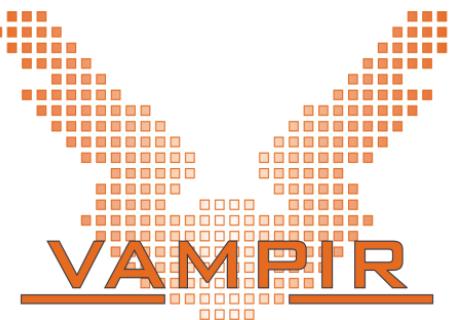


Performance Analysis with Vampir

Bert Wesarg
Technische Universität Dresden



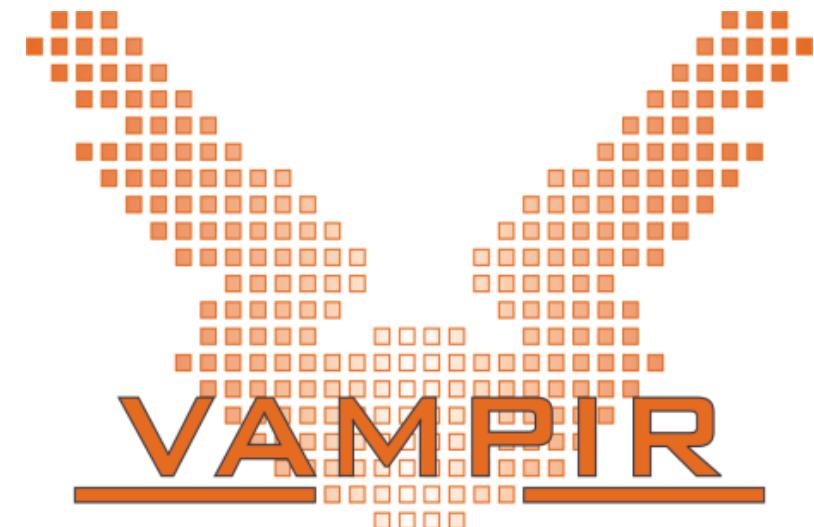
Outline

- **Part I: Welcome to the Vampir Tool Suite**

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

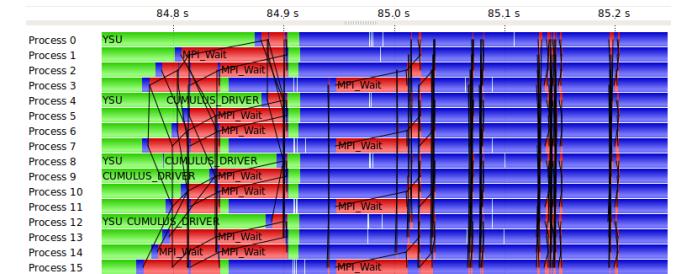
- **Part II: Vampir Hands-On**

- Visualizing and analyzing NPB-MZ-MPI / BT

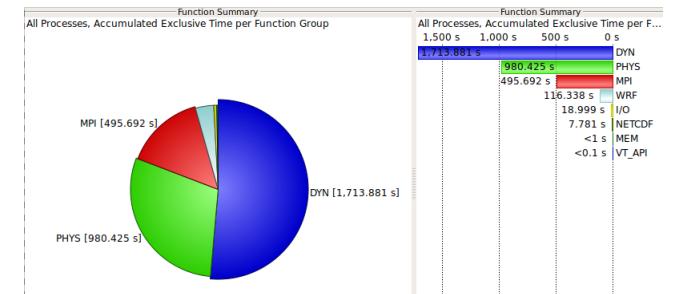


Event Trace Visualization with Vampir

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



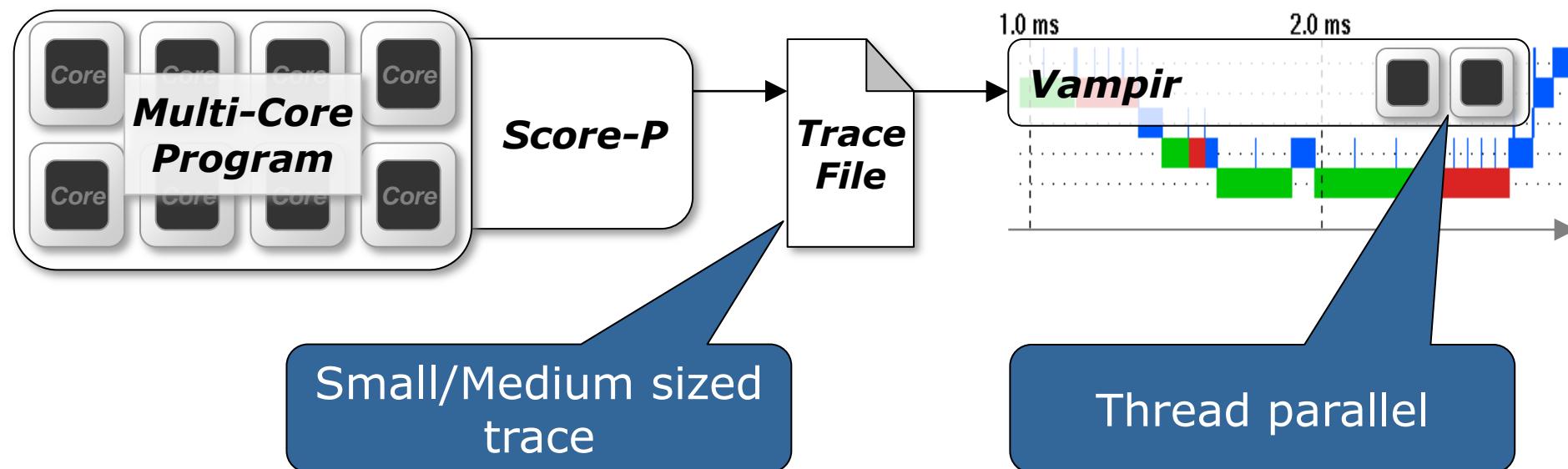
- **Timeline charts**
 - Show application activities and communication along a time axis
- **Summary charts**
 - Provide quantitative results for the currently selected time interval



Visualization Modes (1)

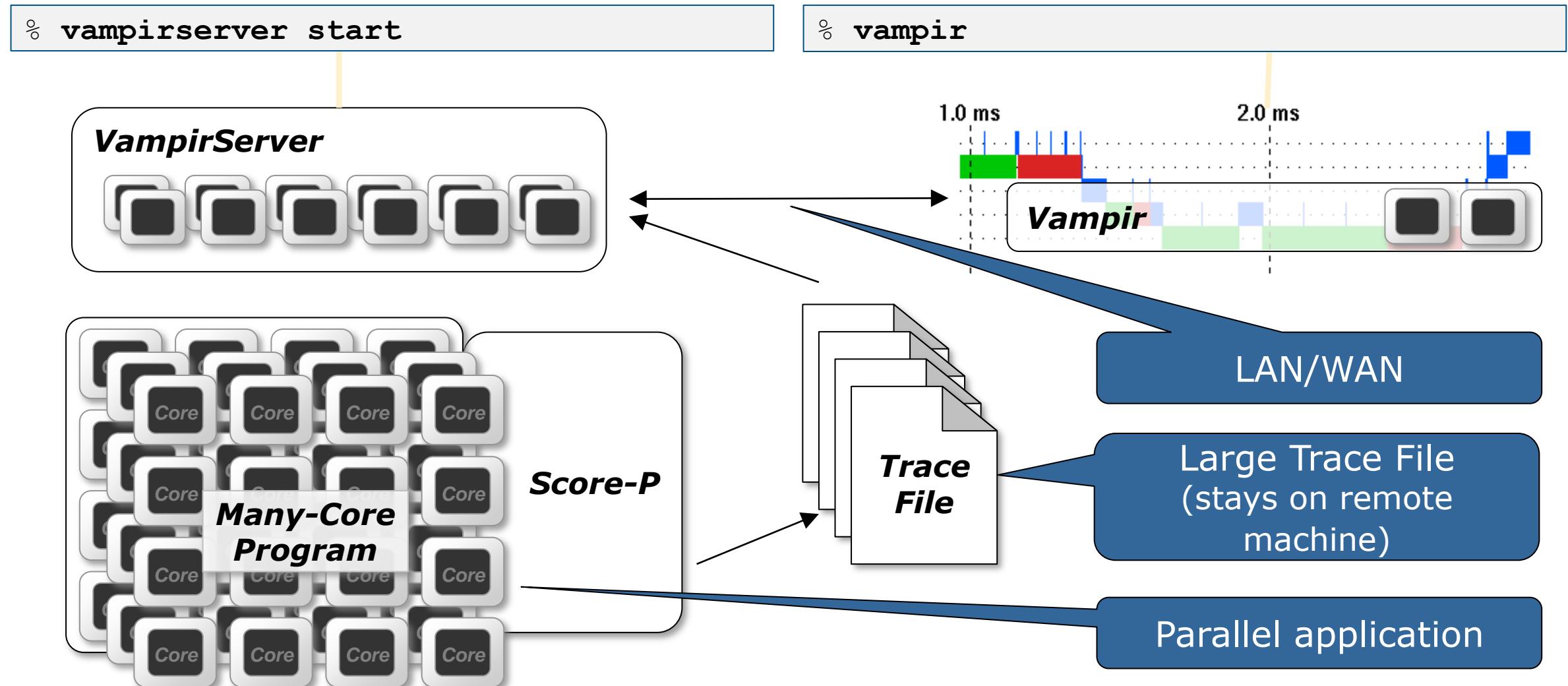
Directly on front end or local machine

% **vampir**



Visualization Modes (2)

On local machine with remote VampirServer



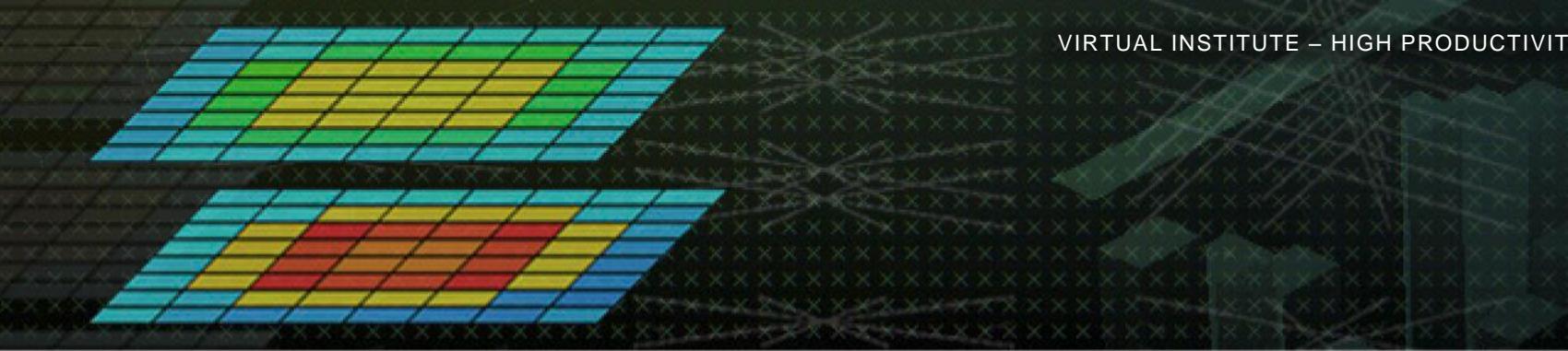
The main displays of Vampir

- Timeline Charts:

