Performance Analysis with Vampir

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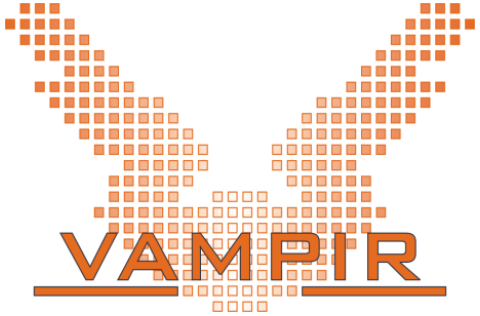
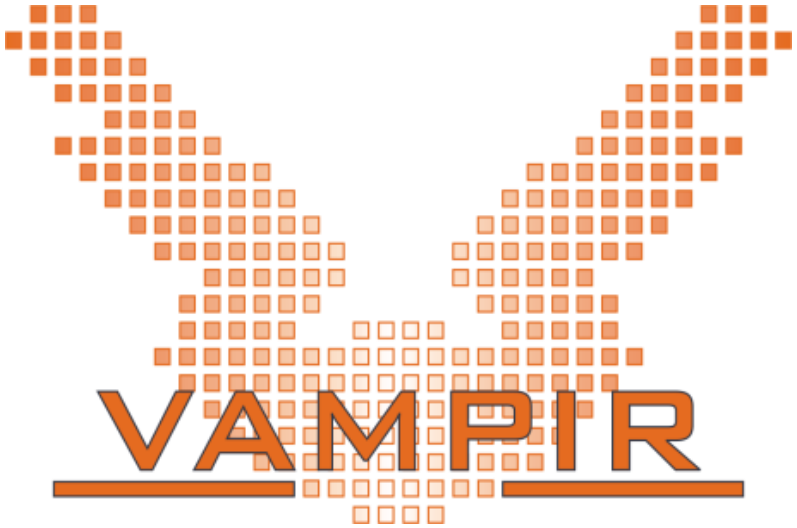


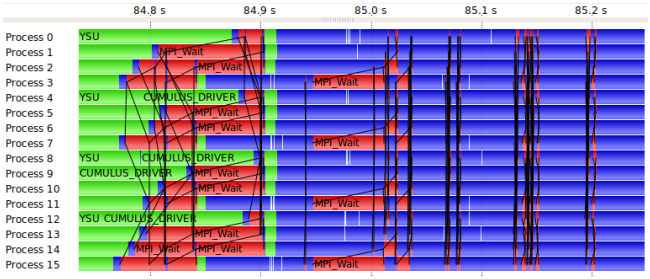
Outline

- **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



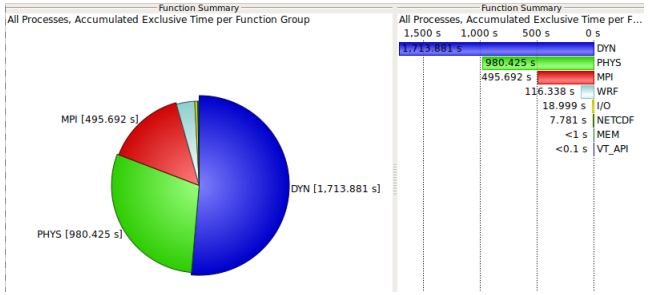
Event Trace Visualization with Vampir

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



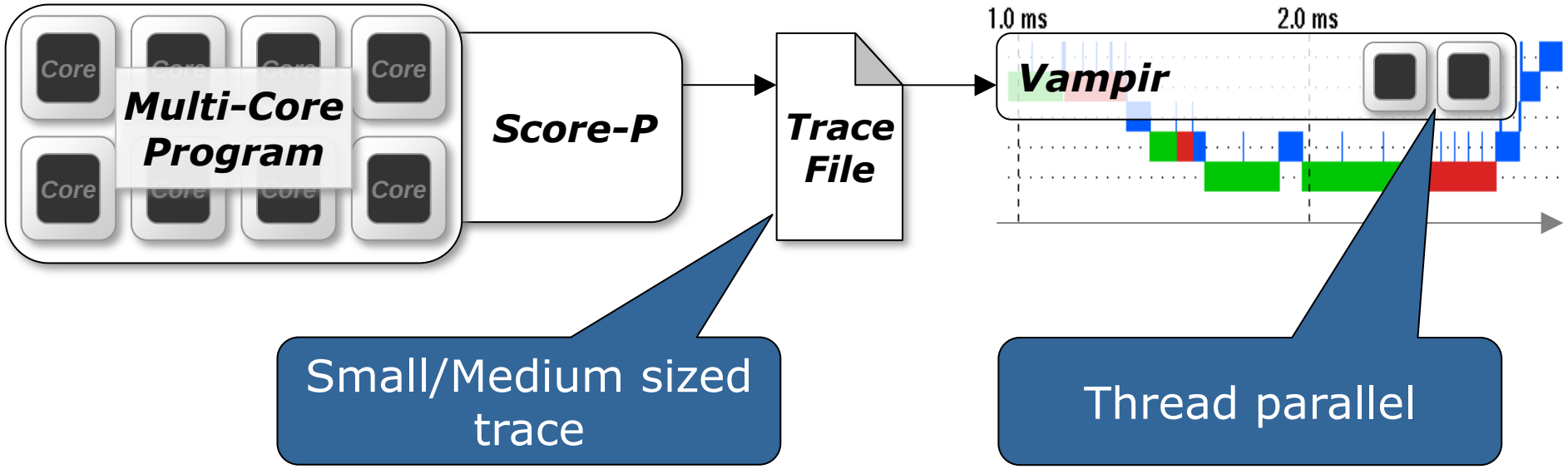
- **Timeline charts**
  - Show application activities and communication along a time axis

- **Summary charts**
  - Provide quantitative results for the currently selected time interval



