Linux Networx and Star Bridge Systems
Computers in hyperdrive
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This is rocket science. At least, that is one of the target markets for the high-performance computing industry in which Utah-based companies Linux Networx, Inc. and Star Bridge Systems are gaining plaudits for their contrasting strategies.

Linux Networx builds calculation speed demons by clustering Intel or AMD central processing units (CPUs) running on its namesake open-source operating system. Away from the bright lights of open-source software, Star Bridge Systems uses field-programmable gate arrays (FPGAs) with proprietary software to make fast, small machines that can be optimized on the fly to boost performance.

You won't find the high-end products from either of these companies at your neighborhood computer store. It can cost a few million dollars when you need teraflops (trillions of floating-point operations per second) to run your software. And Star Bridge's software licensing fee is $45,000 per year for a single seat. But compared to the hundreds of millions of dollars that such computing power once cost, these new products may be bargains for governments and business.

Linux Networx was founded in 2000 to build clustered computing solutions, a method of linking together multiple computers, or nodes, with a super-fast network to form a more powerful system. Company officials contend that the redundant, mass-produced parts make the machines easier to maintain, less expensive to build and more reliable. Linux Networx offers special management tools, service and support designed to make it easy to run the complex machines.

Linux Networx's product line is called Evolocity™, which recently entered its second generation with decreased size and improved cooling. The company also has system management tools called ICE Box™ and Clusterworx®, which can be used to remotely monitor and manage the entire cluster or individual nodes. Evolocity II clusters use LinuxBIOS, a basic input-output system that can initialize hardware and start loading the operating system in as little as three seconds. That is 10 to 20 times faster than a traditional BIOS, according to company officials.

"Linux clusters are becoming the dominant platform for many high-performance computing applications because their price/performance ratio far exceeds that of traditional supercomputers," says Stephen Hill, president of Linux Networx. "Users ranging from government institutions to engineering designers to special-effects shops are recognizing the value Linux Networx cluster systems provide and are seeing significant returns on their clustering investment."

Last year, Linux Networx installed the world's fastest Linux computer (fifth-fastest computer overall) for the Lawrence Livermore National Laboratory (LLNL). The $15 million machine is called the MCR, which is an acronym of more acronyms that refers to a government initiative to share computer costs and resources. The MCR has 2,304 Intel Xeon CPUs, 4.6 terabytes of RAM and 132 terabytes of disk space, and calculates at the rate of 5.69 teraflops. LLNL uses the computer to help scientists study a wide range of physical, chemical, biological and environmental processes.

"This landmark achievement will ensure Linux Networx will have a place in supercomputing history," Hill says. "Linux Networx is competing and winning against the major players in the computing industry and is having a permanent impact on the evolution of the supercomputer."

The world's fourth-fastest supercomputer, an IBM also at LLNL, is rated at 7.22 teraflops but cost about $110 million, according to Linux Networx officials.

The Centers for Disease Control and Prevention (CDC) uses an Evolocity for research into smallpox and its vaccine. Parts of the research that previously took two weeks of computer processing can now be performed in one day with the new Linux cluster.

Not every application for Evolocity machines seems as crucial or grim as battling deadly diseases. Linux Networx recently announced that one of its 25-node clusters became a graphics render farm to create special effects in the new science fiction movie The Core. Evolocity machines also support popular Unix-based graphics programs, such as Pixar's RenderMan Toolkit. Linux Networx also built a 12-node system for the government of Iceland to map geothermal locations and simulate climate conditions.

While Linux Networx focuses on an open-source operating system with lots of CPUs, Star Bridge Systems (SBS) uses its home-grown software, Viva, and just a few FPGAs to achieve high-performance computing. SBS refers to its machines as Hypercomputers, and company officials believe their technology represents a paradigm shift in computing.

Conventional CPUs perform only one calculation at a time, but FPGAs can be programmed to do thousands of calculations in parallel. The gates, or transistors, in the chips also can be reconfigured in milliseconds to better handle different kinds of calculations. Because the transistors are working all the time, an FPGA is considered 100 percent efficient (unlike a typical CPU, which is at best 10 percent efficient, according to company officials).

The resulting machine can be about the size of a desktop PC, or a two-drawer file cabinet for a really high-powered model. Either way, it's smaller than competing supercomputers. A Hypercomputer uses ordinary household electrical current and doesn't need its own room, much less any special cooling systems.

The difficulty of programming FPGA-based systems has slowed their widespread industry adoption. Currently, FPGAs are typically used for a specific purpose, such as testing designs for other chips. A programmer rarely would change an FPGA configuration except when a chip design needed debugging. Star Bridge claims to have changed that with Viva, a programming language and development environment that makes FPGA capabilities more accessible to developers.

Viva allows programmers to develop applications that reconfigure the FPGAs dynamically. This capability makes it possible to merge numerous kinds of related but previously separate applications, according to Star Bridge founder and CTO Kent Gilson. For example, if you were designing magnetic coils, a program created with Viva could reconfigure the FPGAs not only to study electromagnetic properties, but also to calculate how mechanical stress influences the design.

Founded in 1998, Star Bridge recently began a transition from research and development toward marketing and sales. The company expanded its executive team, including the hiring of CEO Daniel Oswald, founder of MultiLing International, a language translation and software services company; vice president of sales and services Ed McGarr, former VP of worldwide product marketing for Novell; vice president of marketing Rebecca Krull, former director of business development for 3Com's mobile division; and vice president of business development and corporate communications Kimball Thomson, founder of Wasatch Digital iQ. The vice president of operations and General Counsel is Brent Ward, former U.S. District Attorney for Utah.

Star Bridge recently announced a number of Hypercomputer sales to government agencies and universities. The National Security Agency bought five Star Bridge computers, but details regarding the purchases are classified secrets. Educational institutions equipped with Hypercomputers include George Washington University, the University of South Carolina and the University of California's San Diego Supercomputer Center. The U.S. Air Force is currently partnering with Starbridge to develop a number of aircraft and munitions control systems.

In addition, the National Aeronautics and Space Administration is using several of the machines for structural, electromagnetic and fluid analysis; atmospheric science analysis; pattern recognition; and acoustic analysis. One of NASA's objectives is to use Star Bridge technology to build satellites that

can be upgraded or modified while in space.

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