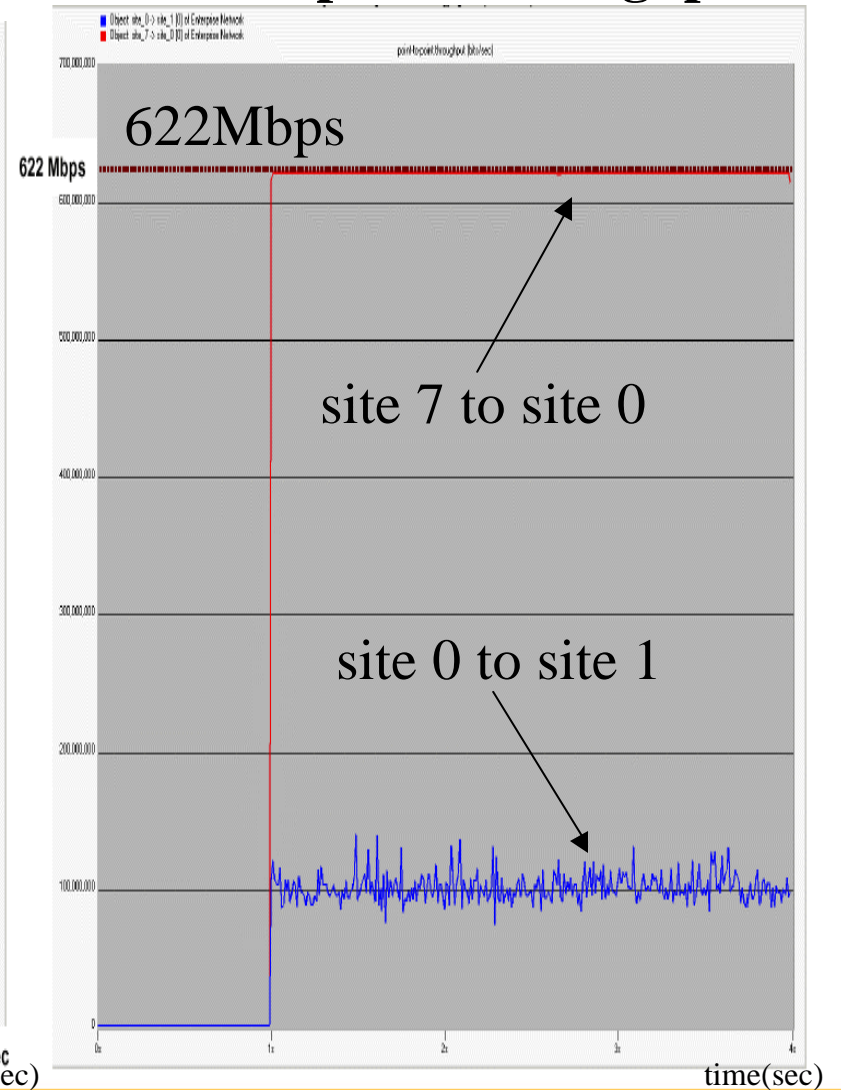
# Example 1 Results (Lantern's)