Visualization Modes (1)
Directly on front end or local machine

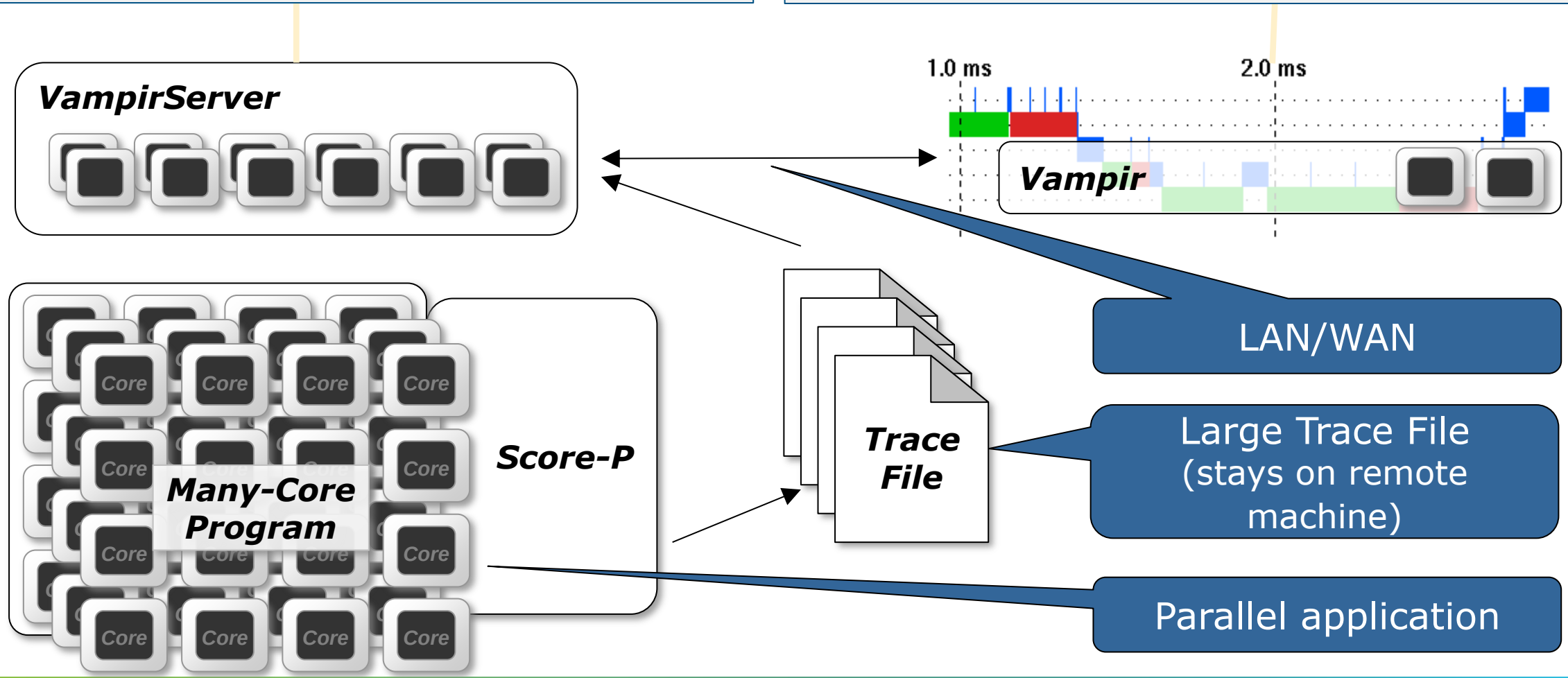
```
% vampir
```



Visualization Modes (2)
On local machine with remote VampirServer

```
% vampirserver start
```

```
% vampir
```



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 $SCRATCH_LEGACY/NPB3.3-MZ-MPI/bin.scorep/\
> scorep_bt-mz_C_32x4_trace
profile.cubex  scorep.cfg   traces/   traces.def  traces.otf2
```

```
% ls /home/hpc/a2c06/lu23bud/analysis_examples/\
> scorep_bt-mz_C_32x8_trace
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

Start Vampir

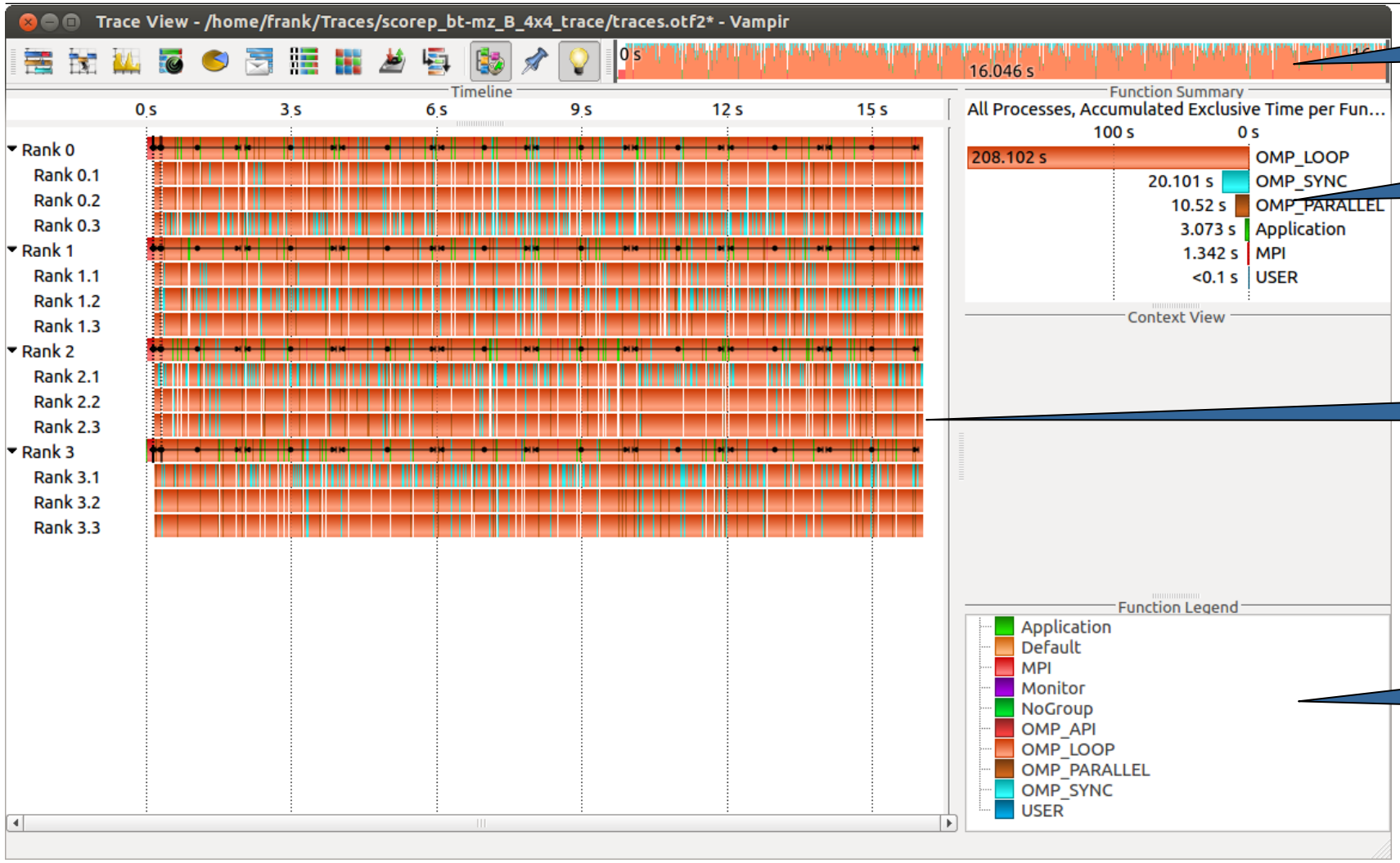
```
% vampir $SCRATCH_LEGACY/NPB3.3-MZ-MPI/bin.scorep/\
> scorep_bt-mz_C_32x4_trace



% vampir /home/hpc/a2c06/lu23bud/traces/\
> scorep_bt-mz_C_32x8_trace
```

- Load correct module to add local tool installations to $PATH (required for each shell session)
- Start Vampir on the current login-node
  (requires ssh X-forwarding)

