Introduction to VI-HPS

Brian Wylie
Jülich Supercomputing Centre

Virtual Institute – High Productivity Supercomputing

- **Goal**: Improve the quality and accelerate the development process of complex simulation codes running on highly-parallel computer systems
- Start-up funding (2006–2011)
  by Helmholtz Association of German Research Centres
- Activities
  - Development and integration of HPC programming tools
    - Correctness checking & performance analysis
  - Academic workshops
  - Training workshops
  - Service
    - Support email lists
    - Application engagement

HELMHOLTZ ASSOCIATION

http://www.vi-hps.org

VI-HPS partners (founders)

Forschungszentrum Jülich
- Jülich Supercomputing Centre

RWTH Aachen University
- Centre for Computing & Communication

Technische Universität Dresden
- Centre for Information Services & HPC

University of Tennessee (Knoxville)
- Innovative Computing Laboratory

VI-HPS partners (additional members)





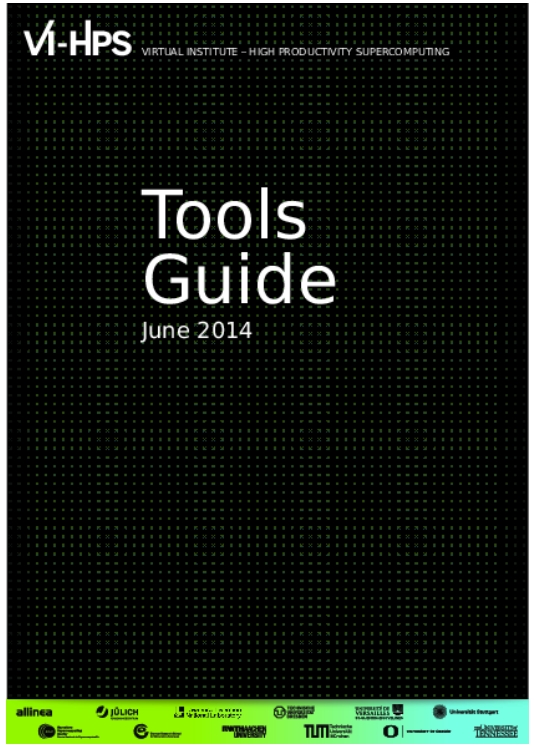



- Barcelona Supercomputing Center
  - Centro Nacional de Supercomputación
- Lawrence Livermore National Lab.
  - Center for Applied Scientific Computing
- Technical University of Darmstadt
  - Laboratory for Parallel Programming
- Technical University of Munich
  - Chair for Computer Architecture
- University of Oregon
  - Performance Research Laboratory
- University of Stuttgart
  - HPC Centre
- University of Versailles St-Quentin
  - LRC ITACA
- Allinea Software Ltd (Now part of ARM)

Productivity tools

- MUST & ARCHER
  - MPI usage correctness checking & OpenMP race detection
- PAPI
  - Interfacing to hardware performance counters
- Periscope Tuning Framework
  - Automatic analysis via an on-line distributed search
- Scalasca
  - Large-scale parallel performance analysis
- TAU
  - Integrated parallel performance system
- Vampir
  - Interactive graphical trace visualization & analysis
- Score-P
  - Community-developed instrumentation & measurement infrastructure