-  Master Timeline
-  Process Timeline
-  Counter Data Timeline
-  Performance Radar

- Summary Charts:

-  Function Summary
-  Message Summary
-  Process Summary
-  Communication Matrix View



Hands-on: Visualizing and analyzing NPB-MZ-MPI / BT

Help! Where is my trace file?

```
% ls $WORK/NPB3.3-MZ-MPI/bin.scorep/\  
> scorep_bt-mz_C_8x6_trace  
profile.cubex  scorep.cfg      traces/    traces.def  traces.otf2
```

```
% ls ~hpclab/Tutorial/traces/scorep_bt-mz_C_8x6_trace+HWC  
profile.cubex  scorep.cfg      traces/    traces.def  traces.otf2
```

- If you followed the Score-P hands-on up to the trace experiment
- If you did not follow to that point, take a prepared trace

Starting VampirServer on CLAIX

```
% cd $WORK  
% tar xf ~hpclab11/tutorial/examples.tar.gz  
  
% module load UNITE vampir  
  
% vampirserver start -- -P hpclab -U PPCES17 -W 60  
Launching VampirServer...  
Submitting batch job (this might take a while)...
```

- Extract hands-on traces into your work space
- Load the Vampir module
- Start VampirServer on CLAIX
 - Pass the project and reservation to the job
 - Set a job walltime of 60 minutes

Install and start Vampir on local computer

- Start a new terminal on your local computer
- Copy the appropriate Vampir package and license file from CLAIX

```
% scp -r hpclab11@login.hpc.itc.rwth-aachen.de:tutorial/vampir .
```

- Install Vampir

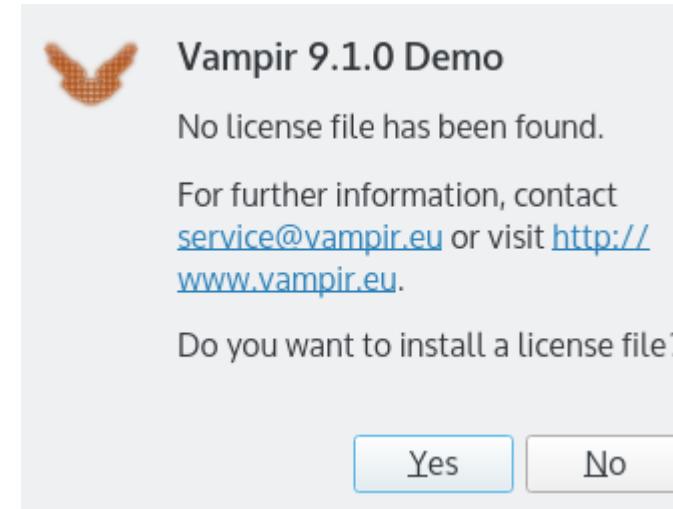
```
% sh vampir-9.2.0-linux-x86_64-setup.bin [--instdir=]
```

- Start Vampir

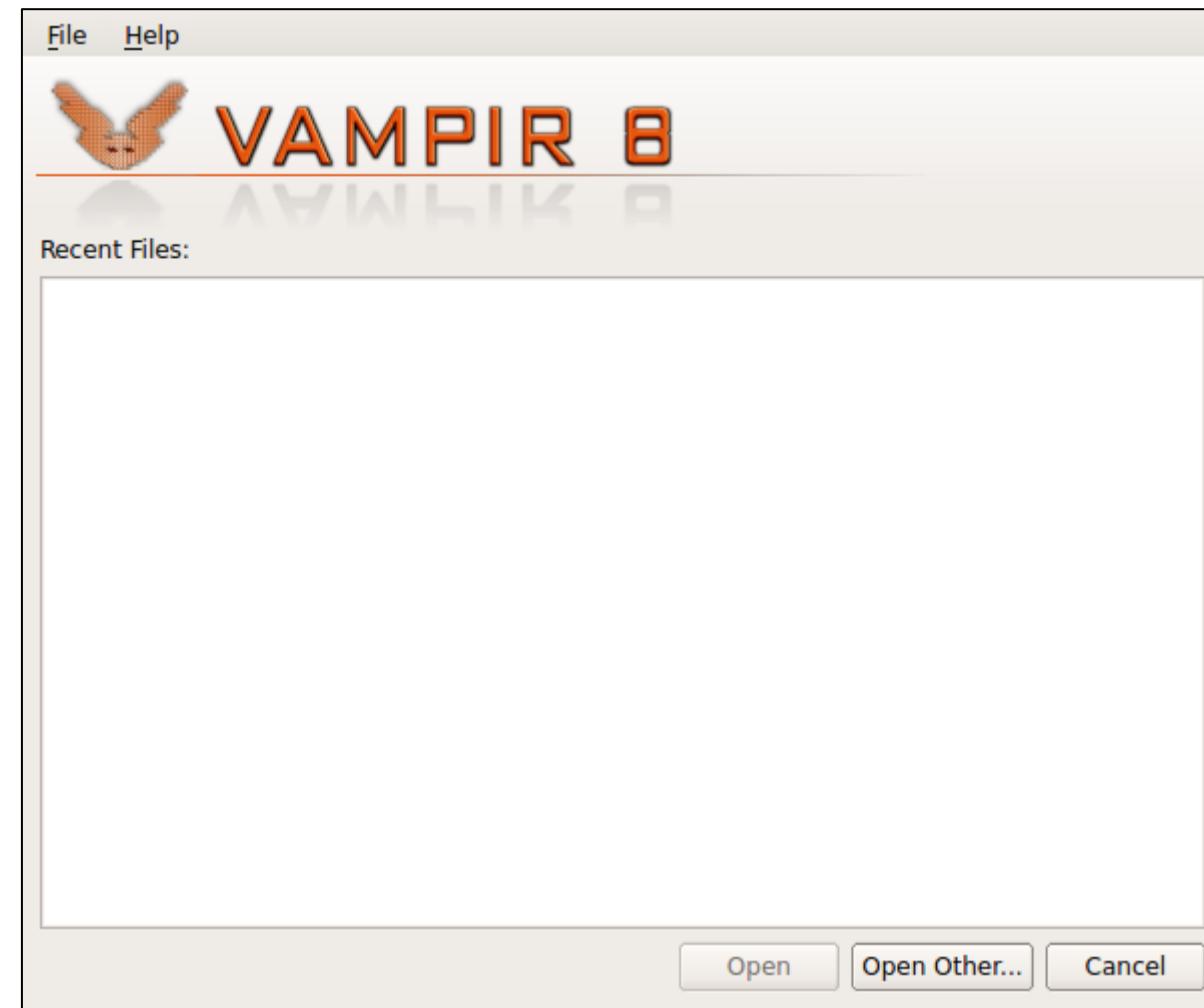
```
% /vampir/install/path/bin/vampir &
```

Activate Vampir with provided license file

- Select the `vampir-remote.licence` file from the `vampir` directory:



Start Vampir on local computer



Starting VampirServer on CLAIX

```
% vampirserver start
Launching VampirServer...
Submitting batch job (this might take a while)...

VampirServer 9.2.0 (r10676)
Licensed to RWTH Aachen
Running 4 analysis processes... \
  (abort with vampirserver stop 25007)
VampirServer <25007> listens on: \
  lnm011.hpc.itc.rwth-aachen.de:30063
```

