



Performance Analysis with Vampir

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Part I: Welcome to the Vampir Tool Suite

- Mission
- Event Trace Visualization
- Vampir & VampirServer
- The Vampir Displays

Part II: Vampir Hands On

- Visualizing and analyzing NPB-MZ-MPI / BT

Part III: Summary and Conclusion



Mission



- Visualization of dynamics of complex parallel processes
- Requires two components
 - Monitor/Collector (Score-P)
 - Charts/Browser (Vampir)



Typical questions that Vampir helps to answer:

- What happens in my application execution during a given time in a given process or thread?
- How do the communication patterns of my application execute on a real system?
- Are there any imbalances in computation, I/O or memory usage and how do they affect the parallel execution of my application?

- Alternative and supplement to automatic analysis
- Show dynamic run-time behavior graphically at any level of detail
- Provide statistics and performance metrics

Timeline charts

 Show application activities and communication along a time axis



Summary charts

 Provide quantitative results for the currently selected time interval





% export MODULEPATH=

/zhome/academic/HLRS/xhp/xhprt/privatemodules:\$MODULEPATH

- % module load vampir
- % vampir



Vampir – Visualization Modes (2)

• On local machine with remote VampirServer



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- 1. Instrument your application with Score-P
- 2. Run your application with an appropriate test set
- 3. Analyze your trace file with Vampir
 - Small trace files can be analyzed on your local workstation
 - 1. Start your local Vampir
 - 2. Load trace file from your local disk
 - Large trace files should be stored on the HPC file system
 - 1. Start VampirServer on your HPC system
 - 2. Start your local Vampir
 - 3. Connect local Vampir with the VampirServer on the HPC system
 - 4. Load trace file from the HPC file system



- Timeline Charts:
 - Timeline Master Timeline
 - Process Timeline
 - Lounter Data Timeline
 - Performance Radar
- Summary Charts:
 - 「 Function Summary
 - 🔄 Message Summary
 - Process Summary
 - Communication Matrix View



Vampir hands-on

Visualizing and analyzing NPB-MZ-MPI / BT





 If you followed the Score-P hands-on up to the trace experiment, yours is in:



 If you removed the trace or did not follow to that point, copy a prepared trace

% cd **\$SCRATCH/NPB3.3-MZ-MPI/bin.scorep**

% cp /zhome/academic/HLRS/xhp/xhprt/scorep_trace ./

Load modules

```
% export MODULEPATH=
/zhome/academic/HLRS/xhp/xhprt/privatemodules:$MODULEPATH
% module load vampir
```

Start Vampir on the frontend (small traces only!)





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🚦 Process Timeline



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Typical program phases



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Performance Radar



Zoom in: Inititialisation Phase



Feature: Find Function



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Computation Phase



Zoom in: Computation Phase



Zoom in: Finalisation Phase



Process Summary

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For reference Option B: Larger Traces – Overview





For reference Option B: Step 1, Starting Vampirserver on Hornet

Load modules

```
% export MODULEPATH=
    /zhome/academic/HLRS/xhp/xhprt/privatemodules:$MODULEPATH
% module load vampirserver
```

• Start a vampirserver job on the backend

% vampirserver start Launching VampirServer... Submitting PBS batch job (this might take a while) ... Batch job is submitted - Job ID: 168008.hornet-batch.hww.de VampirServer 8.4.1 (r9456) Licensed to VI-HPS Tools Workshop 02/2015 Running 16 analysis processes... (abort with vampirserver stop 23731) VampirServer <23731> listens on: mom12:30081

Remember these coordinates we will need them in a second



• Write down the host on which the server runs

% vampirserver start

Launching VampirServer... Submitting PBS batch job (this might take a while)... Batch job is submitted - Job ID: 168008.hornet-batch.hww.de VampirServer 8.4.1 (r9456) Licensed to VI-HPS Tools Workshop 02/2015 Running 16 analysis processes... (abort with vampirserver stop 23731) VampirServer <23731> listens on: mom12:30081

 Establish Port Forwarding from your local machine to Hornet

% ssh \
 -L 30000:mom12:30081 \
 <user>@hornet.hww.de

- Start a new shell on you laptop
- Copy the appropriate Vampir package from Hornet to your laptop

% ls /zhome/academic/HLRS/xhp/xhprt/tutorial vampir-linux-ia32.zip vampir-win-x64.zip vampir-linux-x86_64.zip vampir-win-x86.zip vampir-mac.zip % scp <user>@hornet.hww.de:/zhome/academic/HLRS/xhp/xhprt/tutorial/<version> ./

• Extract the archive and install (example with linux-x86-64)

```
% unzip vampir-linux-x86_64.zip
% cd vampir-linux-x86_64
% ls
vampir-8.4.1-linux-x86_64-setup.bin
vampir-remote.license
```

Install and start the Vampir GUI



• Select the vampir-remote.licence from the archive file when asked

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For reference Option B: Step 2, Install Vampir client locally

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For reference Option B: Step 2, Install Vampir client locally



For reference Option B: Step 2, Install Vampir client locally

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Summary and Conclusion







- Vampir & VampirServer
 - Interactive trace visualization and analysis
 - Intuitive browsing and zooming
 - Scalable to large trace data sizes (20 TiByte)
 - Scalable to high parallelism (200,000 processes)
- Vampir for Linux, Windows, and Mac OS X
- Note: Vampir does neither solve your problems automatically, nor point you directly at them. It does, however, give you FULL insight into the execution of your application.



- Performance analysis very important in HPC
- Use performance analysis tools for profiling and tracing
- Do not spend effort in DIY solutions, e.g. like printf-debugging
- Use tracing tools with some precautions
 - Overhead
 - Data volume
- Let us know about problems and about feature wishes
- vampirsupport@zih.tu-dresden.de





Vampir is available at http://www.vampir.eu, get support via vampirsupport@zih.tu-dresden.de