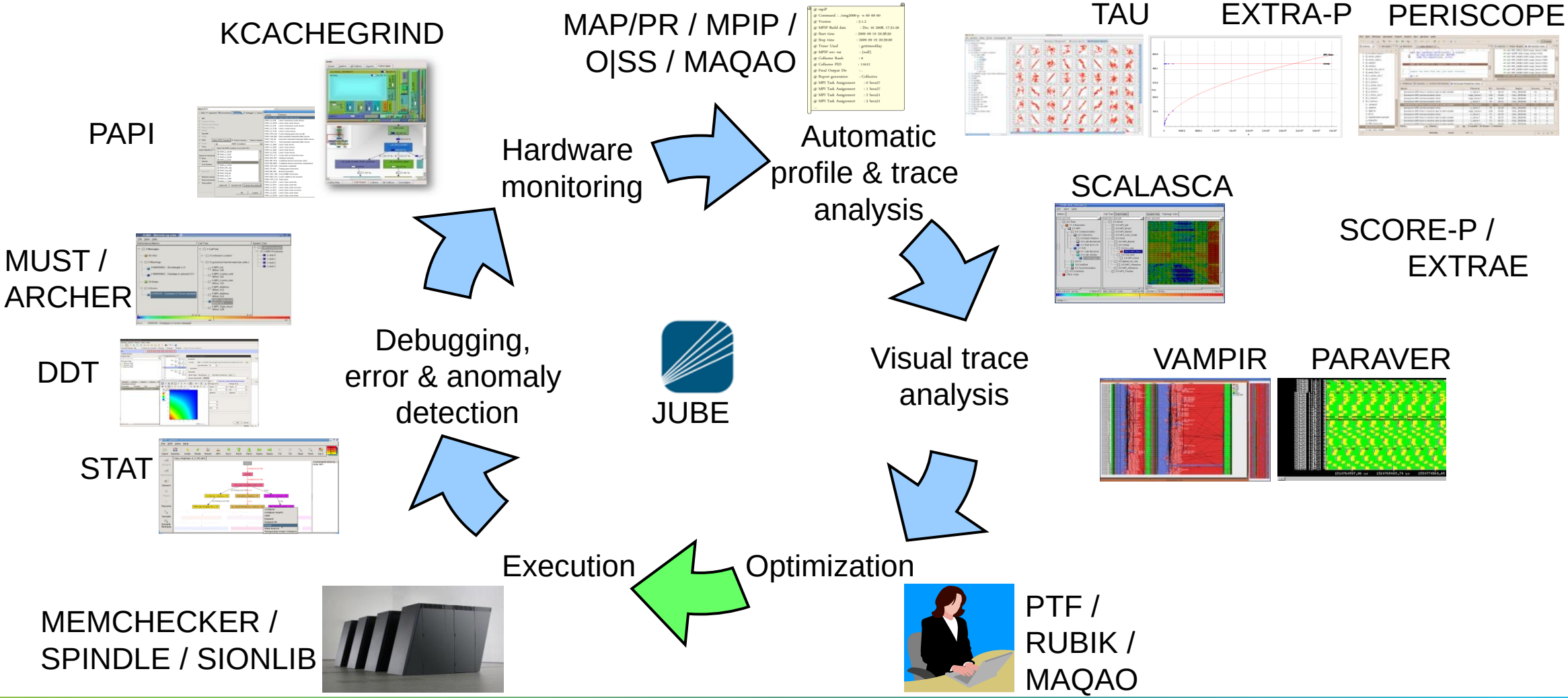
For a brief overview of tools consult the VI-HPS Tools Guide:



Productivity tools (cont.)

- DDT/MAP/PR: Parallel debugging, profiling & performance reports
- Extra-P: Automated performance modelling
- JuBE: Benchmark set creation, execution & evaluation framework
- Kcachegrind: Callgraph-based cache analysis [x86 only]
- MAQAO: Assembly instrumentation & optimization [x86-64 only]
- mpiP/mpiPview: MPI profiling tool and analysis viewer
- Open MPI Memchecker: Integrated memory checking
- Open|SpeedShop: Integrated parallel performance analysis environment
- Paraver/Dimemas/Extrae: Event tracing and graphical trace visualization & analysis
- Rubik: Process mapping generation & optimization [BG only]
- SIONlib/Spindle: Optimized native parallel file I/O & shared library loading
- STAT: Stack trace analysis tools

Technologies and their integration



Disclaimer

Tools will ***not*** automatically make you, your applications or computer systems more productive.

