Introduction to VI-HPS

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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

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 (cont.)

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
  - 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
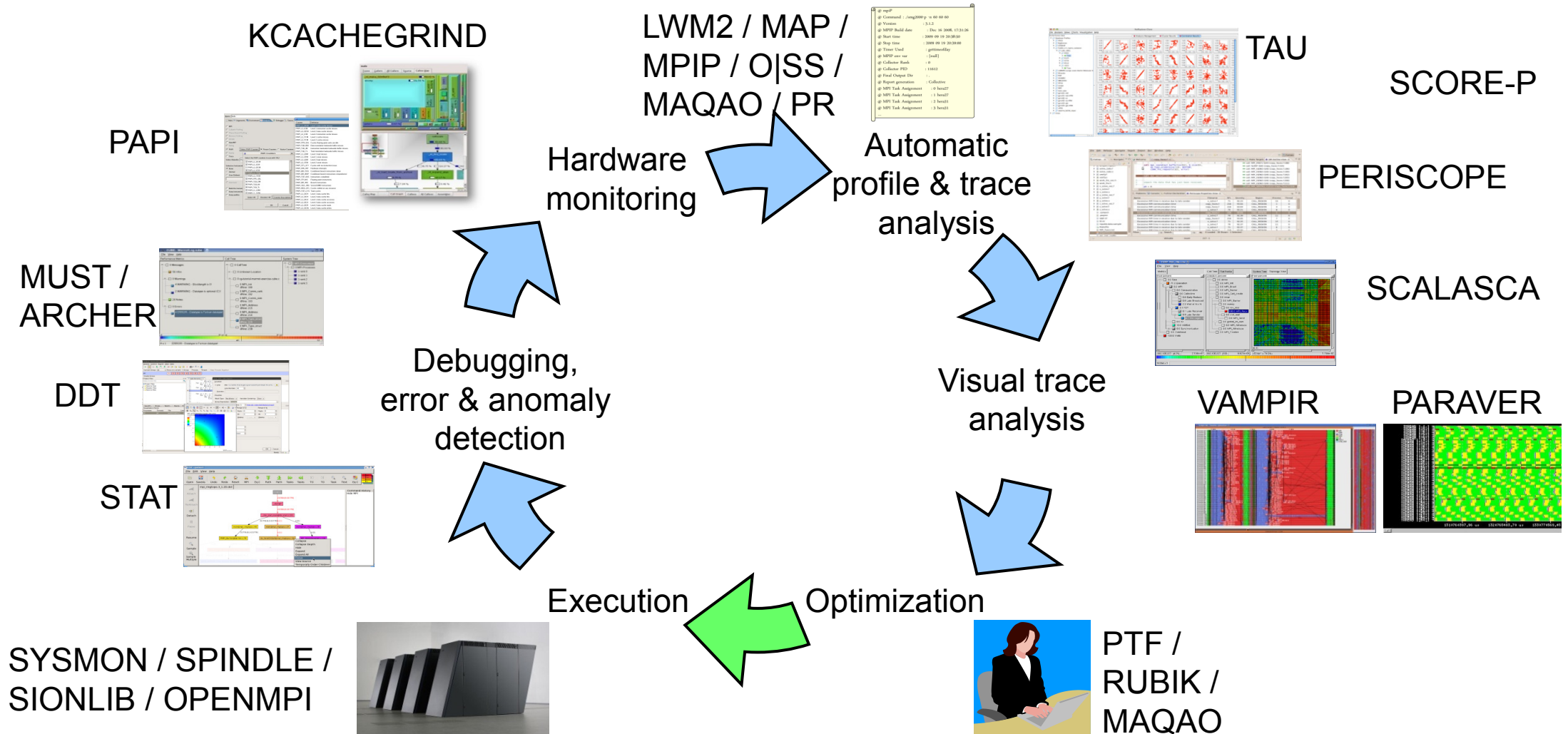 - Community-developed instrumentation & measurement infrastructure

