ProPE – A joint effort to establish a unified service infrastructure for Performance Engineering in German HPC-Centers

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Overview and Partners

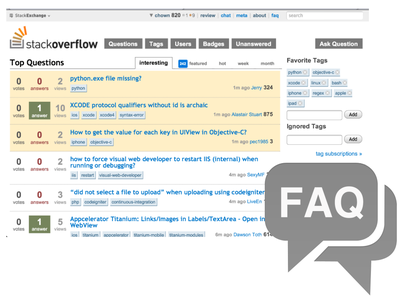
HPC competence in German HPC centers is distributed across the country. The Gauss-Allianz is an initiative to integrate and organize TIER 2/3 HPC landscape in Germany. Furthermore there are multiple local efforts: bwHPC, KONWIHR, HKHLR, HLRN and JARA-HPC. Our contribution is to integrate with and built on already existing efforts and further drive the final goal of an hierarchical and yet integrated German HPC infrastructure with an emphasis on Performance-Engineering.

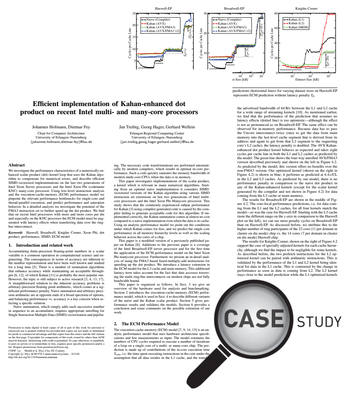
Partners
- RRZE (University Erlangen-Nuremberg)
- IT Center (RWTH Aachen University)
- ZIH (Technical University Dresden)

Associated Partners
- KONWIHR
- TU Munich (Prof. Bungartz)
- Forschungszentrum Jülich
- Technical University Bergakademie Freiberg

Dissemination and Documentation

Increase publicity for the project and raise general awareness for performance issues. Build a central web offering, create content and provide resources to maintain it.

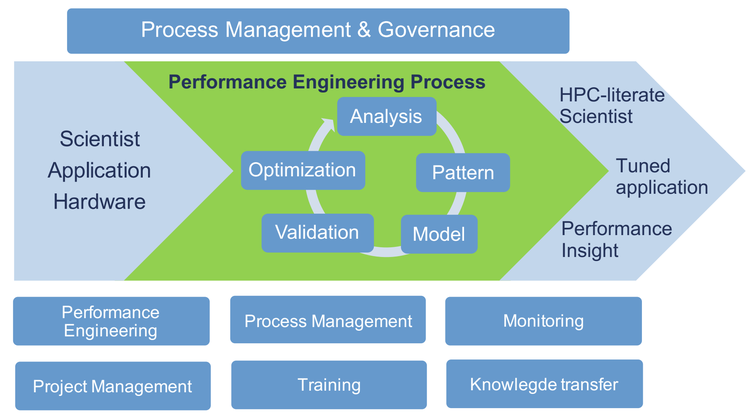




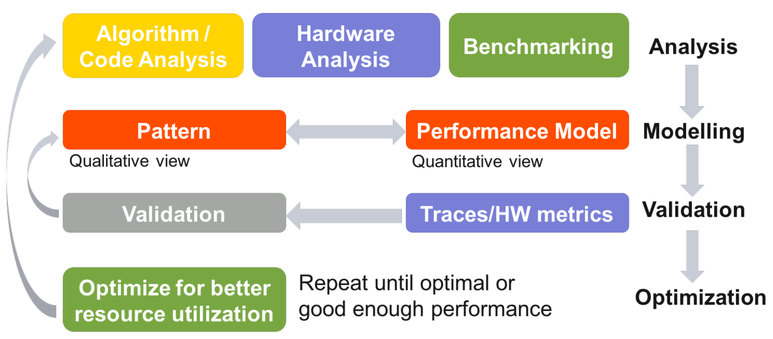
ProPE Project Structure

While the project does not have enough manpower to fully unroll all of the points it will create a **blueprint** and develop the necessary **tools** and **processes**.

