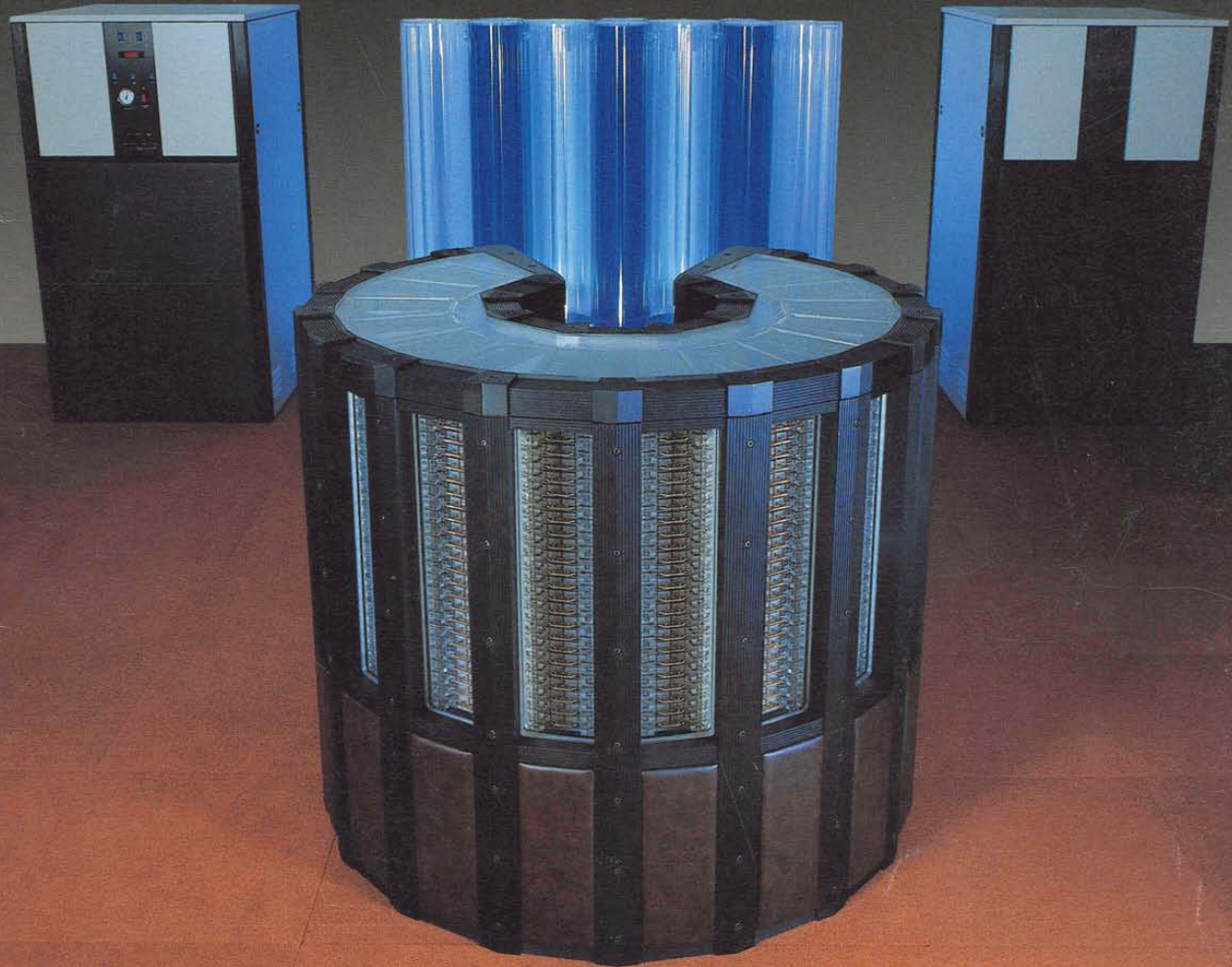# Huppenthal

Reference 2

The CRAY-2 Computer System

Cray Research, Inc.

Cray Research's mission is to lead in the development and marketing of high-performance systems that make a unique contribution to the markets they serve. For close to a decade, Cray Research has been the industry leader in large-scale computer systems. Today, the majority of supercomputers installed worldwide are Cray systems. These systems are used in advanced research laboratories around the world and have gained strong acceptance in diverse industrial environments. No other manufacturer has Cray Research's breadth of success and experience in supercomputer development.