- Start VampirServer on CLAIX

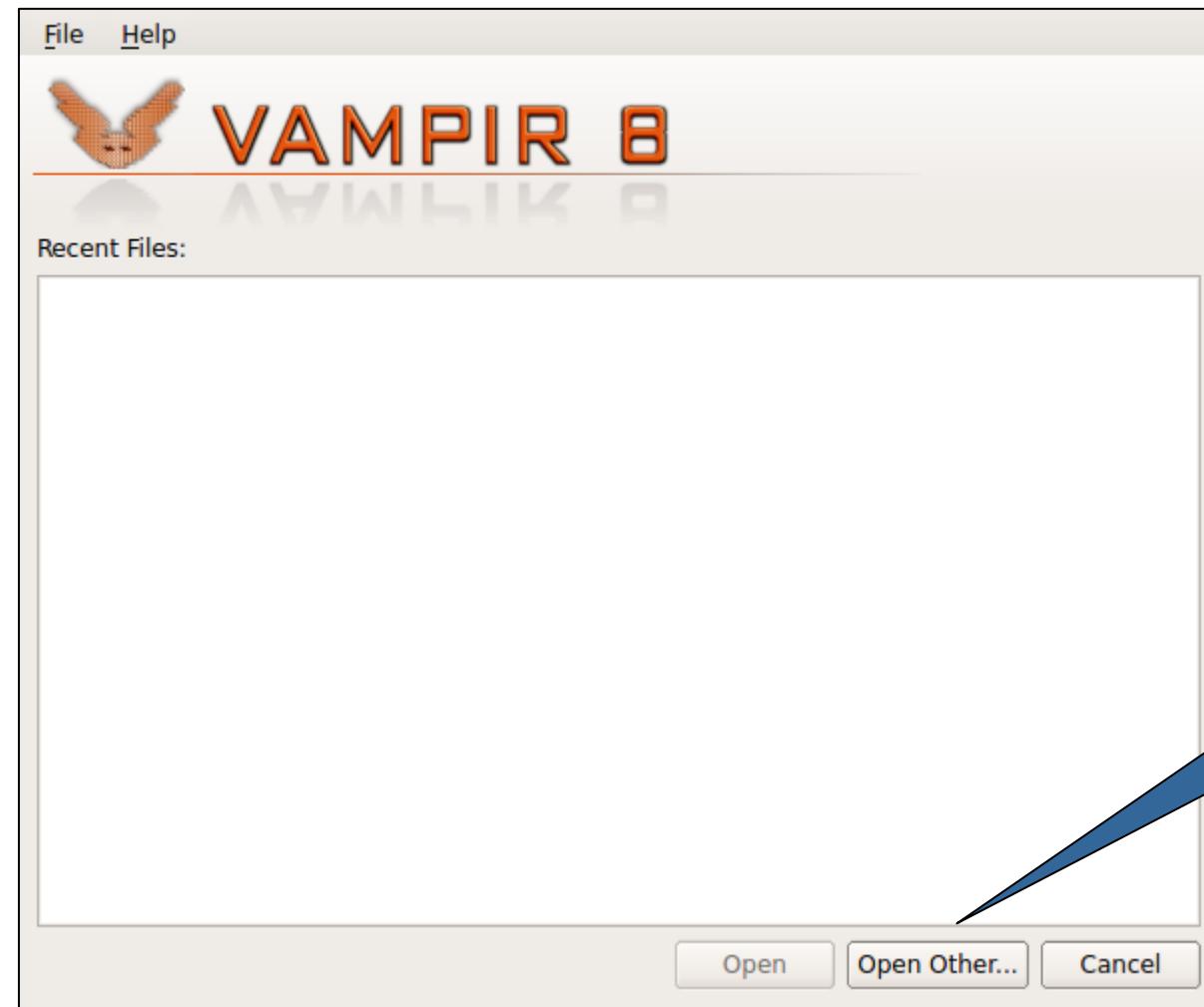
Copy host:port

Start Vampir

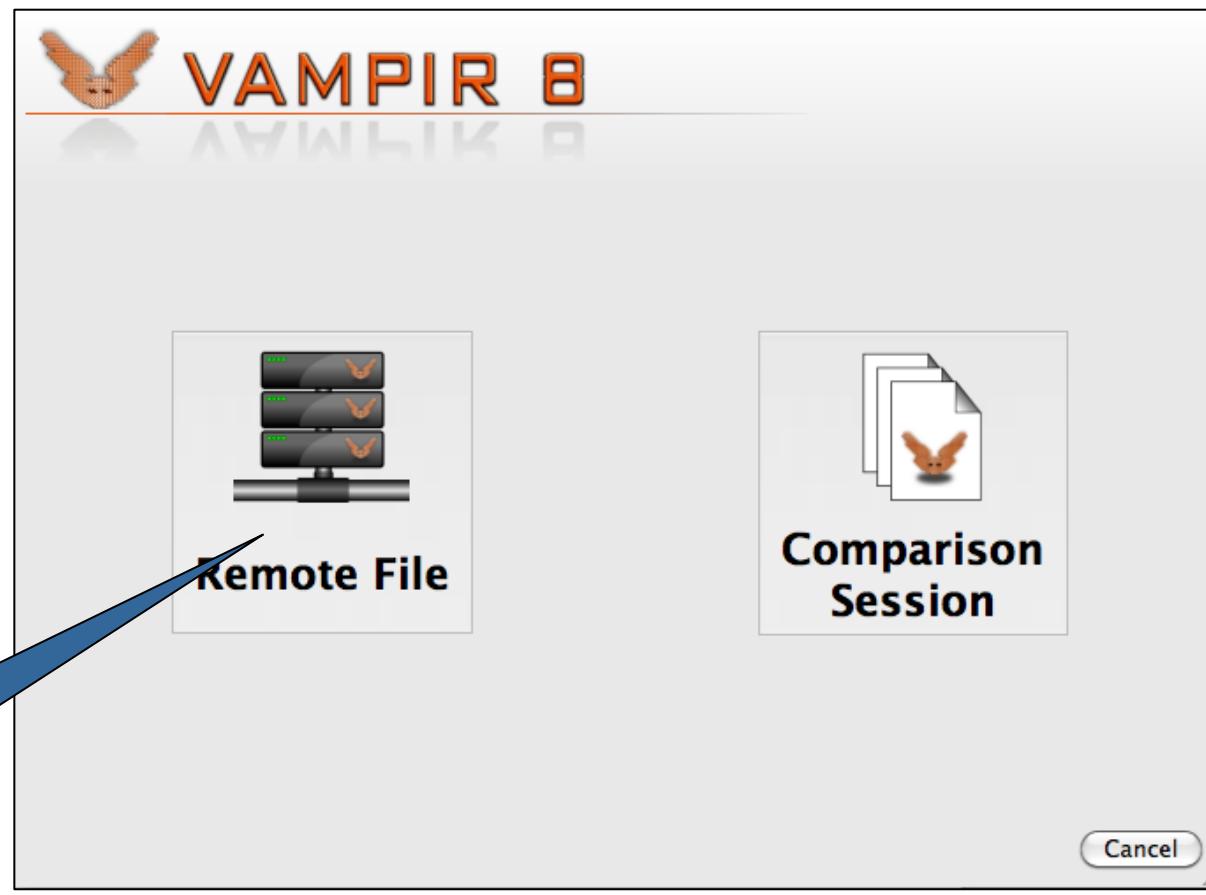
```
% ssh -N -L 30000:lnm011.hpc.itc.rwth-aachen.de:30063 \\\n<hpclab>@login.hpc.itc.rwth-aachen.de
```

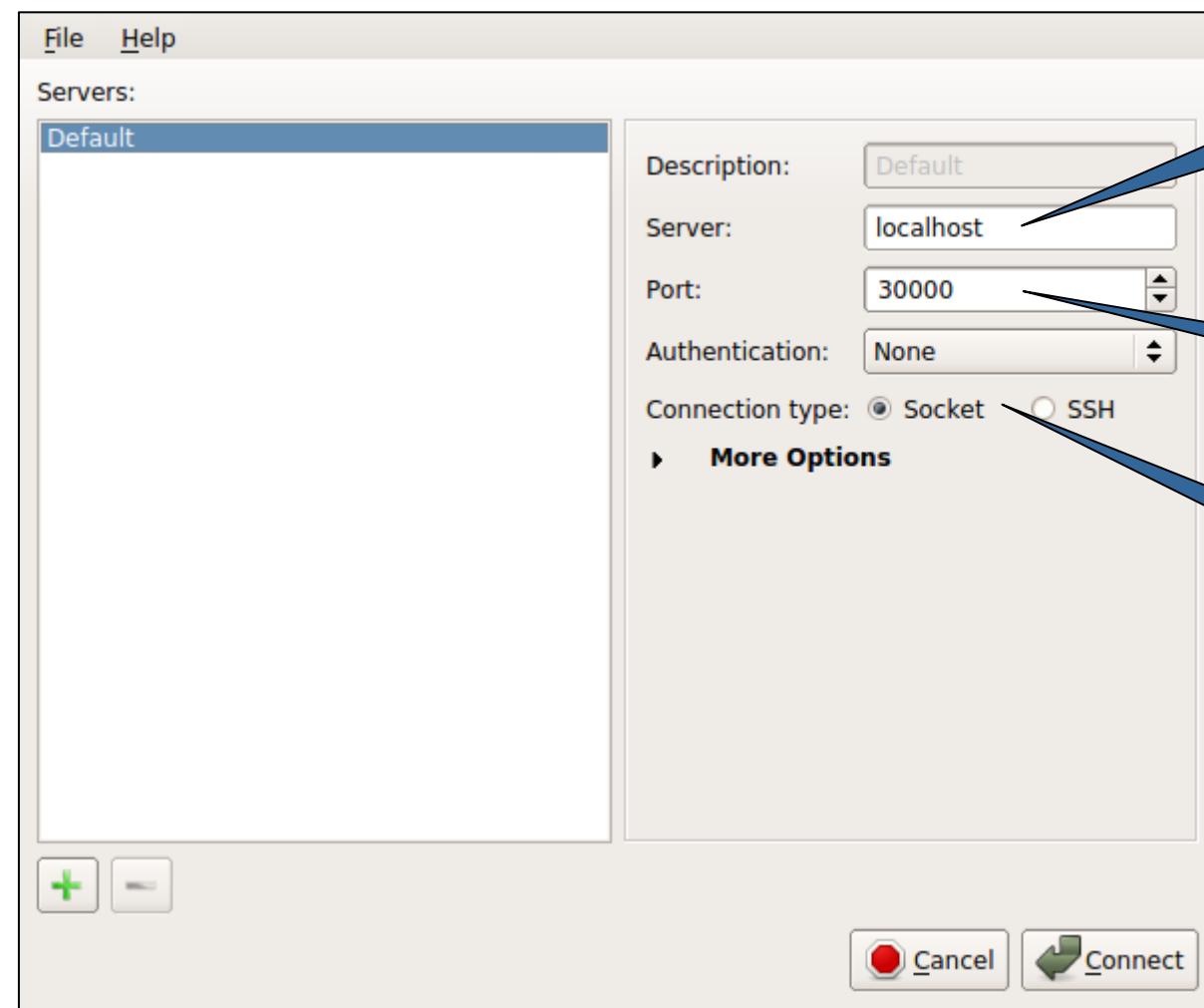
- Open a port forwarding to CLAIX to be able to access the VampirServer

