Mission Statement
Performance analysis and tuning is an important step in programming multicore- and manycore-based parallel architectures. While there are several tools to help developers analyze application performance, no tool provides recommendations about how to tune the code. The AutoTune project is extending Periscope, an automatic distributed performance analysis tool developed by Technische Universität München, with plugins for performance and energy efficiency tuning. The resulting Periscope Tuning Framework will be able to tune serial and parallel codes for multicore and manycore architectures and return tuning recommendations that can be integrated into the production version of the code. The whole tuning process – both performance analysis and tuning – will be performed automatically during a single run of the application.

The Technical Approach
AutoTune is developing the Periscope Tuning Framework (PTF) as an extension to Periscope. It follows Periscope’s main principles, i.e. the use of formalized expert knowledge and strategies, automatic execution, online search based on program phases, and distributed processing. Periscope is being extended by a number of tuning plugins, each of which performs the tuning according to a certain code aspect. The tuning plugins under development are the following:

- High-level parallel patterns for GPGPUs
- Hybrid manycore HMPP codelets
- Energy consumption via CPU frequency
- MPI runtime
- Master-worker MPI
- Compiler flag selection

Development, Experiments and Evaluation
The development of the tuning plugins and their evaluation are based on the AutoTune application repository that includes standard HPC benchmarks and entire applications. All tuning techniques were manually applied at the beginning of the project and the automatically achieved results will be compared to those. The applications’ execution on manycore architectures (different state-of-the-art GPU accelerators) as well as multicore systems (SuperMUC) demonstrate the increase in performance portability, due to automatic tuning with the Periscope Tuning Framework (PTF). The prototypes of the plugins developed in the second year already show promising tuning results.

Scientific, Economic and Societal Impact
AutoTune is developing new productivity tools for parallel programming that increases by orders of magnitude multi- and many-core programming efficiency. The generated code will help to potentially save execution time and billions of euros worth of energy in HPC servers worldwide. Due to the adaptive approach of auto-tuning PTF supports users in achieving performance portability.

Key Features
- Automatic performance tuning of parallel codes
- Increased programmer productivity on GPU accelerated systems
- Less energy consumption of petascale systems

Project Partners

<table>
<thead>
<tr>
<th>Project Partners</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technische Universität München</td>
<td>DE</td>
</tr>
<tr>
<td>(Coordinator)</td>
<td></td>
</tr>
<tr>
<td>Leibniz Supercomputing Centre</td>
<td>DE</td>
</tr>
<tr>
<td>National University of Ireland</td>
<td>IE</td>
</tr>
<tr>
<td>Galway, ICHEC</td>
<td></td>
</tr>
<tr>
<td>CAPS Enterprise</td>
<td>FR</td>
</tr>
<tr>
<td>Universitat Autònoma de Barcelona</td>
<td>ES</td>
</tr>
<tr>
<td>Universität Wien</td>
<td>AT</td>
</tr>
</tbody>
</table>

Contact:
Michael Gerndt
TUM, Boltzmannstr. 3
D-85748 Garching
Tel: +49 89 289 17652
Fax: +49 89 289 17662
Email: gerndt@in.tum.de
Website: www.autotune-project.eu

Contract number: 288038
Coordinator: Technische Universität München
Community contribution: 2,35 Mio Euro

Project start date: 15.10.2011
Duration: 36 months
www.autotune-project.eu