

COE 502 / CSE 661

Parallel Processing Architectures

Quiz 4 on Interconnection Networks: Monday, December 26, 2011

SOLUTION

Suppose the links are 2-byte wide and operating at 500 MHz in an interconnection network where the average distance is $\log_2 N$ for N nodes, and the switch delay is 3 cycles to advance the first 2 bytes (header) of a packet, containing routing information, inside a switch from input to output port.

- a) (5 pts) Compute the average unloaded network latency for 150-byte packets and $N = 16$ nodes under store-and-forward routing.

Average $h = \log_2 16 = 4$ hops, link bandwidth $b = 2 \text{ byte} * 500 \text{ MHz} = 10^9 \text{ byte/sec} = 1 \text{ byte/ns}$

Average unloaded latency = $4 * (150/1 \text{ ns} + 3 * 2 \text{ ns}) = 4 * 156 \text{ ns} = 624 \text{ ns}$

- b) (4 pts) Repeat for $N = 1024$ nodes.

Average $h = \log_2 1024 = 10$ hops

Average unloaded latency = $10 * (150/1 \text{ ns} + 3 * 2 \text{ ns}) = 10 * 156 \text{ ns} = 1560 \text{ ns}$

- c) (5 pts) Repeat for cut-through routing, and $N = 1024$ nodes.

Average unloaded latency = $10 * (3 * 2 \text{ ns}) + 150/1 \text{ ns} = 60 + 150 = 210 \text{ ns}$

- d) (6 pts) Repeat for 1050 byte packets and $N = 1024$ nodes, for both store-and-forward and cut-through routing.

For store-and-forward: latency = $10 * (1050/1 \text{ ns} + 3 * 2 \text{ ns}) = 10 * 1056 = 10560 \text{ ns}$

For cut-through = $10 * (3 * 2 \text{ ns}) + 1050/1 \text{ ns} = 1110 \text{ ns}$