For a brief overview of tools consult the VI-HPS Tools Guide:
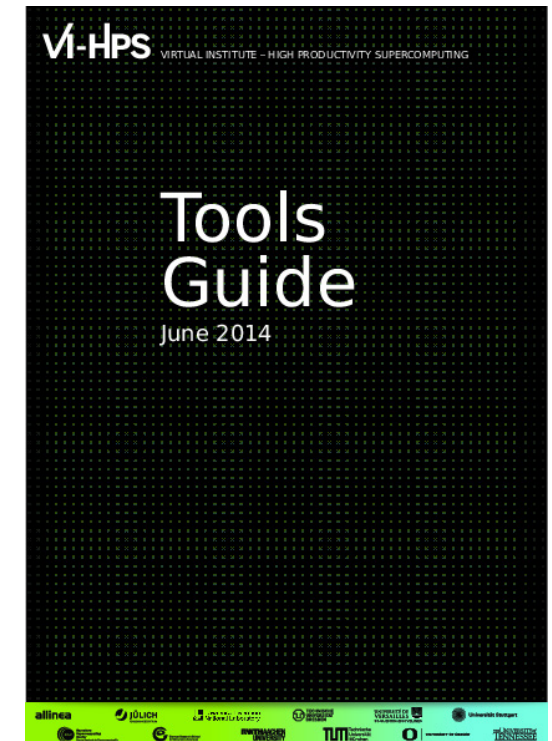
Productivity tools (cont.)

- DDT/MAP/PR: Parallel debugging, profiling & performance reports
- Extra-P: Automated performance modelling
- Kcachegrind: Callgraph-based cache analysis [x86 only]
- MAQAO: Assembly instrumentation & optimization [x86-64 only]
- mpiP/mpiPview: MPI profiling tool and analysis viewer
- Open MPI: 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
- SysMon: Batch system monitor plugin for Eclipse PTP

Technologies and their integration

KCACHEGRIND

PAPI

LWM2 / MAP / MPIP / O|SS / MAQAO / PR

TAU

SCORE-P

PERISCOPE

Hardware monitoring

Automatic profile & trace analysis

MUST / ARCHER

DDT

STAT

Debugging, error & anomaly detection

Visual trace analysis

SCALASCA

VAMPIR   PARAVER

SYSMON / SPINDLE / SIONLIB / OPENMPI

Execution   Optimization

PTF / RUBIK / MAQAO

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)