Visualization of the NPB-MZ-MPI / BT trace



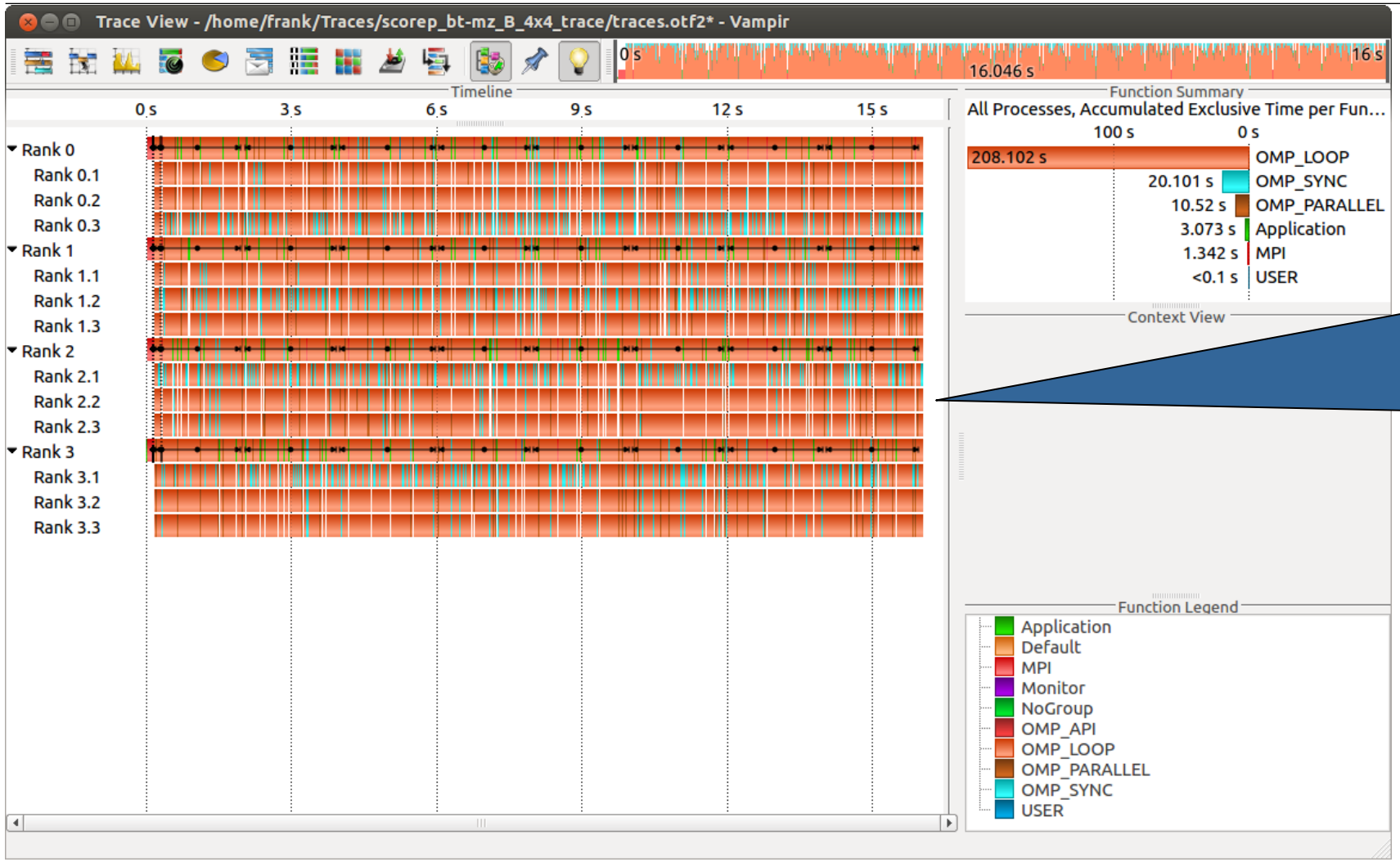
Navigation Toolbar

Function Summary

Master Timeline

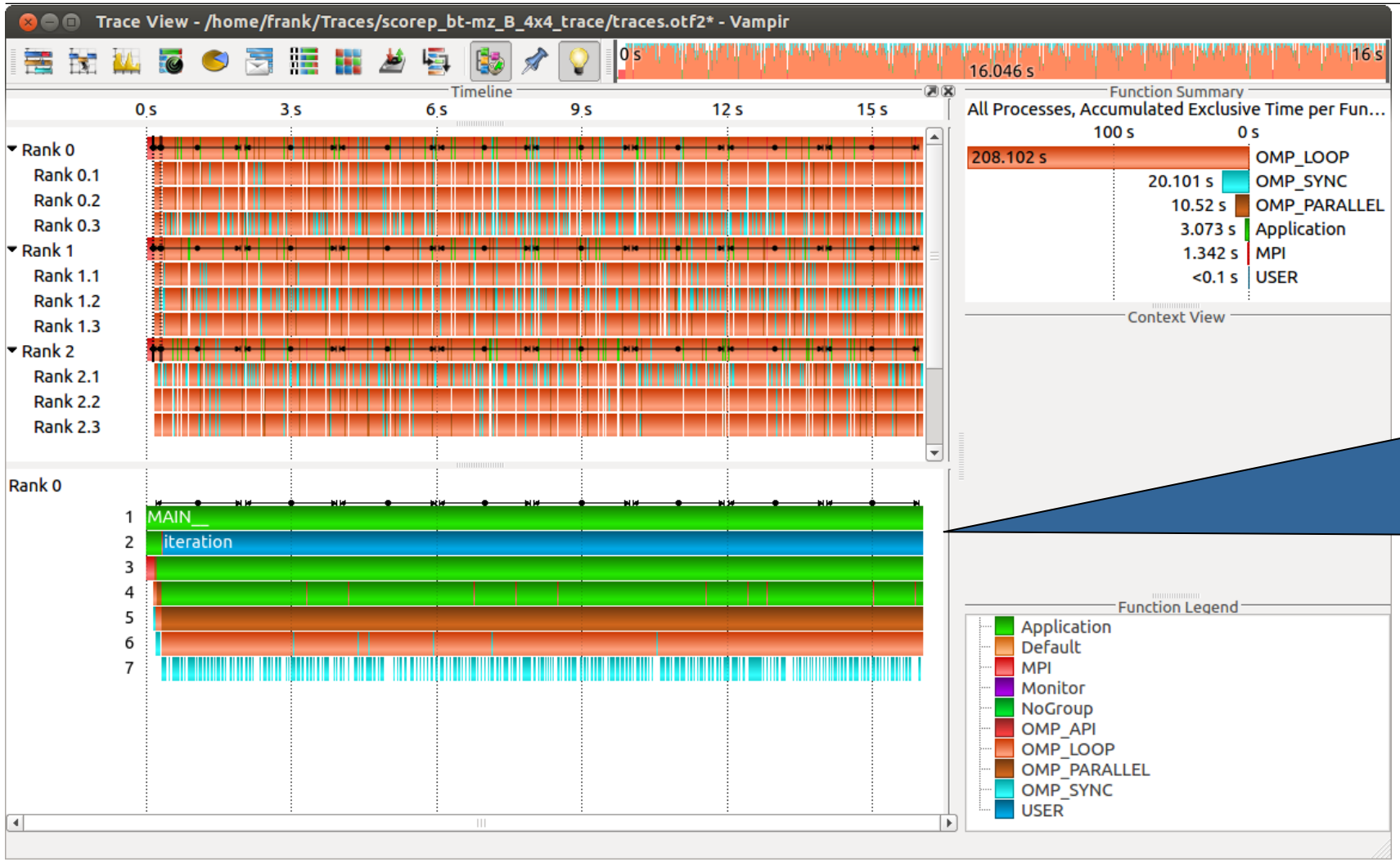
Function Legend

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



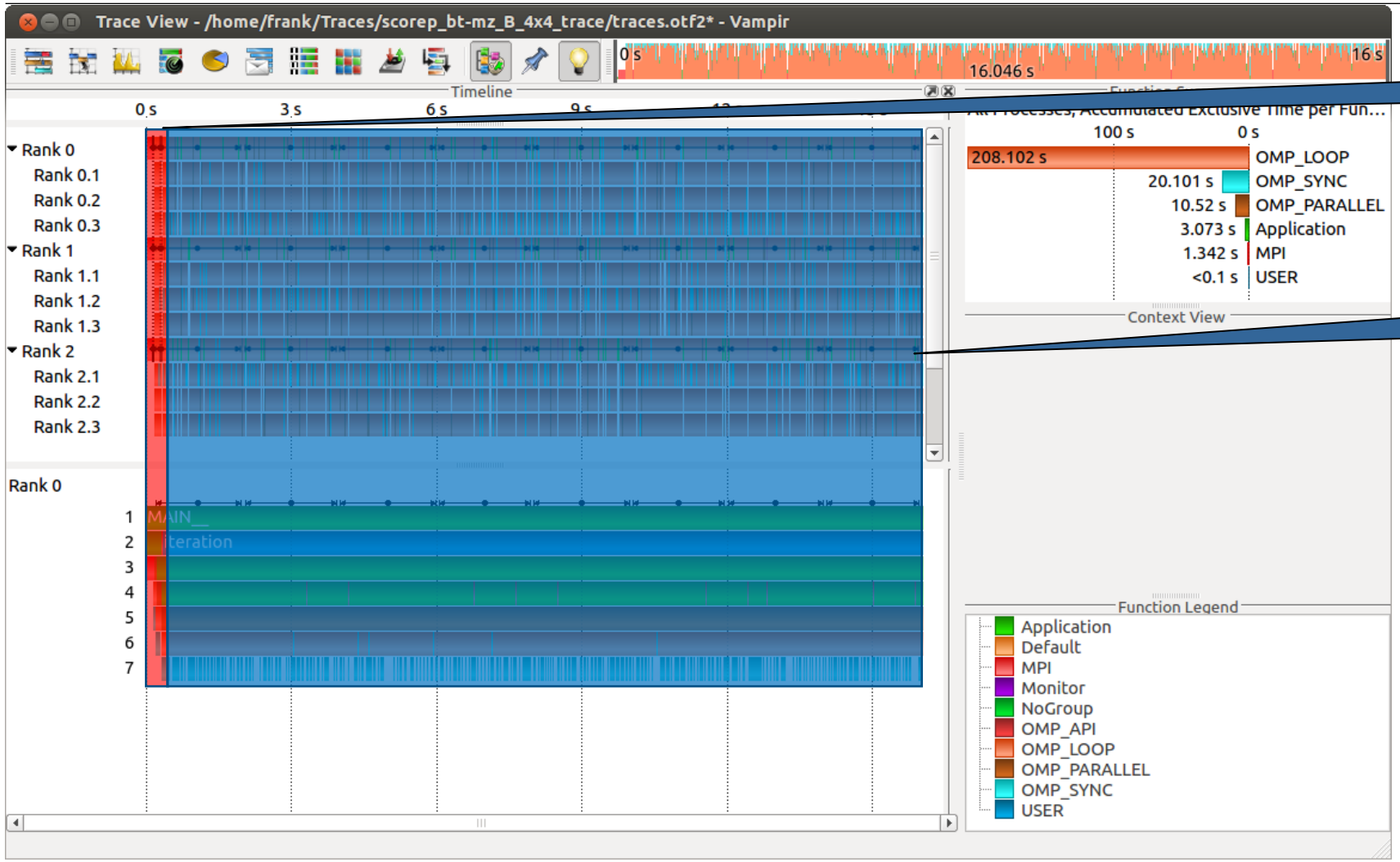
