Lecture 16: On-Chip Networks

- Today: on-chip networks background

Interconnection Networks

- Recall: fully connected network, arrays/rings, meshes/tori, trees, butterflies, hypercubes

- Consider a k-ary d-cube: a d-dimension array with k elements in each dimension, there are links between elements that differ in one dimension by 1 (mod k)

- Number of nodes $N = k^d$ (with no wraparound)

Number of switches	: N	Avg. routing distance	: $d(k-1)/2$
Switch degree	: $2d + 1$	Diameter	: $d(k-1)$
Number of links	: Nd	Bisection bandwidth	: $2wk^{d-1}$
Pins per node	: 2wd	Switch complexity	: $(2d + 1)^2$

Should we minimize or maximize dimension?

Routing

- Deterministic routing: given the source and destination, there exists a unique route

- Adaptive routing: a switch may alter the route in order to deal with unexpected events (faults, congestion) – more complexity in the router vs. potentially better performance

- Example of deterministic routing: dimension order routing: send packet along first dimension until destination co-ord (in that dimension) is reached, then next dimension, etc.