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MASSIVELY PARALLEL SOLUTIONS

CRAY T3E 1350

CRAY T3E-1350 TECHNICAL SPECIFICATIONS

Technical Specifications

Peak Performance	(LC) 54 GFLOPS to 3 TFLOPS
Architecture	MIMD with hardware support for SIMD

Processing Element

Microprocessor	21164A (EV5.6) 4-way superscalar RISC 2 floating-point operations/cycle 32- and 64-bit IEEE arithmetic
Local memory	256 or 512MB
Data error protection	SECDED
Clock speed	675 MHz
Peak performance	1350 MFLOPS per PE
Peak instruction rate	2700 MIPS per PE
Peak memory bandwidth	1200MB/sec per PE
Packaging	8 PEs per module, liquid cooled
PEs per system	40 to 2176 in increments of 8 PEs Includes support PEs that provide for operating system use and resilience

Memory

Technology	64MB 50 nanosecond DRAM
Architecture	Cache coherent, physically distributed, globally addressable
Total system memory	10GB to 1TB

Interconnect Network

Topology	3D bi-directional folded torus
Peak bisection bandwidth	42GB/sec (64 PEs) 166GB/sec (512 PEs)

I/O

One I/O interface per module

Peak I/O bandwidth 500MB/sec/interface

Physical Characteristics

Cabinet footprint area	LC272 35.4ft2 (3.2m2) LC544 57.4ft2 (5.2m2) LC1088 114.8ft2 (10.4m2) LC2176 229.6ft2 (20.8m2)

LIQUID-COOLED CRAY T3E-1350 SYSTEM CONFIGURATIONS

Systems from 40 PEs to 2176 PEs

Model[A]	Cabinets	PEs	Minimum Memory[B]	Peak Performance	I/O Interfaces	I/O Bandwidth
LC40:	1	40	10 GB	54 GFLOPS	5	2.5 GB/sec
LC72:	1	72	18 GB	97 GFLOPS	9	4.5 GB/sec
LC136:	1	136	34 GB	184 GFLOPS	17	8.5 GB/sec
LC272:	1	272	68 GB	367 GFLOPS	34	17 GB/sec
LC408:	2	408	102 GB	557 GFLOPS	51	25.5 GB/sec
LC544:	2	544	136 GB	734 GFLOPS	68	34 GB/sec
LC2176:	8	2176	544 GB	3 TFLOPS	272	136 GB/sec

[A] *This is not a complete list of all liquid-cooled CRAY T3E-1350 systems. Any configuration above 40 PEs is possible in increments of 8 PEs.*

[B] *Minimum memory based on 256 MB per PE. Double with 512 MB per PE. Air-cooled models also available (600 MHz only) up to 128 processors.*

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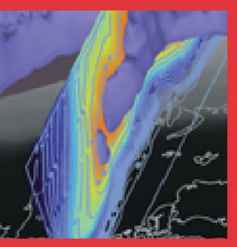
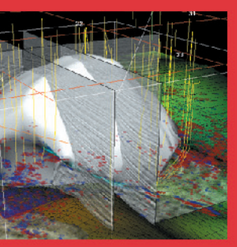
THE SCALABLE PERFORMANCE LEADER — The Cray T3E system is widely recognized as the most technically successful highly scalable supercomputer and holds the world record for sustained performance on a full 64-bit application. The Cray T3E-1350 system is the fifth in a series of enhancements to the Cray T3E line of large-scale massively parallel systems. The Cray T3E-1350 architecture will contribute heavily to Cray's next generation of supercomputers. Cray T3E systems are used worldwide to meet the most challenging scientific and technical problems in aerospace, environmental, government, petroleum, and research markets for a wide range of applications including electromagnetics, chemistry, fluid dynamics, weather forecasting and climate prediction, and 3D seismic processing.