VI-HPS Tuning Workshop series
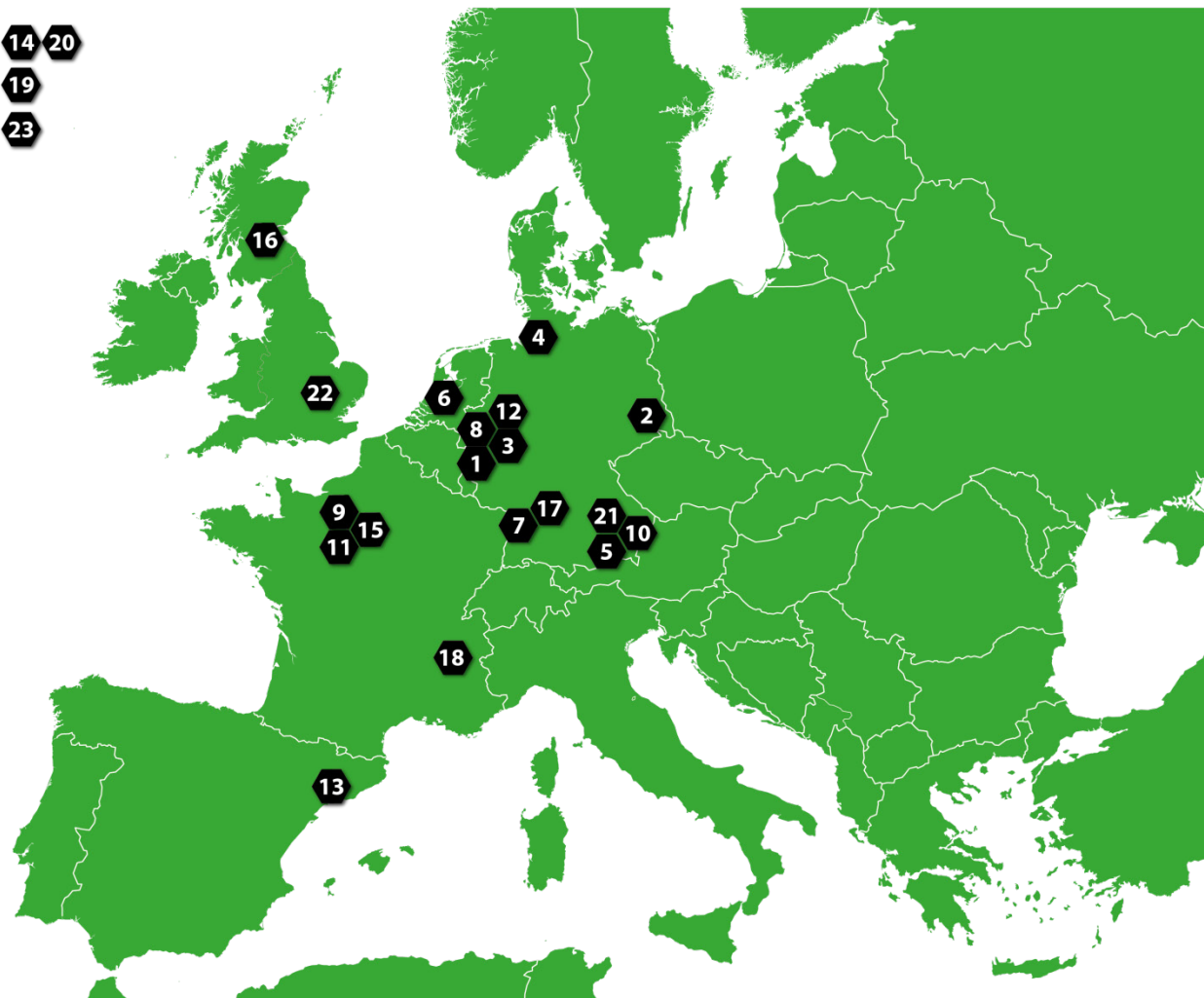
1. **2008/03**/05+3: **RWTH, Aachen, Germany**
2. **2008/10**/08+3: **ZIH, Dresden, Germany**
3. **2009/02**/16+5: **JSC, Jülich, Germany**
4. **2009/09**/09+3: **HLRN, Bremen, Germany**
5. **2010/03**/08+3: **TUM, Garching, Germany**
6. **2010/05**/26+3: **SARA, Amsterdam, Netherlands**
7. **2011/03**/28+3: **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**

Upcoming events

- 26th VI-HPS Tuning Workshop (Paris region, France, May 2017)
  - Details not yet available

- Full-day tutorial at ISC-HPC (Frankfurt am Main, Germany, 18 June 2017)
  - Hands-on practical hybrid parallel application performance engineering
  - Score-P and associated tools Periscope, Scalasca, TAU & Vampir

- 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

Parallel Productivity Tools Live DVD

Also includes: TotalView, DyninstAPI, PDT, Eclipse PTP, Berkeley UPC, ptoolsrte, Chapel, and much more...

Partners:
ParaTools, Inc.
University of Florida
University of Oregon
Totalview Technologies
RWTH Aachen University
HLRS / University of Stuttgart
Jülich Supercomputing Centre
Technische Universität Dresden
Technische Universität München
University of Wisconsin at Madison
Pittsburgh Supercomputing Center
University of Tennessee at Knoxville
National Center for Supercomputing Applications

November 2011

POINT VI-HPS

http://nic.uoregon.edu/point   http://www.vi-hps.org

VI-HPS Linux Live ISO/OVA

- ISO image approximately 5GB, OVA approximately 12GB
  - download latest version from website
  - **http://www.vi-hps.org/training/live-iso/**
  - optionally create bootable DVD or USB drive
- Boot directly from disk
  - enables hardware counter access and offers best performance, but no save/resume
- Boot within virtual machine (e.g., VirtualBox)
  - faster boot time and can save/resume state,
    but may not allow hardware counter access
- Boots into Linux environment for HPC
  - supports building and running provided MPI and/or OpenMP parallel application codes
  - and experimentation with VI-HPS (and third-party) tools