TECHNISCHE UNIVERSITÄT DRESDEN

Center for Information Services and High Performance Computing (ZIH)

Performance Analysis with Open MPI and VampirTrace

Ronny Brendel, Holger Brunst, Jens Doleschal, Matthias Jurenz, Andreas Knüpfer, Matthias Lieber, Holger Mickler, Hartmut Mix, **Matthias Müller**, Michael Peter, Matthias Weber, Thomas William, Wolfgang E. Nagel

Zellescher Weg 12

Willers-Bau A113

Tel. +49 351 - 463 - 39835

Matthias S. Mueller   (matthias.mueller@tu-dresden.de)

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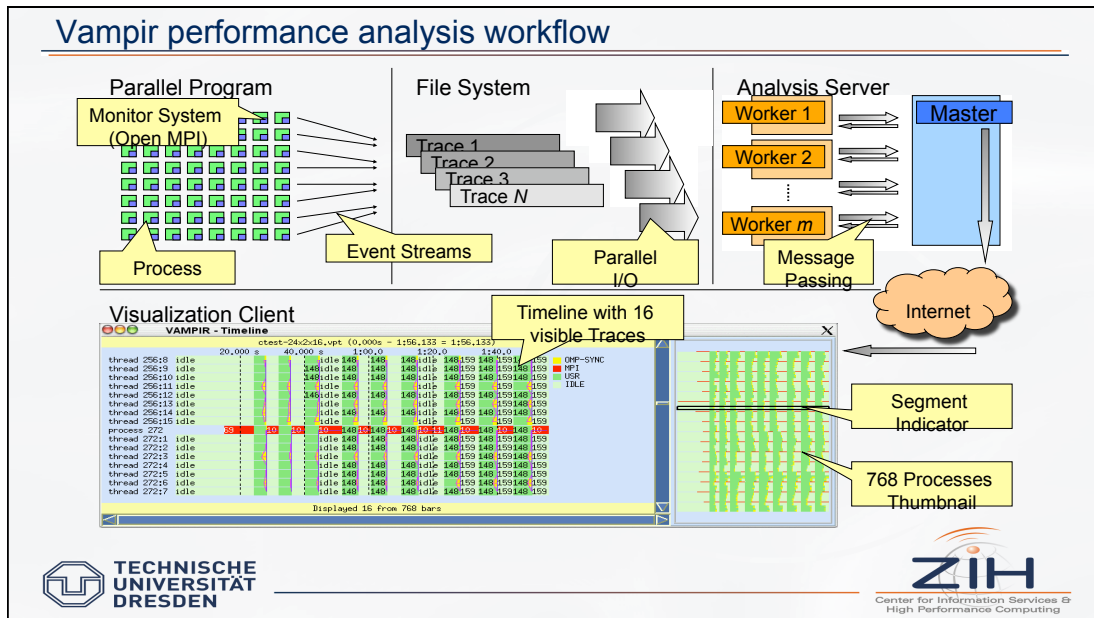

Motivation

- Parallel programing ist about performance!
- Scaling to thousands of cores is required
- You need a decent MPI implementation, e.g. Open MPI
- You also need a ready-to-use performance monitoring and analysis tool

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Vampir performance analysis workflow

VampirTrace

- VampirTrace 5.x,y supports OTF as trace format
- Uses the PMPI interface
- Library implemented in collaboration with FZ Juelich, Univ. Oregon and University of Tennessee
    - OTF (developed with the TAU team at Univ. Oregon)
    - Epilog MPI wrappers (FZ Juelich)
    - Hardware performance counters (PAPI)
- Integrated in Open MPI v1.3 or later
- Available as open source under BSD license:
  http://www.tu-dresden.de/zih/vampirtrace

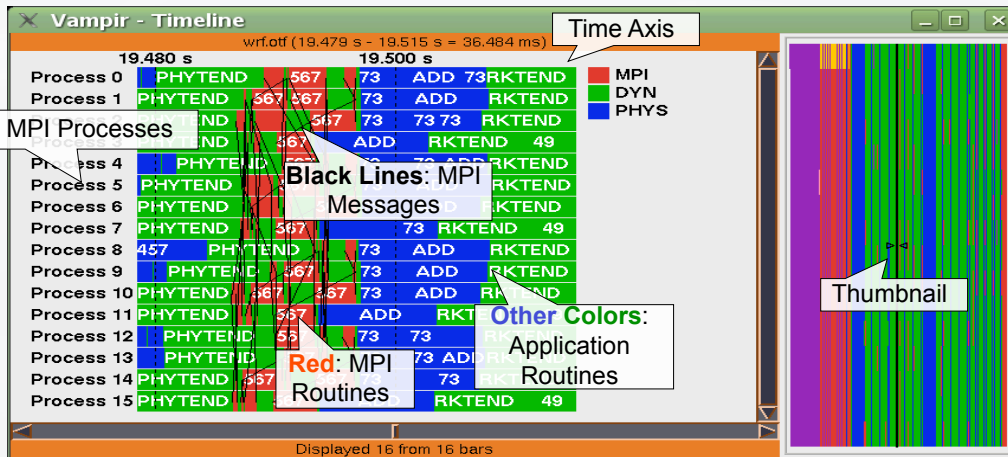## Design of Open Trace Format

- Design of OTF is directed at 3 objectives:

