HOL Delay Bound for Darwin with 1 TB

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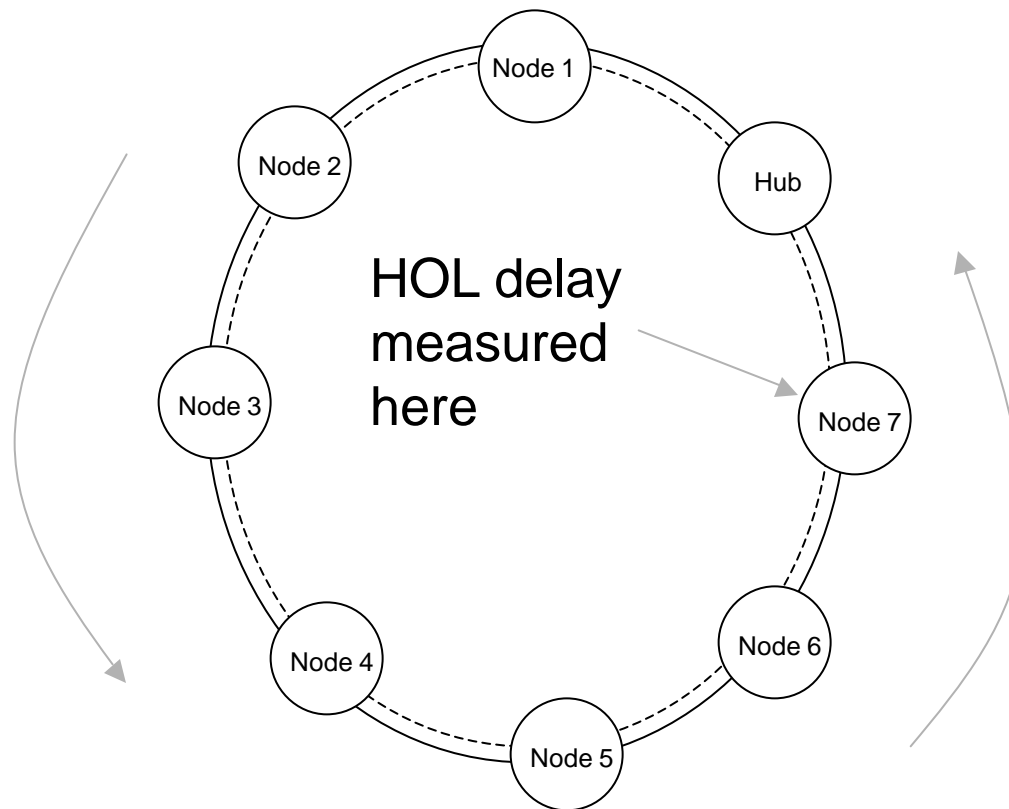January 21, 2002

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Objectives

- Find the steady state HOL delay bound for high and low priority traffic

- Compare simulation results with their analytical bounds

Ring Setup

Hub application is the worst case scenario for HOL delay

Analytical bound

Leaky bucket $i \sim (\boldsymbol{s}_i, \boldsymbol{r}_i)$, $\boldsymbol{s}_i$ bucket size, $\boldsymbol{r}_i$ token rate

Link Capacity c

Define: $B_i = \dfrac{\boldsymbol{s}_i}{c - \boldsymbol{r}_i}$

Define D_i Maximum HOL delay at node i

Then

$$D_n = B_{n-1} + D_{n-1} + \frac{\min\left(D_{n-1}\boldsymbol{r}_{n-1}, \boldsymbol{s}_{n-1}\right)}{C - \left(\displaystyle\sum_{i=1}^{n-1} \boldsymbol{r}_i\right)}$$

Traffic description for simulation

- Low priority: the packet interarrival distribution is exponential (Poisson traffic)

- Packet size distribution is trimodal (60% 64B, 20% 512B, 20% 1518B)