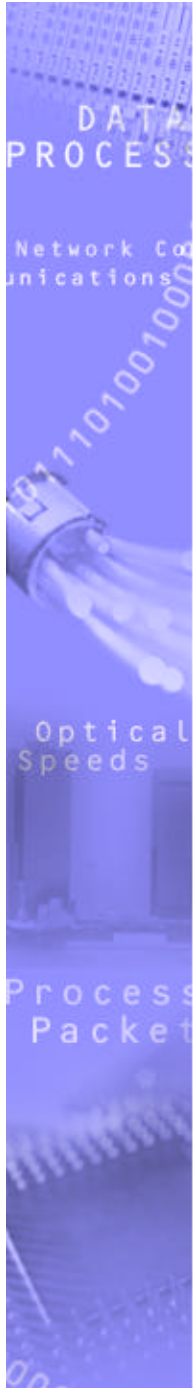
## Traffic Destined



## Point-to-point Throughput

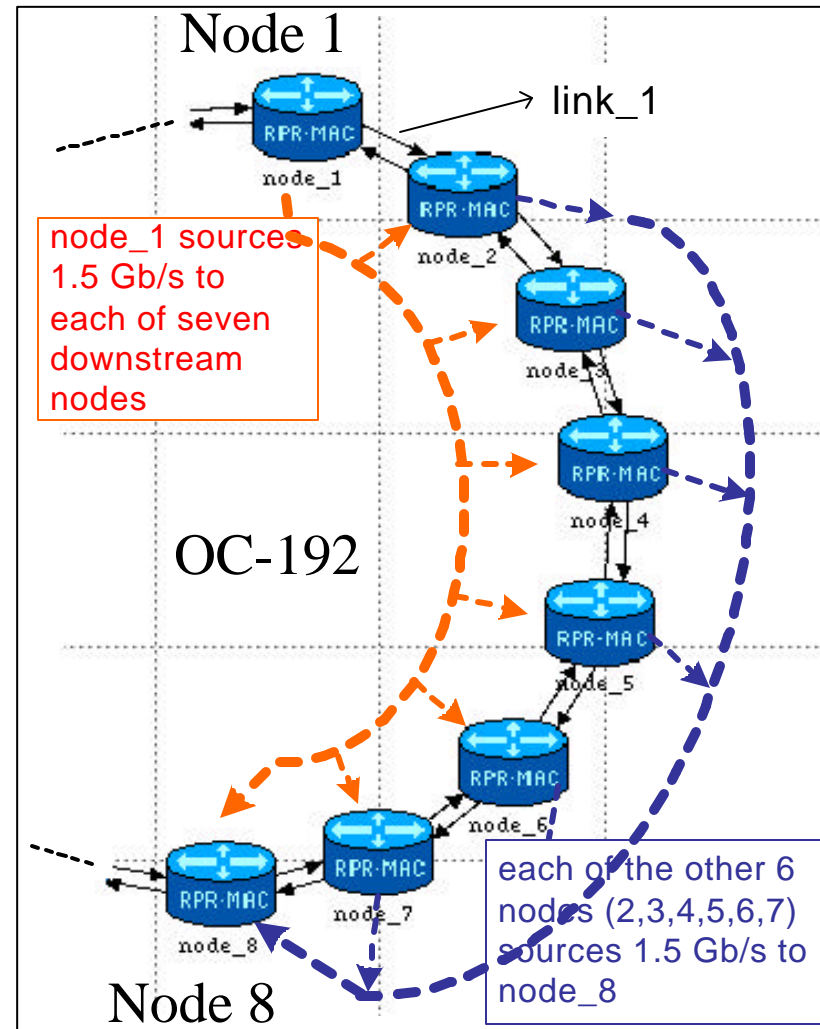






## Example 2 (Generalized)

- Node 1 sends traffic to all downstream nodes.
- Intermediate nodes are sending traffic to Node 8.
- Node 7 is congested and sends slow down messages upstream.
- Result:
  - Links 1 to 6 may be under utilized
  - Node 1 may not be able to send enough traffic to destination nodes



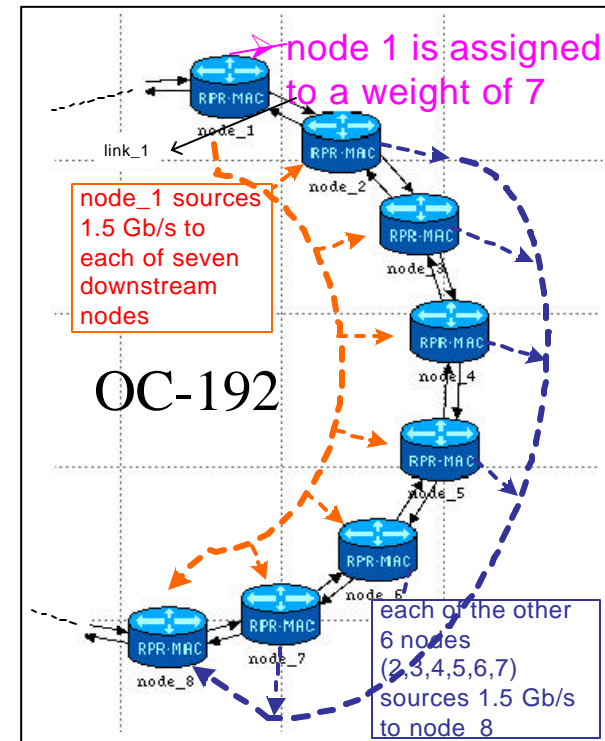


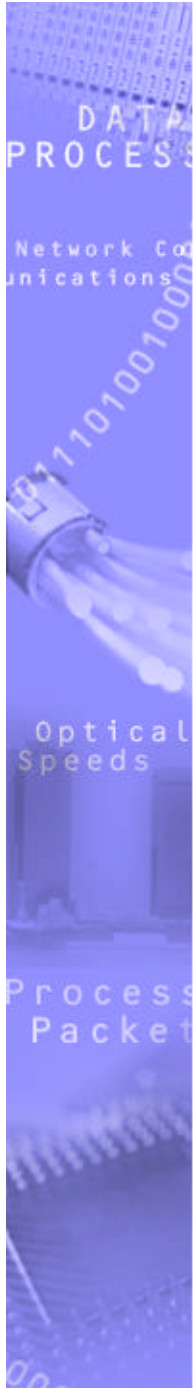
# Solution Using Weighted Fairness



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- Weighted fairness is the simplest solution for this problem.  
([http://www.ieee802.org/17/documents/presentations/may2001/nu\\_wf\\_02.pdf](http://www.ieee802.org/17/documents/presentations/may2001/nu_wf_02.pdf))
- Static weights will be assigned to nodes
  - Weight of the hub node can be set to the number of downstream nodes.
  - Other nodes can be set to a weight of 1.
- This enables hub node to send enough traffic and network utilization will increase as much as possible without using complex/global algorithms.
- In the example, a weight of 7 is assigned to node 1, while all other nodes are assigned to weight of 1.

