COMPUTING MILIEUX

Parallel Computing: Glory and Collapse

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A decade ago, university researchers were in love with parallel computers, and the US government amorously responded. Those were the days of glory. Times have changed. The market for massively parallel computers has collapsed, and many companies have gone out of business. But the researchers are still in love.

Glory

Ten years ago, researchers basked in parallel-computing glory. They developed an amazing variety of parallel algorithms for every applicable sequential operation. They proposed every possible structure to interconnect thousands of processors. Federal agencies generously sponsored this research, hoping parallel computers would help gain a strategic advantage in the cold war against the Soviets. Many parallel computer companies emerged, and for a while business was good. They sold machines to the US government for several millions of dollars, and just a few sales generated profit.

Collapse

Today, the few parallel computing companies still in business are struggling to survive and probably won't. According to the Smaby Group study,[1] the scientific and engineering market for massively parallel processing machines has decreased significantly over the last several years to only $300 million in 1993. As a result, there are fewer than 10 parallel computer companies. Two companies, Intel and Thinking Machines, control over 60 percent of the market. Yet Thinking Machines lost $20 million last year and has recently announced Chapter 11 bankruptcy. The parallel computing industry has collapsed. But why? What happened?

The market for massively parallel computers has collapsed, but researchers are still in love with parallel computing.

Reasons for collapse. Many researchers[2,3] blame this collapse on the lack of good parallel-processing software. We complained about this ten years ago and we will complain in the future, so we might as well complain today. But this is only one reason. The other reasons are more significant.

First, the cold war is over, and the federal government is no longer willing to spend millions of dollars for these very specialized, expensive machines. The government has dramatically reduced funding in this area and transferred it to new, promising technologies, such as multimedia applications, information superhighways, digital libraries, interactive television, and virtual reality.

Second, there is new competition from personal computers and workstations, which increasingly employ more powerful, inexpensive processors. In distributed configurations, these systems offer solutions to many problems once solved only by parallel computers.

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Finally, when W. Daniel Hillis, Thinking Machines Corporation founder, decided to develop a machine with millions of parallel processors to resemble the human brain, was he on the right track? In building computers, should our ultimate goal be to create another human being? Experience indicates otherwise: we need fast and inexpensive sequential machines, which will solve about 99 percent of today's problems. For the remaining 1 percent, small parallel processors (multiprocessors) or sequential machines connected and distributed on networks should achieve satisfactory solutions.

The research continues. Despite the parallel computing market collapse, many university researchers not only study, but actually *promote* parallel computing. From 1993 to the present, there have been at least a dozen international conferences on parallel processing, and attendance is increasing. In the last few years, many journals, magazines, books, and papers on parallel processing have been published. Who is sponsoring these activities?

The most appalling trend is that education related to parallel processing has peaked. For his recent article, "The Status of Parallel Processing Education,"[4] Russ Miller investigated over 70 institutions. He indicates that several universities offer both undergraduate and graduate courses on topics like parallel algorithms, parallel programming, and parallel architecture. Some, like Michigan State, Auburn, and University of Central Florida, offer seven to nine courses, but the champion is Purdue University, which offers 10.

Will our graduates ever use parallel computers in real life? Probably not. According to a recent survey of 400 chief information officers by consulting firm Deloitte & Touche,[5] the hot technologies of the future are

- multimedia systems,
- expert systems,
- handheld computers,
- voice recognition,
- neural networks,
- fuzzy logic, and
- virtual reality.

This is bad news for the parallel computing community. How many undergradute or graduate courses do universities offer on these hot subjects? Probably fewer combined than the number of parallel processing courses offered. (And we complain that our graduates cannot find jobs.)

Potential solutions

Parallel computer companies have three choices: change their focus, file bankruptcy, or allow a larger corporation to acquire them. Some companies (Encore, Hewlett-Packard, IBM, Pyramid, Tandem, Stratus, and AT&T) have already changed their focus to transaction processing and fault-tolerant computing, which are more profitable.

Other companies are trying to find a new niche for their parallel machines. For example, nCube has formed an alliance with Oracle, whereby applications such as on-demand multimedia services and interactive television use nCube's massively parallel computer as a large multimedia server.[6] Similarly, Dow Jones employs two of Thinking Machines' CM-2 massively parallel systems in the interactive media market.[1] These parallel machines are not performing traditional parallel operations such as parallel matrix multiplication or parallel fast Fourier transforms, but are storing and delivering thousands of movies to customers. In other words, instead of operating as massively parallel processors for number crunching, they are operating as large input/output switching systems.

In his excellent article, "Where is Computing Headed,"[3] Ted Lewis tries to predict the future of computing. I agree with his statement that "we can expect multiprocessing to become widely accepted in the practical world of everyday computing," where "multiprocessor systems consisting of four, eight, and 16 processors will be integrated into desktop PCs. . . ." However, I disagree with his claims that a lack of software will keep massively parallel computers "outside the mainstream of computing" and that "the lack of good parallel processing software languages, tools, and environments makes for fertile areas of research that will continue to attract the research community throughout this decade."

We should stop developing parallel algorithms and languages. We should stop inventing interconnection networks for massively parallel computers. And we should stop teaching courses on advanced parallel programming. Let's turn to the real world. Let's listen to those 400 chief information officers. Let's refocus our research to match industry needs. Let's teach our students something they can use today, something their future employers might want them to know.

Those *still* in love with parallel computing should woo practical applications such as video-on-demand, interactive television, expert systems, or digital libraries. ■

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