Collaborative **R**esearch into **E**xascale **S**ystemware,
Tools and **A**pplications

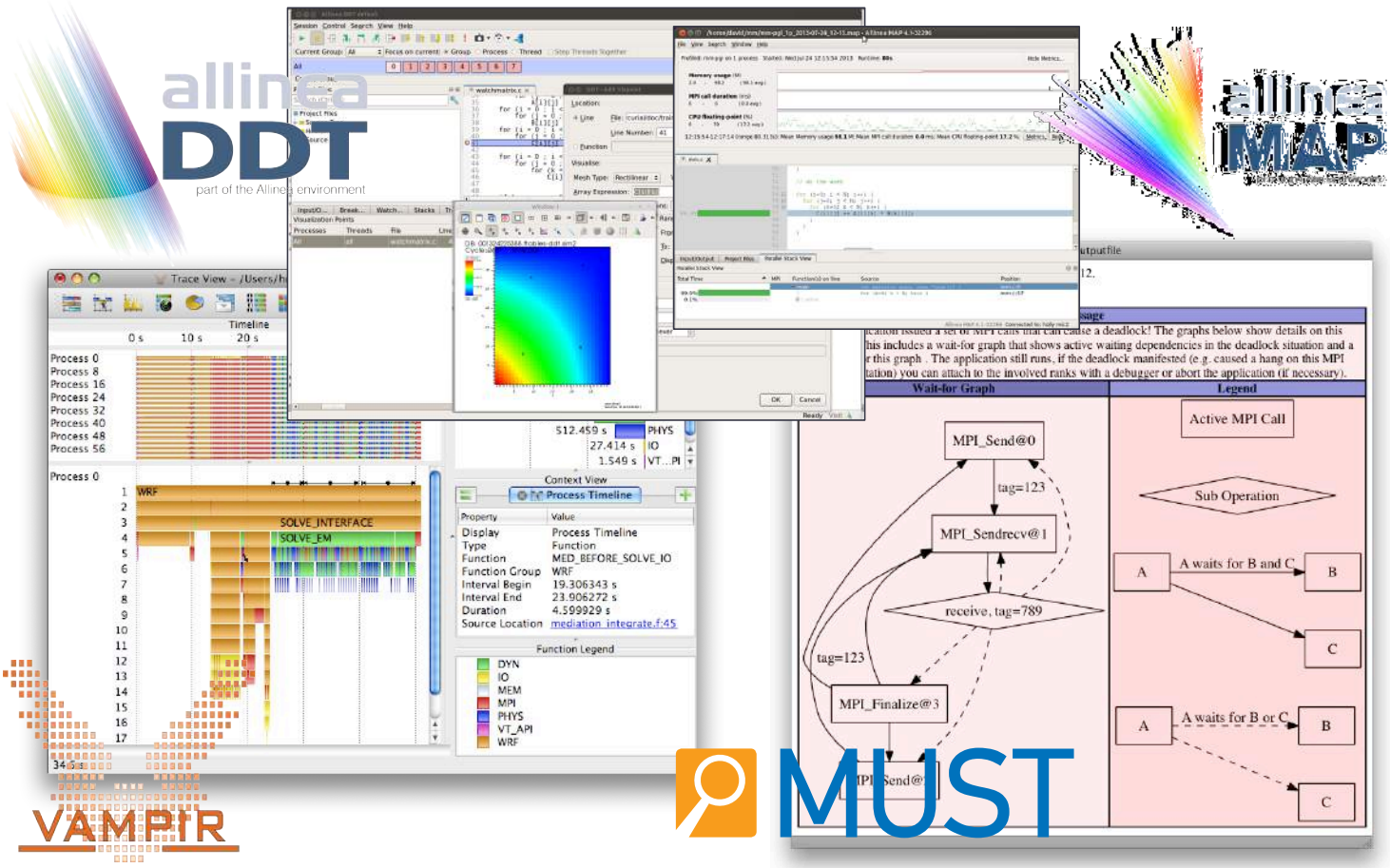
Vampir and CRESTA Tools

Tobias Hilbrich (Technische Universität Dresden)
tobias.hilbrich@tu-dresden.de

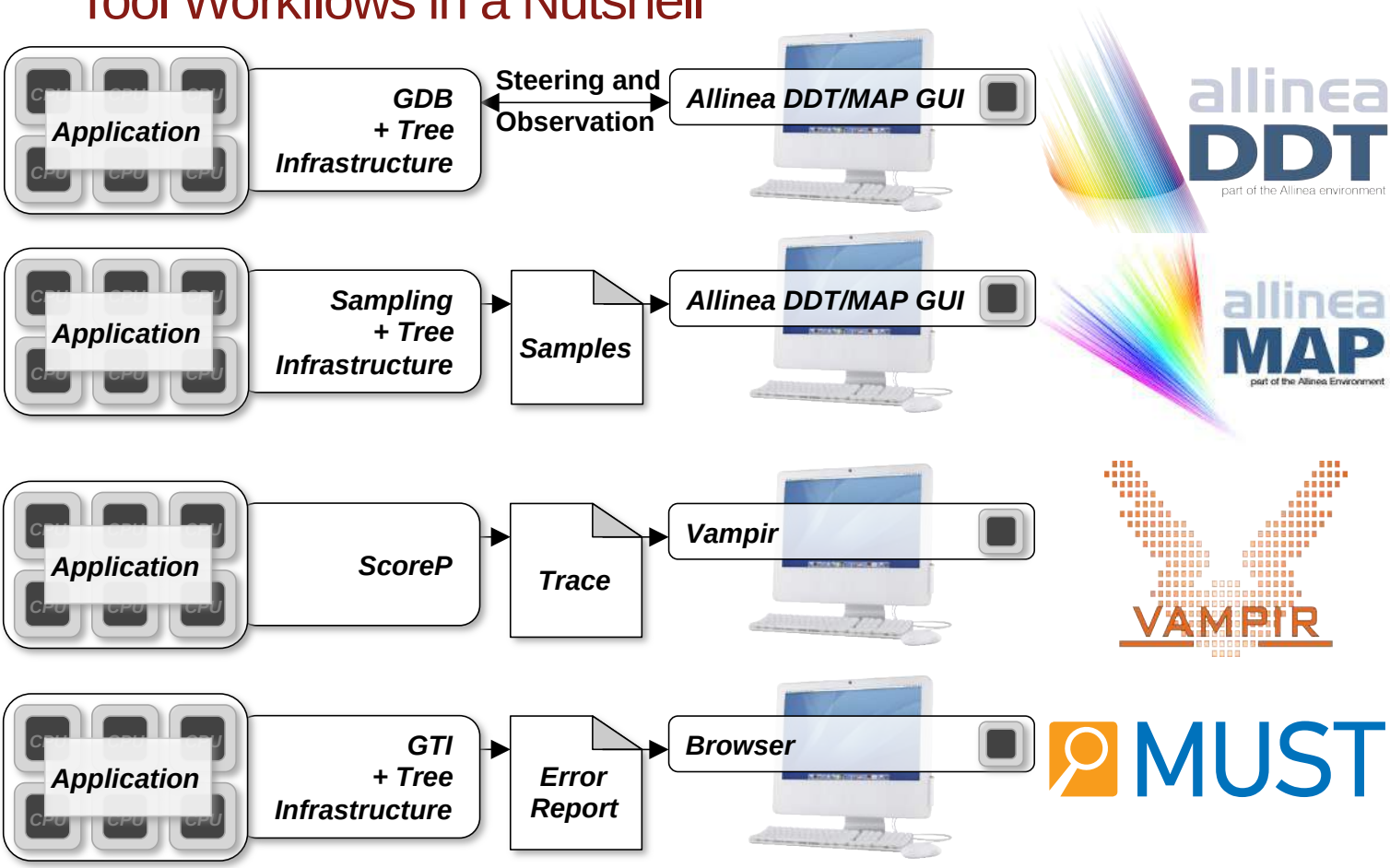
Challenges for Exascale Tools [Selection]

CREST

CRESTA Performance/Correctness Tools



Tool Workflows in a Nutshell



Scalability Challenge

Scalability

Allinea DDT/MAP	Vampir	MUST
• Highest scale of use: **700K cores** • Both tools same tree infrastructure • Features scale • System: Blue Waters [Cray]	• Highest scale of use (VampirTrace): **200K cores** • System: Jaguar [Cray] • Technology: I/O Forwarding (IOFSL) • ScoreP (current environment): SionLib as Technology	• Highest scale of use: **16K cores** • Tree infrastructure to distribute and offload correctness analysis • System: Juqueen [BG/Q]

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Paradigm Challenge – Support [tentative list]