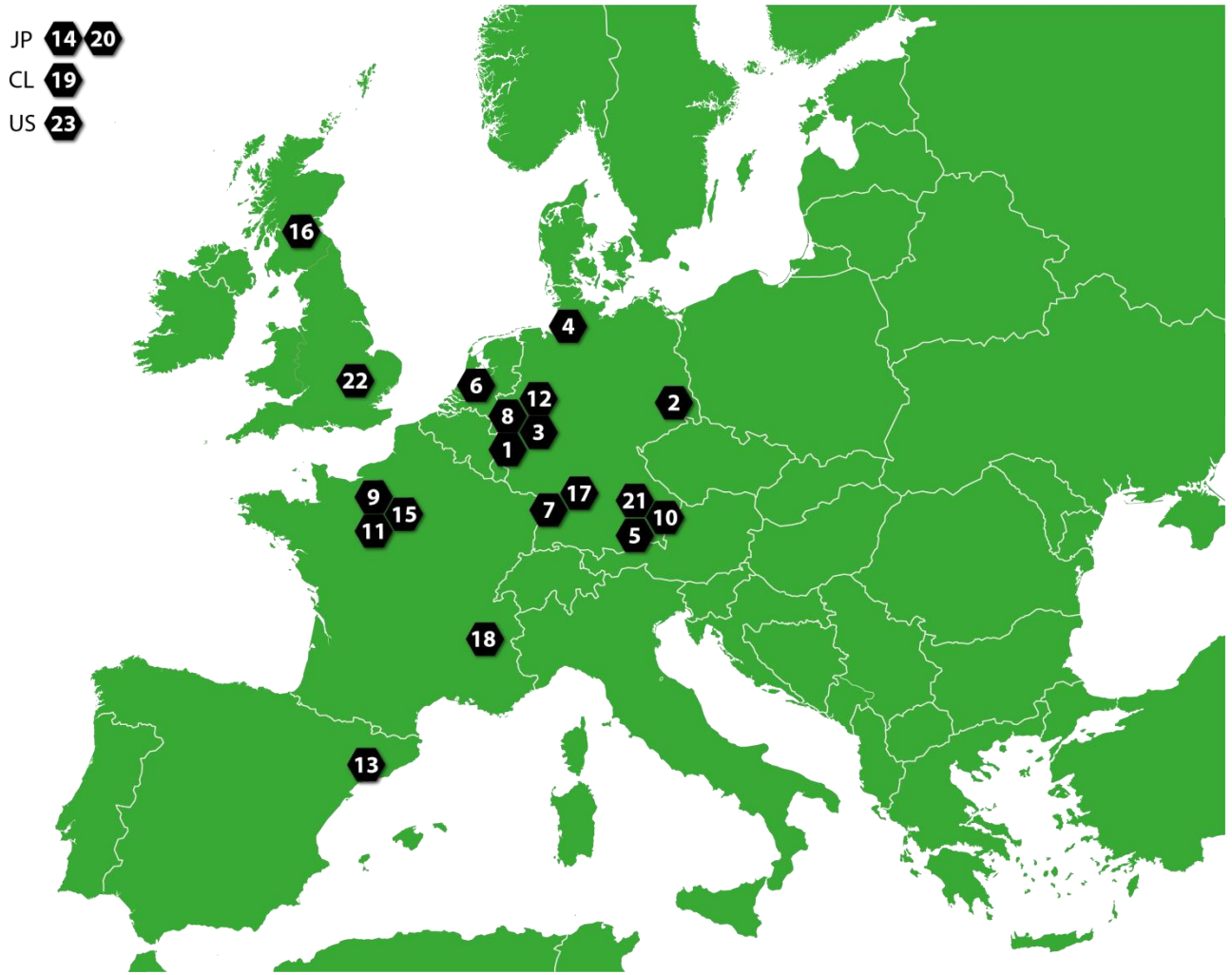
However, they can help you understand ***how*** your parallel code executes and ***when / where*** it's necessary to work on correctness and performance issues.

VI-HPS training & Tuning Workshops

- Goals
  - Give an overview of the programming tools suite
  - Explain the functionality of individual tools
  - Teach how to use the tools effectively
  - Offer hands-on experience and expert assistance using tools
  - Receive feedback from users to guide future development
- For best results, bring & analyze/tune your own code(s)!