host:port from
VampirServer output



Use the “Open
Other” option

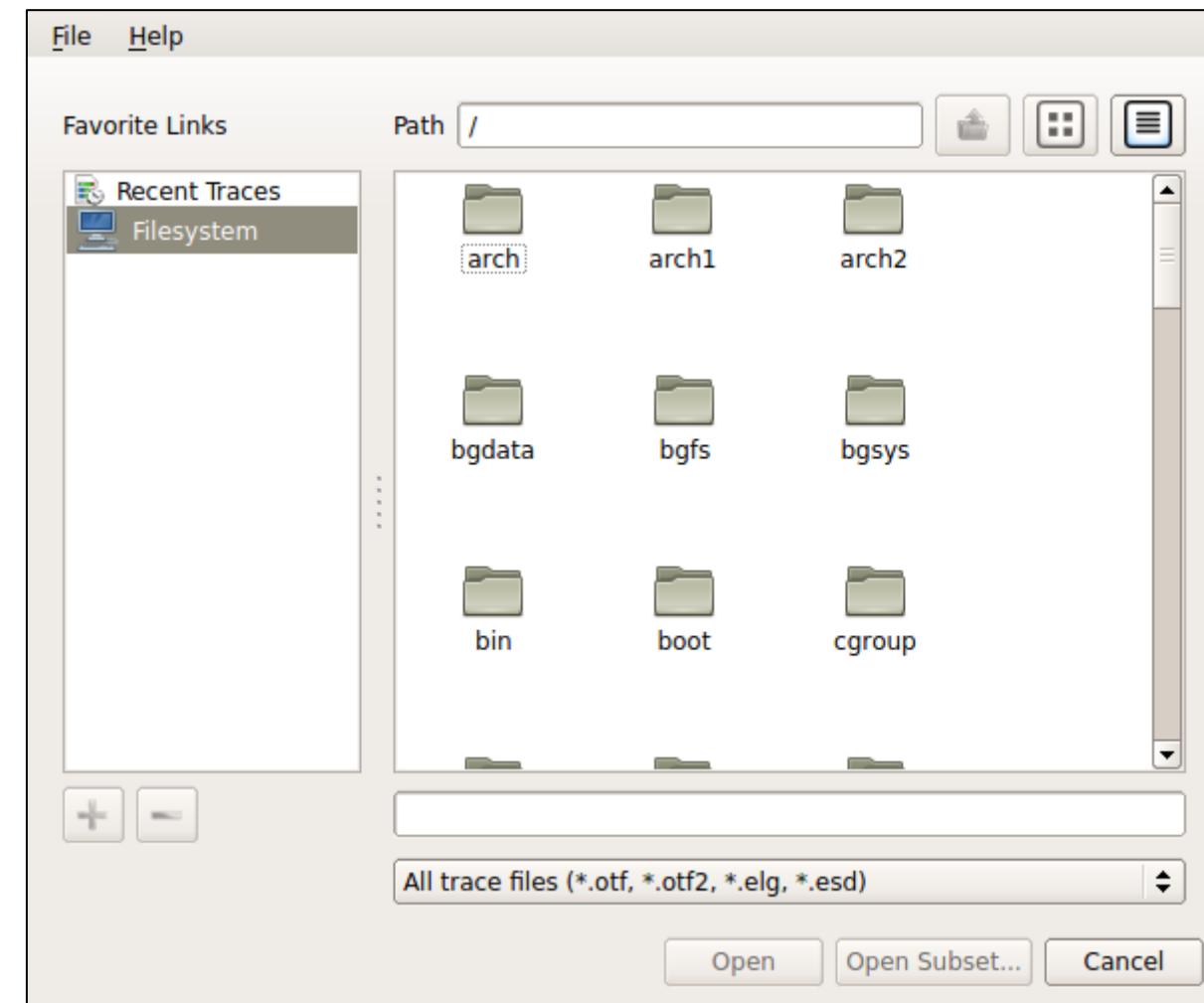




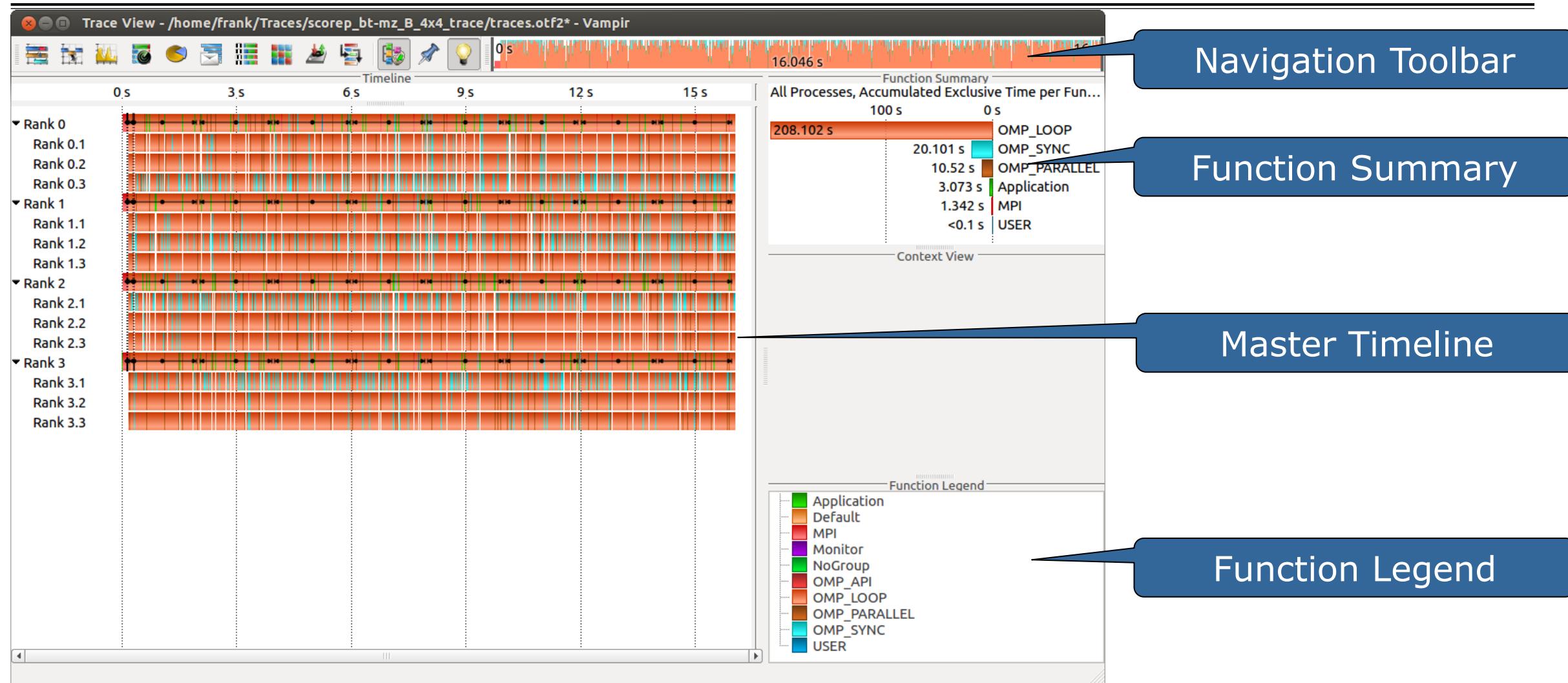
Server is
“localhost”

Port is “30000”

Connection
type “Socket”

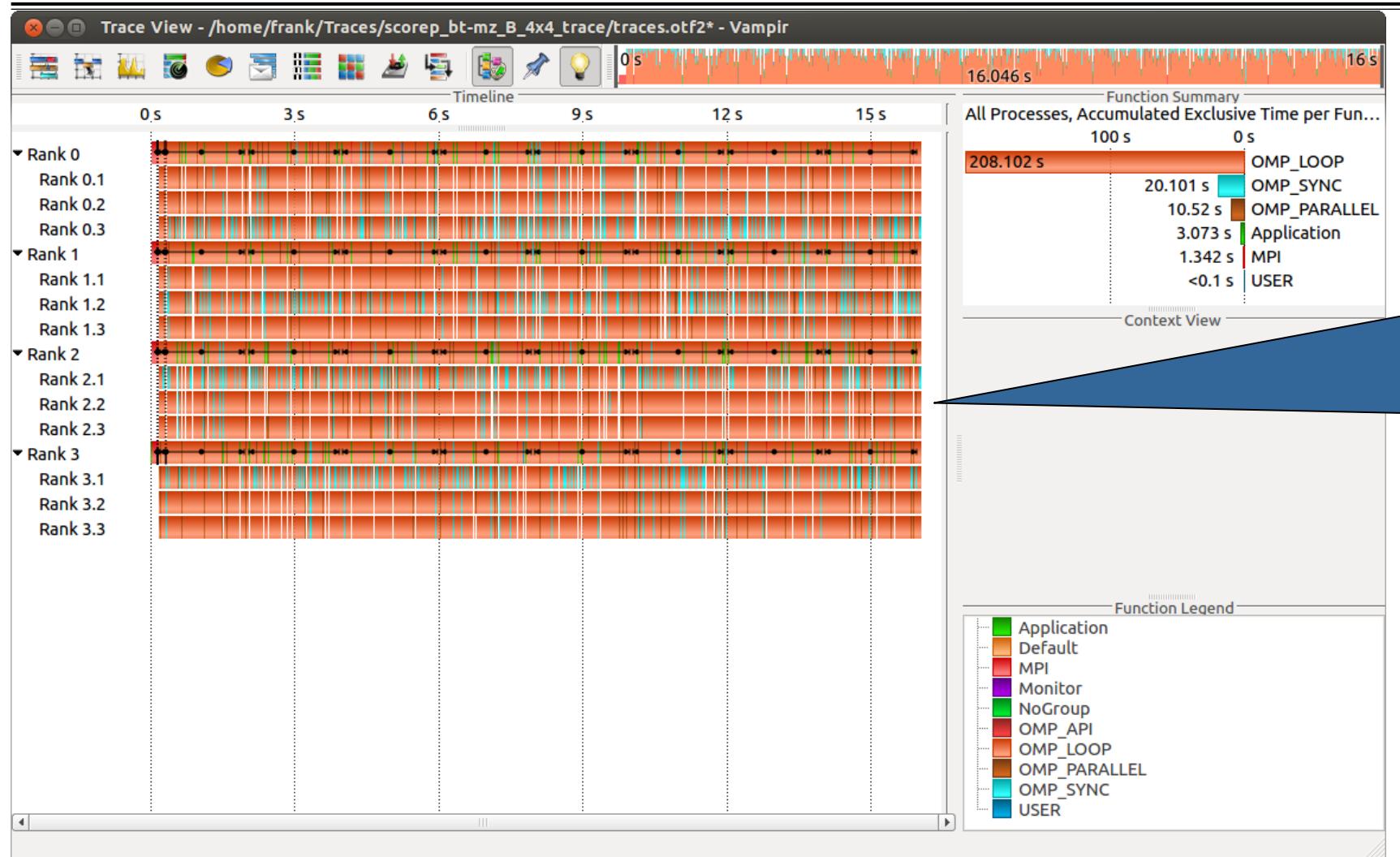


Visualization of the NPB-MZ-MPI / BT trace



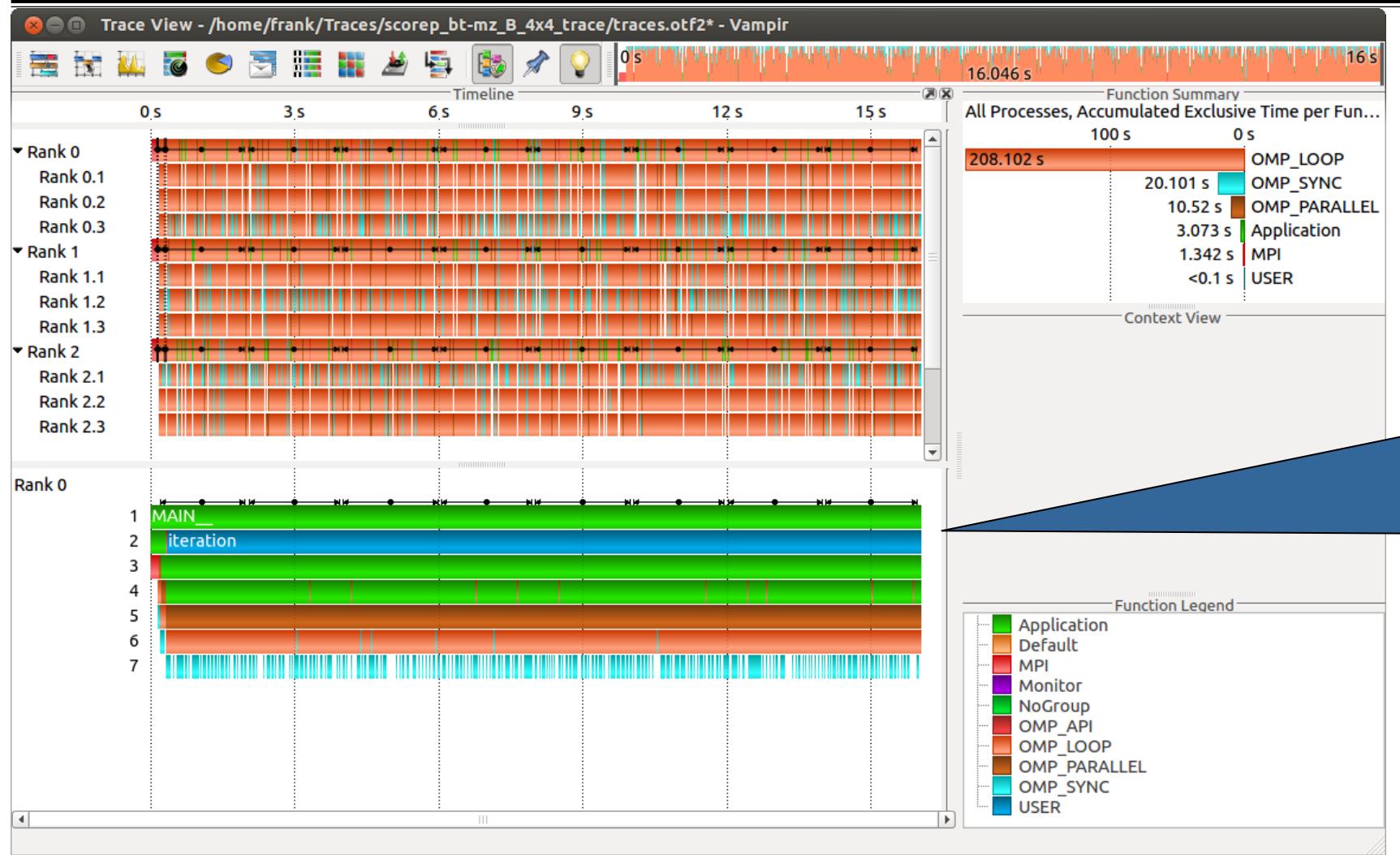
Visualization of the NPB-MZ-MPI / BT trace

