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RPR Transit Buffer Schemes

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May 14, 2001

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Objectives

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- Guaranteed delay and jitter bound for high priority traffic
- Priority discrimination
- No packet loss on the ring
- Maximum available ring throughput
- Best possible delay and jitter for low priority traffic

Applications

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- TDM emulation
- Voice over IP
- Interactive video
- Video streaming
- Web browsing

Delay and jitter requirements

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Speech Category	End to End Delay[1]	Peak Jitter
Perfect	100 msec	0 msec.
Good	100 msec	75 msec.
Medium	150 msec	125 msec.
Poor	400 msec	225 msec.

[1] including encoding/decoding delays

Source: ITU and ETSI TIPHON (European Telecommunications Standards Institute "Telecommunications and Internet Protocol Harmonization Over Networks")

What is cut-through?

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Two interpretations:

- Cutting through traffic
  - Ring traffic “cuts through” host traffic
  - Versus allowing host traffic (high priority) to be transmitted before low priority ring traffic
- Cut-through buffers
  - No need to store complete packet before starting transmission
  - Versus Store-and-forward, storing complete packet (checking for errors, etc.) before starting transmission

Cutting through

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- If transit traffic “cuts through” transmit traffic:
  - It does not make sense to have multiple transit buffers
  - High-priority transmit packet have to wait for low priority transit packets (incurring more jitter for high priority)
- If transit traffic does not cut through transmit traffic:
  - Single transit buffer is fatal for high priority traffic
  - High- and low-priority transit buffers may or may not be dequeued in “cut-through” fashion, i.e., may not store complete packet before transmission

Why cut-through buffers?

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- High priority transit buffer may be cut-through:
  - high priority traffic demonstrates CBR characteristics: short packet size, does not vary much, small Tx delay
  - 1.5KB packet at 1Gbps = 12µsec
  - cut-through buffer is not justified for the link rates considered in RPR

Single transit buffer (cut-through)

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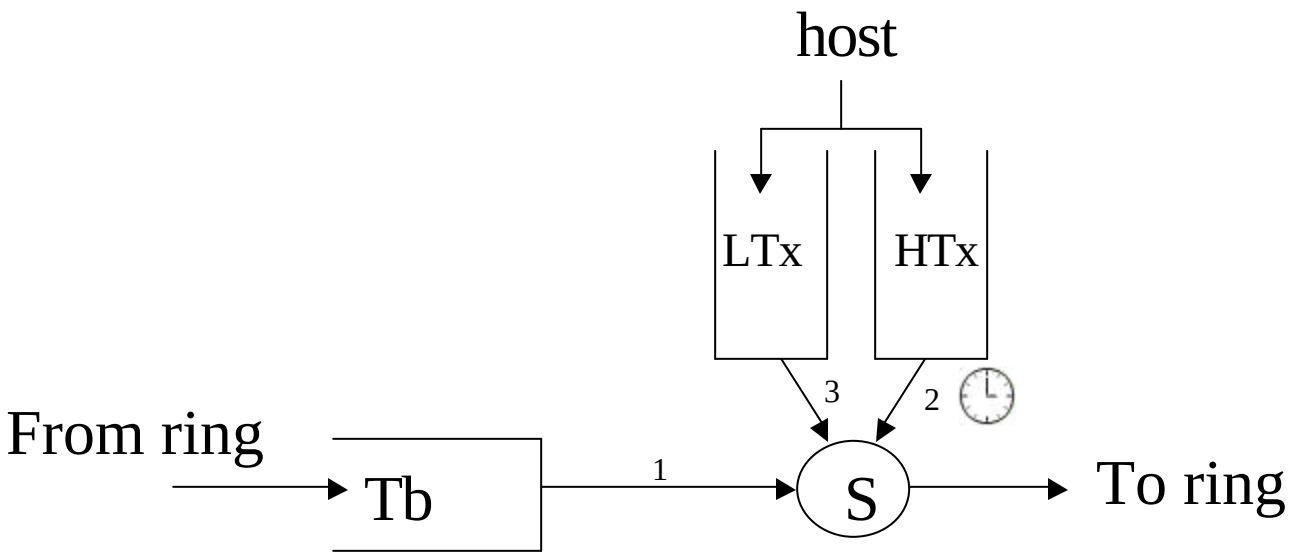
- Transit traffic cuts through the transmit traffic
  - Transit packets have priority over transmit packets
  - Transit packet may not be stored in whole before starting transmission



Dual transit buffer (store and forward)