- **Openness**
  - open format defines record types and file structure so that OTF traces can be generated and read correctly
  - external wishes will be considered .. just talk to us!
- **Flexibility**
  - efficiently selective access is supported
- **Performance**
  - is determined by how efficient & fast OTF trace query and manipulation can be done
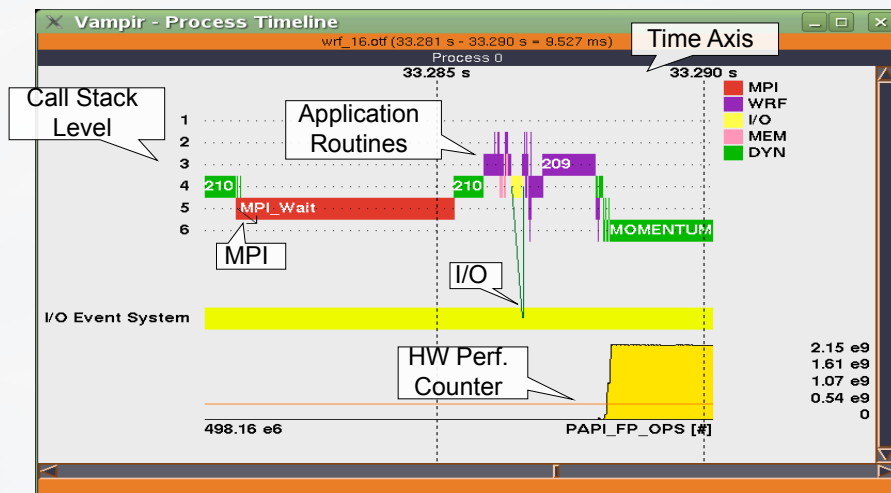 - parallel I/O

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Tools using the Open Trace Format

- OTF profiler (comes with latest VampirTrace)
- Vampir
- Scalasca
- TAU
- Open SpeedShop
- Microsoft Windows Compute Cluster Environment

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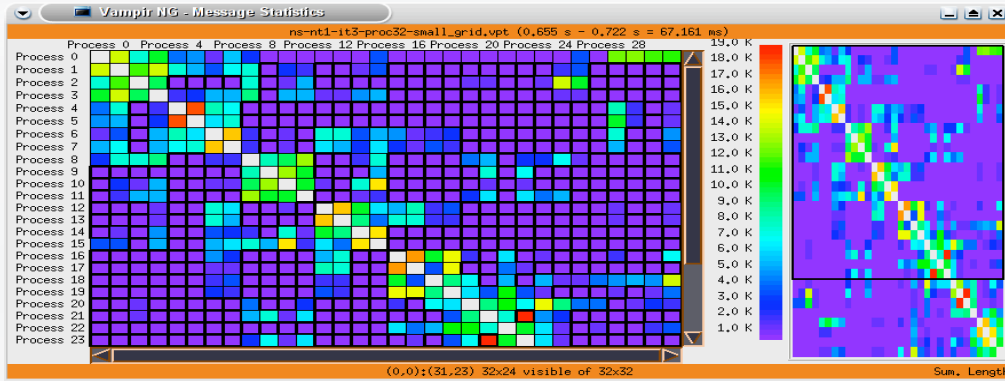**ZIH** — Center for Information Services & High Performance Computing