CRAY T3E 1350

MASSIVELY PARALLEL SOLUTIONS

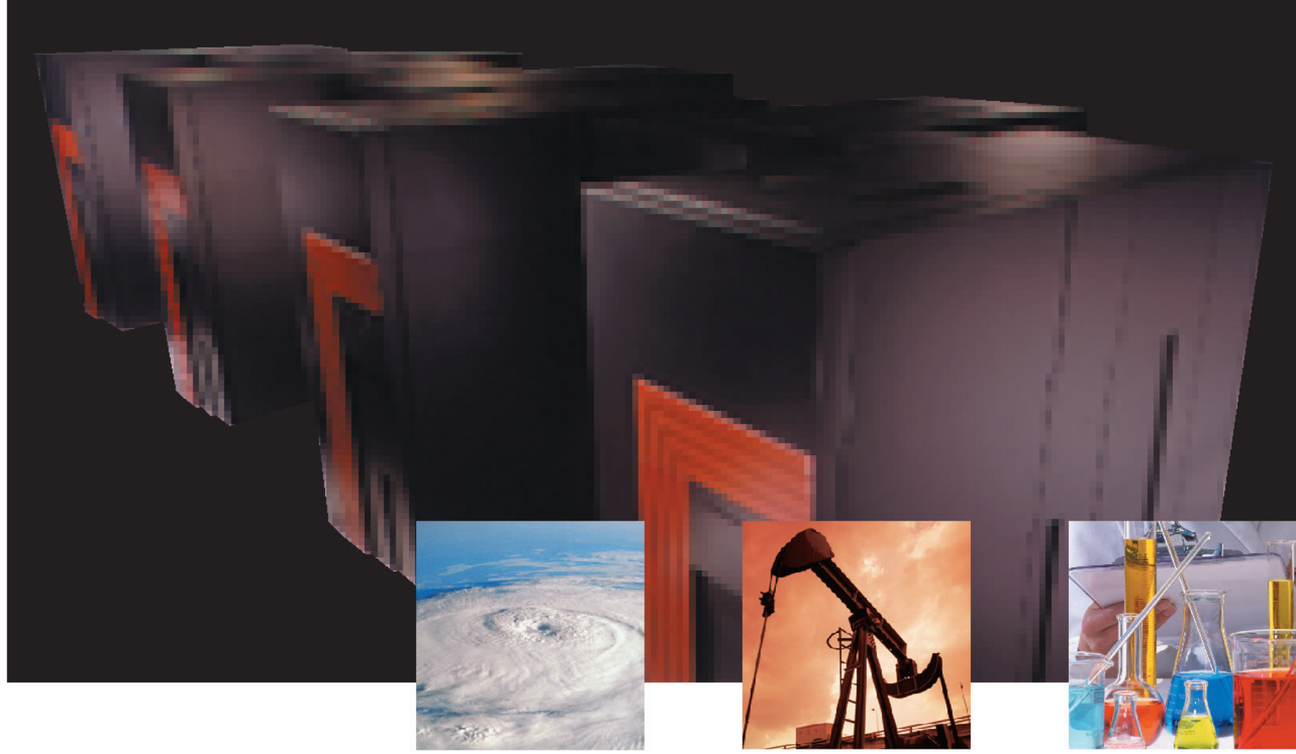




"The Cray T3E will help us understand and prepare for climate change, one of humanity's greatest challenges in the next century." — Peter Ewins, Chief Executive, The United Kingdom Meteorological Office

"User have brought their software over to the Cray T3E, and have been able to accomplish in one day what took them thirty days on other systems. Even though those other systems have comparable compute power. So, peak gigaflops in and of itself is not sufficient condition. It is the total package of the system — its reliability, its user-friendliness, its stability. And the Cray T3E is a rock solid system." — Paul Muzio, Director, Army High Performance Computing Research Center

"In highly parallel computing, Cray's pioneering T3E has long been the platform of choice for solving the most demanding technical problems." — Rich Partridge, Vice President, Enterprise Servers, D.H. Brown Associates



FLEXIBLE, SCALABLE DESIGN

Cray is the leader in extreme scalability due to its unrivaled ability to design balanced computer systems. The Cray T3E-1350 systems' scalable performance is derived from combining ultrafast microprocessors (675 MHz) and industry-leading interprocessor communications with scalable operating system and high-performing input/output (I/O) capabilities. Cray T3E-1350 processors are tightly coupled by the unique Cray interconnect: a three-dimensional bi-directional torus capable of extremely low latency and high bandwidth. The Cray T3E-1350 offers a peak interconnect speed of 650MB/sec to maintain system balance with the system's faster processors and memory.

The Cray® UNICOS/mk™ distributed functionality operating system (OS) and scalable GigaRing™ I/O system complement the Cray hardware technology to create capable high-end systems that typically range from a few hundred to thousands of processors.

The Cray T3E systems' flexibility allows customers to affordably expand their systems as their applications and capacity needs grow. The systems are designed to grow in increments of eight processing elements, and provide a choice of 256MB or 512MB of dedicated memory for each processing element (PE) and 1200MB per second bandwidth.

UNICOS/MK OS

To support the scalability of the Cray T3E systems, Cray created UNICOS/mk, a scalable version of its UNICOS® operating system. UNICOS/mk is divided into servers, which are distributed among the processors of the Cray T3E systems. Local servers process OS requests specific to each user PE, while global servers provide system-wide OS capabilities. The result is the world's first truly scalable OS. This distribution of functions provides a global view of the computing environment — a single-system image —that allows administrators to manage a system-wide suite of resources as a single entity.

Cray T3E-1350 systems support both explicit and implicit methods. Implicit methods include distributed-memory parallelism through CF90 and C/C++ with message passing (SHMEM, MPI, and PVM) and Co-array Fortran programming models. Implicit parallelism is supported through HPF and the Cray CRAFT work-sharing features.

GIGARING TECHNOLOGY

Cray T3E systems perform I/O through multiple ports onto one or more scalable GigaRing channels. Each dual-ring I/O channel, containing data in two rings traveling in opposite directions, delivers high I/O bandwidth and enhances reliability. All I/O channels are accessible and controllable from all PEs. On the Cray T3E systems, each GigaRing interface has a maximum bandwidth of 500MB/sec.

ARCHITECTURE HIGHLIGHTS

In addition to the extreme performance and bandwidth of the PE, and the extreme scalability through the low-latency and high bandwidth interconnect, the Cray T3E-1350 systems have two unique features – STREAMS and E-Registers. STREAMS maximize local memory bandwidth, allowing the microprocessor to run at full speed for vector-like data references. E-Registers provide gather/scatter operations for local and remote memory references and utilize the full bandwidth of the interconnect for single-word remote reads and writes. Together these features add up to a no-compromise design creating the world's most powerful solution for highly scalable applications — hundreds and thousands of processors.