

Course:

Node-Level Performance Engineering

Abstract:

This course teaches performance engineering approaches on the compute node level. “Performance engineering” as we define it is more than employing tools to identify hotspots and bottlenecks. It is about developing a thorough understanding of the interactions between software and hardware. This process must start at the core, socket, and node level, where the code gets executed that does the actual computational work. Once the architectural requirements of a code are understood and correlated with performance measurements, the potential benefit of optimizations can often be predicted. We introduce a “holistic” node-level performance engineering strategy, apply it to different algorithms from computational science, and also show how an awareness of the performance features of an application may lead to notable reductions in power consumption.

Topics:

1. Introduction to modern architectures
2. Why performance modeling and engineering?
3. Basic node-level performance properties
4. Basic performance modeling and optimization:
Roofline applied to the 3D 7-point (“Jacobi”) stencil
5. Practical performance analysis and typical performance patterns
6. Case Study: The Lattice-Boltzmann Method (LBM)
7. Advanced modeling on cache-based multicore processors
8. Case Study: Sparse Matrix-Vector multiplication (spMVM)
9. Energy modeling and engineering (OPTIONAL)

Date: March 13, 2013 (10:00 – 17:00) & March 14, 2013 (9:00 – 16:30)

Location: DLR Köln, Linder Höhe, 51147 Köln
(see http://www.dlr.de/dlr/desktopdefault.aspx/tabid-10265/347_read-219/)
Building 53 (close to „55-Nord-Pforte“), 1.Obergeschoss, Hörsaal
(see http://www.dlr.de/Portaldata/1/Resources/standorte/koeln/Lageplan_DLR-Standort_K_In.pdf)

Teachers: G. Hager, G. Wellein

Please register by sending an e-mail to georg.hager@fau.de using the subject “PE-03-2013”

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