Most prominent displays: Global Timeline

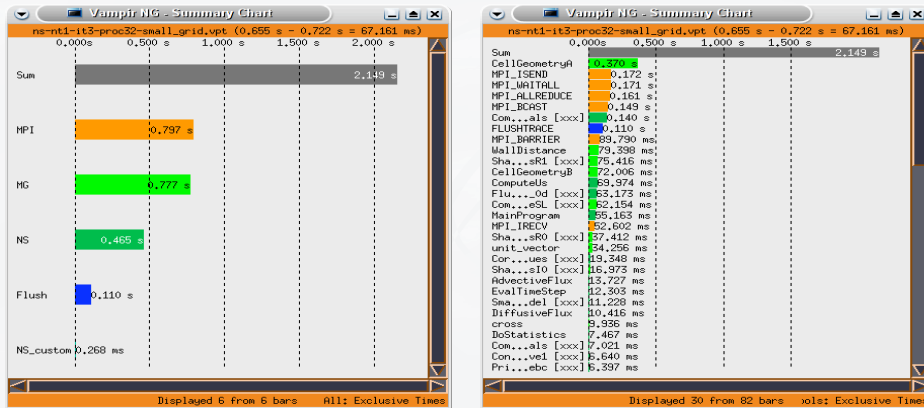
Most prominent displays: Single Process Timeline
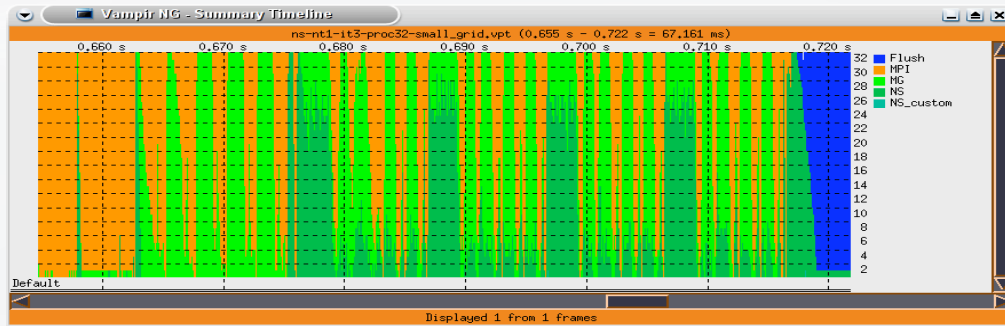
Vampir Displays - Message Statistics

Message Statistics with Thumbnails

Vampir Displays - Summary Chart

Grouped / Comprehensive Function Statistics
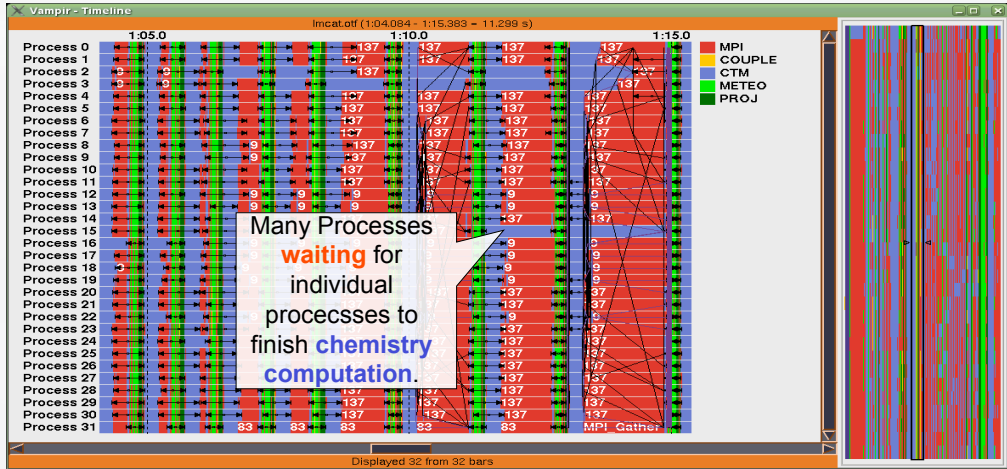
Vampir NG Displays - Summary Timeline

A Tour Through Typical Performance Phenomena Seen With Vampir

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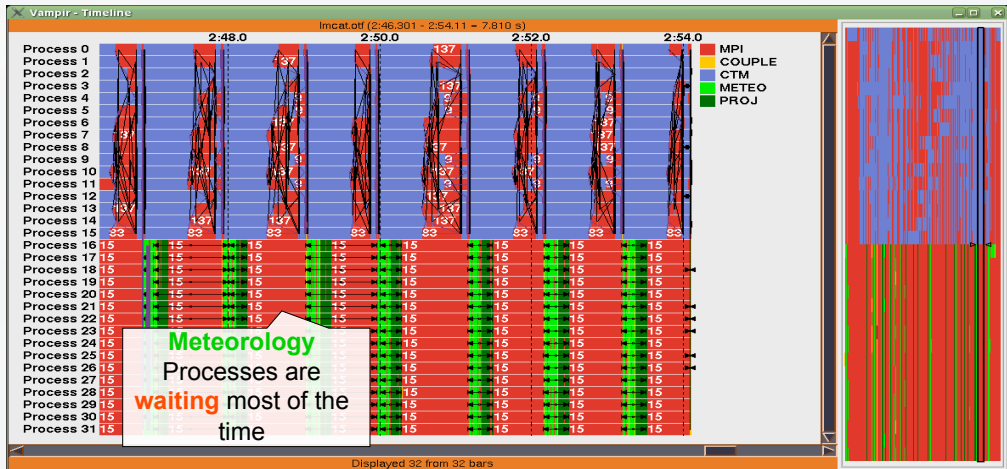Matthias S. Mueller   (matthias.mueller@tu-dresden.de)