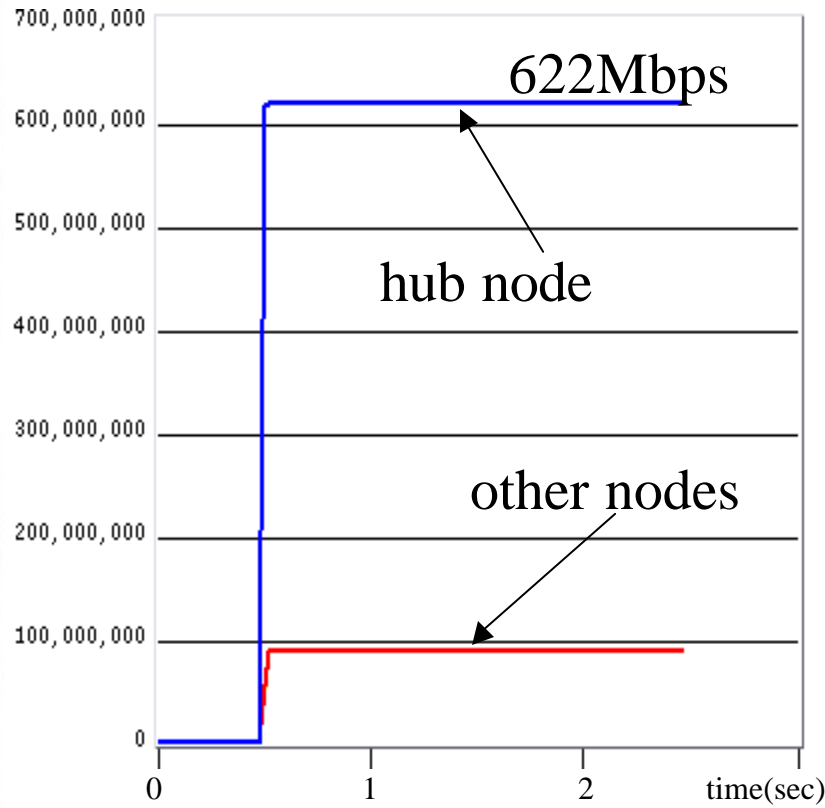




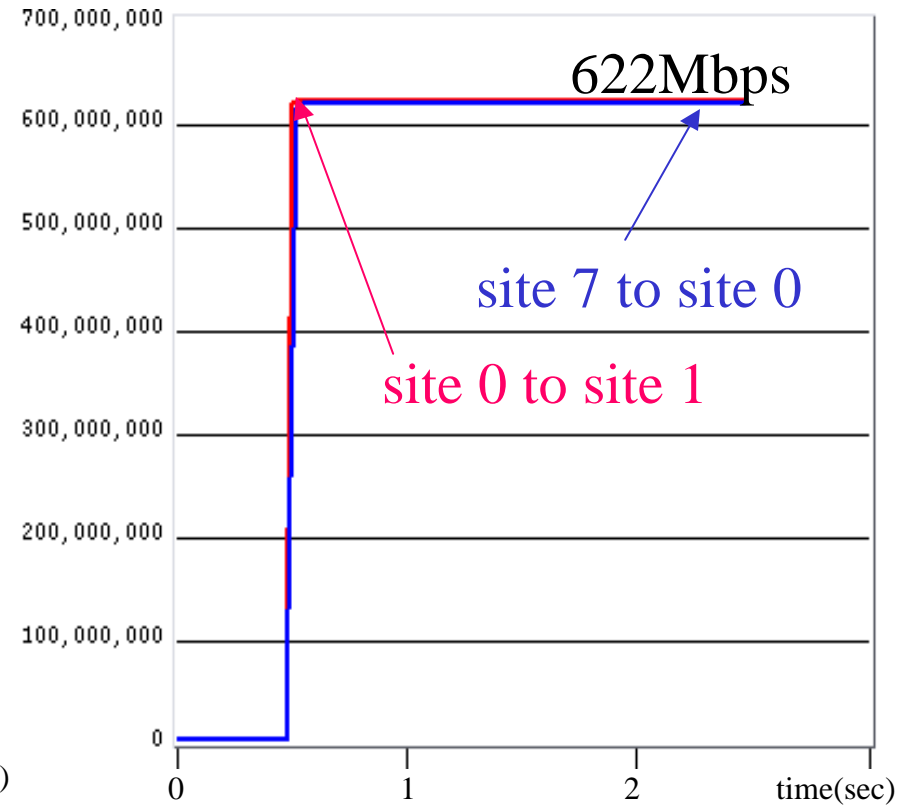
# Simulation Results (Example 1)