Master Timeline



Detailed information about functions, communication and synchronization events for collection of processes.

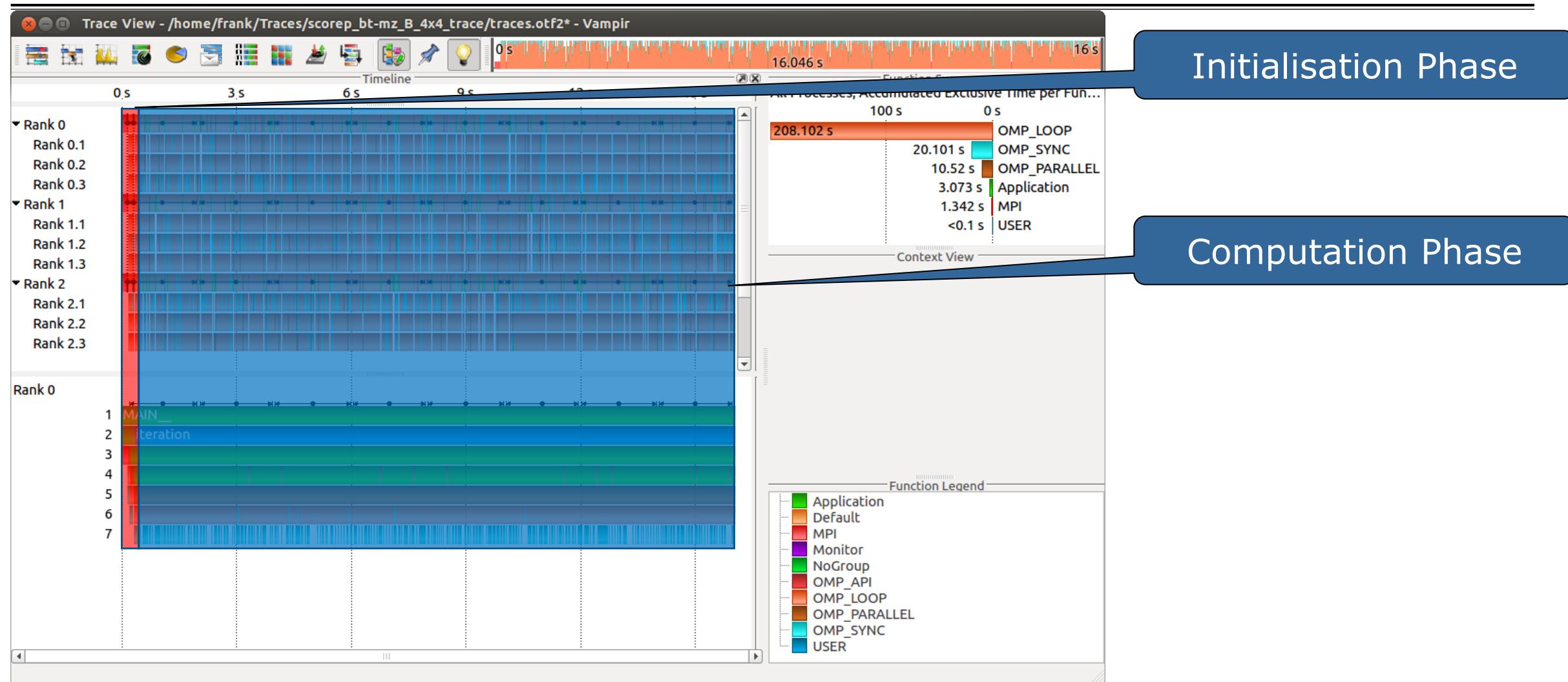
Visualization of the NPB-MZ-MPI / BT trace Process Timeline



Detailed information about different levels of function calls in a stacked bar chart for an individual process.

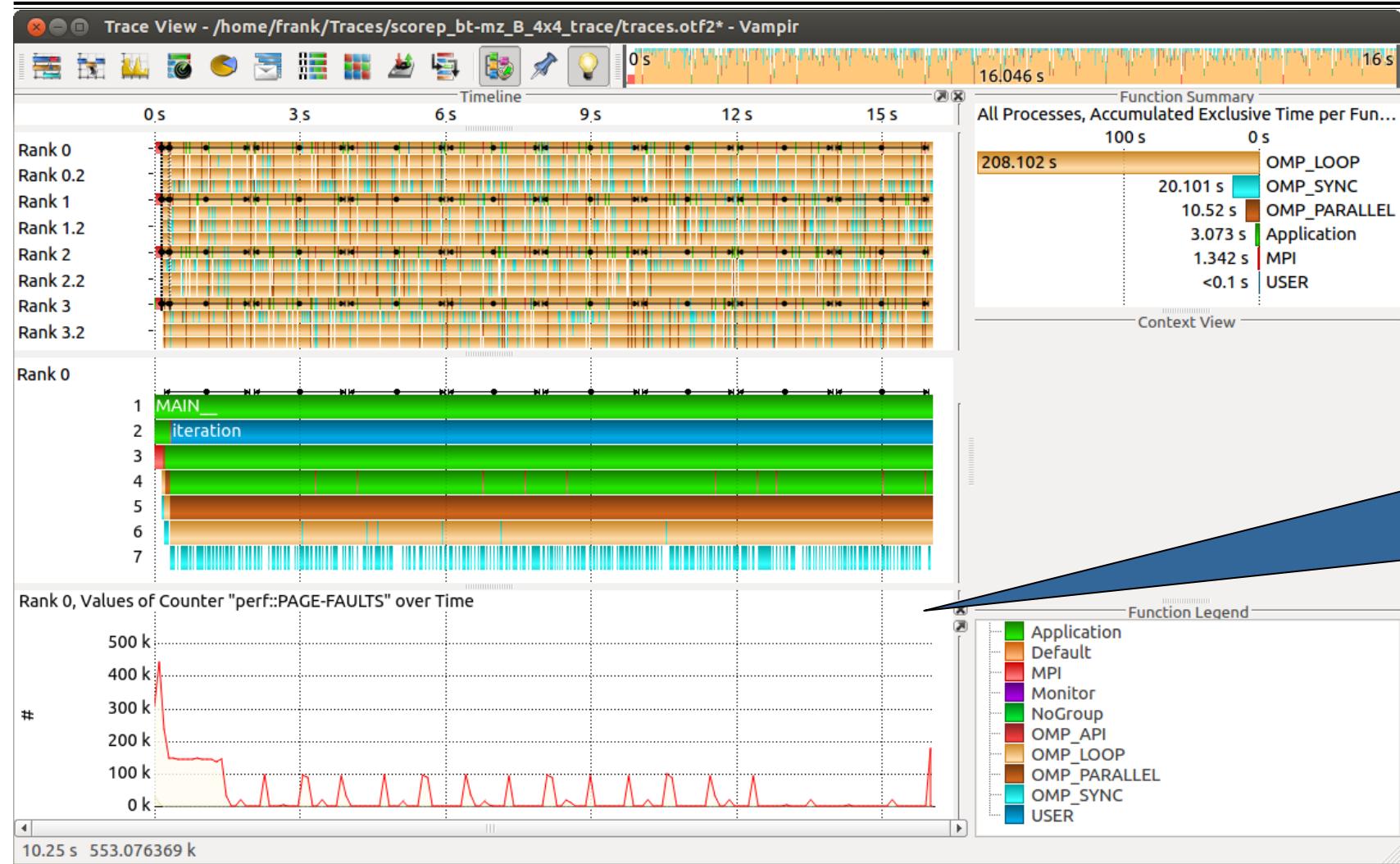
Visualization of the NPB-MZ-MPI / BT trace