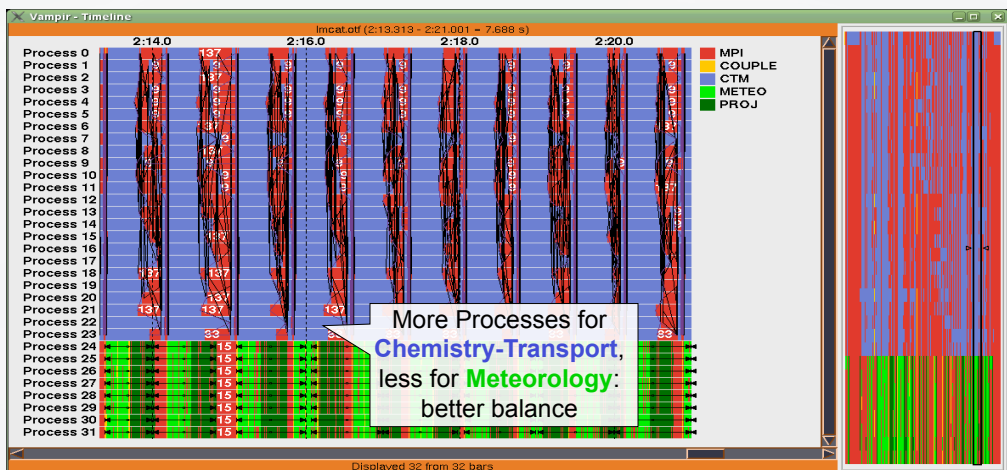## LM-MUSCAT Air Quality Model: Emerging Load Imbalance

LM-MUSCAT Air Quality Model: Emerging Load Imbalance

LM-MUSCAT Air Quality Model: Bad Processor Partitioning
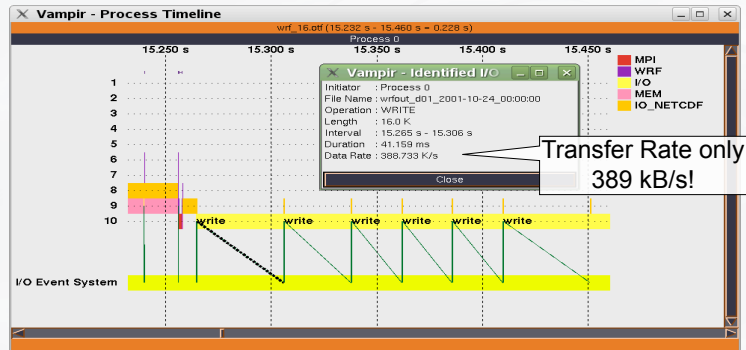

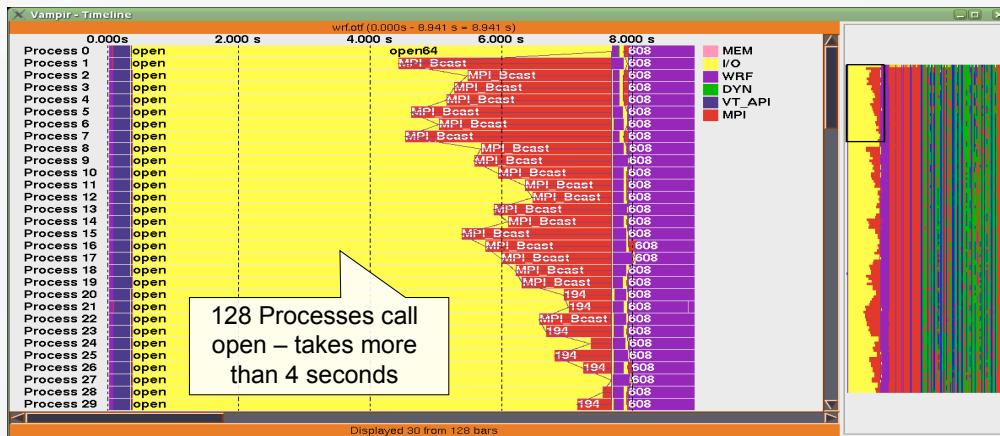LM-MUSCAT Air Quality Model: Good Processor Partitioning

WRF Weather Model: Low I/O Performance

WRF Weather Model: Slow Parallel Metadata Operations

Semtex CFD Application: Serial I/O Leads to Waiting Times

WRF Weather Model: Hybrid MPI/OpenMP - Idle Threads