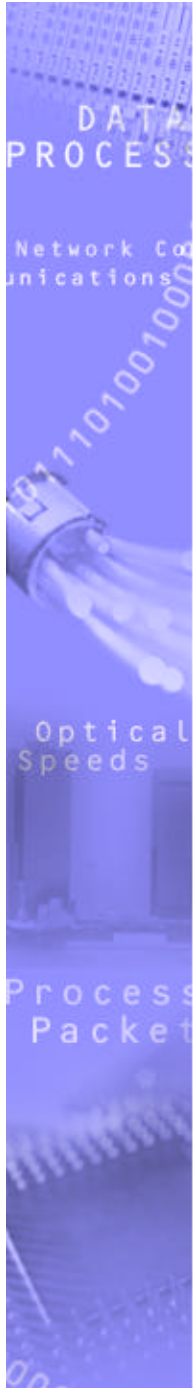
Destined Traffic(bps)



Point-to-point throughput (bps)





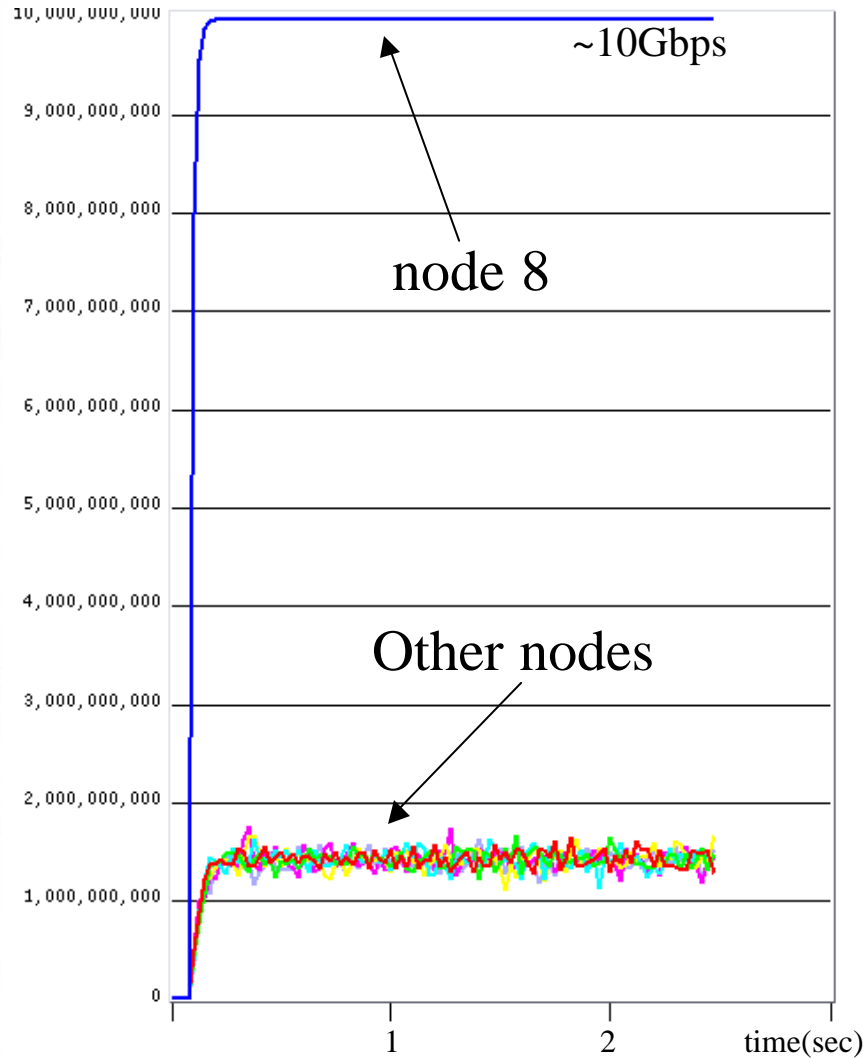


# Simulation Results (Example 