Detailed information about functions, communication and synchronization events for collection of processes.

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.

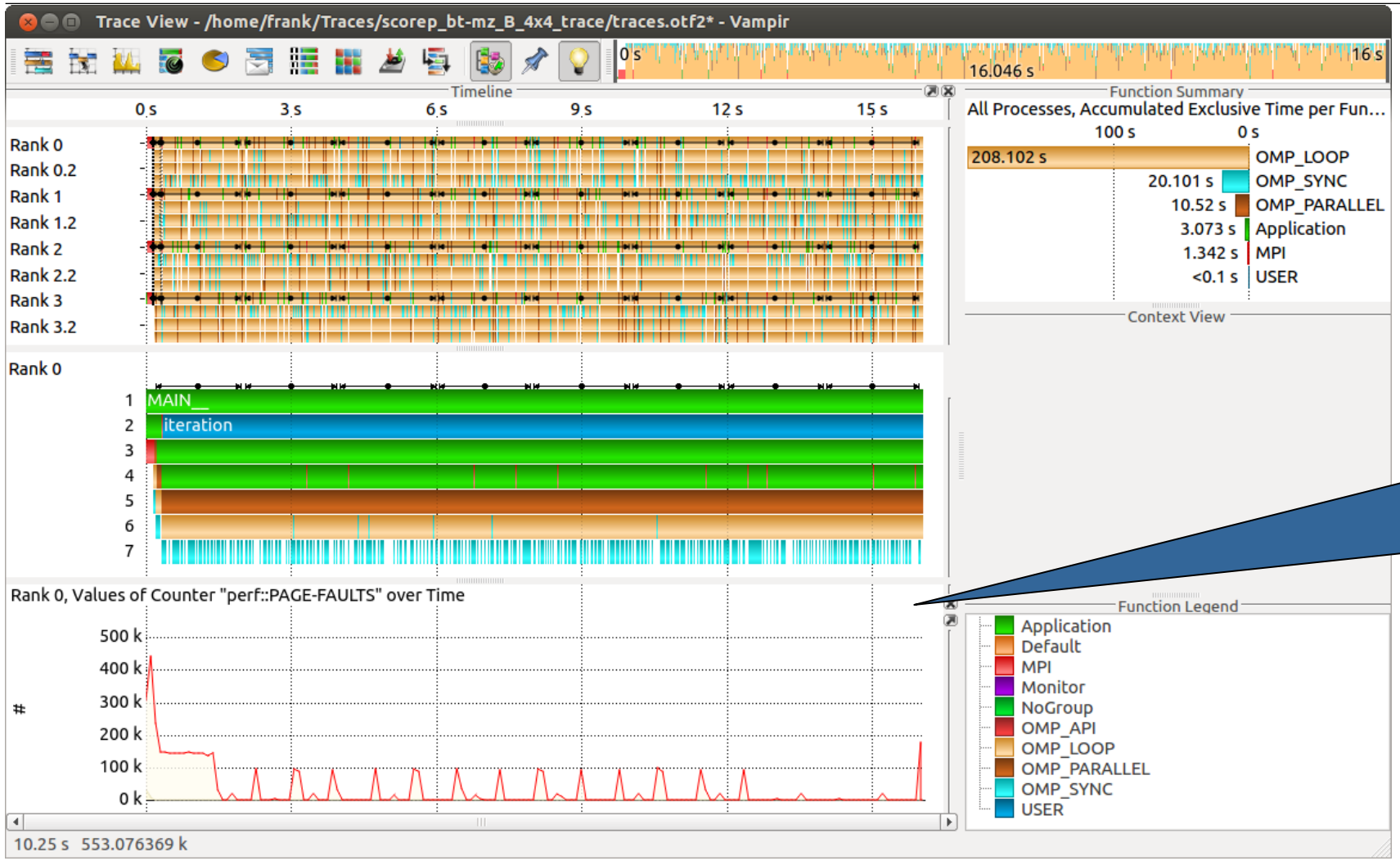
Visualization of the NPB-MZ-MPI / BT trace
Typical program phases