Important ingredients will be **show-cases** by
- Carrying out real **Performance Projects**
- **Organizing tutorials** and **researcher exchanges** between sites
- Establishing system-wide job specific **performance profiling** infrastructures



Structured PE-Process

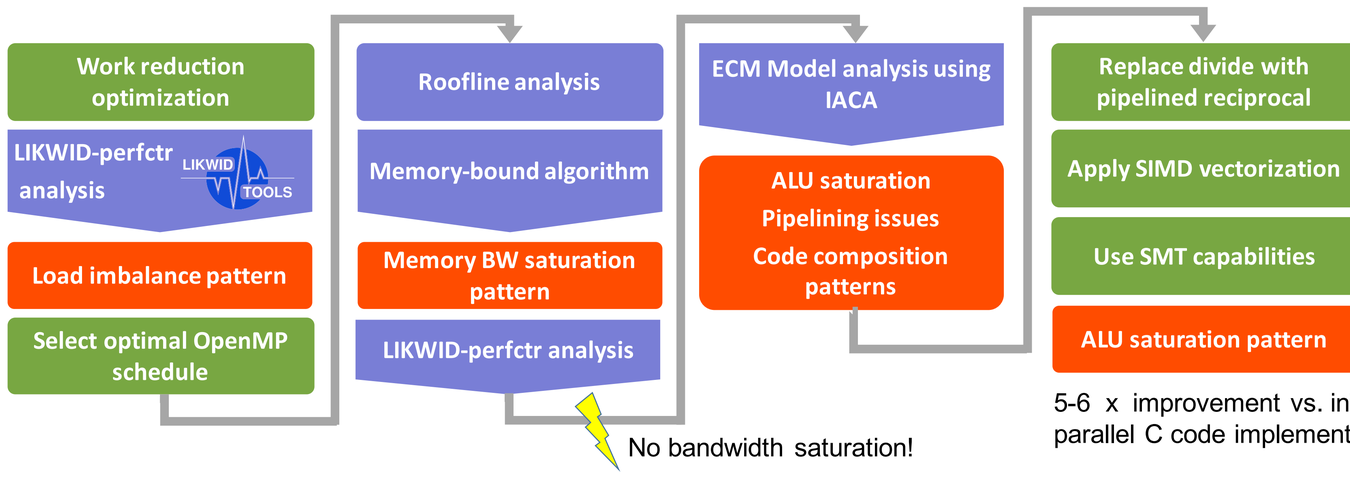


The core activity of analyzing and optimizing application performance is guided by a systematic PE-Process. At its core are typical performance limiting settings called performance patterns. To validate and to get a quantitative view of a pattern white box performance models are employed. Identifying a performance pattern is achieved by a set of hardware performance counter metrics but might also involve static code analysis and benchmarking results.

Case Study

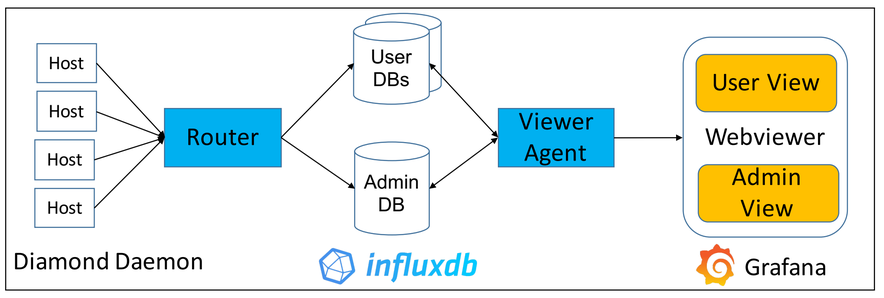
J. Treibig, G. Hager, H. G. Hofmann, J. Hornegger, and G. Wellein: *Pushing the limits for medical image reconstruction on recent standard multicore processors.* International Journal of High Performance Computing Applications **27**(2), 162–177 (2013).