2)

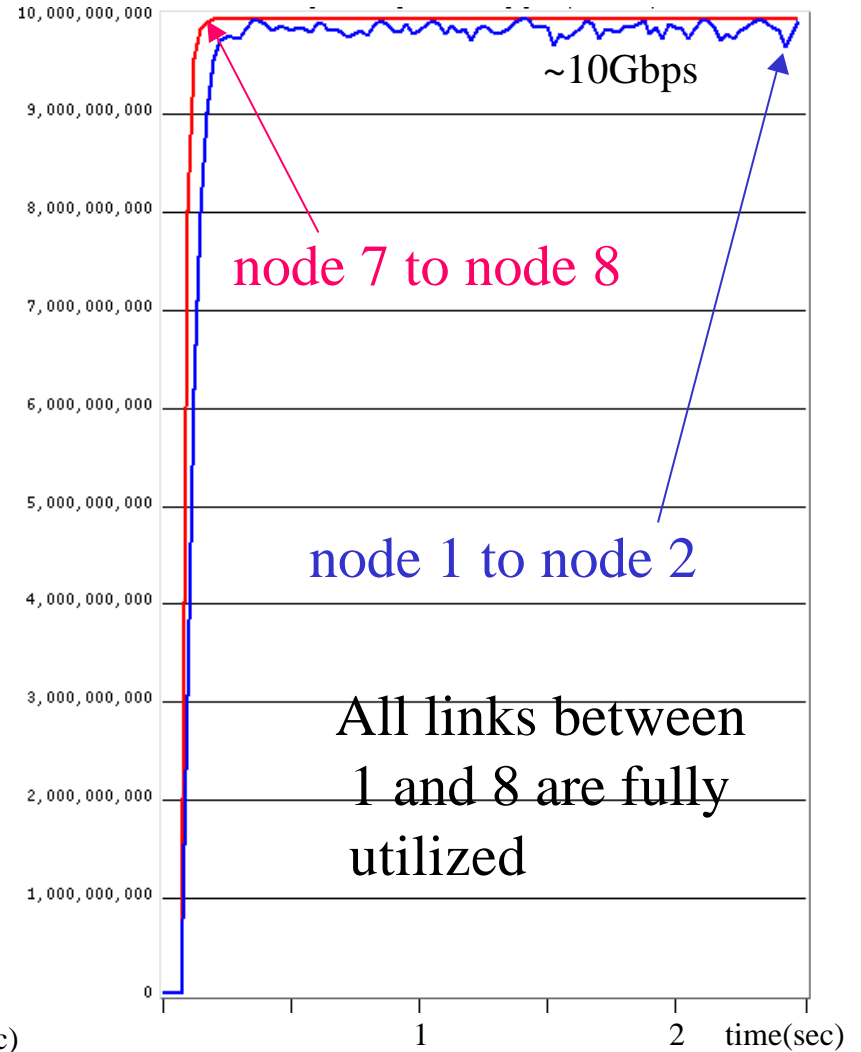


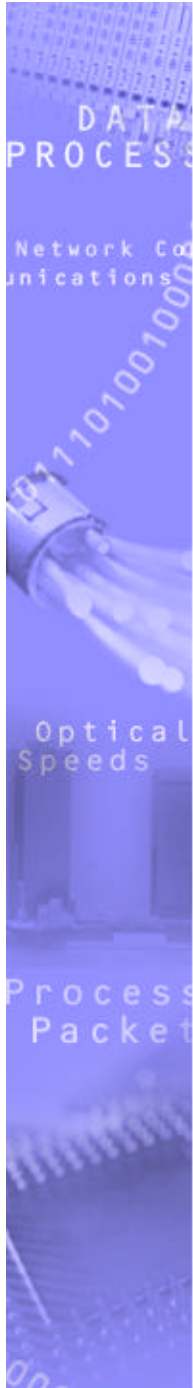
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### Destined Traffic(bps)