- The mean packet size is 444.4B

- High priority: periodic with packet size 444B
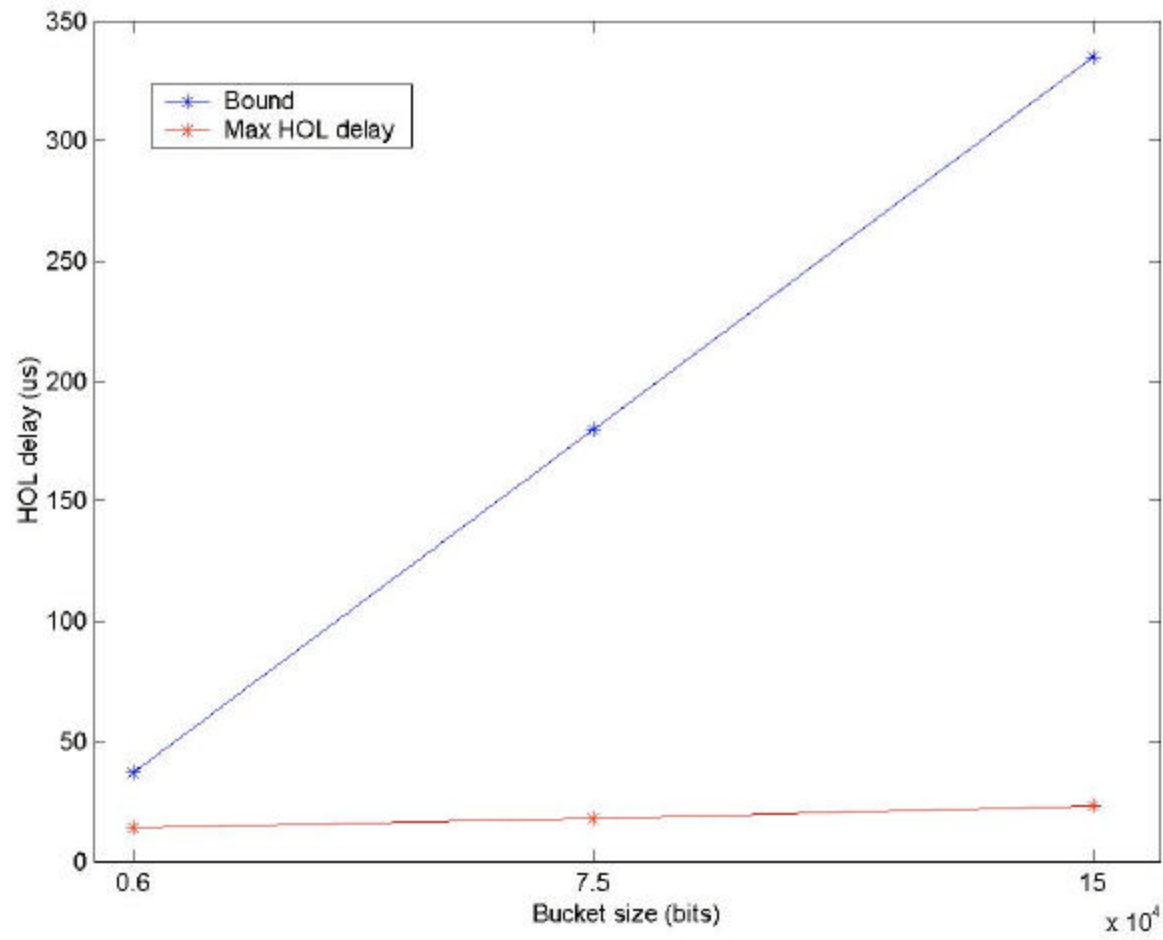
Common simulation setup (hub case)

