



Hessesches Kompetenzzentrum
für Hochleistungsrechnen

CASE STUDY: Hessian Competence Center for High Performance Computing

Advancing scientific progress with TotalView multi-site licenses

INDUSTRY

Academic

APPLICATION

State-wide management
and access to HPC clusters

WEBSITE

www.hkhlr.de/en/

CHALLENGES

- No ability to debug across clusters due to different tools used across sites
- Support HPC users at various levels of expertise
- Reduce debugger licensing and maintenance costs

SOLUTION

TotalView for HPC

RESULTS

- Simplified debugging across clusters
- Higher quality of user support and education with train-the-trainer seminars
- Reduced time to solution and fewer installation issues by installing on HPC cluster

“Debuggers are like fire extinguishers. As long as there is no fire, you don’t need them. But if there is a fire, you want the best.”

DR. IWAINSKY, HKHLR HPC EXPERT

High performance computing (HPC) has emerged as a key technology in the world of academia, allowing researchers across academic fields to solve complex problems not possible with general-purpose computing. For example, the Department of Energy and Power Plant Technology at TU Darmstadt in Hesse, Germany is using HPC to simulate combustion in engines. Billions of computational steps are required for a complete simulation of the combustion of petrol and air. This task would be impossible without the aid of high performance computing.

Hesse is home to two of the world’s 500 fastest high performance computing clusters, which are available to researchers from five major Hessian universities across various disciplines. These researchers are experts in their own fields, but are typically not experts in computer science, requiring support and training to effectively leverage the power of HPC.

The Hessian Competence Center for High Performance Computing (HKHLR) supports university researchers in the state who are striving for the efficient and sustainable use of modern HPC systems. HKHLR was founded by the universities of Darmstadt, Frankfurt, Giessen, Kassel, and Marburg, and is funded by the Hessen State Ministry of Higher Education, Research and the Arts. HKHLR offers a variety of different services to aid researchers, including courses and workshops for beginning and advanced HPC users.

Bugs throttle scientific progress; clean code advances it

Accuracy is critical to any research project. For researchers making use of high performance computing, clean code is critical to achieving accuracy, which means adopting the right dynamic analysis tool to identify any bugs that can throttle scientific progress.

“Debuggers are like fire extinguishers. As long as there is no fire, you don’t need them. But if there is a fire, you want the best,” says Dr. Iwainsky, one of HKHLR’s HPC experts who supports researchers at TU Darmstadt.

Whichever debugging solution HKHLR adopted, it had to support a diverse user base. Hessian researchers run the gauntlet of programming expertise. Some are just starting out,

ROGUE WAVE PARTNER



while others are advanced users with years of experience. Researchers also span an array of academic fields and use a variety of programming languages, including C++ and Python.

“Many of our users are used to debugging with printf’s, which can be time-consuming. We wanted to use something more sophisticated and powerful,” says Dr. Iwainsky.

HKHLR found its “fire extinguisher” in TotalView for HPC from Rogue Wave Software. Leveraging TotalView allows for faster fault isolation, improved memory optimization, and dynamic visualization for high-scale HPC applications. Hesse’s researchers can simultaneously debug many processes and threads in a single window to get complete control over program execution: running, stepping, and halting line-by-line through code within a single thread or arbitrary groups of processes or threads. Users can also work backwards from failure through reverse debugging, isolating the root cause faster by eliminating repeated restarts of the application.

TotalView supports debugging of many programming languages, including C++ and Python. Whether researchers are experienced or novice programmers, TotalView finds errors quickly, validates prototypes, verifies calculations, and certifies code correctness.

Shared licenses make support and training easy

HKHLR considered other debugging products, but TotalView offered several strengths over the competition, including reverse debugging and a single license agreement model for all Hessian universities. Two universities initially adopted TotalView, but HKHLR wanted to deploy the solution to more universities with larger HPC systems. TotalView is now the only officially supported debugger at the central computing installations at all universities participating in HKHLR.

“Having shared licenses enables us to share this technology across sites, forming a uniform platform, which is easier to support than locally-changing technologies,” says Dr. Sternel, general manager of HKHLR.

Using just one industry-leading debugger across all sites makes it easier to train users, as HKHLR’s trainers do not have to be experts on many different debugging platforms. HKHLR’s trainers are themselves trained on the TotalView platform by TotalView experts in a “train the trainer” program. Coupling a leading debugging solution with effective education has significantly expedited researchers’ ability to find and resolve coding issues.

Multi-site licensing offers a few other benefits over traditional team licensing. Unlike the team license, the shared license is installed and configured on the HPC cluster, reducing installation time. Licensing and maintenance costs are also lower compared to the team model. If HKHLR wants to expand the solution to more universities, the licensing model allows the user base to be increased. The license also allows HKHLR to quickly get access to all new releases and software improvements.

High performance computing is a major driver of scientific innovation. Hessian researchers are now seeing that clean code plays a major role as well. “By combining a leadership-grade commercial debugger with high-quality training workshops, Hesse’s scientists have become more aware of the importance of stable code in academic research,” says Dr. Sternel. For HKHLR, this education is the top outcome of the TotalView project.

Dr. Iwainsky adds, “Learning how to debug is an investment in the future health of your code. With the floating pool of licenses usable by any university, plus the training program, HPC experts aren’t the only ones who can use this tool. All of our researchers can use it in their daily work to find problems in their codes.”



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