- VI-HPS Hands-on Tutorial series
  - **SC**'08/09/10/11/13/14/15/16, ICCS'09, Cluster'10, EuroMPI'12/14, XSEDE'13, **ISC-HPC**'15/16/17
- VI-HPS Tuning Workshop series
  - 2008 (Aachen & Dresden), 2009 (Jülich & Bremen), 2010 (Garching & Amsterdam/NL), 2011 (Stuttgart & Aachen), 2012 (St-Quentin/F & Garching), 2013 (Saclay/F & Jülich) 2014 (Barcelona/Spain, Kobe/Japan, Saclay/France, Edinburgh/UK) 2015 (Stuttgart & Grenoble/France & Santiago/Chile) 2016 (Kobe/Japan, Garching, Cambridge/UK, Livermore/USA), 2017 (Southampton/UK, Aachen)

VI-HPS Tuning Workshop series



1. 2008/03/05+3: RWTH, Aachen, Germany
2. 2008/10/08+3: ZIH, Dresden, Germany
3. 2009/02/16+5: JSC, Jülich, Germany
4. 2009/09/09+3: HLRN, Bremen, Germany
5. 2010/03/08+3: TUM, Garching, Germany
6. 2010/05/26+3: SARA, Amsterdam, Netherlands
7. 2011/03/28+3: HLRS, Stuttgart, Germany
8. 2011/09/05+5: GRS, Aachen, Germany
9. 2012/04/23+5: UVSQ, St-Quentin, France
10. 2012/10/16+4: LRZ, Garching, Germany
11. 2013/04/22+4: MdS, Saclay, France
12. 2013/10/07+5: JSC, Jülich, Germany
13. 2014/02/10+5: BSC, Barcelona, Spain
14. 2014/03/25+3: RIKEN AICS, Kobe, Japan
15. 2014/04/07+4: MdS, Saclay, France
16. 2014/04/29+3: EPCC, Edinburgh, Scotland
17. 2015/02/23+5: HLRS, Stuttgart, Germany
18. 2015/05/18+5: UGA, Grenoble, France
19. 2015/10/27+3: NLHPC, Santiago, Chile
20. 2016/02/24+3: RIKEN AICS, Kobe, Japan
21. 2016/04/18+5: LRZ, Garching, Germany
22. 2016/07/06+3: Univ. of Cambridge, England
23. 2016/07/27+3: LLNL, Livermore, California, USA
24. 2017/02/08+3: Uni. Southampton, England
25. 2017/03/27+5: RWTH, Aachen, Germany

Upcoming events

- Full-day tutorial at SC17 (Denver, CO, USA, 12 November 2017)
  - Hands-on practical hybrid parallel application performance engineering using Stampede2
  - Score-P and associated tools Scalasca, TAU & Vampir
- 4th EoCoE/POP Performance Evaluation Workshop (MdS, France, 11-14 Dec 2017)
  - In-depth analysis of parallel application codes particularly suited to developer teams
  - Score-P/Scalasca/Vampir & Extrae/Paraver

- Further events to be determined
  - (one-day) tutorials: with guided exercises sometimes using a Live-ISO/OVA
  - (multi-day) training workshops: with your own applications on actual HPC systems
- Check **www.vi-hps.org/training** for announced events

- Contact us if you might be interested in hosting a training event

VI-HPS Linux Live ISO/OVA

- Bootable Linux installation on DVD (or USB memory stick)
- Includes everything needed to try out our parallel tools on an 64-bit x86-architecture notebook computer
  - VI-HPS tools: Score-P, Periscope, Scalasca, TAU, Vampir*
  - Also: Eclipse/PTP, DDT*, MUST, PAPI, TotalView*
    * evaluation licences provided for commercial products (limited time/capability)
  - GCC (w/ OpenMP), OpenMPI
  - Manuals/User Guides
  - Tutorial exercises & examples
- Produced by U. Oregon PRL
  - Sameer Shende

http://www.vi-hps.org/training/live-iso/