Typical program phases



Visualization of the NPB-MZ-MPI / BT trace

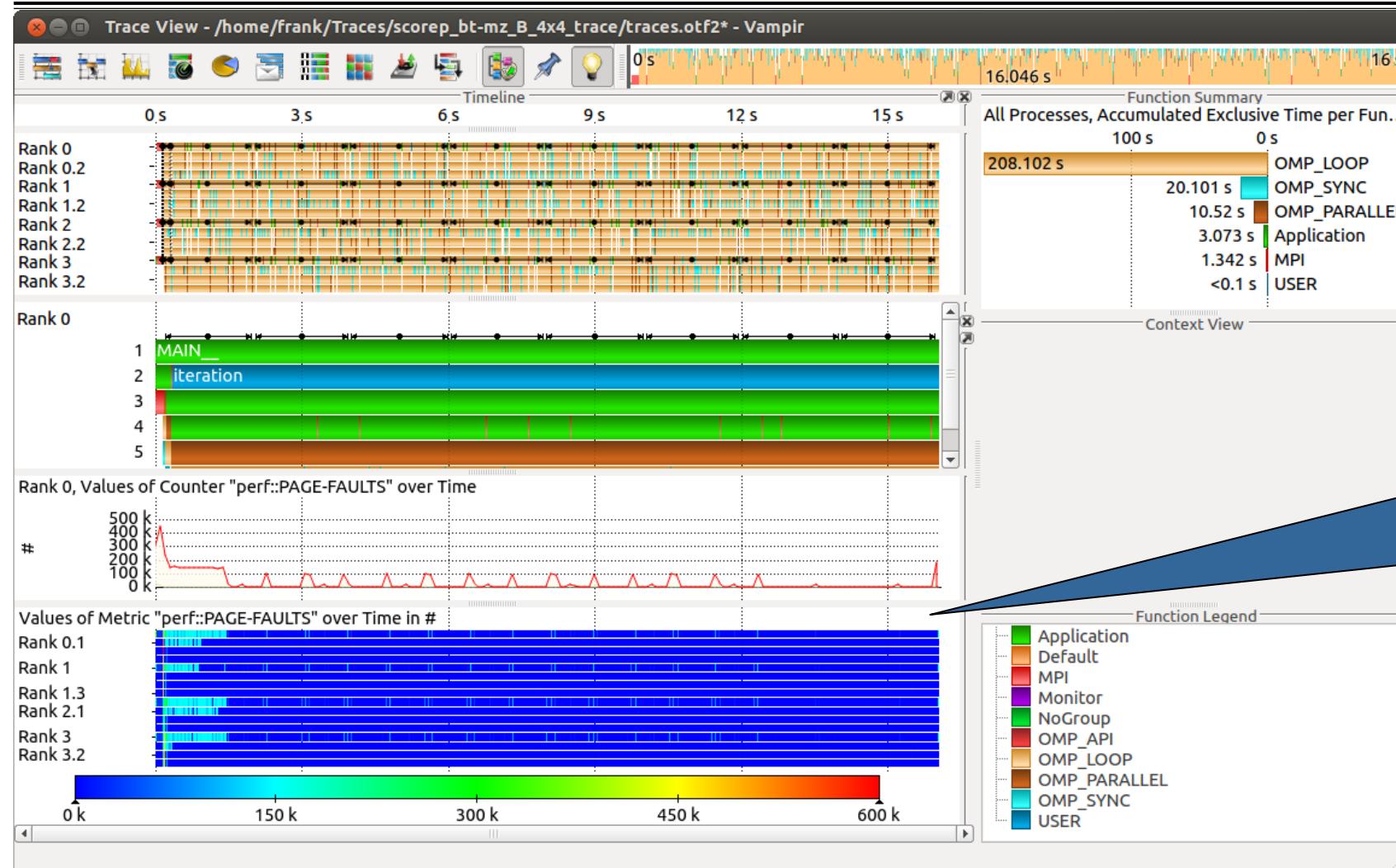
Counter Data Timeline



Detailed counter information over time for an individual process.

Visualization of the NPB-MZ-MPI / BT trace

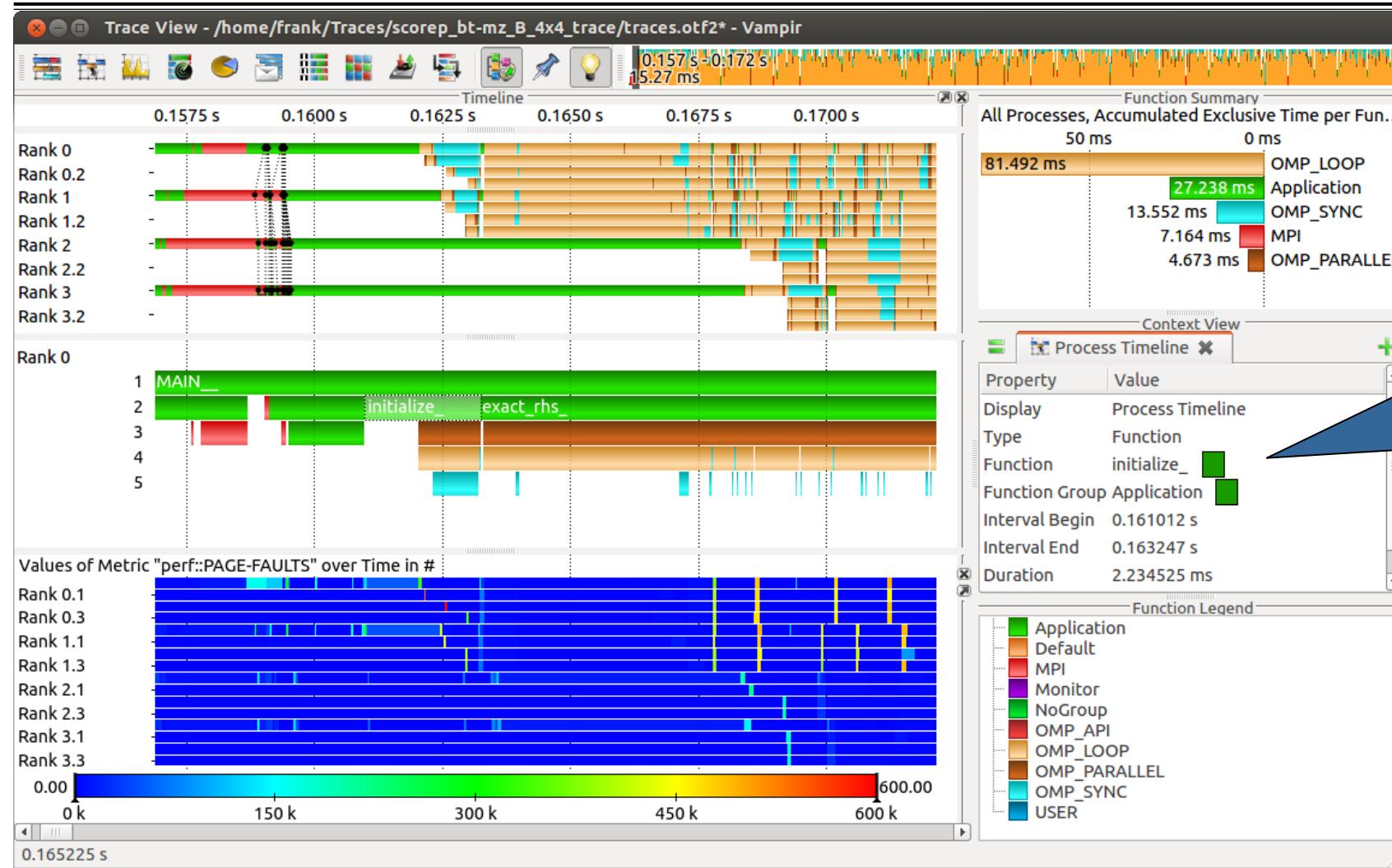
Performance Radar



Detailed counter
information over time
for
a collection of
processes.

Visualization of the NPB-MZ-MPI / BT trace

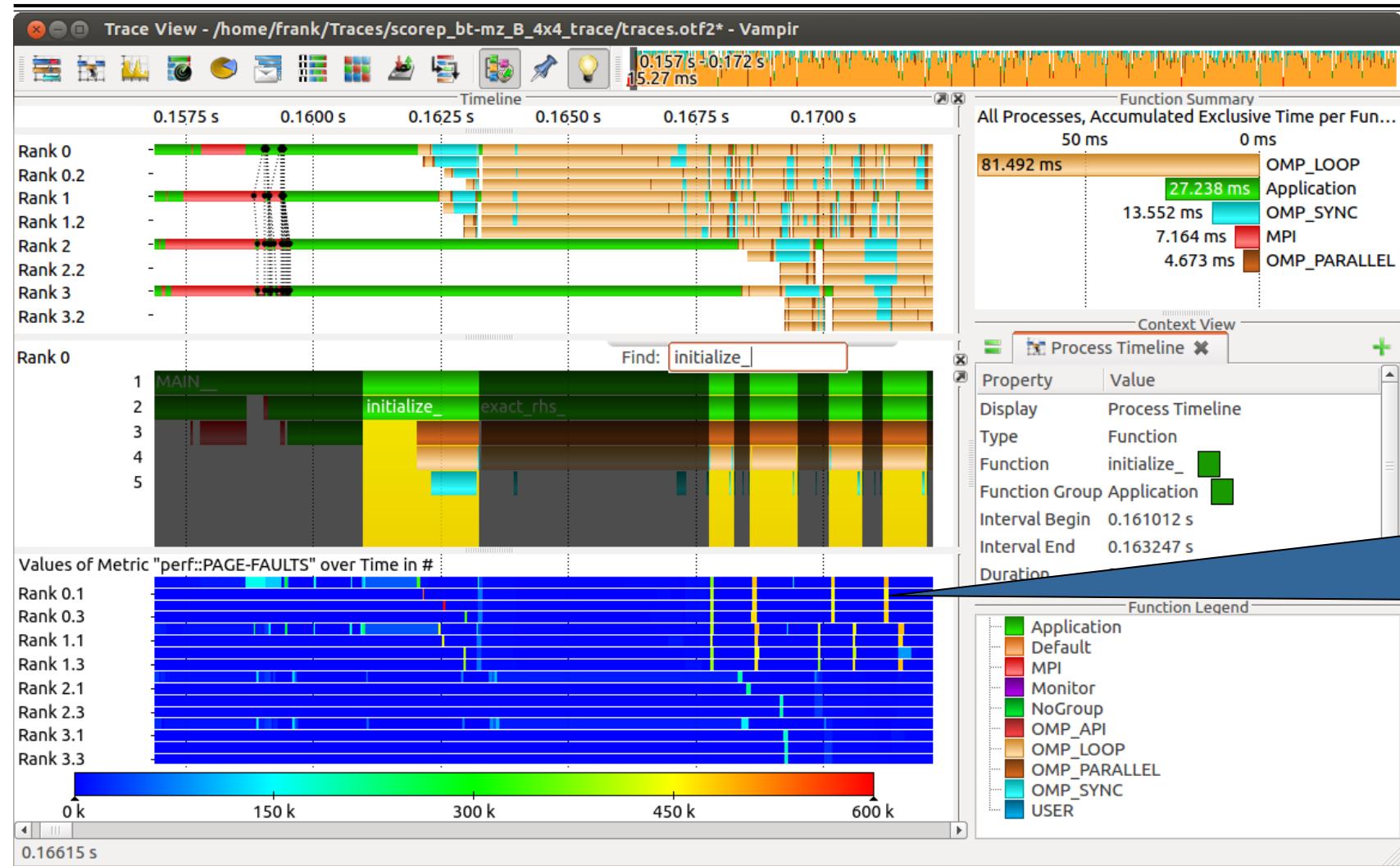
Zoom in: Initialisation Phase



Context View:
Detailed information
about function
“initialize_”.