Initialisation Phase

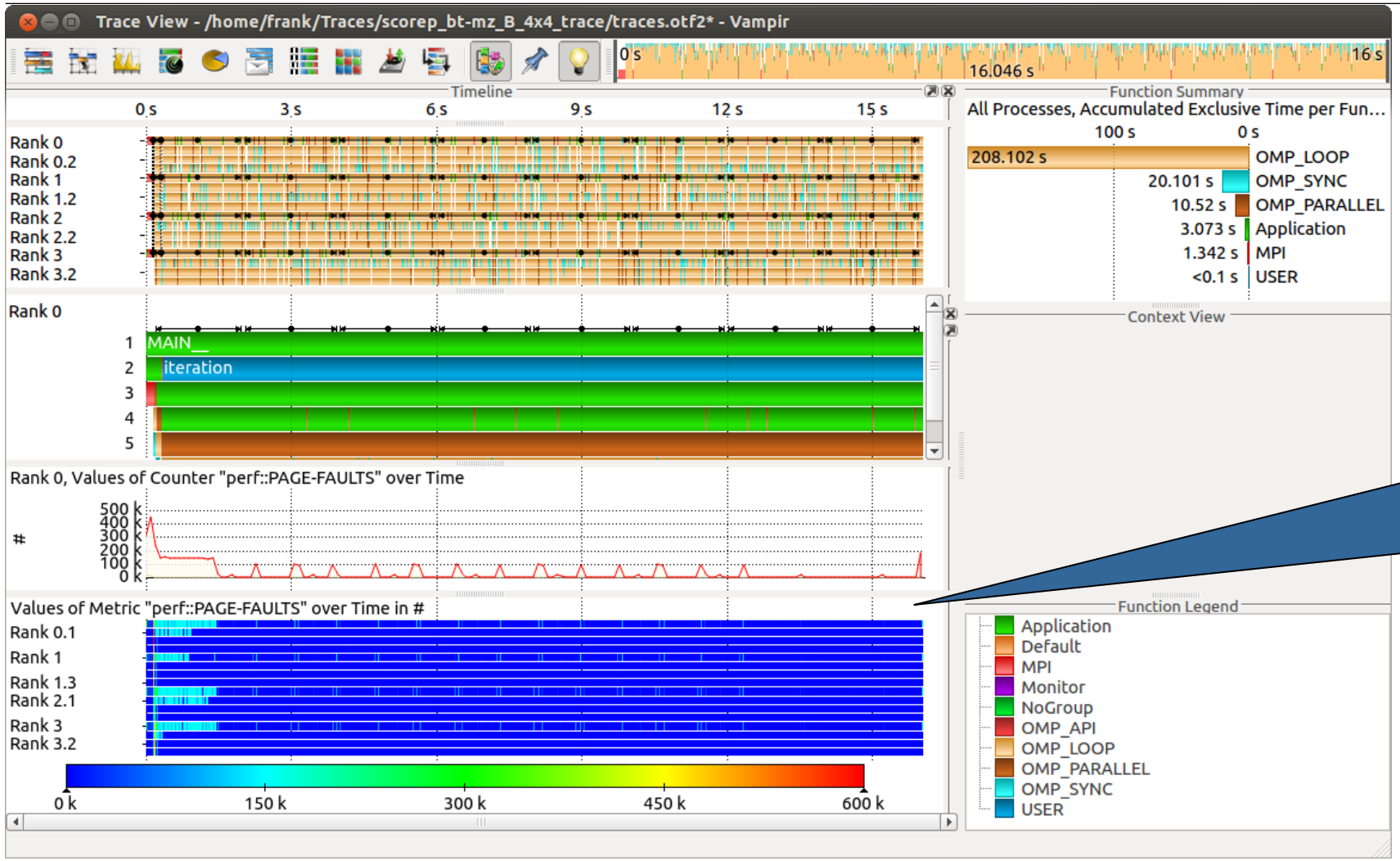
Computation Phase

Visualization of the NPB-MZ-MPI / BT trace
Counter Data Timeline



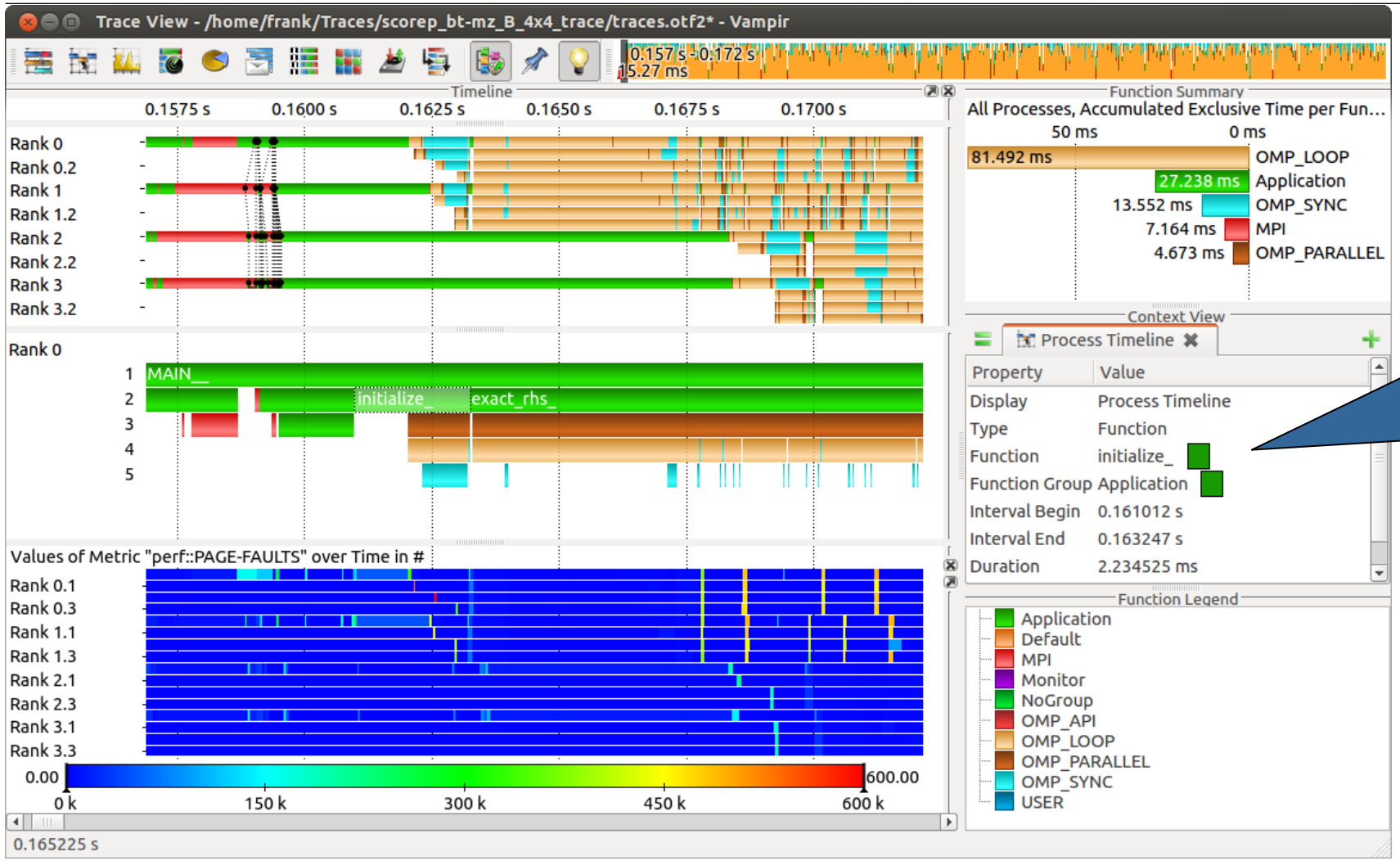
Detailed counter information over time for an individual process.