- Common parameters:
  - HOL Delay Threshold: 1,000us
  - Sample Window: 200 us
  - Token size: 1000 bits
  - Tandem Rate Min Threshold :   0.0001
  - Add Rate Min Threshold: 0.0001
  - Link rate :   10 Gbps
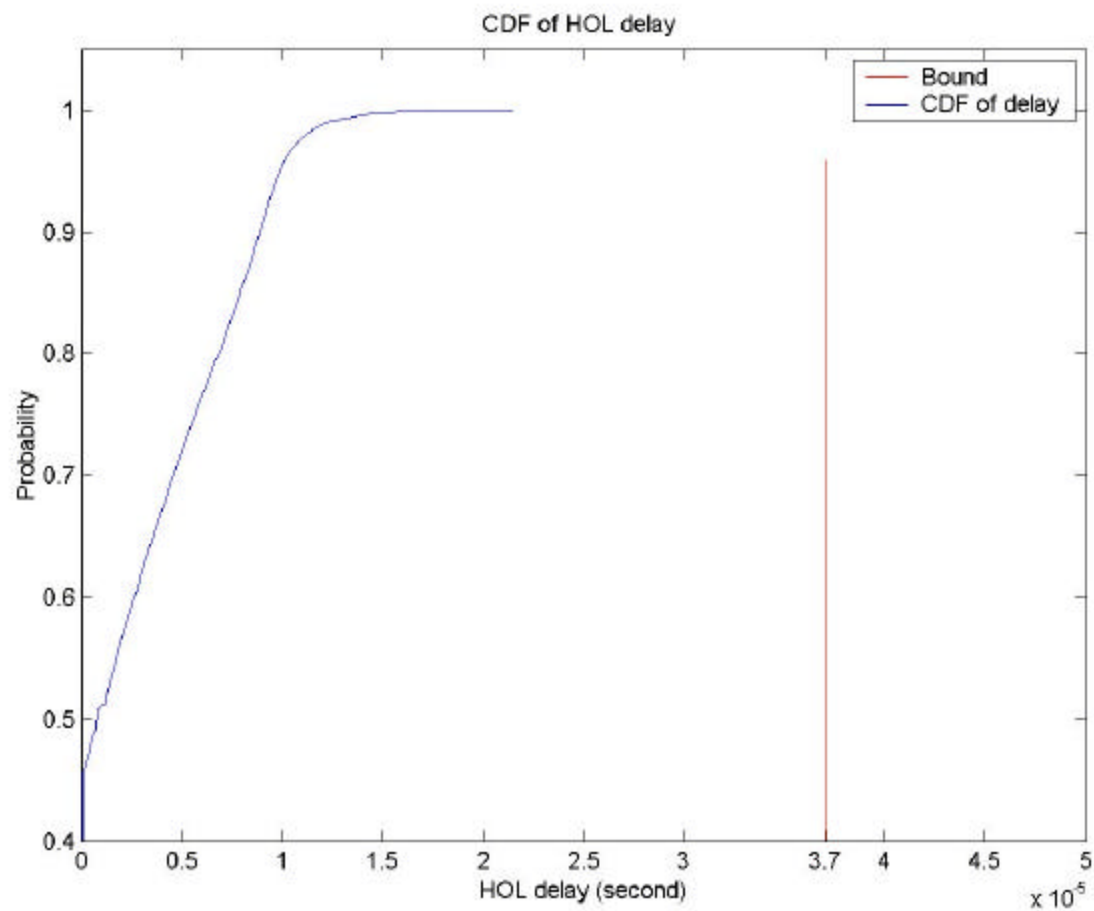 - Propagation delay (per link): 70 us (about 15KM)

Case I Simulation Setup

- Number of nodes: 8 nodes
- Equal weights for all nodes
- Target utilization: 0.95

