New generation Intel parallel computer arrives at San Diego Supercomputer Center

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INTEL PARALLEL COMPUTER ARRIVES AT SAN DIEGO SUPERCOMPUTER CENTER

One of a new generation of parallel computers, capable of approaching the performance of the most powerful supercomputer, has been acquired by the University of California, San Diego (UCSD) and the San Diego Supercomputer Center (SDSC) from Intel Scientific Computers in Beaverton, Oregon. The arrival of the so- called massively parallel machine is part of a long-term research program in advanced computing architectures and software development.

The 32-processor iPSC/860, with a peak operating speed of nearly 2 billion floating point operations per second (GFLOPS), represents the first result of the Touchstone project, a three- year project being carried out by Intel with the help of a $7.6 million grant from the Defense Advanced Research Project Agency (DARPA).

The Touchstone project, launched in April 1989 with a total expected cost of $27.5 million, calls for a 2,048-processor machine capable of peak speeds of 150 GFLOPS by 1992. By comparison, the CRAY Y-MP8/864 at SDSC -- the most powerful supercomputer available today -- has a peak speed of 2.6 GFLOPS.

Ultimately, it is hoped the funding of massively parallel systems will lead to the Holy Grail of supercomputing -- a trillion floating point operations per second, or teraflop.

"The rallying cry has been a teraflop by 1995, and that opens just tremendous opportunities for solving previously intractable problems," said Wayne Pfeiffer, deputy director for research at SDSC.

According to a September 8, 1989, report from the President's Office of Science and Technology Policy, a major jump in supercomputing performance is needed to help solve some of the thorniest problems in science and technology. The report listed 20 of these so-called "Grand Challenges," including world climate prediction, semiconductor circuit design and test, superconductivity research, mapping of the human genome and support for advanced drug design.

In recent years, federal science officials have concluded that the best way to reach these scientific goals is through parallel supercomputers -- machines that are capable of performing a single computing task by dividing the problem among many processors (units that do the computational work). Several companies including Intel, NCUBE and Thinking Machines Corp., already have manufactured and sold hundreds of such machines, primarily to industry, government and universities.

"The installation of an iPSC/860 at the San Diego Supercomputer Center is a milestone for Intel," said Robert Rockwell, general manager of Intel Scientific Computers. "SDSC affiliated researchers are investigating numerous computational challenges and it's very exciting for Intel to join SDSC in the advancement of computational research."

The National Science Foundation also is encouraging the four supercomputer centers it sponsors, which include SDSC, to become more involved in parallel computing. The new computer will be housed at the center.

But there's a catch. Parallel computers, particularly those with hundreds and thousands of processors, are difficult to program and use. Before any massive switch from traditional computing, these newer architectures will have to be made as easy and painless to use as most of today's technical workstations.

"I have full confidence that the manufacturers will build machines capable of very high performance," said Pfeiffer. "The challenge is how to make them usable. It is a software challenge, for systems software and applications software."

As part of its agreement with Intel, researchers from UCSD (more) and SDSC will work on several projects to help develop software of mutual interest to the academic community, as well as Intel.

One of the projects, to be conducted by SDSC staff researchers, will seek to enhance the systems software. Several applications software packages also will be created for the computer by SDSC staff.

Scientists from UCSD's Computer Science & Engineering Computing Facility (CSE) also will help create software for the system, as well as compilers capable of translating programs created for traditional computers for use on parallel systems. Two new faculty members recently have been hired to help with this effort.

A third group, involving UCSD physicists and chemists, will use the new parallel system to help with several problems requiring intense computation, including the simulation of chemical properties in bulk matter and problems in particle physics known as lattice gauge theory. The Superconducting Supercollider (SSC) is intended to be used primarily for experiments in this latter field.

"The machine we are getting will be competitive with anything in the country," said Roger Dashen, chairman of the UCSD physics department. "As it grows it will become more important in particle physics, long before the SSC is built. It should make UCSD a leading university in scientific computation."

The iPSC/860 is built around Intel's i860 microprocessor, a RISC (for reduced instruction set computer) chip containing more than one million transistors and capable of performing up to 80 million calculations per second. In 1976, the CRAY 1 was introduced with a peak performance of 160 million calculations per second.

The Intel machine, currently is available with 8 to 128 microprocessors. Two 128-processor models have been shipped for testing to the Oak Ridge National Laboratory and NASA's AMES Research Center. Among those who have purchased systems are: Prudential-Bache Securities; Boeing Advanced Systems; and GSF, the Gesellschaft fur Strahlen Forschung, in Munich, Germany.

The iPSC/860 is a so-called MIMD (multiple-instruction-stream/multiple-data-stream) machine. In these computers, problems and tasks are split into separate pieces and distributed to the processors, each acting independently from the other.

By contrast, so-called SIMD (for single-instruction-stream/ multiple-data-stream) machines operate on a single set of instructions to all the processors. At any given time, each processor either executes precisely the same command as all the others, or it does nothing. The Connection Machine, which contains as many as 65,536 processors, is an example of SIMD machines.

SDSC is administered and operated by General Atomics at UCSD. The center was established to foster advances in computational science, and to provide a vital link between academic and industrial researchers.

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