Visualization of the NPB-MZ-MPI / BT trace
Performance Radar



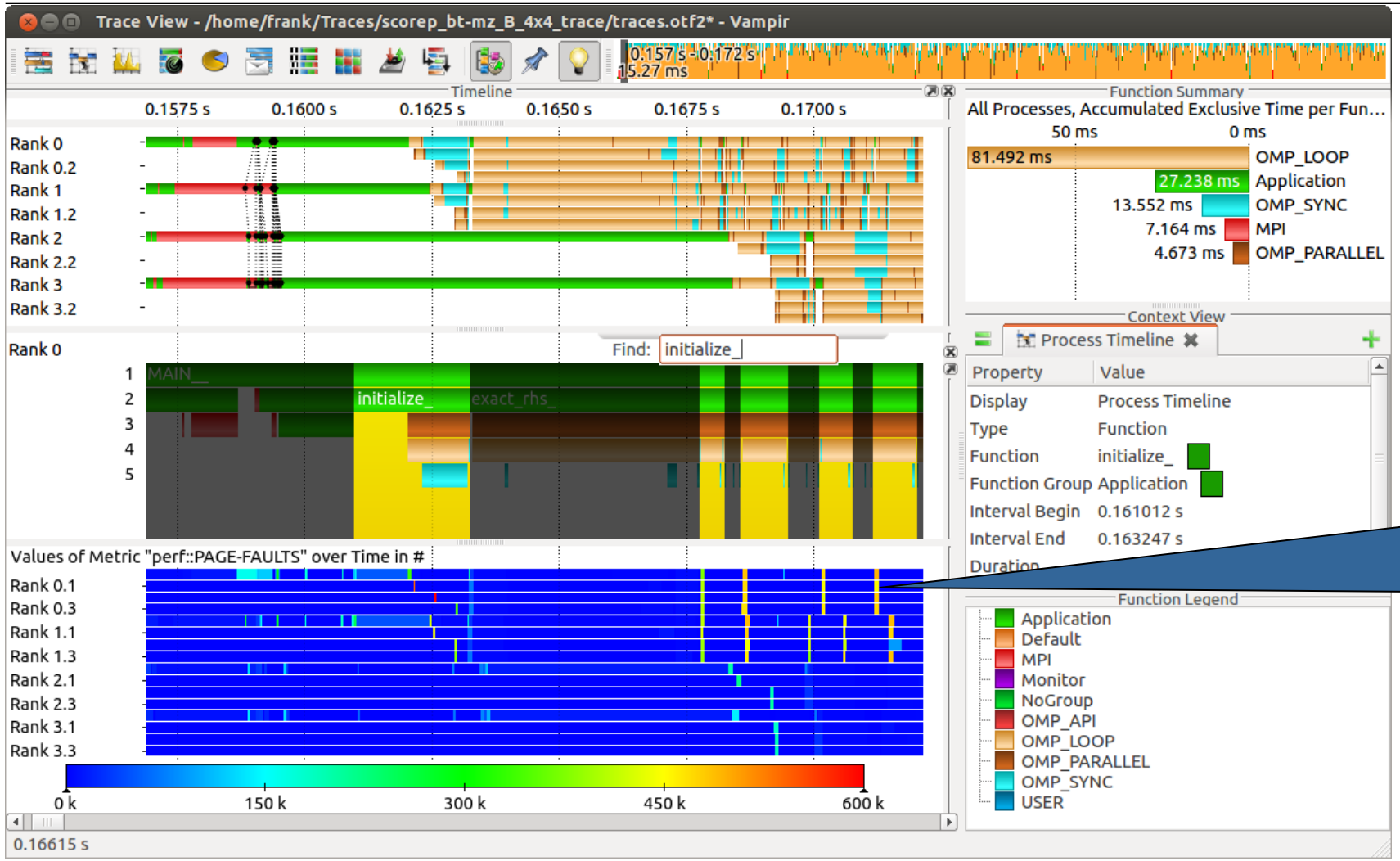
Detailed counter information over time for a collection of processes.

Visualization of the NPB-MZ-MPI / BT trace
Zoom in: Inititialisation Phase



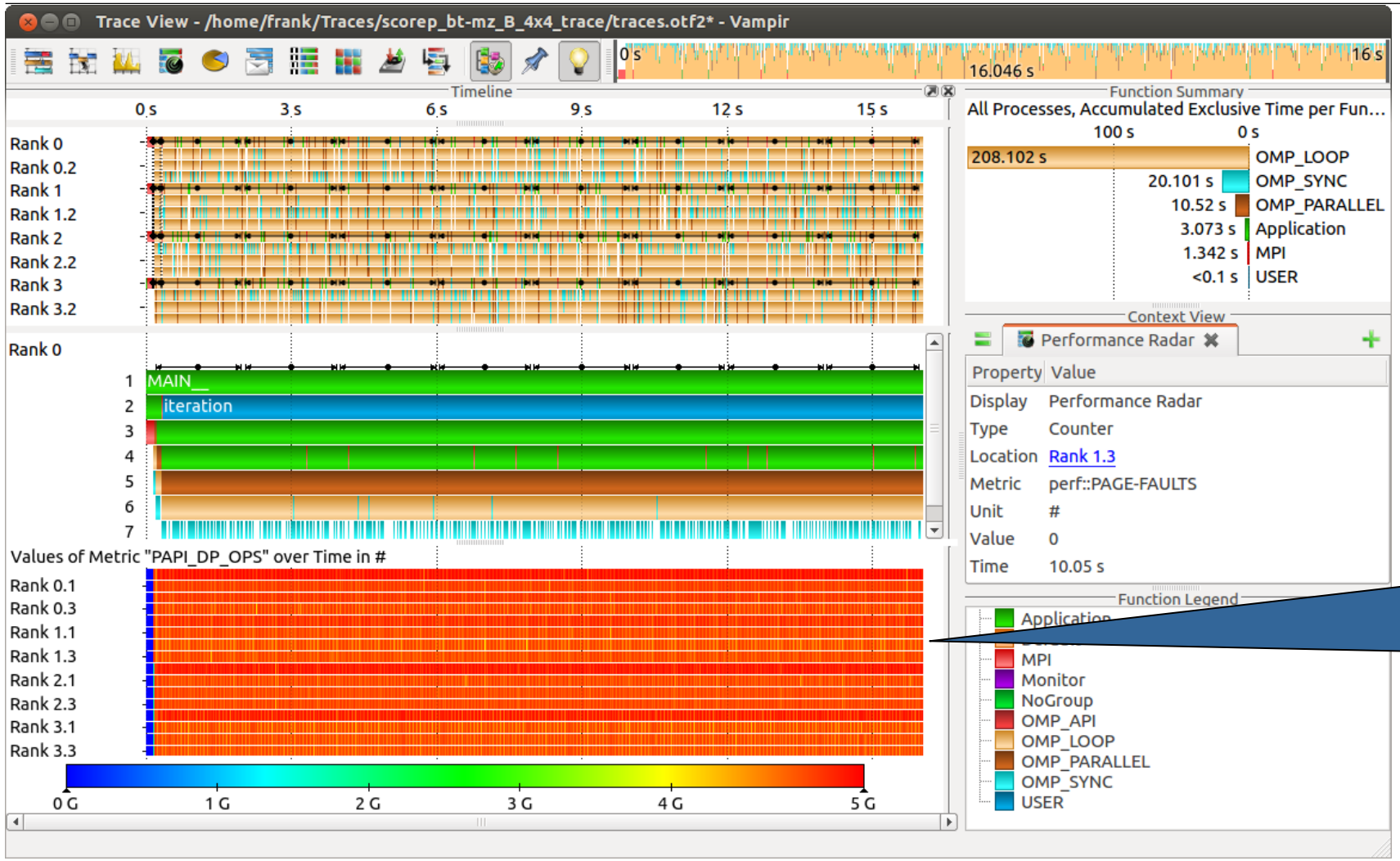
Context View: Detailed information about function “initialize_”.

