

Lecture 20: Parallel Systems

- Last Time:
 - I/O
- Today
 - Introduction to parallel processing

Multiprocessors

- Today
 - Example machines
 - Multiprocessor taxonomies
 - SIMD, MIMD
 - UMA, NUMA, CC-NUMA
 - Parallel applications
 - Basic organization
 - Communication and Synchronization

Cluster of Workstations

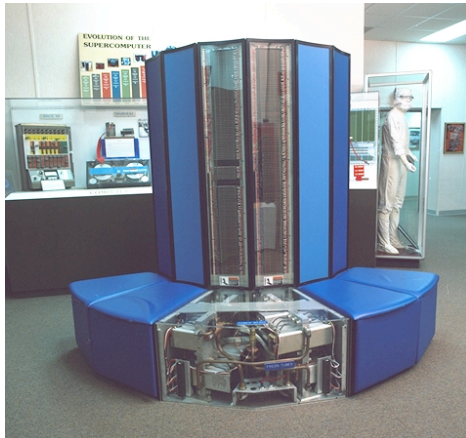


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Cray Vector Supercomputer - Cray XMP



Vector-multiprocessor
4 vector CPUs, 112 MHz
800 Megaflops peak
Vintage 1982

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DOE ASCI White



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IBM Regatta Machine



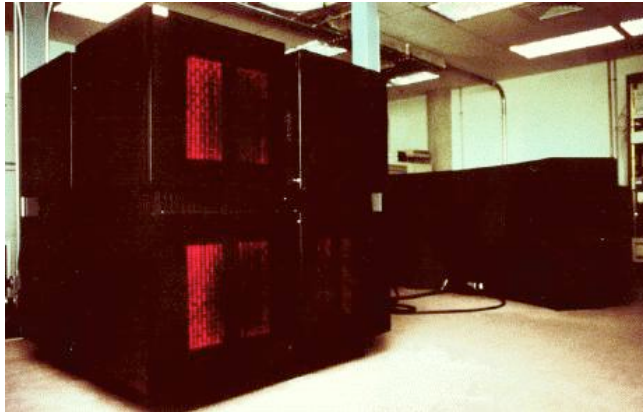
32 processors
32GB DRAM

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Connection-Machine CM-2



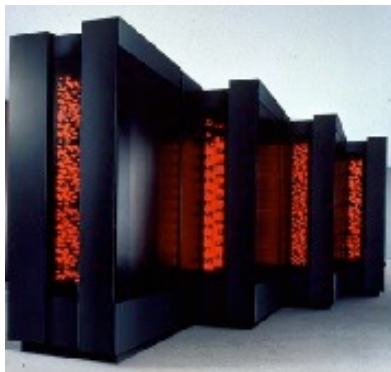
64K processors – simple 4-bit processors
10GB high speed “data vault”
Vintage 1990

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Connection Machine CM-5



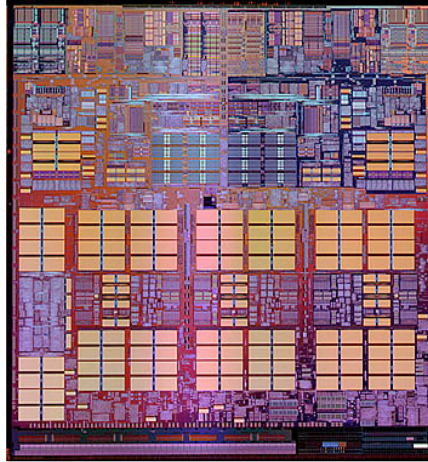
16K Nodes
Each node = 22MIP Sun Sparc processor
1 Teraflop peak
Vintage 1996

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2001- IBM Power4 Processor



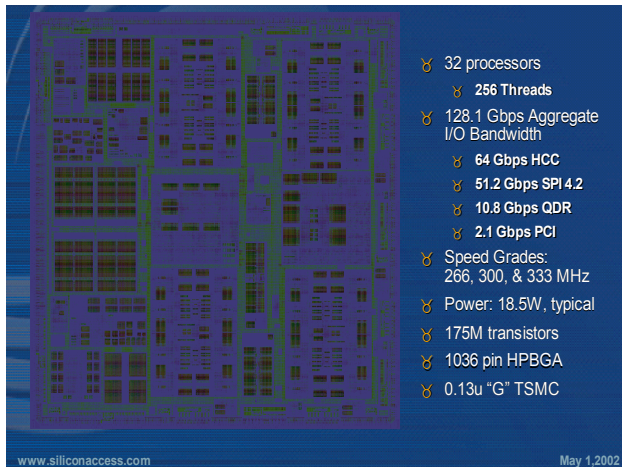
Two processor
cores on one
die

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2002 - Network processor



Silicon Access
Packet Processor

- ✧ 32 processors
 - ✧ 256 Threads
- ✧ 128.1 Gbps Aggregate I/O Bandwidth
 - ✧ 64 Gbps HCC
 - ✧ 51.2 Gbps SPI 4.2
 - ✧ 10.8 Gbps QDR
 - ✧ 2.1 Gbps PCI
- ✧ Speed Grades: 266, 300, & 333 MHz
- ✧ Power: 18.5W, typical
- ✧ 175M transistors
- ✧ 1036 pin HPBGA
- ✧ 0.13u "G" TSMC

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2004 - Graphics processor (GeForce 6800)



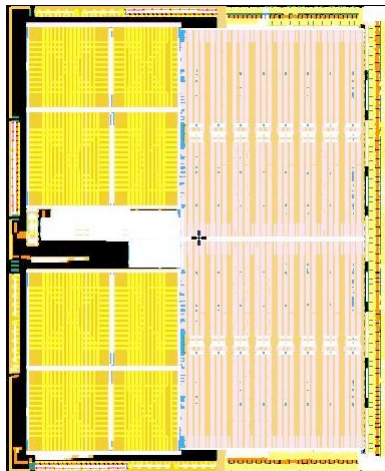
- * 6 vertex processors
- * 16 fragment (pixel) processors
- * plus lots of other ALU's

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2005 - AMD Opteron dual-core

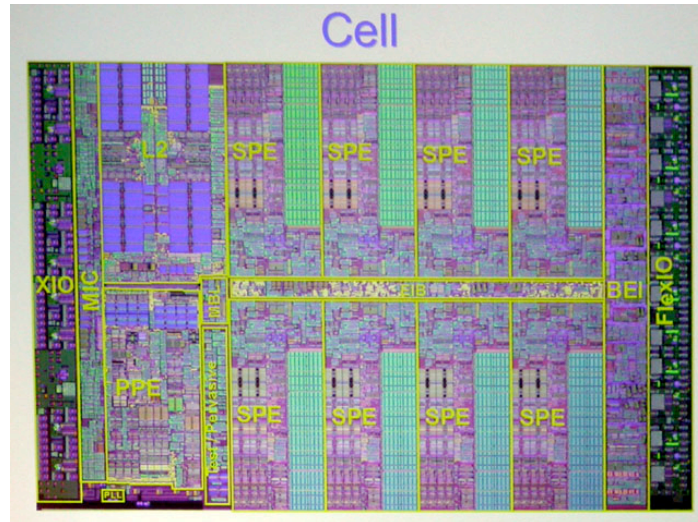


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IBM Cell - 2006



Summary

- Next Time
 - Parallel architecture continued