Report
by Ehud Shapiro,
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I was invited to attend FGCS'92 in order to evaluate its progress and present a report in the "Project Evaluation Workshop". Hence I will focus in my report on the workshop.

The workshop seemed like a well-orchestrated psychological warfare against the two MITI officials attending, with side-effects for the representatives of the "private sector", i.e. lab chiefs from the participating companies. The troops used in this warfare were the "Logic Programming Mafia", who stood up, one after another, praised the Fifth Generation Project, and urged the MITI officials to extend the lifespan of ICOT.

Even though the different presentations were not coordinated (as far as I know), they showed remarkable uniformity of opinion. So perhaps the opinions expressed were sensible after all. All speakers praised the project for its achievements, noting especially (F)GHC and PIMOS as the notable achievements. GHC was praised for being an innovative and elegant concurrent logic programming language. PIMOS was praised for being a complete operating system built from the ground up using FGHC/KL1.

Most of the speakers also claimed that the hardware developed by the project was of a lesser long-term significance. Some went as far as saying that investing so much in hardware development was a mistake. All seem to agree that the fact that the software developed by ICOT was available only on proprietary machines diminished its impact.

As for the future, everyone stressed that without a continued presence of ICOT, the research results produced by the project would vanish into thin air. One of the main functions ICOT should play is to make the software technology available on stock hardware, under stock operating systems (Unix), provide documentation and support for the software, and integrate the various changes and improvements the users of the software, who will have access to its source code, are bound to make.

Every workshop participant got a collection of reports by ICOT visitors. Ogawa-san showed me my 1982 report, which appears there. I must admit I read it with great

interest, not remembering at all what I wrote there 10 years ago. Reading the report caused me to change my presentation. I started by quoting the goals of the project, as I saw them then: "[The Fifth Generation Project's] ultimate goal is to develop integrated systems — both hardware and software — suitable for the major computer applications of the next decade, identified by the Japanese as 'Knowledge Information Processing'."

"In addition ... the project is expected to elevate Japan's prestige in the world. It will refute accusations that Japan is only exploiting knowledge imported from abroad, without contributing any of its own to benefit the rest of the world. Hence the project aims at original research, and plans to make its results available to the international community."

In retrospect, I think that both of these goals — realizing an integrated, innovate, and useful system, and elevating Japan's in the world — have been fully achieved. MITI's recent decision to allow free distribution of software is consistent with the plan of making the results available to the international community. However, I agree with the other speakers in the workshop, that without continuing support from ICOT, that software will simply die.

I agreed with some of the previous speakers, that the international impact of the project was not as large as one hoped for in the beginning. I think all of us who believed in the direction taken by the project, i.e. developing integrated parallel computer systems based on logic programming, hoped that by the end of the 10 years period the superiority of the logic programming approach will be demonstrated beyond doubt, and that commercial applications of this technology will be well on their way. Unfortunately, this has not been the case. Although ICOT has reached its technological goals, the applications it has developed were sufficient to demonstrate the practicality of the approach, but not its conclusive superiority.

This can be partly attributed to the short period available for application development, give the software and hardware development schedule. But, more importantly, I think that this was the result of the applications being developed in an artificial setup. I believe applications should be developed by people who need them, and in the context where they are needed. The suitability of the software technology developed by ICOT cannot be fully evaluated until such applications are attempted.

Therefore I made some concrete suggestions for the future direction of ICOT. Some of them are in line with what is already planned. I suggest that ICOT now focus on making its concurrent logic programming software technology widely available, and actively encourage and support research and development groups who will use it in real-life applications. Specifically, I suggest that ICOT will:

- Port KL1/Pimos to stock hardware (both Unix workstations and commercially available parallel computers, including the recently emerging small-scale symmetric multiprocessors. I believe even a PC version of a mini-system can be quite useful for teaching and exploratory purposes.)

- Initiate some standardization effort for concurrent logic programming languages and systems.

- Provide specification and documentation for the software.

- Make the software widely available, with a GNU-like distribution policy.

- Provide teaching material, tutorials, and consulting services for users who wish to use the software.

- Provide research grants for research groups who are interested in applying and/or improving ICOT's concurrent logic programming system.

Since the last point has raised considerable interest, I would like to elaborate on it.

I think that applications are best developed by people who care about them. There are research groups around the world who are interested in developing applications using parallel computers. ICOT can more fully achieve its goal of international contribution and impact by supporting such groups and encouraging them to use ICOT's concurrent logic programming system. Fostering an active user's community for ICOT's system will have many positive impacts. First, it will require ICOT to clean-up, fully specify, and document its system. User's feedback will suggest improvements, and the body of knowledge accumulated by users of the system will help the development of future applications, and suggest ways to evaluate and improve the system.