Visualization of the NPB-MZ-MPI / BT trace
Find Function



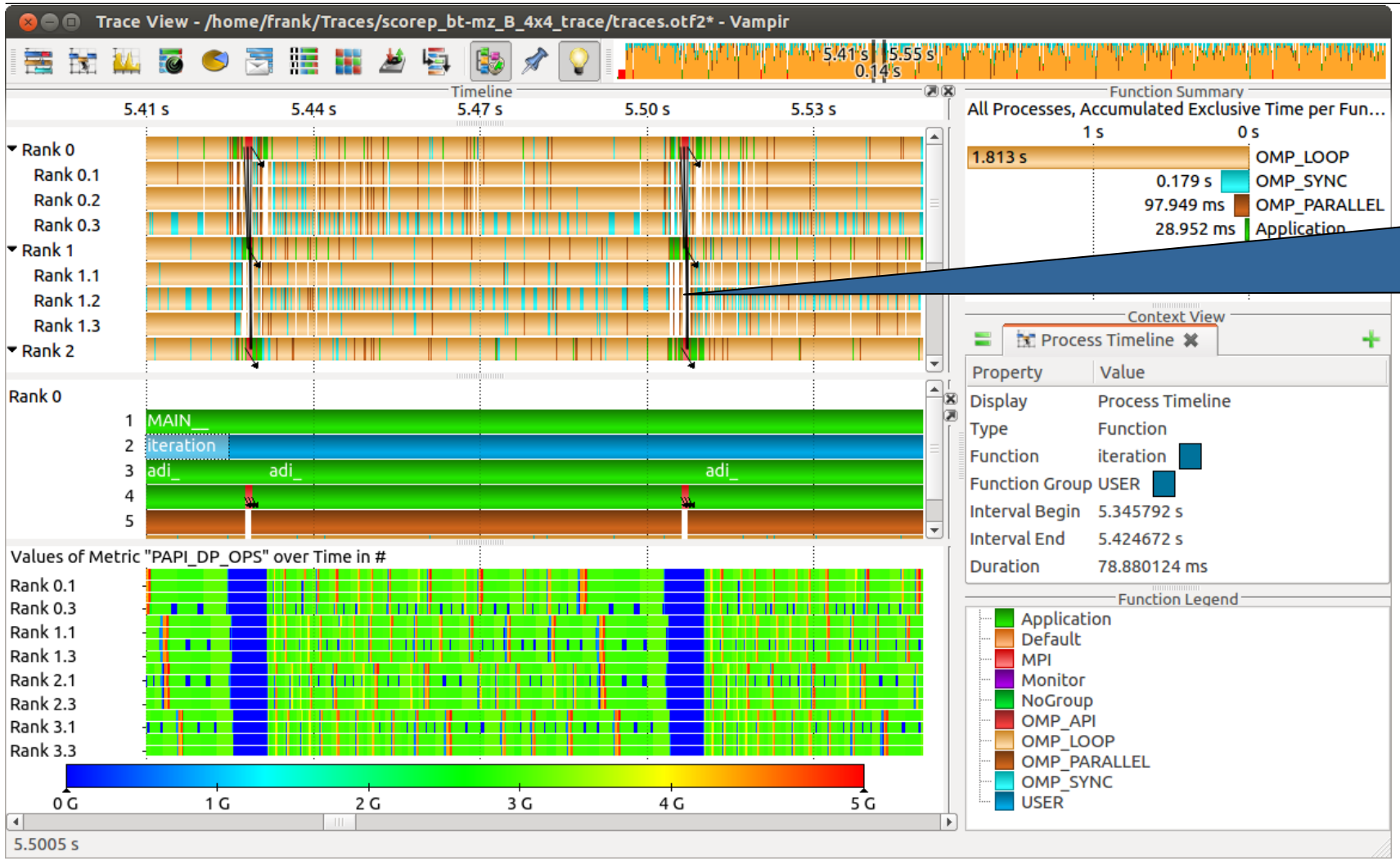
Execution of function "initialize_" results in higher page fault rates.

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



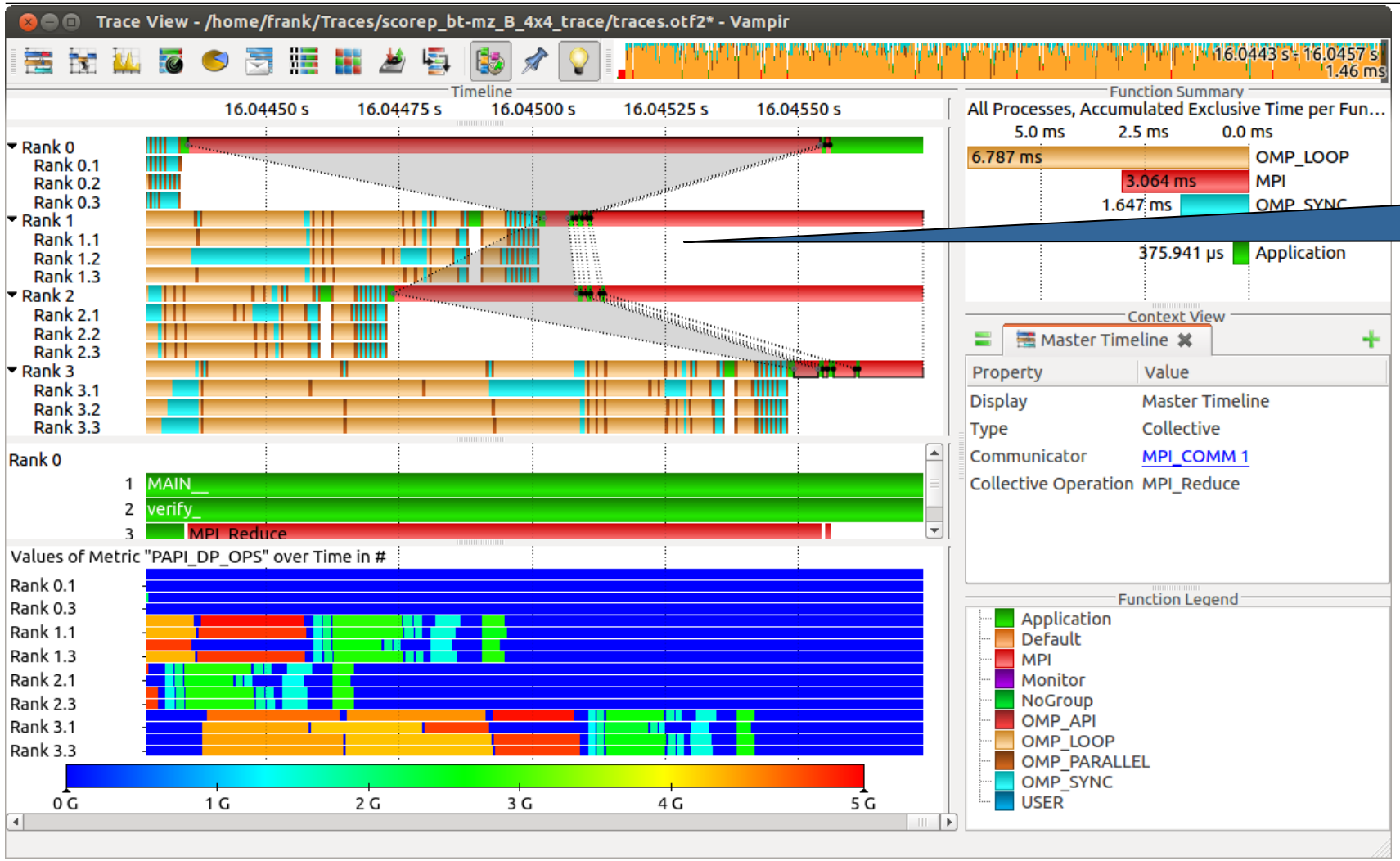
Computation phase results in higher floating point operations.

