Computer Projects in Japan

To learn what is going on in another country is often difficult. You may come across some articles with a few statistics or some comments about the country in which you are interested. But putting these pieces together to form a comprehensive picture of the scene in a foreign country is no easy task. I hope the articles assembled in this issue of IEEE Micro help readers acquaint themselves with the Japanese computer scene.

Since the articles in this issue can cover only a tiny portion of the computer activities, I summarize here very briefly three of Japan's ongoing computer projects, all major projects of particular interest to Micro readers. The Fifth Generation Computer project develops artificial intelligence systems, the Sigma project strives to increase the software productivity of the Japanese computer software industry, and the TRON project, the one in which I am deeply involved, aims at establishing a computer system architecture.

The Fifth Generation Computer and Sigma projects have strong financial backing from Japanese government agencies. The TRON project, on the other hand, receives support from 130 commercial organizations that include European, American, and Japanese companies.

The 10-year Fifth Generation Computer project is now into its eighth year of operation. Last year (1988) saw the demonstration of Multi-PSI, a cluster of 64 PSI-II sequential inference machines. Using these inference machines, project designers developed KL1, a parallel language; PIMOS, a multiprocessor operating system; and PIM (Parallel Inference Machine), which runs Prolog rapidly and will eventually contain 100 processors. In the last three years of the project, the stated goal is to build a prototype of PIM that contains 1,000 processors.

The Sigma project, started in 1985 and extending to 1989, aims at making a standard software development environment available to computer software developers. Sigma-OS (a variant of Unix), a group of software productivity tools called the Sigma tools, and Sigma workstations form the basis of this environment. Plans call for setting up a centralized depository of topics on software productivity tools known as the Sigma center. This center will disseminate the latest information to Sigma workstations connected to it, thus promoting software productivity by providing the latest tools and recycling reusable components. In 1990 we expect to see Sigma-OS version 1 and the full use of Sigma workstations and tools.
The TRON project’s goal is to produce an HFDS, or Highly Functionally Distributed System, in which a very large number of computer objects are connected. The number, on the order of millions and more, far exceeds the number of processors in existing computer networks. The network is heterogeneous. Currently, project participants work at designing the components of the computer architecture to make the HFDS a reality.

The readers of Micro are aware that I introduced articles about the TRON project in 1987 and in 1988. This latest update on the project should mention that six companies now produce the VLSI CPU family of chips based on the TRON specification. The Gmicro/200 and TX1 CPUs are commercially available, and samples of the floating-point processor unit, cache controller, and DMA controller to be used with the CPUs have been released. Various sources, including US companies such as Microtec Research, Inc. in Santa Clara and Ready Systems Corp. in Sunnyvale, California, offer the software tools to support software development for the CPU family. Designers are also working on a general-purpose system bus called Tobus/Toxbus.

The industrial version of the TRON operating system, ITRON, now includes a smaller specification called Micro-ITRON that is targeted to single-chip CPU application. Micro-ITRON will be used in high-end home appliances and will be important in developing electronics goods that connect to the HFDS environment in the future. Also in design is the ITRON2 (an interim name) operating system for the VLSI CPU in the TRON project.

Designers working with BTRON, the business version of TRON, have produced some prototypes for software development. BTRON incorporates multimedia capability, as you can see from one of the articles in this issue. Samples of such machines will become commercially available in Japan through special outlets such as third-party software publishers or system houses interested in building new BTRON applications.

The network operating system tying these pieces together is called MTRON, or Macro TRON. MTRON researchers have formed and activated TRON computer housing, computer building, and urban development projects. The projects include construction companies and furniture manufacturers in their membership. The inclusion of these participants will ensure that the HFDS can really be built on an experimental basis. Their activities will bring new insights to future TRON design activities.

The articles from Japan in this issue contain a discussion of a data-driven VLSI processor for consumer electronics developed by Mitsubishi Electric, Sharp, and the Osaka University team. Hitachi’s article concerns a numerical processor developed for the TRON project that should also be of interest to workstation designers. The BTRON/286 article describes the first implementation of the BTRON architecture on 286-based computers.

I hope the articles in this issue give you some idea of the current development activities in Japan.

Ken Sakamura is an associate professor in the Department of Information Science at the University of Tokyo. He initiated the TRON project in 1984. Under his leadership, several universities and over 100 manufacturers now participate in the project to help build computers in the 1990’s. In addition to his involvement with TRON, Sakamura chairs several committees of the Japan Electronics Industry Development Association and the Information Processing Society of Japan. He has written numerous technical papers and books and received the BS, ME, and PhD degrees in electrical engineering from Keio University in Yokohama. He is a member of the IEEE and the IEEE Computer Society.

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