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IBM's chess-playing 'Deep Blue' computer is harbinger of the future of supercomputing, Cornell's Kalos says

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PHILADELPHIA -- Checkmate? Not yet. But having a supercomputer battle the world's human chess champion to a draw is just a hint of the future power of these man-made analytical superstars.

So says a Cornell University expert, Malvin H. Kalos, a physicist and director of the Cornell Theory Center, which houses a more elaborate version of the IBM SP supercomputer that is tying up Garry Kasparov in the six-game match being played in Philadelphia at the Association of Computing Machinery '96 annual meeting. The match is tied 2-2.

Kalos, speaking on a panel Feb. 17 about the next 50 years of computing, said that the evenly divided match between "Deep Blue" -- IBM's SP supercomputer -- and world champion Kasparov shows that "we are on the cusp" of what these increasingly powerful machines can do.

"In the past, no computer could beat the best human chess player," Kalos said. "Now, the computer can play as well as the best human. Within the decade, no human will be able to beat a computer. It's just another example of the progress of civilization. Humans with the tools will do better than humans without the tools."

Kalos, who directs a center at Cornell that houses a different IBM SP supercomputer, the world's fastest general purpose computer with 512 processors that work in parallel, described his vision of the supercomputing future at a panel on "Strategic Directions for Computer Science." Chairing the panel is Juris Hartmanis, Cornell's Walter R. Read Professor of Engineering and professor of computer science, and former Turing Award winner.

"Fifty years ago," Kalos said, "no one could have come anywhere close to predicting where computers are now. Just what's in my laptop in power and memory was inconceivable back then. The transistor hadn't even been invented, and to imagine millions of them on a chip just was not possible." He continued: "The basic technology of computers, its speed and power, has been increasing by a factor of five every 10 years. That's an exponential increase. We probably won't continue exponentially for the next 50 years, but computers will continue to get faster and more powerful." He added, however, "There are no obvious physical limits for the next couple of decades."

Kalos said that "incredible" growth in technology has spurred these advances in computing technology, particularly VLSI -- Very Large Scale Integrated Circuits, the chips that serve as the brains of the computer that hold tiny transistors -- and optical fibers that allow 1 billion bits of data to be transmitted each second.

In turn, there has been an "incredible growth in applications and services that were not predicted," Kalos said. "In early computing, everyone was thinking numbers. But now we've got information-related applications, like word processing and desktop publishing. The rapid infusion of the Internet into society and the World Wide Web changes the future of computing."

The computing future also depends on two mutually interdependent things: "While invention is the mother of necessity," he said, rewording the old maxim, "affordability matters. It must be affordable. If it's cheap enough, then applications will be found. But if applications could be found, people will buy them."

While there are no immediate physical limits, there are economic limits, Kalos said, asking what he called the question of the day: "We've got to decide, is it worth spending $1 billion for radically new technology?" Kalos said that teraflops computing -- machines capable of calculating one trillion operations per second -- will be mundane within two to five years. "Eventually, teraflop computers will be everywhere -- in your watch, the car, the toaster -- there will be services we can't even know about yet."

And while today's fastest supercomputers are 1,000 times as powerful as desktop models, the supercomputers of the future will be 1 million times more powerful, or more, he said. "The architecture may be the same. They will be scalable and will be built from mainstream technology. But all this will be transparent to the user."

The Cornell Theory Center uses the 512-processor IBM SP supercomputer, among other resources, to help solve Grand Challenge problems -- worldwide problems identified by the federal government as requiring high-performance computing capabilities. While not playing chess, the system is used by scientists in such areas as astrophysics, enviromental science, biochemistry and medical technology. It is funded by the National Science Foundation, New York state, Cornell, IBM and other corporate partners.

Kalos said that the main themes of future supercomputers will be in modeling the physical, economic and social world. And trying to imagine far into the future, he foresees a "personal physiological modeler," a pocket computer that will monitor humans' bodies from birth; and a "personal brain clone," a computer so powerful it can simulate the human brain and learn along with its human counterpart.

"Within 50 years, we will certainly have the computing power and memory to do all that," Kalos said.

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