University Research Center Sets Benchmark Record with Windows HPC Server 2008

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Bo Kågström, Professor and Director, High Performance Computing Center North, Umeå University

The High Performance Computing Center North (HPC2N) at Umeå University, which has traditionally provided HPC support for Linux-based applications, wanted to extend its support to include Windows®-based applications. In April 2008, HPC2N deployed Windows HPC Server 2008 and achieved 46.04 teraflops with an efficiency rating of 85.6 percent. With this outstanding result, HPC2N looks forward to serving a broader range of customers.

Customer: Umeå University
Web Site: www.umu.se
Customer Size: 29,000 students
Country or Region: Sweden
Industry: Education—Universities

Customer Profile
Founded in 1965, Umeå University is the fifth oldest university in Sweden. Its High Performance Computing Center North (HPC2N) is a consortium that includes all universities in Northern Sweden.

Software and Services
- Microsoft® Server Product Portfolio
  – Windows® HPC Server 2008

Hardware
- IBM blade servers
- InfiniBand interconnect switches
- Intel processors

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Business Needs

The High Performance Computing Center North (HPC2N) at Umeå University serves mainly researchers in natural and engineering sciences from universities throughout Sweden. The center's HPC systems assist researchers with mathematical and theoretical simulations, statistical mechanics, molecular dynamics, and bioinformatics.

HPC is critical to these research projects because many complex and demanding research applications couldn't successfully be pursued without parallel computing. "We need large parallel computers for these types of applications in order to stay at the forefront of research," says Dr. Mats Nylén,

Senior Consultant at HPC2N. "The more large computer resources we have, the more complex and realistic models we can study, such as models going from one dimension to three dimensions and also across time."

Traditionally, HPC2N has provided Linux-based HPC resources to its customers, but recently the demand has risen for HPC support for applications based on the Windows® operating system. "Linux is not necessarily a user-friendly system, and our mission in Swedish academia is to provide HPC resources to more users of Windows-based PC software," says Bo Kågström, Professor and Director of HPC2N. "We traditionally work with engineering, physics, chemistry, and life sciences research

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scientists, but we would like to expand our services to humanities and social sciences, which are typically more Windows-based users."

HPC2N also believes that support for parallel processing in HPC cluster environments is inevitable. "We all know that in the future, personal computers will support parallelism, so the ability to scale up from a PC to very large parallel systems is important for Microsoft and is a research area we have been pursuing for several years," says Kågström. Ideally, HPC2N wanted a solution that would support both Windows and Linux in the same cluster environment.

Solution

In December 2007, HPC2N began exploring HPC solutions. "In the beginning, we didn't know that Microsoft was in the business of running such big systems," says Kågström. Microsoft, which had been looking to collaborate with a research institute on HPC, worked with IBM to demonstrate the combined strength they could offer in the HPC environment. "After meeting with Microsoft, IBM, and Intel, we began to see the advantages of using Windows HPC Server 2008 and we decided this was an interesting and challenging way to proceed," says Nylén.

In April 2008, HPC2N deployed a cluster consisting of 672 IBM blade servers each configured with two quad-core Intel processors (for a total of 5,376 processors), 16 gigabytes of memory, and InfiniBand interconnect switches. The blades are organized in 48 blade centers with 14 blades per center. "To our knowledge, this is one of the largest clusters of its kind in the world running Windows HPC Server 2008 on IBM hardware," says Kågström.

After deploying the Umeå HPC cluster, named Akka, HPC2N ran the LINPACK Benchmark for the TOP500 project. Published twice a year in June and November, the TOP500 list ranks the 500 most powerful supercomputers. Akka achieved a LINPACK score of 46.04 teraflops, or 85.6 percent efficiency, far exceeding its expected efficiency target of 75 to 80 percent.

HPC2N was thrilled with the result. "We estimate that for the list published in June 2008, we will place somewhere between 35 and 50 out of 500," says Kågström. That would put the Umeå HPC cluster more than 40 places ahead of 93rd position, the highest position ever attained with a Linux-based HPC system run by HPC2N.

Benefits

HPC2N is still in the testing phase of Akka but is on track for placing Windows HPC Server 2008 into production. With the new solution, HPC2N can offer customers a broader range of options for running complex computational simulations and models. Benefits include the following:

■ **Outstanding performance.** "The efficiency levels achieved on the Umeå cluster are surpassed only by massively parallel processing systems and by symmetric multiprocessing systems," says Kågström. "It remains to be seen what happens in June. But based on the November 2007 list, there are no x86 clusters with efficiency this high." Kågström adds, "The Umeå cluster with Windows HPC Server 2008 performed well enough to become the fastest academic system in Sweden. We are very happy with that result."

■ **Dual operating environment.** Windows HPC Server 2008 is a dual-boot system,

making it easy to switch between the Linux and Windows operating systems that coexist on the cluster. "In our case, dual imaging would be a better description," says Nylén. "Rather than setting up a true dual-boot system, we will deploy both operating systems on different portions of the system and then modify that based on user demand." As a result, the new solution adds to the center's portfolio offering with minimum intrusion to users and jobs that are currently running.

■ **Collaborative relationship with Microsoft.** This HPC deployment marks the beginning of a close relationship between Umeå University and Microsoft. "We look forward to working with Microsoft, IBM, and Intel to see the possibilities of future research and development through our collaboration," says Kågström. "We would like to see parallel spreadsheet capabilities; in fact, we would like to see every Microsoft PC product work as efficiently on HPC systems. We know that doesn't exist today, but we hope we can contribute to that progress through this collaboration." Pelle Olsson, HPC Product Manager at Microsoft, agrees. "A closer collaboration between Microsoft and Umeå University on HPC will benefit both parties. I believe Umeå would be a perfect test bed for testing math libraries." Kågström also sees long-term opportunity in contributing to math libraries and tools such as the new parallel debuggers in the Microsoft® Visual Studio® 2008 development system. "We are interested to see how these tools will work in a production HPC environment," he says.

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