Microsoft Server Product Portfolio
Customer Solution Case Study

Supercomputing Consortium Adds Flexibility, Improves Usability with New HPC System

Customer: Interuniversity Consortium for the Application of Supercomputing for Universities and Research (CASPUR)
Web Site: www.caspur.it
Customer Size: 150 employees
Country or Region: Italy
Industry: Education—Higher education

Customer Profile
Based in Rome, Italy, the Interuniversity Consortium for the Application of Supercomputing for Universities and Research (CASPUR) manages an advanced scientific information processing center.

Software and Services
- Microsoft Server Product Portfolio
  - Windows HPC Server 2008
- Microsoft Visual Studio
  - Microsoft Visual Studio 2008 Professional Edition

Hardware
- HP BladeSystem c7000 servers with quad-core Intel Xeon 5400 series processors, 16 gigabytes of RAM, and Fibre Channel SAN storage
- Dell PowerEdge M-Series Dell PowerEdge M-Series blade servers, with quad-core Intel Xeon 5400 series processors, 16 gigabytes of RAM, and local storage subsystems
- NVIDIA Tesla S1070 1U GPU computing system

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"We find HPC cluster configuration easy with the Windows utility, and we can recompile code quickly using Visual Studio 2008."

Nico Sanna, Senior Technology Manager, Interuniversity Consortium for the Application of Supercomputing for Universities and Research

CASPUR, a computing consortium in Rome, wanted to improve the usability of its high-performance computing (HPC) center for Italy's research community, so it adopted a pilot cluster that runs the Windows HPC Server 2008 operating system. Researchers now have an easier HPC option that is more compatible with their scientific software and provides accelerated data processing of more than two orders of magnitude over single-processor systems.

Business Needs

The Interuniversity Consortium for the Application of Supercomputing for Universities and Research (CASPUR) in Rome manages a high-powered processing service center that is open to the entire Italian national scientific community, with priority given to its associated universities and the Ministry for Education, Universities, and Research. Researchers in the fields of biology, chemistry, medicine, fluid dynamics, mathematics, and materials science use the center's high-performance computing (HPC) clusters to run simulations, process large amounts of data, and otherwise further their research.

The center's HPC environment consisted of two UNIX HPC clusters and two Linux HPC clusters from different vendors. CASPUR sought to enhance the center's value by making it easier for researchers to use HPC. "Many scientific research applications in the biomedical field, for example, have been developed to run on Windows operating systems. So users often had to perform calculations on our multicore UNIX systems only to then move those calculations into a Windows program to process their data," explains Nico Sanna, Senior Technology Manager for CASPUR.

Due to the time and hassle related to the UNIX and Linux clusters' incompatibility with their software, some researchers

wanted to conduct their projects in the Windows environment, with which they were more comfortable. Continues Sanna, "We wanted to integrate the computational phases and offer researchers a more familiar interface than those of UNIX and Linux."

At the same time, CASPUR aimed to produce an architecture that would support General-Purpose computation on Graphics Processing Units (GPGPU)—Graphics Processing Units (GPUs) are high-performance, many-core processors—as well as computing on field-programmable gate arrays (FPGAs), to increase the flexibility and performance of HPC calculations. The consortium also wanted to make it easier to develop and use parallel computing software for scientific research.

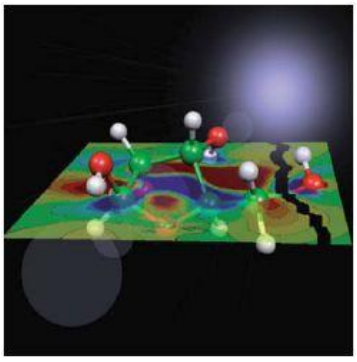
Solution

To make the most of researchers' familiarity with the Windows platform and the wealth of application choices available for it, CASPUR decided to implement a pilot cluster on Windows HPC Server 2008, with eight nodes and eight cores per node. The cluster includes HP BladeSystem c7000 servers and Dell PowerEdge M-Series blade servers, both with quad-core Intel Xeon 5400 series processors.

The consortium worked with HPC specialists from Microsoft to design the cluster so that CASPUR can install various types of applications adapted to run on multicore and many-core clusters. The design includes hardware graphic accelerators for use as coprocessors for numeric calculations.

CASPUR used CUDA development tools from NVIDIA and a Ylichron Harwest computing environment compiler, integrated with the Microsoft Visual Studio 2008 Professional development system. It configured the cluster for GPGPU with a series of programmable NVIDIA Tesla GPUs and FPGAs to support various application demands.

"Many producers of graphic cards use Windows as a reference operating system, which constitutes a point in favor of including Windows HPC Server 2008 in the field of GPU computing," says Sanna. "We find HPC cluster configuration easy with the Windows utility, and we can recompile code quickly using Visual Studio 2008. Those capabilities combine to give us the necessary flexibility to respond rapidly to a range of scientific research and industrial application requirements.



This is a simulation of ribose sugar molecular fragmentation caused by electron impact. Such simulations are heavily used by researchers who rely on CASPUR resources, such as the Windows HPC Server 2008 cluster.

CASPUR configured Windows HPC Server 2008 to make remote access possible to the pilot cluster. Researchers can log on to different nodes with different numerical acceleration technologies, GPU or FPGA, through the Windows HPC Server 2008 Job Scheduler. They have begun using the pilot cluster for financial mathematics experiments, and soon CASPUR will make it available for chemistry, biology, and biomedical research applications.

Benefits

For CASPUR, adding a cluster that runs Windows HPC Server 2008 offers significantly increased performance, flexibility for cluster configuration, straightforward development, and the ability to meet the needs of a greater number of researchers. Benefits include:

Accelerated data processing. In tests, CASPUR has found that its pilot cluster's performance has exceeded that of all previous multicore systems and is comparable to that of its Linux clusters. "We noted performance from 10 to more than 100 times greater than that of single-processor systems," says Sanna. "Computation times have therefore been reduced by more than two orders of magnitude."

Enhanced usability. By implementing a Windows-based cluster, CASPUR has made it possible for users to work within a single, familiar environment. Overcoming the usability and application compatibility drawbacks of the center's UNIX and Linux systems opens up HPC resources to a wider pool of researchers.

Greater flexibility. CASPUR plans to replicate its design model for Windows HPC Server 2008 for use with a variety of applications. "Our tests show just how straightforward it is to configure and scale our Windows-based HPC cluster at the hardware and software levels," concludes Sanna. "We'll be able to adapt the platform to meet the needs of our users and take advantage of the maximum processing capacity of GPU and FPGA, which is already in high demand from companies and research institutes."

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