Performance Tools for Petascale Systems

The growing number of cores on modern supercomputers imposes scalability demands not only on applications but also on the software tools needed for their development. At the same time, the optimization of parallel codes becomes more difficult due to increasing system complexity, creating a need for advanced and robust performance-analysis technology. The SILC project (Skalierbare Infrastruktur zur automatischen Leistungsanalyse paralleler Codes), funded under the BMBF call "HPC-Software für skalierbare Parallelrechner", therefore further reinforces the development of performance-analysis tools for High-Performance Computing, which has traditionally been a strong discipline in Germany.

Emerged from the Virtual Institute – High Productivity Supercomputing, a collaboration of leading German HPC tool builders, the goal of the SILC project is the design and implementation of a scalable and easy-to-use performance measurement and monitoring infrastructure for supercomputing applications. The infrastructure will serve as a common basis for the performance tools Vampir, Scalasca, and Periscope, which are developed by research groups in Dresden, Jülich, and Munich, respectively. Vampir is an interactive trace browser whose particular strength is the detailed visualization of the interactions between the different processes of a parallel program, offering highly flexible views

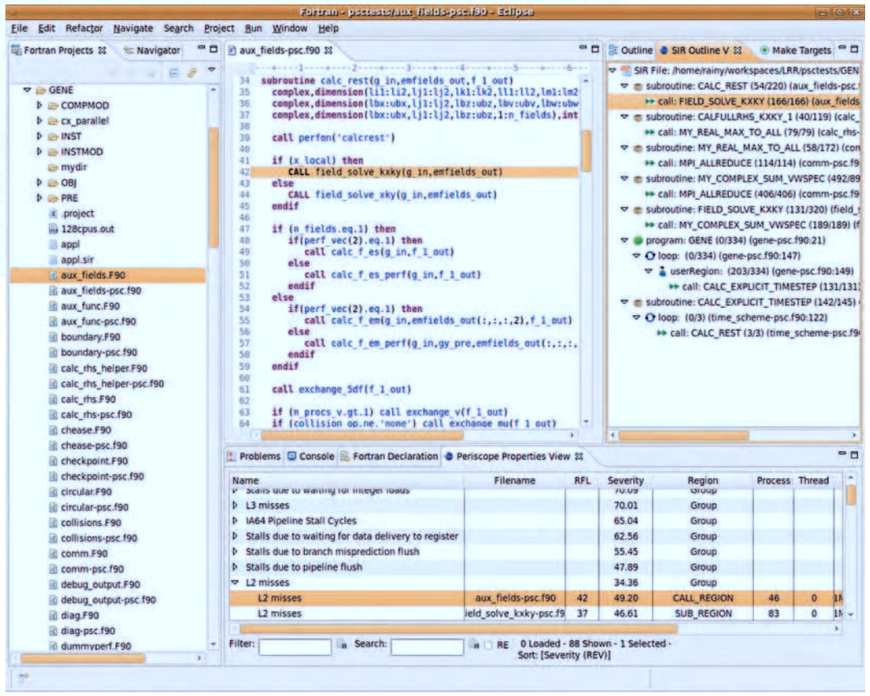

Figure 1: Periscope integrating performance analysis with application development within the Eclipse IDE

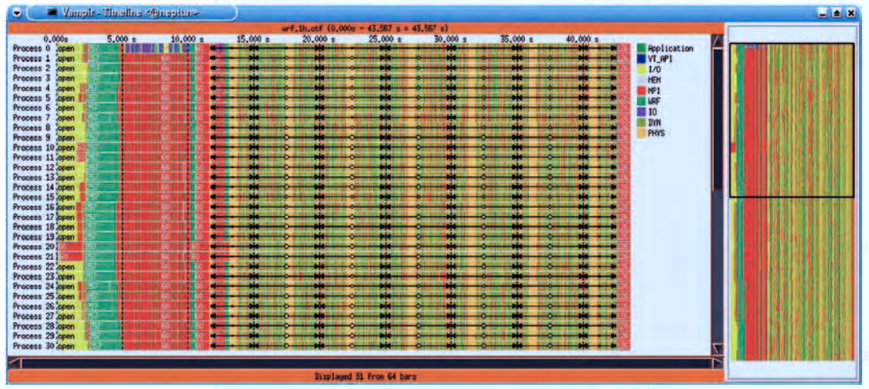

Figure 2: Vampir timeline display zoomed in on a subset of the application processes

to the user. Scalasca, which has been specifically designed for large-scale systems, integrates efficient performance summaries with the ability to automatically identify wait states that occur in simulation codes, for example, as a result of unevenly distributed workloads. Whereas the first two tools analyze the performance data postmortem, that is, after the parallel program has been terminated, Periscope characterizes the performance properties of an application and quantifies associated overheads already at runtime. In addition to increasing their scalability, making the three tools rest on this joint basis will allow them to interoperate more easily and simplify their installation. The enhanced tool suite will be used to tune the performance of academic and industrial simulation programs especially from the Gauss-Alliance, preparing them for the new peta-scale era.

The academic project partners in SILC are TU Dresden as the coordinator, the Jülich Supercomputing Centre, RWTH Aachen University, and TU Munich. Aachen, which plays an active role in the OpenMP Architecture Review Board, plans to equip the infrastructure with support for the more advanced features defined in the OpenMP standard. Industrial partners include the GNS mbH, a private company that specializes in services related to metal forming simulations, such as mesh generation for complex structures and finite element analyses, and – as an associate partner – the GWT-TUD GmbH, which is the commercial distributor of Vampir.

For more information see http://www.vi-hps.org/projects/silc/

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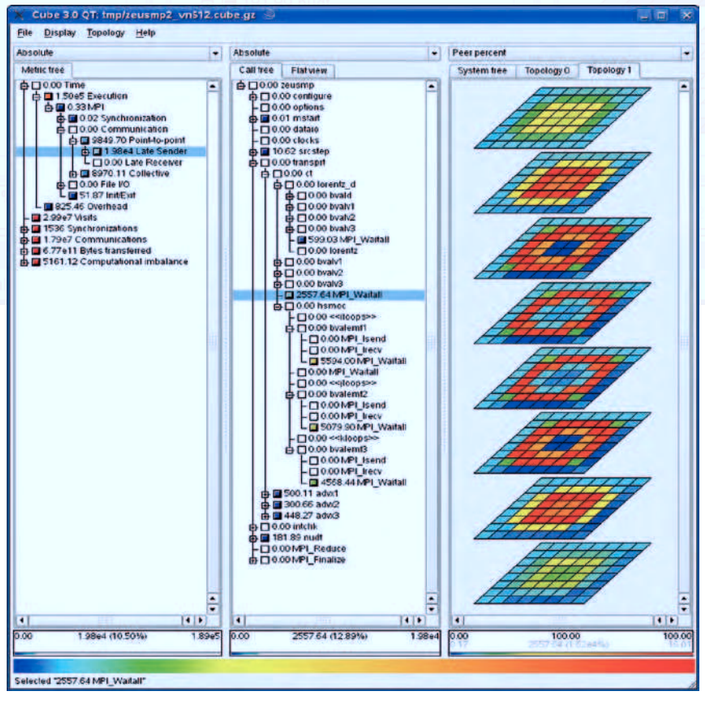

Figure 3: Scalasca showing the distribution of wait states across a three-dimensional process topology