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## New game for PlayStation 3: Crunching numbers

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When it comes to high-performance computing, Sony's PlayStation 3 is not all fun and games.

Four years after Sony unveiled its gaming console to the world, some researchers and federal agencies are using PS3s for serious work.

For the last year, the U.S. Immigration and Customs Enforcement agency's Cyber Crimes Center in Fairfax, Va., has used a bank of 40 interconnected PS3 consoles to decrypt passwords. It's working to add 40 more units.

Through Stanford University's Folding@home project, almost 40,000 PS3s volunteered by their owners during idle time currently contribute to the study of protein folding. More than 880,000 PS3 consoles have participated in the project, researchers said.

The U.S. Air Force Research Laboratory in Rome, N.Y., uses a cluster of 336 PS3s for research on urban surveillance and large image processing. Last month, the lab ordered 2,200 more units.

"We're taking gaming consoles and doing something scientific," said Mark Barnell, high-performance computing director at the information directorate of the Air Force's research lab.

Since the PS3's unveiling in 2005, the console has been touted not only for its amped-up gaming capabilities but also for its ability to generate complex real-time graphics and calculations thanks to its ground-breaking Cell processor, created by IBM in collaboration with Sony and Toshiba.

What particularly caught the attention of researchers was the PS3's ability to have the Linux operating system installed on it - which allows the gaming console to be transformed into a powerful home computer.

That opened the door for researchers to use the PS3's power for projects and experiments that required high-performance computing.

The Cell processor, researchers said, is perfect for applications that need a heavy amount of number-crunching and can vastly outperform traditional CPUs. The processor, for example, can do 100 billion operations per second while a typical CPU can only run 5 billion, said David P. Anderson, a computer  
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scientist and director of the Berkeley Open Infrastructure for Network Computing.

## **Games to science**

"The PlayStation 3's Cell processor allows video games to simulate physical reality. You can have a character with clothing and the clothing will flap in the wind," he said. "It turned out that with a certain amount of work, it was possible to run scientific applications in the processor."

The real performance edge of the PS3 shows off when the computing power of several consoles is joined together. While early experiments tried clustering several consoles, Stanford's Folding@home project was among the first to try something more ambitious.

Since 1999, FAH has studied the way proteins fold and misfold in an effort to better understand diseases like Alzheimer's, Huntington's and Parkinson's. Because running simulations requires staggering amounts of computing power, the FAH team appeals to computer owners across the globe to help by leaving their computers on to perform calculations and simulations when they're not using them.

The combined computing power coming from the network of volunteers was modest until FAH and Sony developed an application that would allow PS3 owners to contribute their idle consoles to the project.

"We more than tripled or quadrupled the power of FAH with the addition of the PlayStations," said FAH director Vijay Pande.

Soon after, FAH won the Guinness world record for achieving the first Petaflop, or one quadrillion operations per second. The project now runs the most powerful supercomputer cluster in the world, Pande said.

"The PS3 is an example of something that has a remarkable processor and is relatively inexpensive," he said.

## **Performance, price**

And cost has been an enormous selling point among researchers. While the console's initial \$499-\$599 price caused shock waves among consumers, researchers actually saw a high-performance processor that was both energy and cost-efficient. (The newest version of the PS3 retails for \$299 but cannot run Linux.)

For cash-strapped federal agencies, the balance between performance and price was crucial.

Chris Landi, senior special agent and section chief at ICE's Cyber Crimes Center, said each PlayStation 3 in the center's decryption silo is capable of generating 25,000 passwords per second while a Dell PowerEdge server, several of which are part of the silo, produces 17,000.

"The cost for each Dell server is around \$3,500, he said. Landi estimates the cost of the silo - which is

used in child exploitation and pornography investigations and is often used by local, state, federal and even foreign agencies - to be around \$1 million. The figure for a machine with similar capabilities that didn't use PS3s would be much higher, he said.

Berkeley's Anderson said newer technologies can now easily outperform the PS3's Cell processor. The Nvidia and ATI graphic processing units, for example, are at least 10 times faster than the Cell processor, he said.

But both Landi and Barnell said they believe the PS3s in their machines will serve them for many years.

"Whatever new equipment we get, we'll just tie it to old equipment. It'll never stop being useful," Landi said.

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