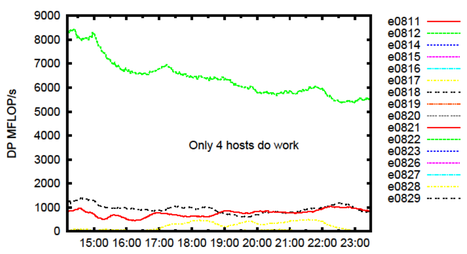
J. Hofmann, J. Treibig, G. Hager, and G. Wellein: Performance Engineering for a Medical Imaging Application on the Intel Xeon Phi Accelerator. PASA 2014, the 11th Workshop on Parallel Algorithms and Systems and Algorithms, Lübeck, Germany, Feb 25-26, 2014. IEEE



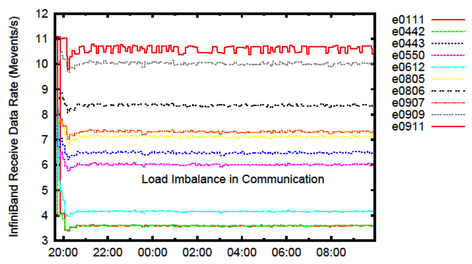
Application Performance Monitoring

Global automatic **application performance monitoring** is essential to improve **efficient** usage of HPC systems.
- Give users feedback on job runs
- Identify applications with high optimization potential or pathological performance behavior
- Create databases with ***performance footprints*** and ***performance maps*** to characterize applications and track HPC usage statistics

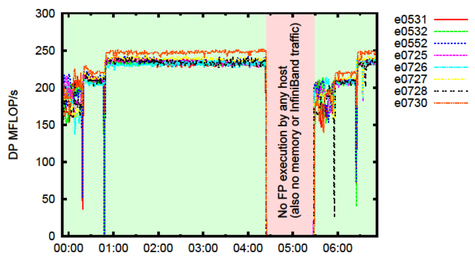




Bad utilization of reserved hosts

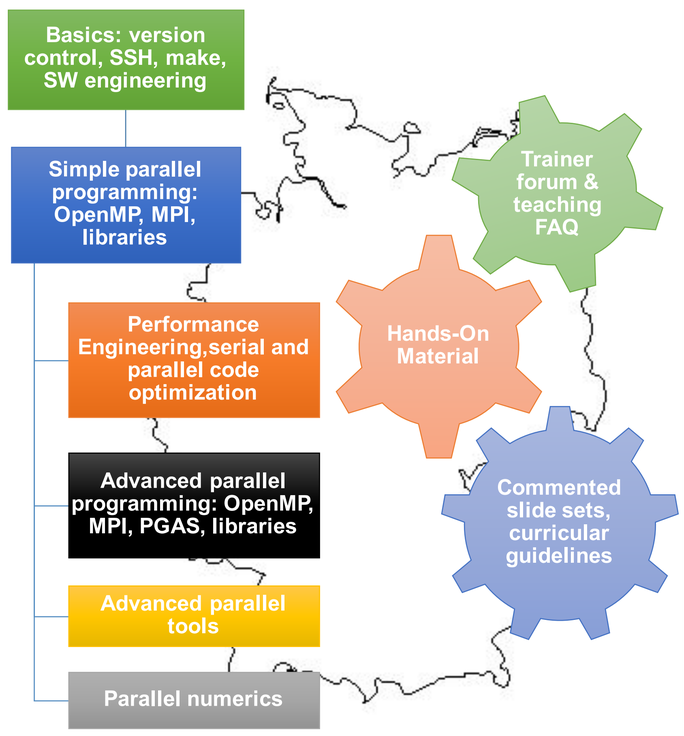


Possible performance limitations



Strange performance behavior

HPC Curriculum



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More information