### Point-to-point throughput (bps)



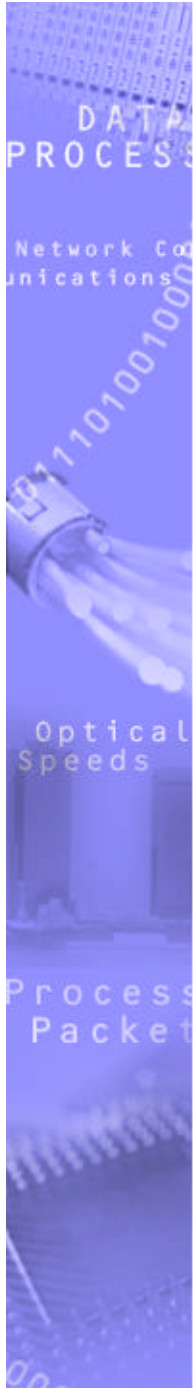


# Dynamic weight assignment



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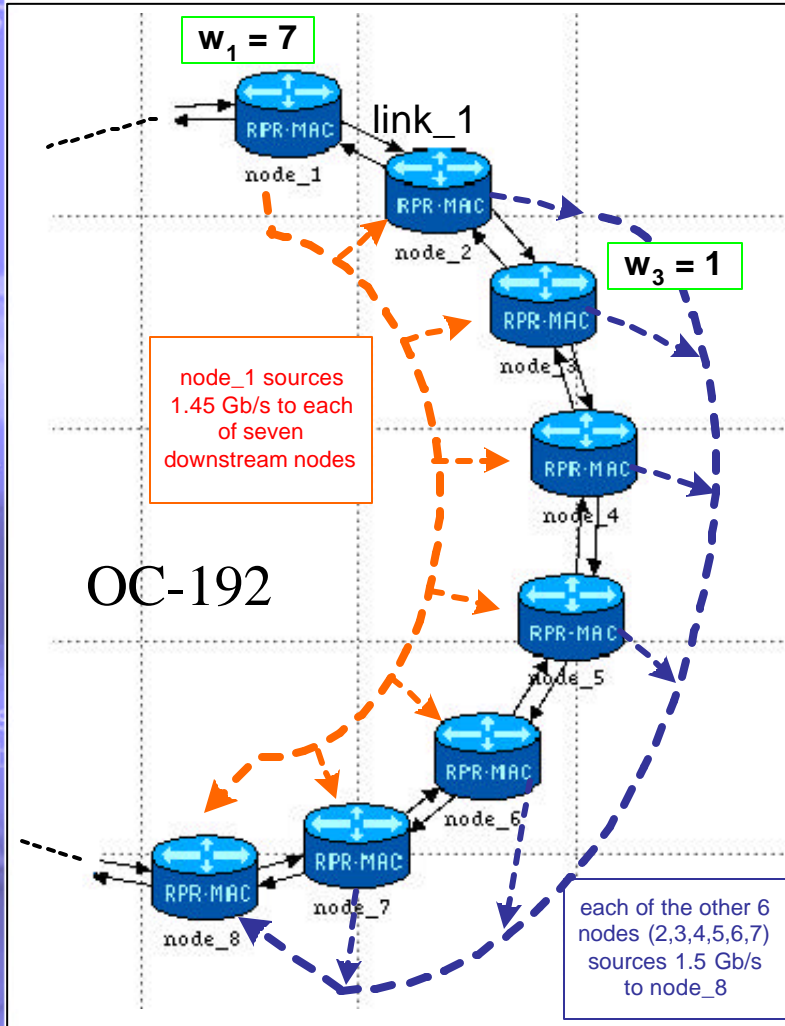
- The weight assignment technique, if done on the fly, can cope with dynamically changing scenarios.
- Dynamic assignment can be controlled by the available information at L3 and/or through other means. (e.g., bandwidth management protocols like RSVP, LDP, etc.)



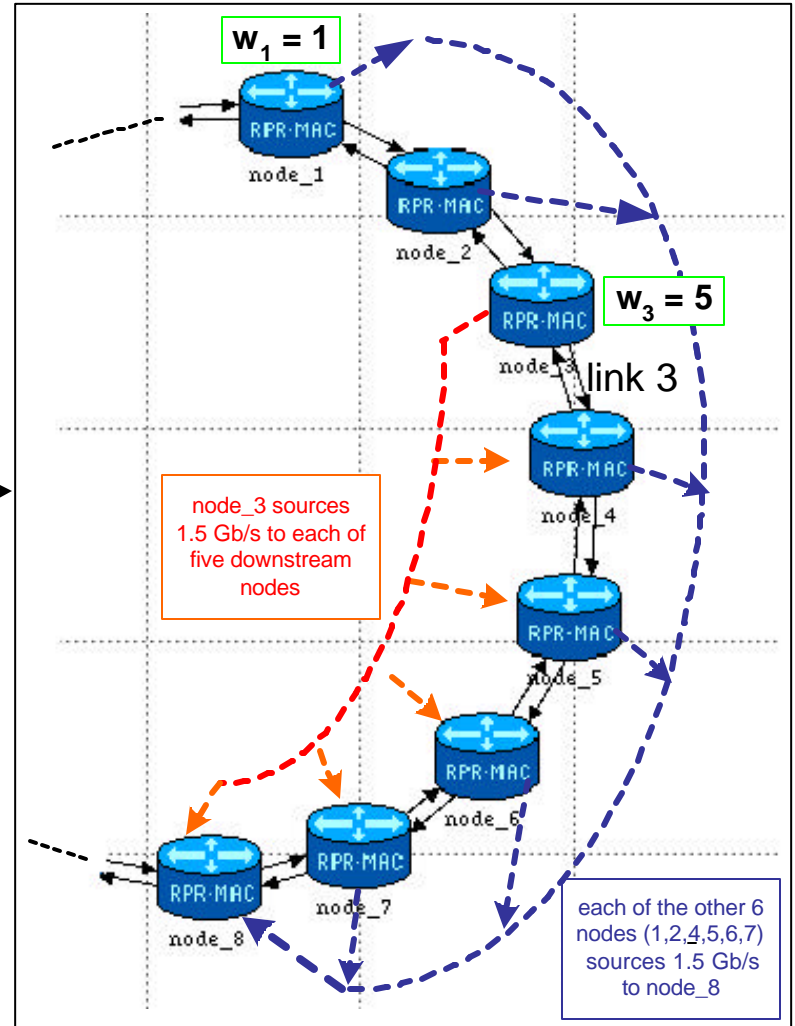
# Example 3



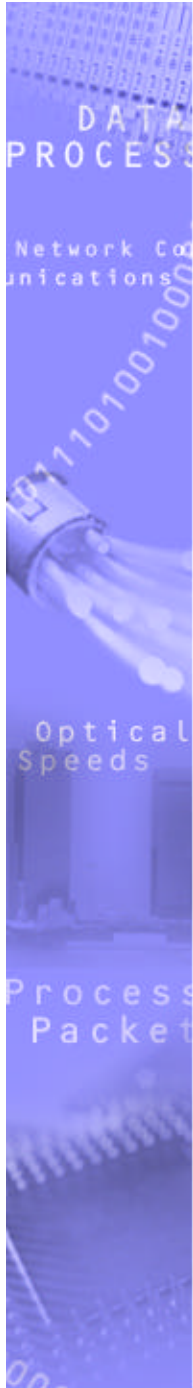
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time=0sec to 1.5sec