Case I simulation result

Case I simulation result (cont'd)
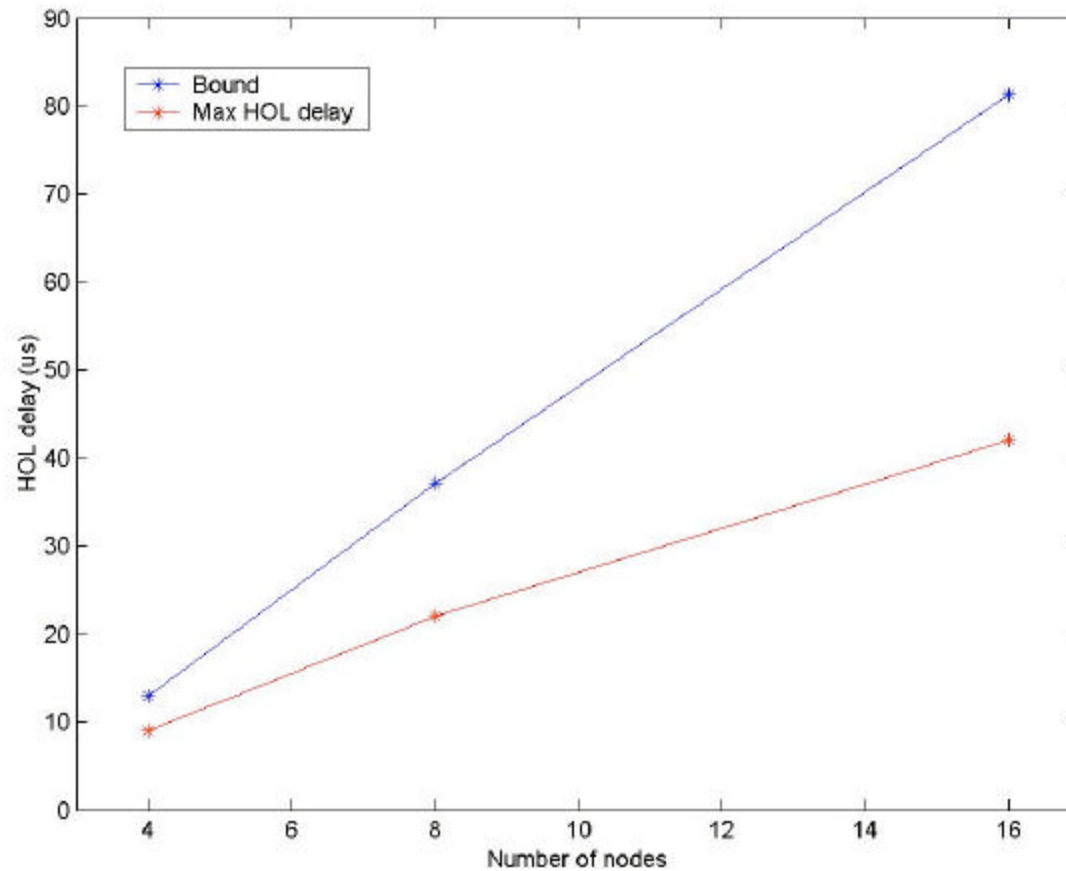

CDF of HOL delay

Case II simulation setup

- Equal weights for all nodes
- Bucket size: 6000 bits
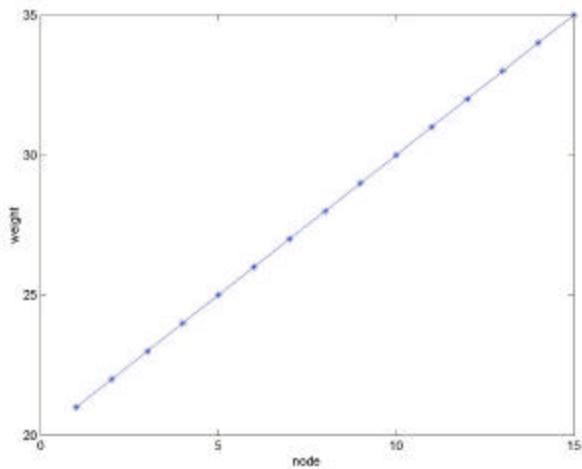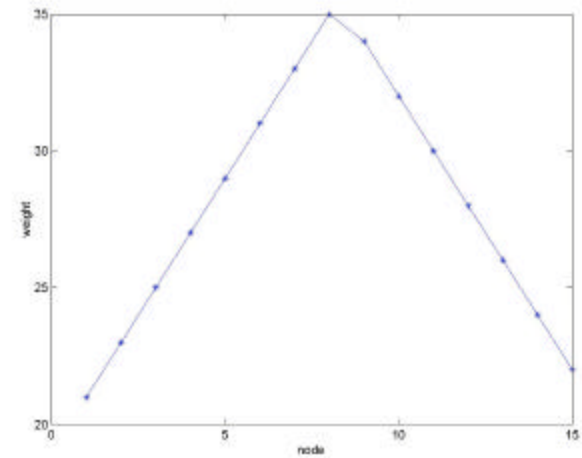- Target utilization: 0.95

Case II simulation result

Case III simulation setup

- Number of nodes: 16
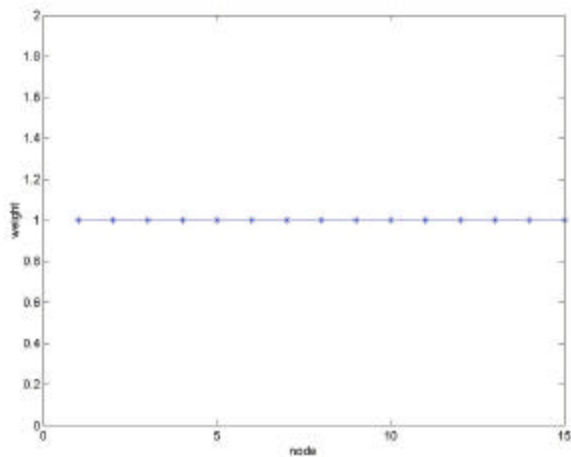- Bucket size: 6000 bits
- Target utilization: 0.95