The company's initial product, the CRAY-1 Computer System, was first installed in 1976. The CRAY-1 quickly established itself as the standard of value for large-scale computers and was soon recognized as the first commercially successful vector processor. For some time previously, the potential advantages of vector processing had been understood, but effective practical implementation had eluded computer architects. The CRAY-1 broke that barrier, and today vectorization techniques are used commonly by scientists and engineers in a wide variety of disciplines.

With its significant innovations in architecture and technology, the CRAY-2 Computer System sets the standard for the next generation of supercomputers. The CRAY-2 design allows many types of users to solve problems that cannot be solved with any other computers. The CRAY-2 provides an order of magnitude increase in performance over the CRAY-1 at an attractive price/performance ratio.

Introducing the CRAY-2 Computer System

The CRAY-2 Computer System sets the standard for the next generation of supercomputers. It is characterized by a large Common Memory (256 million 64-bit words), four Background Processors, a clock cycle of 4.1 nanoseconds (4.1 billionths of a second) and liquid immersion cooling. It offers effective throughput six to twelve times that of the CRAY-1 and runs an operating system based on the increasingly popular UNIX™ operating system.

The CRAY-2 Computer System uses the most advanced technology available. The compact mainframe is immersed in a fluorocarbon liquid that dissipates the heat generated on the densely packed electronic components. The logic and memory circuits are contained in eight-layer, three-dimensional modules. The large Common Memory is constructed of the most dense memory chips available, and the logic circuits are constructed from the fastest silicon chips available.

The CRAY-2 mainframe contains four independent Background Processors, each more powerful than a CRAY-1 computer. Featuring a clock cycle time of 4.1 nanoseconds — faster than any other computer system available — each of these processors offers exceptional scalar and vector processing capabilities. The four Background Processors can operate independently on separate jobs or concurrently on a single problem. The very high-speed Local Memory integral to each Background Processor is available for temporary storage of vector and scalar data.

Common Memory is one of the most important features of the CRAY-2. It consists of 256 million 64-bit words randomly accessible from any of the four Background Processors and from any of the high-speed and common data channels. The memory is arranged in four quadrants with 128 interleaved banks. All memory access is performed automatically by the hardware. Any user may use all or part of this memory.

In conventional memory-limited computer systems, I/O wait times for large problems that use out-of-memory storage run into hours. With the large Common Memory of the CRAY-2, many of these problems become CPU-bound.

Cray Research, Inc.

1
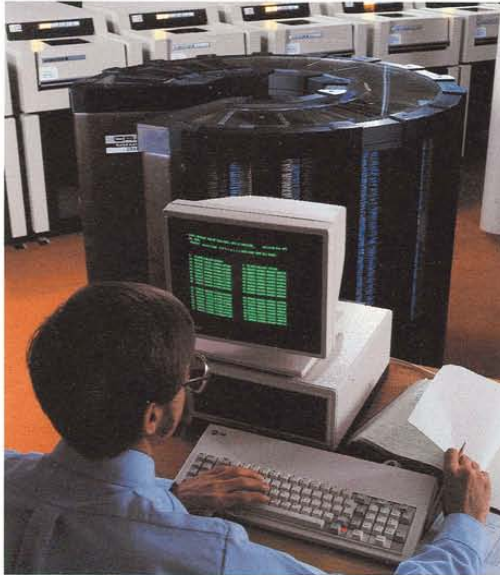
Control of network access equipment and the high-speed disk drives is integral to the CRAY-2 mainframe hardware. A single Foreground Processor coordinates the data flow between the system Common Memory and all external devices across four high-speed I/O channels. The synchronous operation of the Foreground Processor with the four Background Processors and the external devices provides a significant increase in data throughput.

To complement the new CRAY-2 architecture, Cray Research has developed an interactive operating system based on AT&T's UNIX System V. The CRAY-2 Operating System is supported by a FORTRAN compiler based on the proven Cray Research FORTRAN compiler, CFT.

The CRAY-2 Computer System represents a major advance in large-scale computing. The combination of four high-speed Background Processors, a high-speed Local Memory, a huge Common Memory, an extremely powerful I/O capability and a comprehensive software product offers unsurpassed and balanced performance for the user.

Features of the CRAY-2

☐ Extremely large directly addressable Common Memory
☑ Fastest cycle time available in a computer system (4.1 nsec)
☐ Scalar and vector processing combined with multiprocessing
☑ Integral Foreground Processor
☐ Elegant architecture
☑ Extremely high reliability
☐ Uses high density memory chips and extremely fast silicon logic chips
☐ Liquid immersion cooling
☐ An operating system based on industry recognized UNIX system
☐ Automatic vectorizing FORTRAN compiler

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.