I suggest that research groups involved in such activity will be offered grants for periods of 2-3 years each, for the sum of about ¥10M a year. Grants should be offered to academic and research institutions on the basis of the scientific merit of the research proposal. The fact that such grants are available can be easily publicized to the international research community through electronic bulletin boards and other means, inviting grant applications, which include a research proposal and a budget proposal. The applications can be ranked using external referees, and the best ones will be selected by a committee. The research agreement could either state the results of the research be put in the public domain, or that they belong, independently, to the funding agency (ICOT), and the institute carrying out the project. Under such an agreement ICOT can, if it so chooses, put the results in the public domain.

The return on investment for say, 50 such grants, meaning ¥500M a year, will be

much higher than any investment in an application development team assembled inside ICOT for such a task.

I ended my presentation with another quotation from my 1982 report: "The eventual success of the project will follow not from the amount of money invested in it, nor from the number of people working on it, nor even from the individual excellence of these people. It will follow from the coherent vision of its leaders, the genuine enthusiasm that they generate, and from the promising path of research that they chose."

I believe the statement to be as true today as it was 10 years ago. I thank ICOT and its leaders for these most exciting and rewarding 10 years.

CACM
1982

8. Conclusion

People who believe in the unpredictability of scientific progress and revolutions find a planned revolutionary project to be almost a contradiction in terms. But sometimes ideology has to give way to reality: the Japanese project is both well planned and revolutionary. It did not invent the concepts of logic programming, but it is certainly the first, and perhaps today the only one, which grasped the immense potential of this approach, and gathered the critical mass of resources necessary to utilize it on a large scale. [1] [2]

There are thoughts and attempts throughout the world at responding to the Fifth Generation project, but I suspect that this battle is already won. The eventual success of the project will follow not from the amount of money invested in it, nor from the number of people working on it, nor even from the individual excellence of these people. It will follow from the coherent vision of its leaders, the genuine enthusiasm that they generate, and from the promising path of research they chose. [3] [4]

Any response to the project may match the amount of money or other resources invested in it, but will fail to to come up with the same sense of direction and devotion that holds the Fifth Generation project together. One such example is the British response, which basically says: Let's keep doing what we do today, but with more money. Money will increase the progress of research, but by itself will not result in a new generation of computers. [5]

The Fifth Generation project faces two dangers: one is that it will succeed too late; the other is that it will succeed too early. If several years pass before any applicable [6]

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CACM
1982

Last April Japan's Ministry of International Trade and Administration (MITI), in cooperation with eight leading computer companies, launched a research project to develop computer systems for the 1990's. The project, called the Fifth Generation Computers Project, will span 10 years. Its ultimate goal is to develop integrated systems — both hardware and software — suitable for the major computer application for the next decade, identified by the Japanese as "Knowledge Information Processing". Even though it may ultimately have applicable results, the current focus of the project is basic research, rather than the development of commercial products.

In addition to bringing Japan into a leading position in the computer industry, the project is expected to elevate Japan's prestige in the world. It will refute accusations that Japan is only exploiting knowledge imported from abroad, without contributing any of its own to benefit the rest of the world. Hence the project aims at original research, and plans to make its results available to the international research community.

I was the first non-Japanese researcher invited for a working visit to ICOT, the Institute for New Generation Computer Technology, which conducts the project. Due to the nature of the project I was given explicit permission, even encouragement, to report on everything I saw and heard during my visit; hence this report.

ICOT is located on the 21st floor of an office building in central Tokyo. It currently hosts around 40 researchers, most of them on a 3-year "loan" from their industry-based research laboratories at Fujitsu, Hitachi, NEC, Matsushita, Mitsubishi, Toshiba, Oki, and Sharp.

The institute is divided into three research labs, responsible for research in hardware, basic software and applications software. The leaders of the laboratories are Drs. Munakami of Nippon Tel[illegible]

- The FGCS project is certainly a scientific & technological success!

- Yet, it hasn't ~~reached~~ achieved the desired level of international impact.

- Why? What can be done about it?

Scientific success:

- Contributions to programming language & system design, analysis, & implementation.

- Contributions in various applicat areas (NLP, KB).

- Stimulated basic research around the world, in LP & related / competitive areas.

Technological success:

- Very impressive, complete, (HW+SW) usable parallel computer system, with very clean design
- A result of good leadership with coherent & consistent philosophy.
- A large set of applications.

Additional positive side-effects.

- Greatly improved contact with international computer-science community.
- Exposed industry R&D staff to international standards & competition
- Provided stimulation & focus for Japanese Computer-Science community.

Why disappointing international impact?

- Radical software technology
- Needs "killer applications" to convince the mainstream
- ICOT applications only now emerging
- Available only on special ICOT hardware

⇒ Mainstream C.S. community is not convinced of this direction, yet...

Even though no viable alternative.

What can be done?

Keep the momentum,

Encourage larger circles to use the technology.

How?

- Make software publicly available
- Port to stock hardware (V?)
- Provide maintenance & upgrades (?)
- Provide support for <u>international</u> research groups that apply and/or improve the software technology.

(e.g. 50 × 10M ¥ /yr.)
= 500M ¥