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



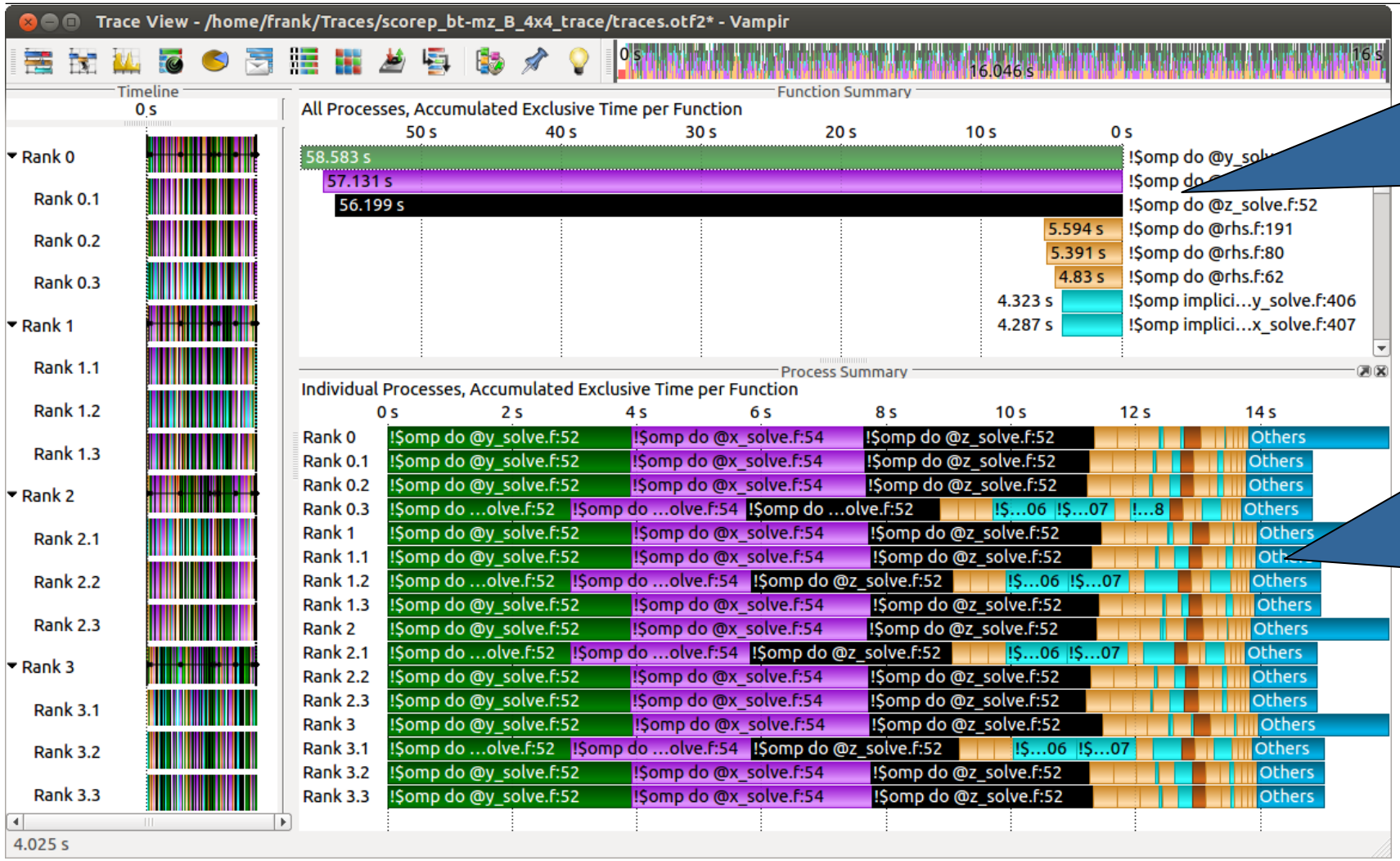
MPI communication results in lower floating point operations.

Visualization of the NPB-MZ-MPI / BT trace
Zoom in: Finalisation Phase



"Early reduce" bottleneck.

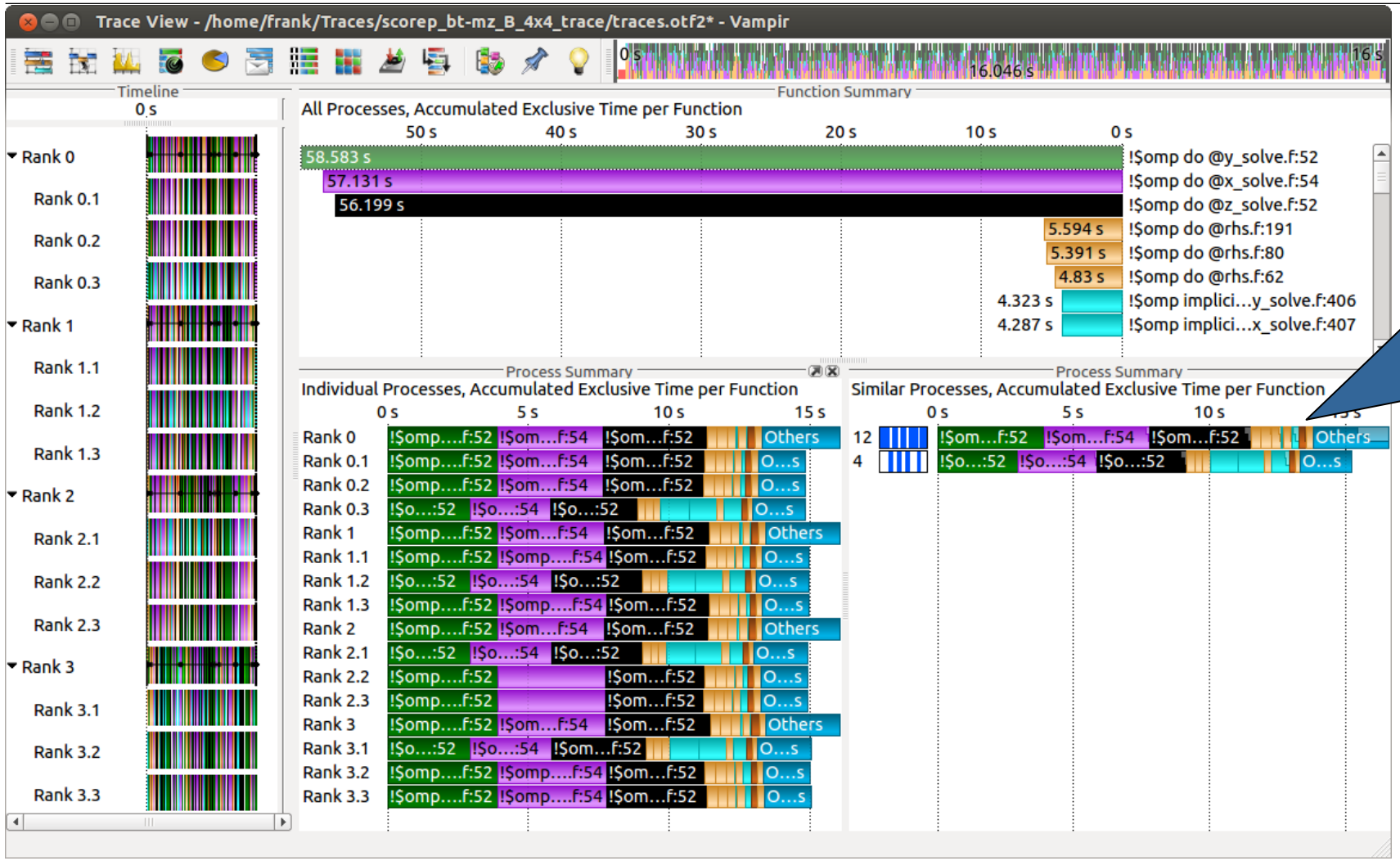
Visualization of the NPB-MZ-MPI / BT trace
Process Summary



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

http://www.vampir.eu

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