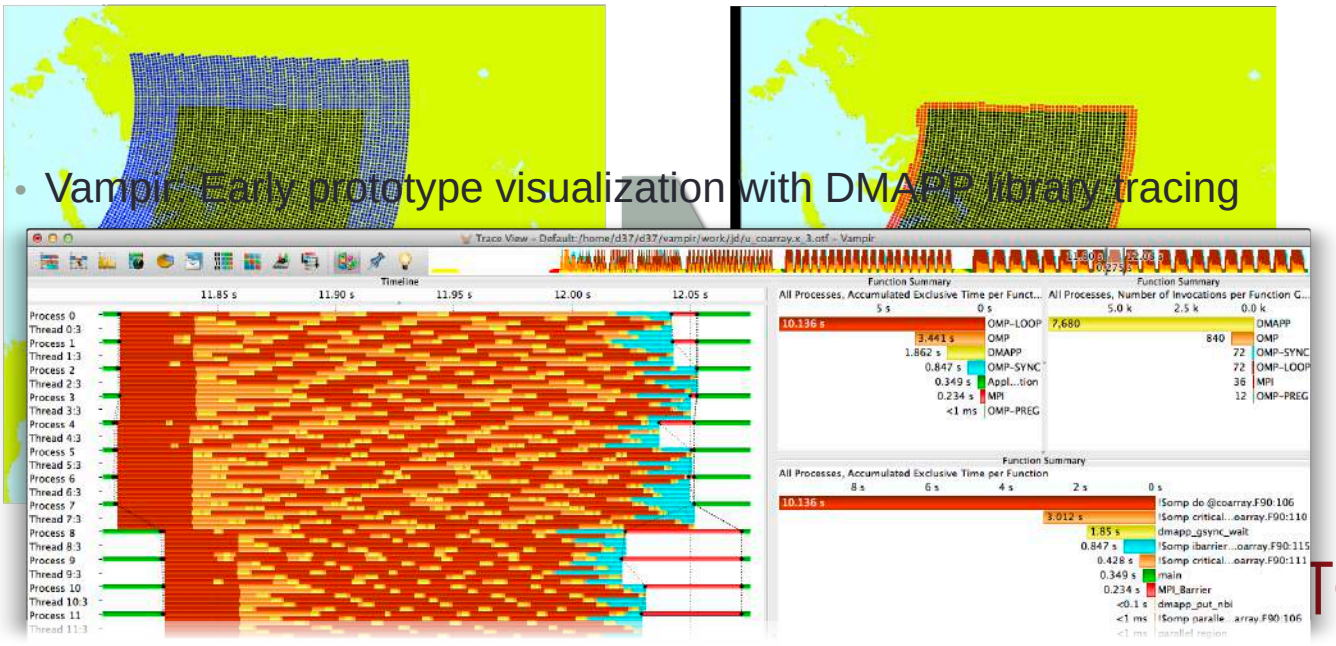
- Allinea DDT:
  - MPI, threads, OpenSHMEM, **Co-Array Fortran**, UPC, **OpenACC**, CUDA, Xeon Phi, ...
- Allinea MAP:
  - MPI, threads, OpenSHMEM
- Vampir (with ScoreP):
  - MPI, threads, OpenSHMEM, **Co-Array Fortran (DMAPP)**, **OpenACC** (CUDA), CUDA, OpenCL
- MUST:
  - MPI
  - Ongoing: threads (different project), investigation into OpenSHMEM/GASPI (CRESTA)