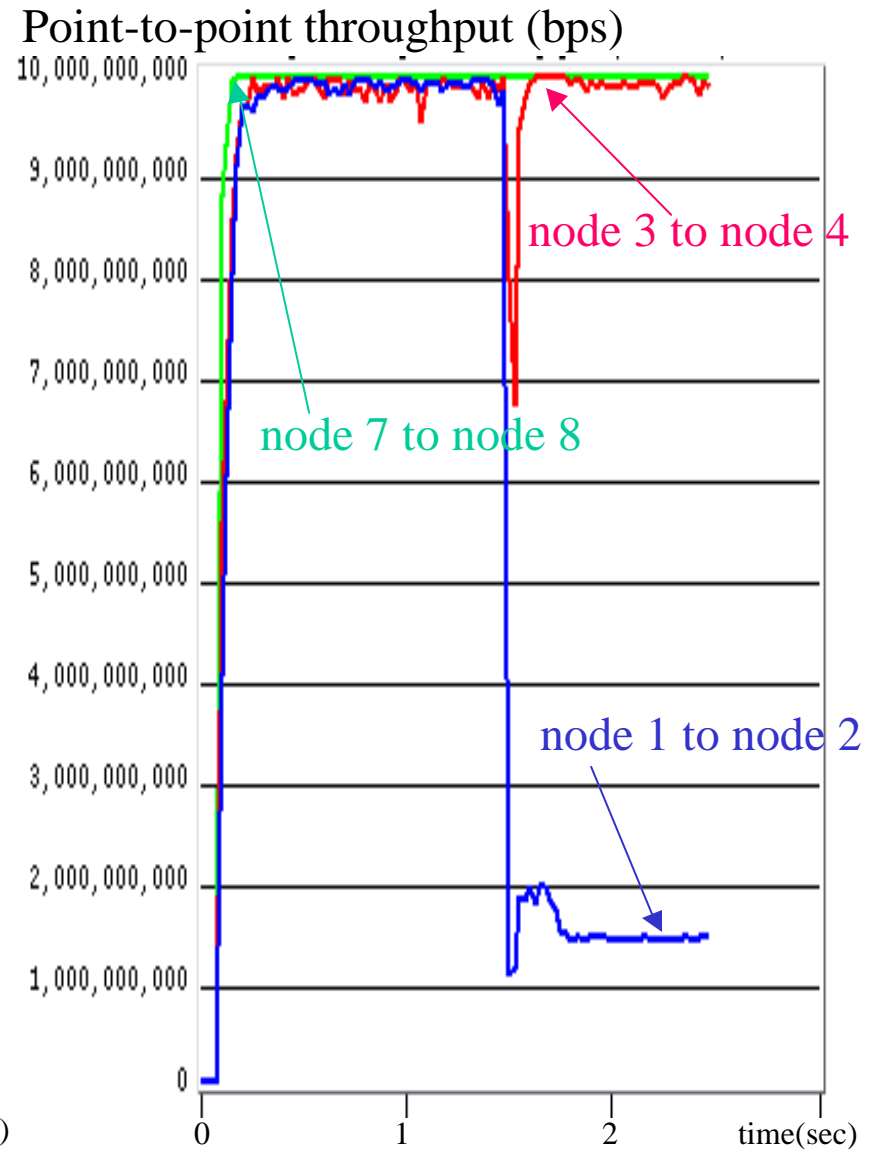
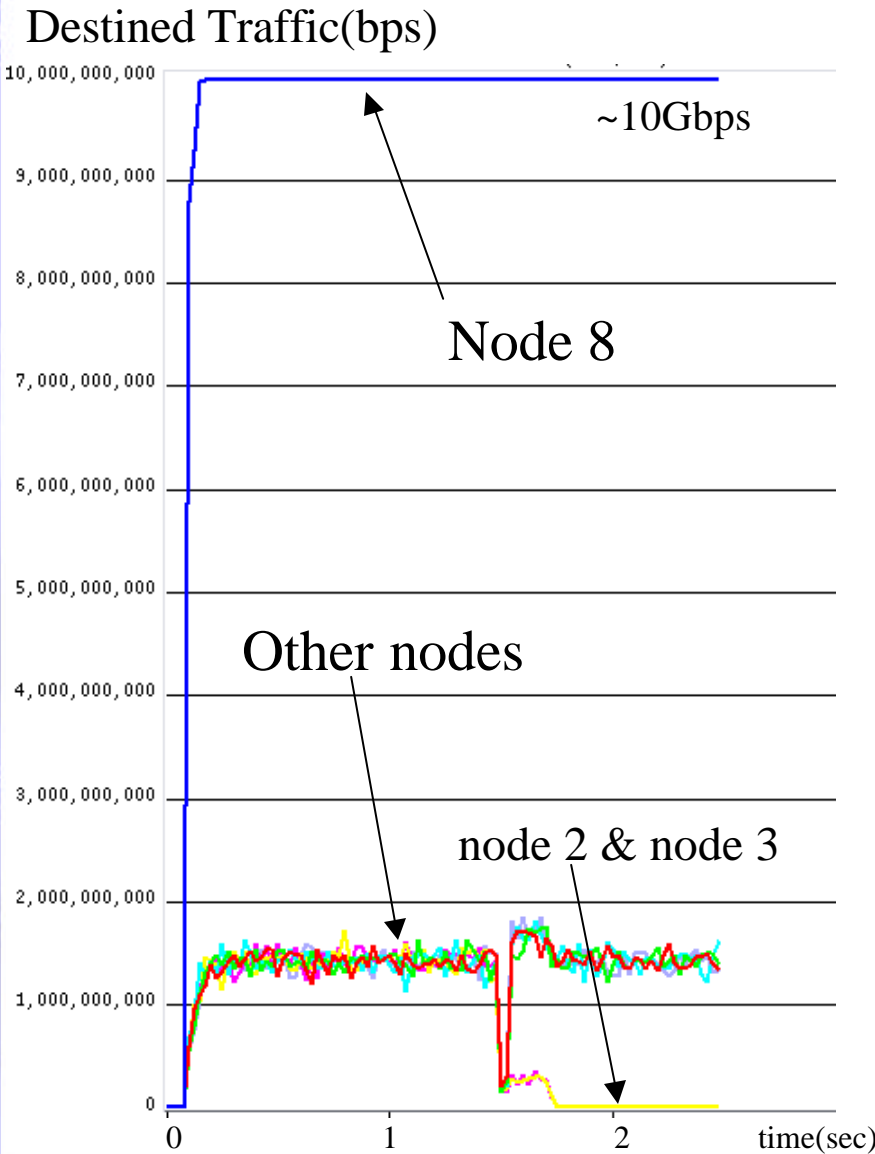
time=1.5sec to 2.5sec