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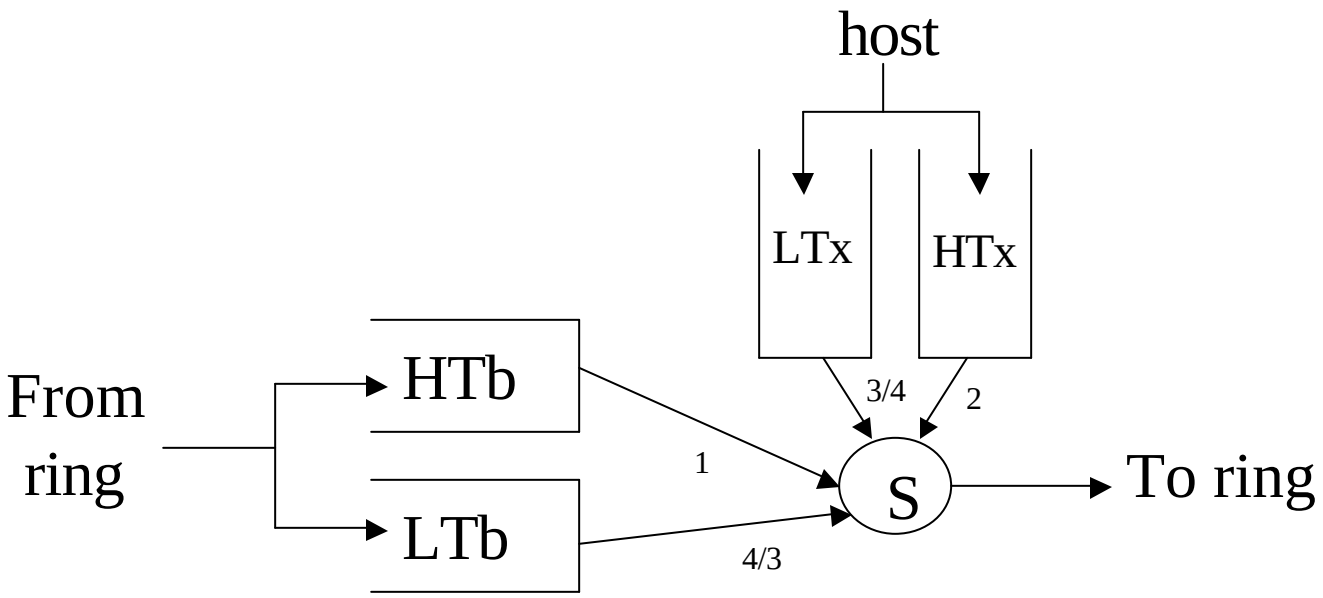
- High priority transit traffic cuts through the transmit traffic
  - Transit packets are fully stored before they are forwarded to the ring



Scenarios

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- 16 Nodes, OC192 dual ring
- Packet size: 64B(%60), 512B(%20), 1518B(%20)
- Single Tb
  - Tb = 32KB
  - Cut-through
- Dual Tb
  - HTb = 32KB
  - LTb = 256KB
  - Store and forward

Traffic scenarios

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- Mesh (Any-to-Any)
  - HTx: 355Mbps CBR
  - LTx: 2Gbps bursts, on 1msec, off 9msec (exp.distr) which gives 3.2Gbps per node
  - Total traffic injected: ~60Gbps
- Hub (Any-to-Hub, Hub-to-Any)
  - Node to Hub:
    - HTx: 380Gbps, LTx: 890Gbps, no bursts
  - Hub to Node:
    - HTx: 5.7 Gbps, LTx: 13.3 Gbps
  - Total traffic injected: ~40Gbps

Simulation results

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- Mesh (Any-to-Any)

- Hub (Any-to-Hub, Hub-to-Any)

Summary

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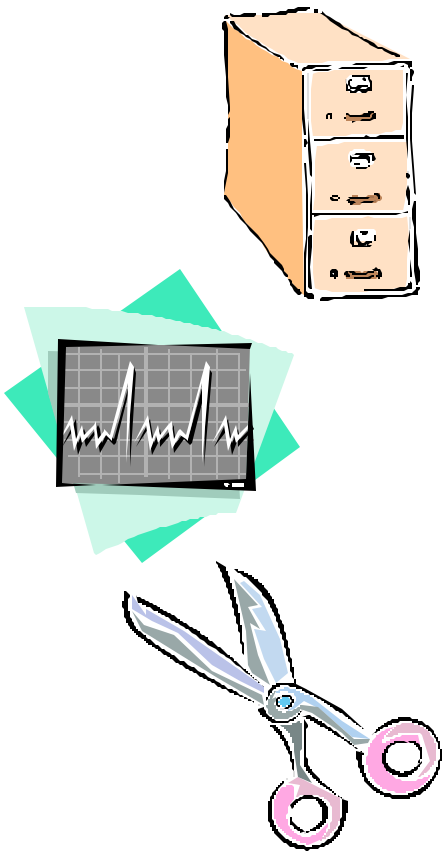

- Store-and-Forward does not require large buffers
- Cutting through transmit traffic causes more jitter for high priority
- Multiple transit buffers can result in more throughput