

## case study



“Putting together a Linux cluster is significantly less expensive than buying a ‘big iron’ mainframe (a traditional supercomputer). The challenging part is managing a whole set of machines. HP’s partnership with Linux NetworX will help customers meet that challenge.”

—HP Business Planner Phil Anderson

### background

Clustering is a way of connecting multiple computers (or “nodes”) at very high speeds to form a single, powerful computing system. Clustered systems, which can range in size from a few nodes to thousands, have been implemented by researchers, scientists, and large industrial corporations to more cost-effectively perform work previously done by supercomputers. A rising percentage of clustered solutions run on Linux, relying on the operating system’s stability and ongoing rapid development.

Many proprietary supercomputers are being replaced by clustered solutions, particularly by those that run Linux on Intel-based systems. According to a recent article in Bio-IT World magazine, a \$100,000 cluster of Intel-powered PCs running Linux can generate as much computing power as a proprietary supercomputer, for about a tenth of the price. That kind of difference is the most obvious reason many observers expect Linux clusters to gain much wider adoption. International Data Corporation has forecast that Linux will soon dominate the cluster market, growing from \$226 million in 2001 to \$1.4 billion by 2005.

HP’s hardware and software innovations have already helped accelerate that trend. In mid-2002, HP began building one of the world’s fastest Linux supercomputers for the Department of Energy’s Pacific Northwest National Laboratory. Employing some 1,400 Intel 64-bit Itanium 2 processors, the system, to be completed in 2003, is expected to reach performance levels exceeding 8.3 teraflops (that’s 8.3 trillion floating-point operations per second). Thanks in part to the expertise HP gained in helping to develop Itanium 2, HP systems



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based on those processors deliver a substantial performance advance for the most demanding cluster environments.

#### **profile**

Linux NetworX provides cluster hardware and software tools primarily to companies and governmental and academic organizations that have very high computation requirements, including those that perform high-end scientific research, oil and gas exploration, fluid dynamics, pharmaceutical research, and biotechnology research.

Formed in 1989 to provide custom board-level products, the company delivered the world's first commercial Linux cluster in September 1997. Linux NetworX is currently building what will be the world's largest and most powerful Linux supercomputer, to be delivered to Lawrence Livermore National Laboratory in fall 2002. The system is expected to reach a theoretical peak performance of 9.2 teraflops. Linux NetworX also provides ClusterWorX™ software to address the challenges of cluster management.

#### **challenge**

Linux-based clusters provide supercomputing power at a relatively low cost, but because the systems are made up of numerous parts, managing them has often been more difficult and time-consuming than with single-unit supercomputers—a shortcoming that has undermined some of the upfront savings. As HP Business Planner Phil Anderson explains, "Putting together a Linux cluster is significantly less expensive than buying a 'big iron' mainframe (a traditional supercomputer). The challenging part is managing a whole set of machines, some of which may be geographically separated."

With early Linux cluster implementations, system administrators often had to perform time-consuming tasks such as manually reconfiguring CPUs and writing scripts to execute menial tasks, in addition to the challenge of getting a diverse set of turnkey and custom hardware and software solutions to work together. Such requirements meant that only Linux experts with a lot of time could successfully manage a Linux cluster. As Linux-based systems become more sophisticated, the need for integrated management solutions becomes even more acute.

#### **solution**

ClusterWorX™ is Linux NetworX's award-winning cluster management software. Dave Craska, lead systems engineer at Boehringer Ingelheim Pharmaceuticals, explains the software's benefits: "With a 120-processor cluster, managing every aspect of the system can be quite overwhelming. The ClusterWorX software from Linux NetworX helps alleviate the complexities of cluster management, especially when upgrading and propagating new releases of software."

HP and Linux NetworX are teaming up to offer ClusterWorX™ atop Red Hat Advanced Server Linux on HP's Itanium 2-based systems and ProLiant server line. By adding ClusterWorX™ to HP's leading cluster hardware, HP will ensure that it can provide customers that want Itanium 2 and Red Hat systems with the most effective, end-to-end cluster solutions available. This combined Linux cluster solution represents the collective expertise and technology both companies have developed while building some of the most powerful systems in the world. An initial release of ClusterWorX™ running on HP hardware is expected by the end of summer 2002.

ClusterWorX™ users can remotely monitor and control a cluster system down to the individual node. Its flexible, scalable architecture enables users to add compute nodes as demands increase. The software also employs an event engine that enables users to set up automatic notification and system administration for a variety of variables. For example, if a processor's temperature passes a specified point, ClusterWorX™ can remotely alert the user of the problem or even shut off the node.

Linux NetworX President and CEO Stephen Hill adds, "As the hardware vendor with the most systems on the Top 500 supercomputer list ([www.top500.com](http://www.top500.com)), HP is an ideal first partner for Linux NetworX to distribute more of its clustering software. By making

comprehensive Linux cluster tools like ClusterWorX™ more widely available to the high-performance computing community, we believe this will further accelerate the adoption of Linux clusters—you no longer have to be an expert in Linux and clustering to take advantage of this industry-changing technology.”

#### results

- Complete cluster solutions that combine cutting-edge HP hardware with advanced Linux NetworX management tools
- More targeted clusters for companies in biotech, oil and gas, entertainment, engineering design, research, and other industries
- More OS and software choices for HP cluster customers

#### conclusion

Linux clusters represent a rapidly advancing technology with impossible-to-ignore cost and performance benefits for companies and organizations that need high-performance computing. The chief obstacle preventing Linux clusters from growing even more quickly has been the relative difficulty of assembling and managing Linux clusters. HP and Linux NetworX are helping to remove that obstacle by delivering Linux clusters that are not only powerful and inexpensive, but also fully and easily manageable.

**“Managing and maintaining Linux-based clusters can be a daunting task and a drain on an organization’s resources without the proper management software. Now HP customers will have access to the industry-leading Linux NetworX ClusterWorX software to work in conjunction with the powerful Itanium 2-based systems and ProLiant server line,” says <Name and Title of HP Vice President>. “HP opted to offer the ClusterWorX software because of the expertise Linux NetworX has in putting together large and efficient Linux clusters. The ClusterWorX software delivers a complete cluster management suite that can help organizations save time and money when implementing a HP Linux cluster system.”**

