

# Lecture 13: Interconnection Networks

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- Topics: lots of background, recent innovations for power and performance

# Interconnection Networks

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- 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

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- 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.