

US technology

Parallel computer unveiled

Cambridge, Massachusetts

JUST two and a half years after setting out to build the world's first "fifth generation" computer, Thinking Machines Corporation (TMC) of Cambridge, Massachusetts, last week unveiled the Connection Machine (CM), a massively parallel computer with 65,536 individual processors. TMC has already developed some remarkable applications for the new machine but the company consultant, Richard Feynman of California Institute of Technology, says the problems have yet to be dreamed up that will make full use of CM's unique abilities.

While a graduate student at Massachusetts Institute of Technology (MIT) in Cambridge, CM's spiritual father Danny Hillis came up with the blueprint for a data-level parallel processing computer. Using data-level processing leads to a more natural way of thinking about certain problems, says Hillis. For example, organizing a visual image by examining one small section at a time makes less sense than processing all the information in the image simultaneously. Data-level processing works best on problems with large amounts of data, whereas control-level parallel processing machines are most effective when the ratio of program to data is high. But control-level parallelism involves the difficult task of developing algorithms for asynchronous control of operations.

Communication among processors is the key to CM. Locally, this is done by interconnections among neighbouring processors. For general communications and dynamic reconfiguration, CM uses routers to send messages to the 64K processors arranged in a 16-dimensional hypercube at speeds of up to 3,000 megabits per second.

CM consists of a front-end computer, either a VAX or a Symbolics 3600, that sends instructions to the parallel processors. Each processor contains 4K of memory, so a fully configured CM has 32 megabytes of memory. Even with a \$3 million price tag, or \$1 million for a CM with 16K processors, prospective buyers are lining up to get hold of the new machine. TMC has so far delivered only one CM, to the Defense Advanced Research Projects Agency (DARPA), but in two months machines will be heading to MIT (2), Yale, Perkin Elmer Corporation and a second machine to DARPA.

In 1983, Hillis teamed up with Sheryl Handler to form TMC. Handler wanted to find a product that would provide a "fundamentally new way of computing". The new company quickly brought on board top scientists as consultants: Hillis's adviser Marvin Minsky and Thomas Poggio

of MIT, Stephen Wolfram of the Center for Advanced Study at Princeton and Caltech's Feynman. With \$16 million in equity capital and a \$4.7 million DARPA contract early on, TMC was able to take the risks Handler felt necessary to leapfrog the competition.

A major advantage of CM for new users is its ability to run in familiar operating environments. Extensions to C and LISP computer languages designed by TMC allow immediate access to CM's parallel capabilities. TMC has already come up with applications packages that show off CM's power. A search for key words in a 16,000-document database takes only 30 milliseconds, much faster than conventional searches. Image processing, very large scale integrated (VLSI) circuit design, and fluid flow problems all take advantage of CM by assigning one processor to each element of the problem's dataset. CM can achieve operating speeds up to 7,000 MIPS (million instructions per second) on certain applications, faster than the fastest computer utilizing more conventional architecture.

Although CM's initial capabilities are

impressive, Wolfram believes that a new computer language is needed to take full advantage of it. CM is well suited to cellular automata, and Wolfram predicts that almost all problems now being solved using differential equations will be done in future by constructs like cellular automata.

Another plus for CM is its expandability. While traditional computers using principles developed 40 years ago by von Neumann are inherently limited by a single central processing unit, an arbitrarily large number of processors can in theory be linked together using CM's design. TMC scientists have already written simulations of a machine with one million processors that can run on current CM computers.

Hillis says TMC's next goal is to develop a true learning system. In a small way, the interconnecting processors of the CM resemble the interconnections of individual neurones of the brain. Hillis hopes that this type of architecture will encourage the development of learning algorithms that more closely resemble biological processes.

Other groups around the world are working on new computers using parallel architecture, but Poggio points out that CM has one obvious advantage over other projects: "It works".

Joseph Palca

AIDS in India

Pool of infected women?

New Delhi

THE Indian Council of Medical Research (ICMR) is expanding its network for surveillance on acquired immune deficiency syndrome (AIDS) following the detection of six cases in Madras, capital of the southern state of Tamilnadu.

All those concerned are female prostitutes aged between 20 and 30. Two of them have disappeared and are being sought by the state government and the other four are under observation. Professor V. Ramalingaswami, director-general of ICMR and chairman of the AIDS task force that has been set up, says that none of the women showed clinical manifestations of AIDS except one who lost weight. The women were among 102 prostitutes whose sera were subjected to enzyme-linked immunosorbent assay (ELISA) at the ICMR centre at the Christian Medical College in Vellore.

The findings were confirmed by scientists at the Centers for Disease Control in Atlanta, Georgia, where the sera were analysed by Western blot technique.

ICMR fears that more AIDS cases may be detected once the male contacts of the prostitutes are traced, but this is an almost impossible task. The women have told social workers that they usually had ten partners a day, mostly truck drivers; they all denied having foreigners among their

customers.

It is not yet known if the virus is HTLV-III or a related virus recently found in Senegal, West Africa. As there is no experience in India of isolating or characterizing the virus, ICMR has sent three scientists to the United States and West Germany for training.

Meanwhile, ICMR is launching a programme to train physicians and technicians in the diagnosis of AIDS. Twenty-five thousand test kits have so far been imported. It is proposed to set up surveillance centres in each district, and to test donations from professional blood donors. Imported blood and blood products now have to be accompanied by certificates testifying that they are free from AIDS, and a requirement for health certificates from visiting foreigners is being seriously considered.

A separate section is being created in the health ministry to implement the AIDS detection and control programme. Ramalingaswami says this will put an extra strain on the health budget, half of which at present goes towards control of malaria. "We have our priorities and there is not much money for AIDS observation", says Ramalingaswami, but he admits that the detection of AIDS must be a priority if it is not to become widespread.

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