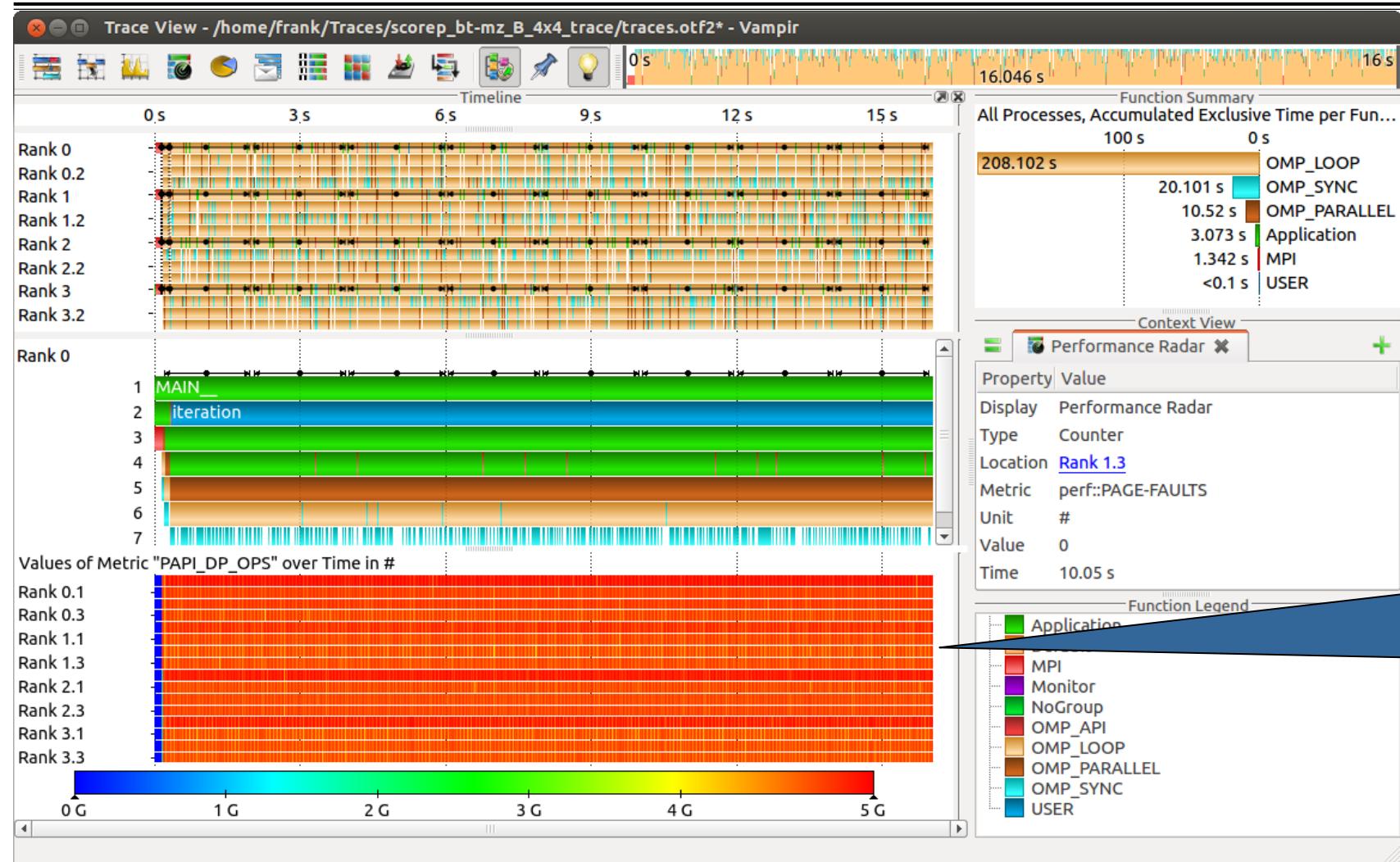
Visualization of the NPB-MZ-MPI / BT trace

Find Function



Execution of function
“initialize_” results in
higher page fault
rates.

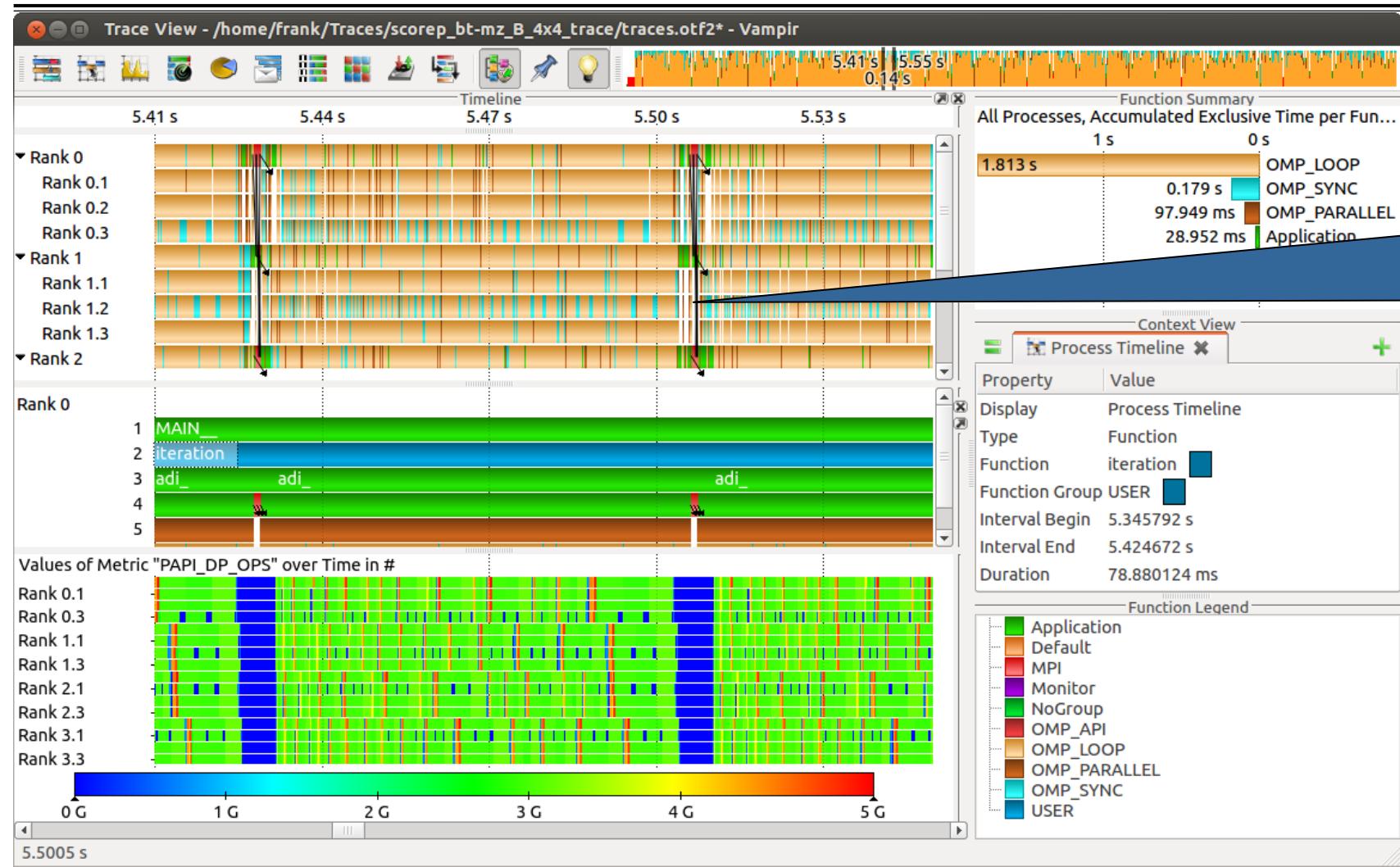
Visualization of the NPB-MZ-MPI / BT trace Computation Phase



Computation phase results in higher floating point operations.

Visualization of the NPB-MZ-MPI / BT trace

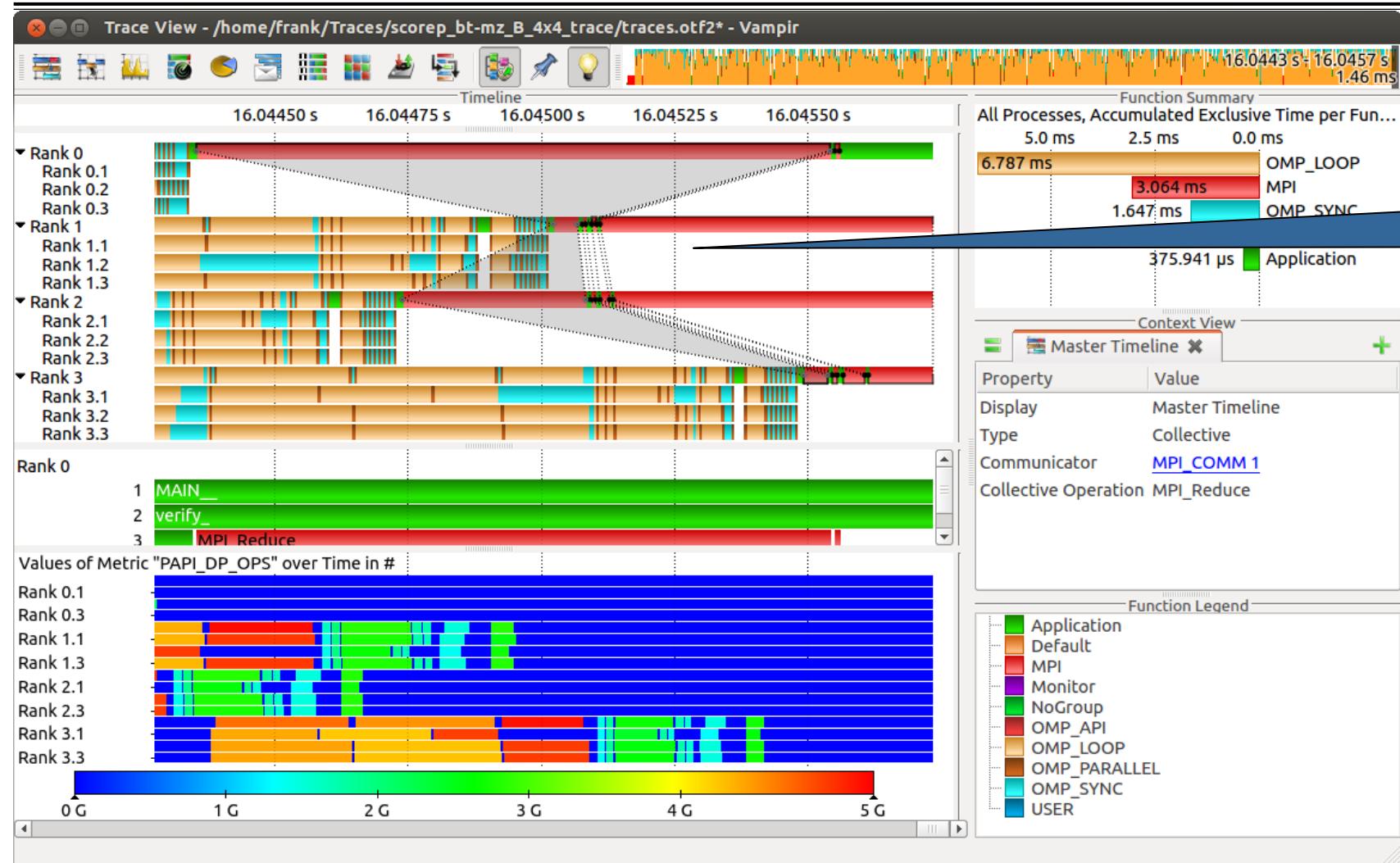
Zoom in: Computation Phase



MPI communication results in lower floating point operations.

