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CASE STUDY

NextIO vCORE™ Express 2070 Dramatically Accelerates Space & Upper Atmosphere Simulations

National Institute of Polar Research, Research Organization of Information and Systems, Inter-University Research Institute Corporation. In cooperation with SGI and ELSA Japan.

NiPR
National Institute of Polar Research

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Simulation Research

"In my day-to-day research, I'm always gathering information on the latest technology. One of the things I've encountered is this small computing appliance."

That remark was made by Associate Professor Masaki Okada, attached to the National Institute of Polar Research (NIPR) in Tachikawa, Tokyo. Professor Okada, who installed the box at the Space and Upper Atmosphere Research Group, studies the physics of magnetosphere plasma and the principles of the auroras that this plasma acts on.

A key to his research has been simulations, which align theoretical models with observational data. And the simulation calculations that Professor Okada has been working on demand faster computer systems to keep up with increasingly penetrating explorations of upper-atmosphere phenomena, to the point where supercomputer-class performance would not be out of order.

With that in mind, the professor's attention fell on the NextIO vCORE™ Express 2070, handled by NextIO's general agent, ELSA Japan.

"I saw them when I went to the HPC Expo. They were running a computational simulation, and the thing that struck me first was how small it was—I thought 'how fast can it be at such a small size?' So that definitely piqued my interest."

The actual deployment happened in April. Currently he is right in the middle of developing software optimized for the NextIO vCORE™ Express 2070, and he is getting a good sense of the high-speed calculation functionality of the NextIO vCORE™ Express 2070.

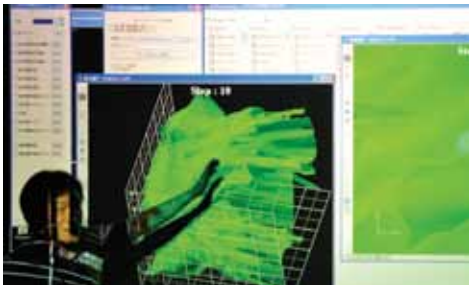
"Deploying the NextIO vCORE Express 2070 has dramatically accelerated computational performance. Look at the program I use in the research I've been working on. I do my own work on a workstation server, and when everything is going right, that's about 100 times faster than a typical workstation. In simple terms, I can get 100 workstations' worth of computing power out of one."

"I myself had used the previous generation of the NVIDIA Tesla series. The most interesting thing about this is that I can get the processing capacity of a big, powerhungry supercomputer out of this one small box. For someone doing solo research such as myself, this is basically like having an extremely easy-to-use personal supercomputer, a mini supercomputer, so to speak, that lets me do calculations that I could only perform on a massive supercomputer otherwise."

Aurora Research

Professor Okada is a scientist at the forefront of aurora research, and was part of the 49th Japan Antarctic Observation Team, spending a solid year at the South Pole from February 2008 through January 2009, collecting observational data while experiencing the extreme winter there.

"First I create a model and program it into the computer. Then I see whether the results from that model match the actual data from the natural phenomenon while varying the parameters. With the NextIO vCORE™ Express 2070, I can work through that process in whatever order I want. If some aspect of the model turns out to be at odds with the observational data, I can immediately correct the model and keep iterating over the experiment. With that kind of flexibility, it's amazingly easy to work in a way that lets me get closer to the raw data."



A slide visualizes the results of the plasma simulation. Even at this early stage in the process, this has been worked out using nodal plasma data representing 100 million elements, with the NextIO vCORE™ Express 2070 handling the calculations.

"Moving some 100 million plasma nodes so that they follow the motion equation lets me see how they would move. We can make predictions like "this is what happens in space based on those patterns of motion," Okada said.

Reimei Satellite Program

Professor Okada is also involved in a project on the Reimei satellite (launched August 2005), giving him close ties to astronautics researchers. The Reimei is equipped with aurora-observing instruments, so that he can collect data on auroras as viewed from space while on the ground and study the plasma environment around the satellite. The result of his research and studies is reflected in a "space weather report" that assists in the safe operation of satellites in orbit. Because auroras involve plasmas with extremely high energy levels, conditions near where they form can get rough.

"Obviously we can't go launching people into space to repair broken satellites. When you look at it that way, simulations turn out to be a valuable technique. Reproducing the space environment and performing calculations from a model is an important part of designing safety measures into satellites. The teams that do that are at the university, and I'm in touch with those teams."

Not that long ago, performing space-related simulations was impossible without massive computers. Professor Okada isn't the only person to recognize the great potential opened up by a single compact server that can handle the same tasks.

"Other researchers have definitely taken an interest in this computing server, and we're just now at the point where it feels like it's getting competitive. We researchers are very quick to pass around information on new technology, and I expect everyone to be calling me to ask 'can I use that for my paper?' (laughs). Seriously, though, if you're reasonably open with the results of your research and nobody talks about it, maybe it's because your results weren't so great. If I get good material out of this research, word will spread immediately."

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