# Simulation Results (Example 3)



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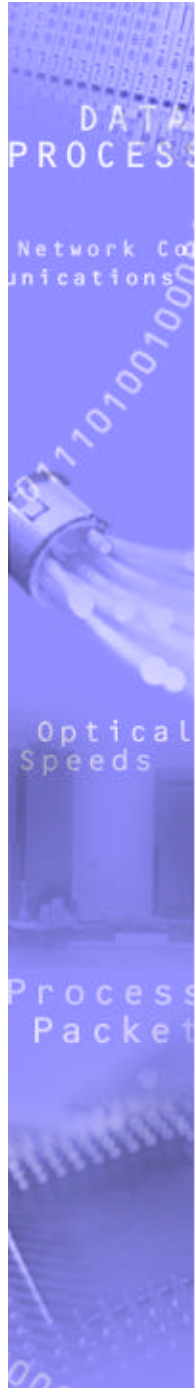
## Conclusion

- Weighted fairness can solve the low network utilization problem that may occur under certain traffic scenarios.
- Dynamic assignment of the weights can be accomplished by higher layer protocols.
- Fast convergence can be obtained.

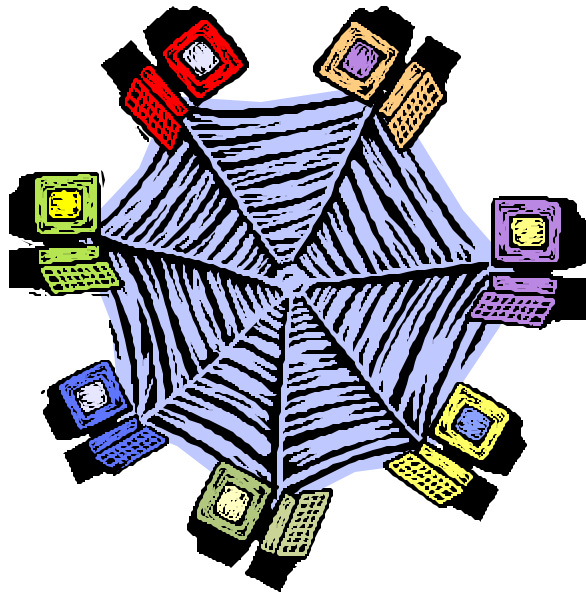


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*Thank you!*

Q & A