CRESTA

Paradigm Challenge – Co-Design

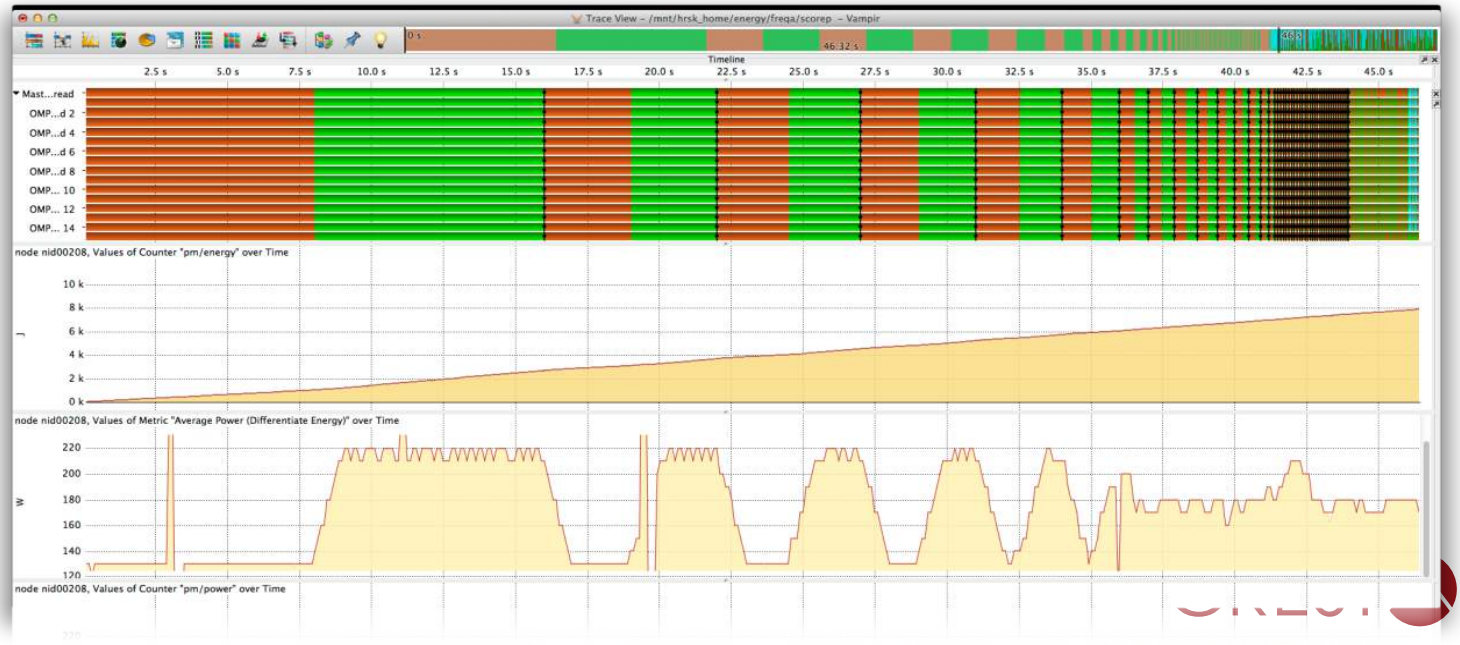
Paradigms

- Requirement:
  - Application developers of IFS investigate suitability of Co-Array Fortran
- IFS halo exchange
- Vampir: Early prototype visualization with DMAPP library tracing



Power Challenge

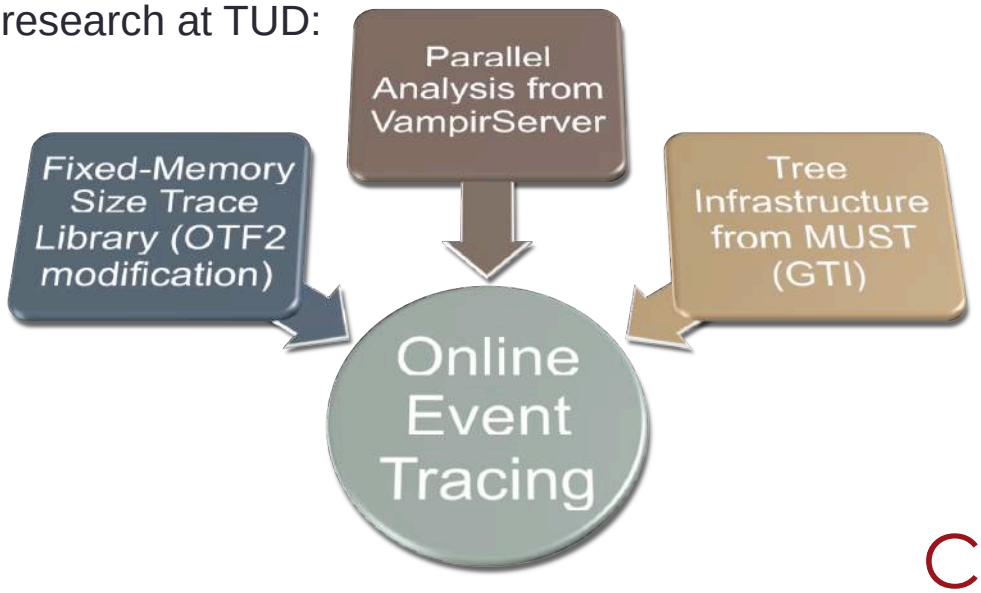
- ScoreP (Vampir suite):
  - Can measure energy consumption as counters
  - Plugin interface to support various counters
  - XC30 energy counter support



I/O and Memory Challenge

Decreasing memory/ core and I/O BW

- Memory:
  - Today: 100MiB/core (Xeon Phi); Exascale Projection: 22MiB/core
- I/O:
  - Bandwith/core decreasing => Challenge for checkpointing, tracing, …
- Current research at TUD:



CREST

Resiliency

- Tools (DDT, MAP, Vampir, ScoreP, MUST) will need to adapt to failures
- Tools with tree infrastructures must protect their own tool services
- Tools should failures and include them in their reports:
  - Impact on performance
  - Impact on correctness