Visualization of the NPB-MZ-MPI / BT trace

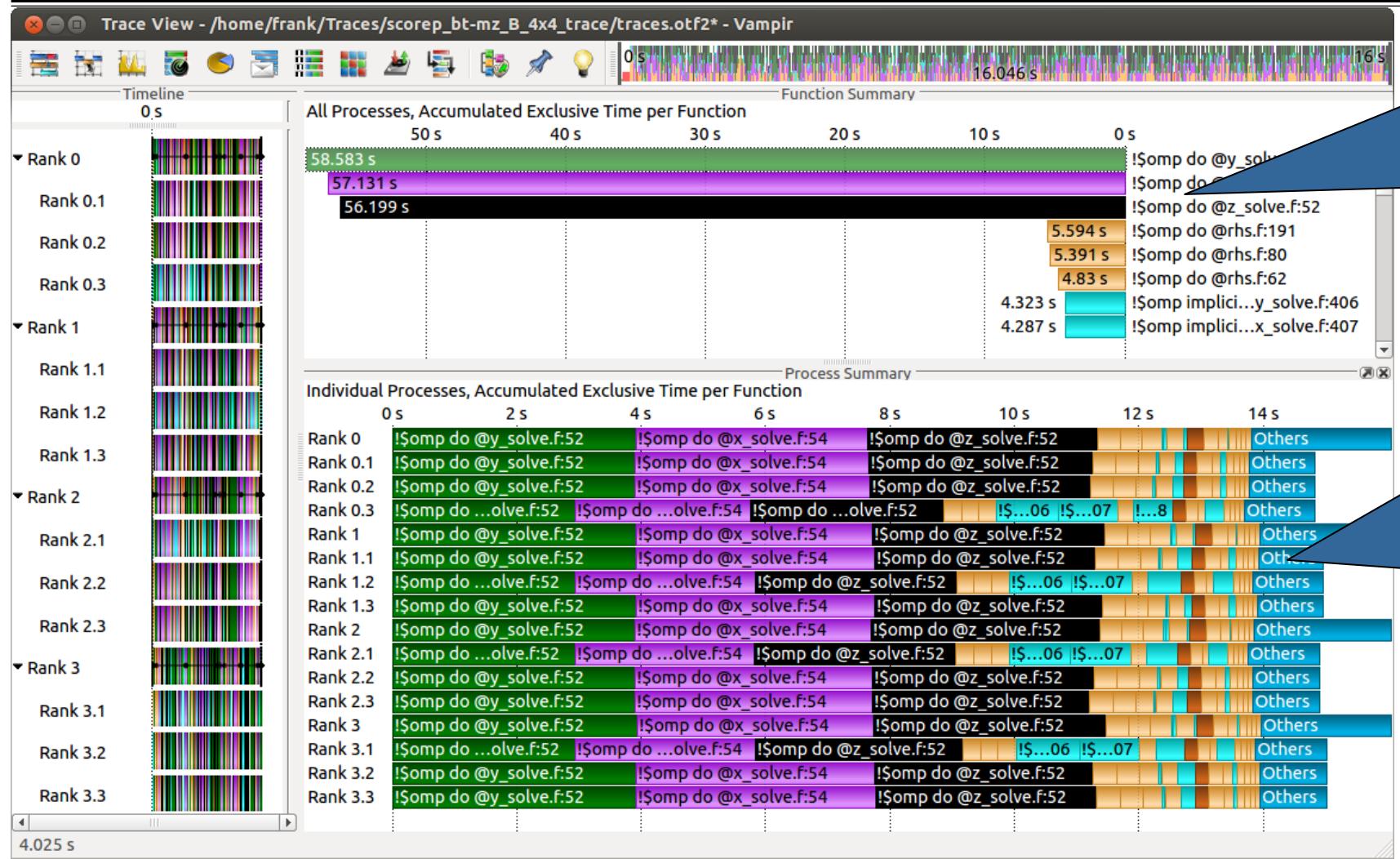
Zoom in: Finalisation Phase



“Early reduce”
bottleneck.

Visualization of the NPB-MZ-MPI / BT trace

Process Summary

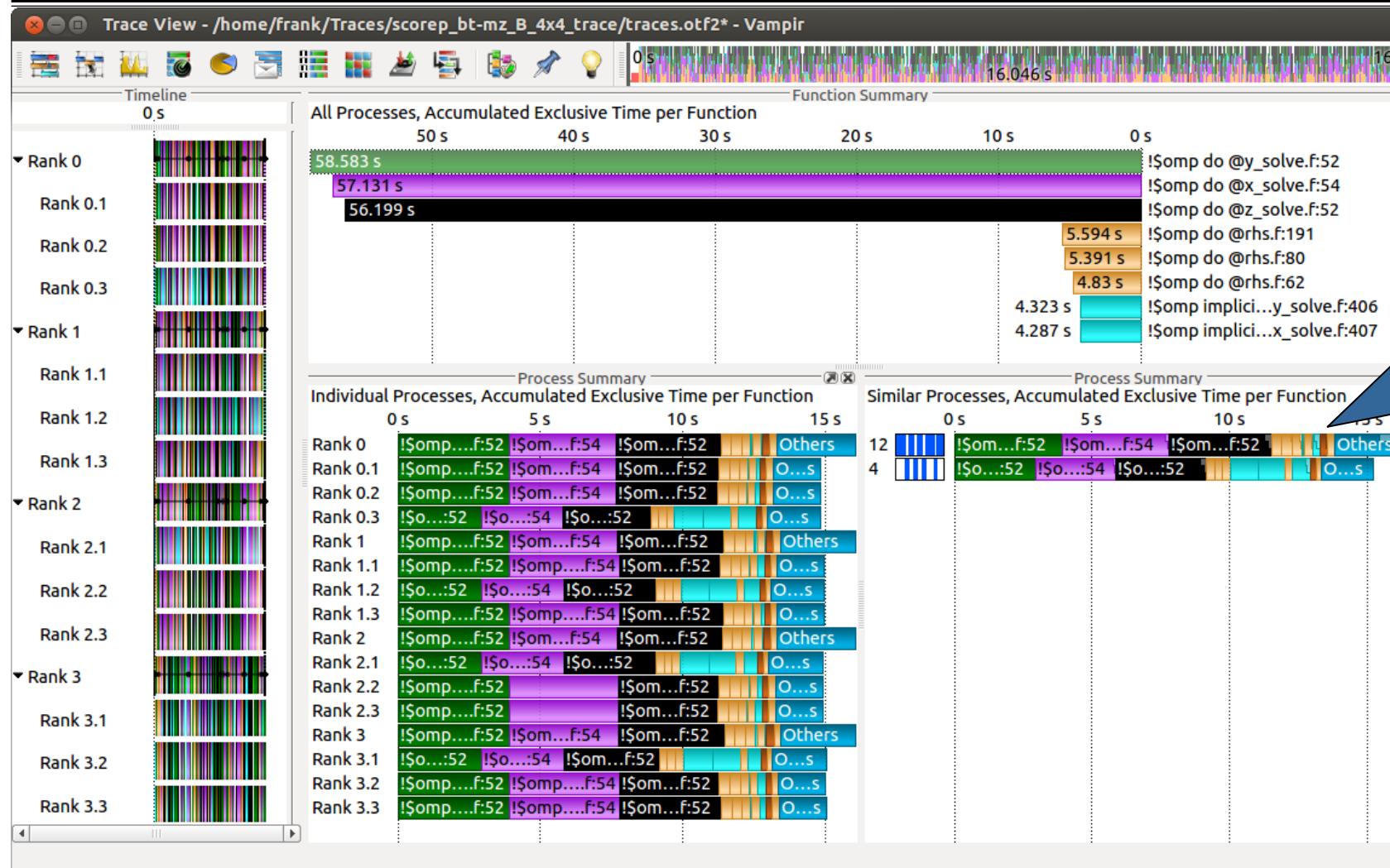


Function Summary:
Overview of the accumulated information across all functions and for a collection of processes.

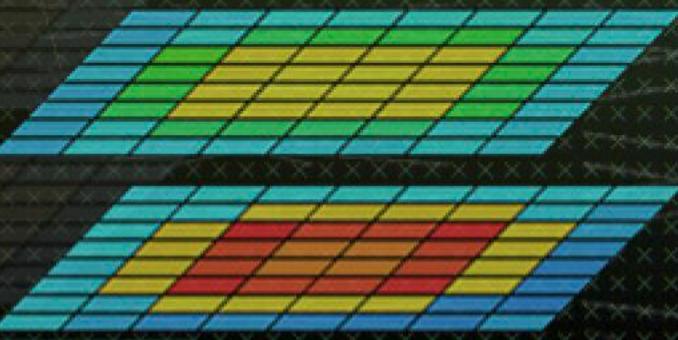
Process Summary:
Overview of the accumulated information across all functions and for every process independently.

Visualization of the NPB-MZ-MPI / BT trace

Process Summary



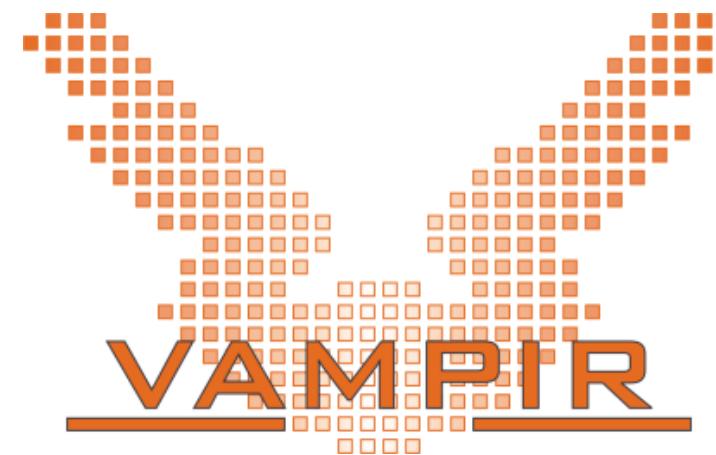
Find groups of similar processes and threads by using summarized function information.



Summary and Conclusion

Summary

- 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

**LMAC****Microsoft®****///H4H** **||ParMA**<http://www.vampir.eu>vampirsupport@zih.tu-dresden.de