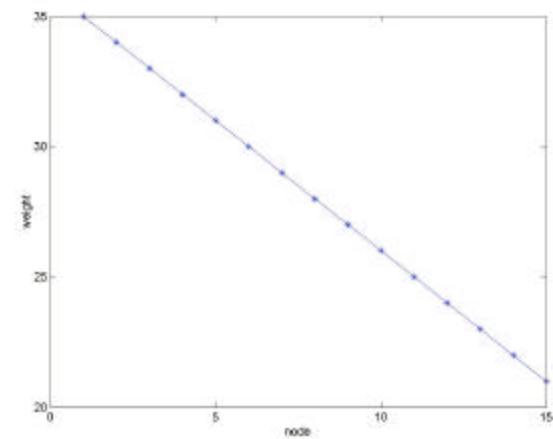# Case III simulation setup (cont'd)
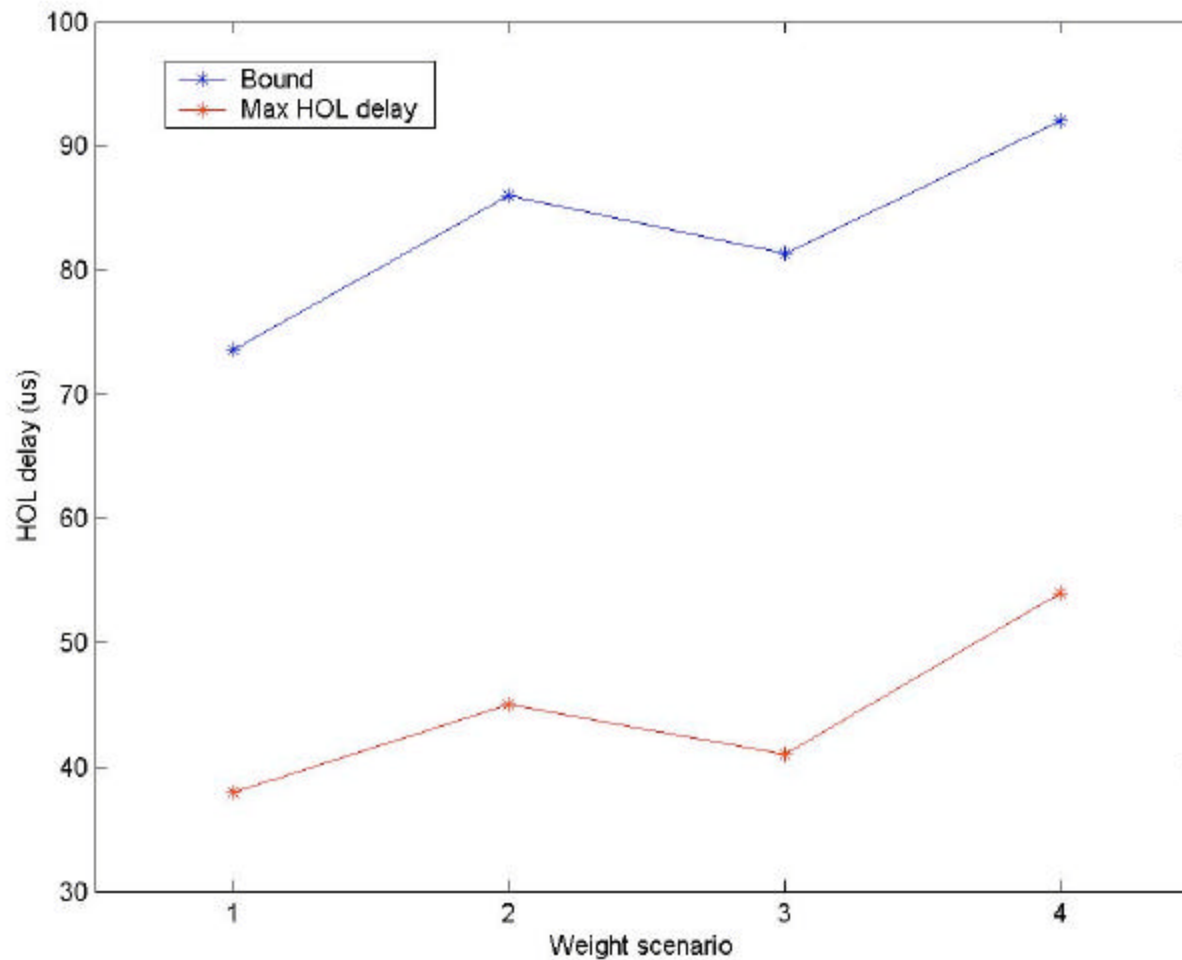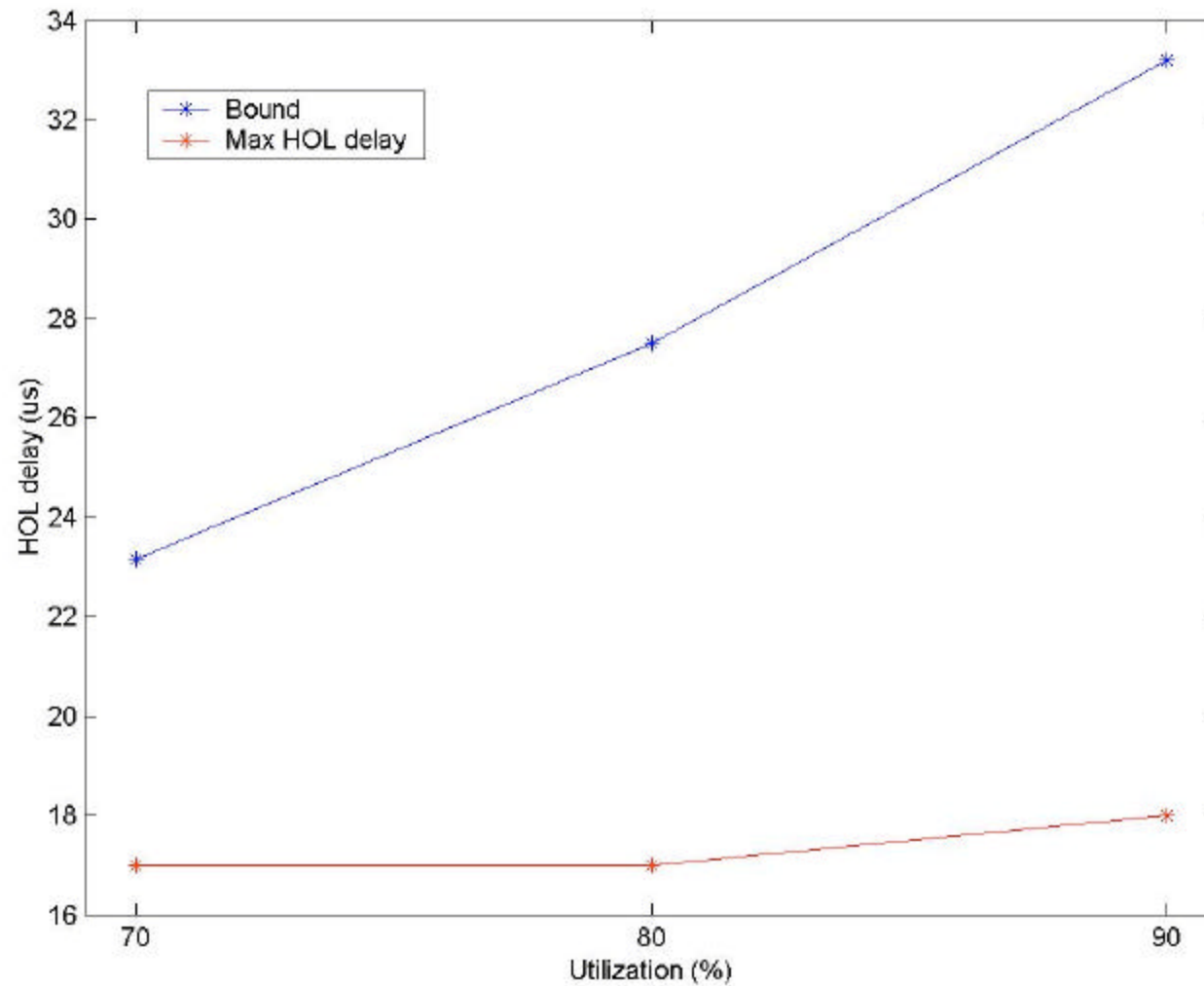

1

2

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4

Case III simulation result

Case IV simulation setup

- Number of nodes: 8
- Equal weights for all nodes
- Bucket size: 6000 bits

Case IV simulation result

Huang

Conclusions

- The maximum HOL delay under steady state is bounded.

- Bound for HOL delay depends on bucket size, number of nodes, weights and utilization.

- Bound for HOL delay can be calculated beforehand.

- Desired bound can be achieved by selecting an appropriate bucket size for a given network setup.