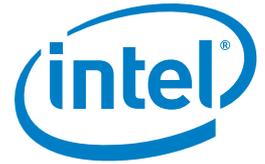


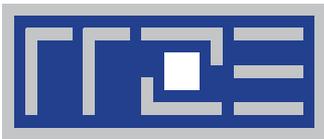
## CASE STUDY

Intel® Cluster Ready  
Intel® Xeon® processor 5600 series  
High-Performance Computing



# Supercomputing on a Standards-Based Cluster Architecture

Intel® Cluster Ready simplifies the deployment of a powerful, 500-node cluster for a leading research university



“Upgrading our high-performance computing platform with the Intel® Xeon® processor 5600 series has enabled us to better support research activities within the University. Researchers can now perform more complex computing tasks in significantly reduced timeframes, allowing them quicker access to the information they need for their studies.”

*Prof. Dr. Gerhard Wellein  
Head of HPC group at  
Erlangen Regional Computing Centre*

The University of Erlangen-Nürnberg is Bavaria's second biggest state university, with over 27,000 students, 12,000 staff members, and a world-class research community. A key component of the university's success is the high-performance computing (HPC) platform provided by Erlangen Regional Computing Centre (RRZE), the university's dedicated IT support service. Recently, RRZE decided to replace the existing HPC platform with a massive new cluster to provide the university's researchers with a more powerful and flexible computing environment.

## CHALLENGES

- **Increase HPC performance and capacity** to support the university's world-class research teams.
- **Simplify the HPC computing environment**, so RRZE can manage it with less effort, and researchers have a more flexible, easy-to-use platform for running their diverse applications.

## SOLUTION

- **A 500-node NEC LX-2400 cluster** based on the Intel® Xeon® processor 5600 series and the Intel® Cluster Ready architecture

## IMPACT

- **Five to six times faster performance<sup>1</sup>** to support more researchers and more complex calculations, while delivering results in a fraction of the time.
- **A simpler application environment**, with a single processor architecture across the entire system and a standards-based cluster architecture that is a target platform for many leading HPC application vendors.
- **Faster deployment and easier maintenance** with the help of Intel® Cluster Checker software

## World-class Research

The University of Erlangen-Nürnberg has an international reputation as a leading teaching and research university, so maintaining world-class HPC resources is essential to its ongoing success. Research teams use the university's HPC platform to perform complex calculations that require substantial computing resources. The system needs to deliver optimized support for a variety of workloads, including applications for drug design, quantum chemistry, Alzheimer's research, materials testing, nuclear physics, fluid dynamics, and many other fields.

Recently, the University decided to upgrade its HPC platform to increase performance and boost overall capacity. A secondary goal was to establish a more flexible and homogeneous platform to simplify management and to make it easier for users to achieve optimal performance for their diverse applications.

## An Open Competition to Upgrade the HPC Environment

The University invited vendors to recommend hardware solutions based on a fixed budget. The tender specified that vendors could submit solutions that used general-purpose computing on graphics processing units (GPGPU) as well as standard CPU-based implementations. As part of the evaluation process, the University provided four sample applications to prospective vendors, who were asked to optimize the code for their particular hardware offering. This approach enabled the University to identify which hardware configurations offered the greatest performance and overall capacity within the specified budget constraints.

## A Powerful, Simple, and Flexible Solution

After assessing the various recommended solutions, the University chose a 500-node HPC cluster designed by NEC and powered by the Intel® Xeon® processor 5600 series. With 6000 cores, a 128 TB parallel filesystem, and fully-nonblocking InfiniBand\* fat-tree interconnect, the cluster provides massive resources, and has been recognized as the 130th largest cluster in the world.<sup>2</sup> NEC LXC<sup>3</sup> cluster software provides efficient tools for deploying, monitoring, and managing the system. The design of the cluster is based on the Intel Cluster Ready architecture, which helped to speed deployment and could provide a number of additional advantages going forward.

## Faster Time to Value

Intel Cluster Checker software helped NEC build and test the cluster quickly and

efficiently. According to Dr. Erich Focht, chief software architect and manager of the research and development group at NEC HPC Europe, "We used Intel® Cluster Checker software as part of our quality assurance procedure. It was a great help for identifying weak components, such as broken InfiniBand links and problematic DIMMs and CPUs. We are integrating it into NEC LXC<sup>3</sup> and intend to make it part of our standard quality assurance procedure for large cluster deployments."

## Enhanced Application Support

NEC used Intel Cluster Checker to certify the cluster as Intel Cluster Ready in November 2010.<sup>3</sup> The certification verifies the cluster is operating as it should and is fully compliant with the Intel Cluster Ready architecture. Along with the use of the Intel Xeon processor 5600 series throughout the cluster, certification helps to ensure a consistent hardware and software environment for running applications.

With these enhancements to the university's HPC environment, researchers will be able to focus more on their research, and less on adapting applications and optimizing code. Additionally, many leading HPC application vendors are optimizing their code for the Intel Cluster Ready architecture, and this could potentially help to simplify the deployment of new applications in the future.

## Simpler Management

RRZE can continue to use Intel Cluster Checker to verify performance and operation during regular maintenance, and to identify any system, component, or software issues that arise. Intel Cluster Checker provides detailed information,

and can often reduce troubleshooting timelines from weeks to days or even hours. This can be particularly valuable in a large cluster with hundreds of nodes and thousands of components. It not only reduces administrative overhead, but also helps to get the system back up and running quickly.

## Five to Six Times Faster Performance

Since implementing the new HPC platform, the University has recorded a five-to-six fold increase in the overall speed at which applications can be run, with comparable improvements in memory bandwidth and peak computational speed. Besides enabling users to process more advanced calculations in less time, the increased capacity enables the system to handle more simultaneous users, so research teams spend less time waiting to run their applications.

## Staying at the Forefront

With its new HPC platform powered by the Intel Xeon processor 5600 series and based on the Intel Cluster Ready architecture, the University of Erlangen has ensured its continued standing as one of the world's leading research institutions. By multiplying the IT resources available to researchers by five to six times, and providing a more flexible and easily managed cluster, the university has given its teams the computing resources they need to take their research to the next level.

Find an Intel Cluster Ready solution that is right for your organization. Contact your Intel representative or visit [intel.com/go/cluster](http://intel.com/go/cluster).

SOLUTION PROVIDED BY:



NEC

LXC<sup>3</sup>

<sup>1</sup> Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit <http://www.intel.com/performance/resources/limits.htm> or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

<sup>2</sup> Source: Top500 Supercomputer Sites, as of March 10, 2011. <http://www.top500.org/system/ranking/10604>

<sup>3</sup> The Intel Cluster Ready certification covered 493 out of the 500 nodes, since this was the number of active nodes during the certification run.

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