TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

Center for Information Services and High Performance Computing (ZIH)

Trace analysis with Vampir

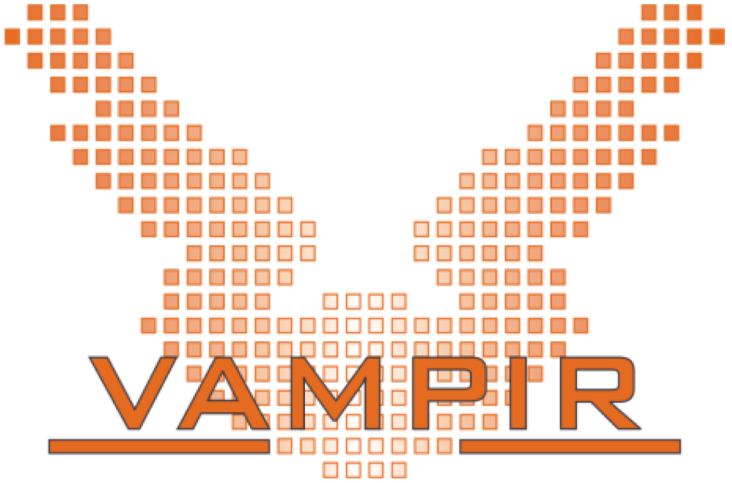
NLPE@HLRS – Tools Day

6 June 2025

Outline

Part I: Welcome to the Vampir Tool Suite

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

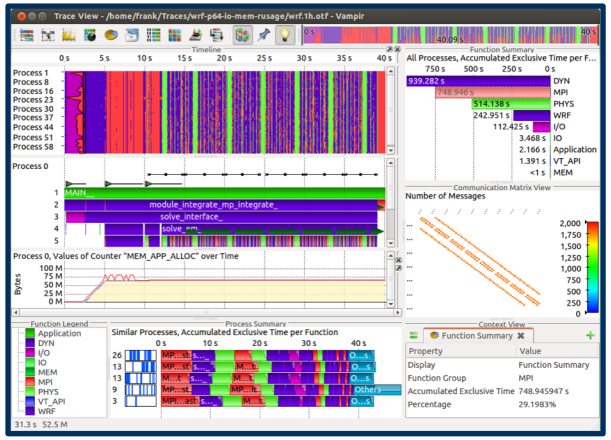


Part II: Vampir Hands On

- Visualizing and analyzing heat example

- 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?

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, which can be zoomed and scrolled
- Master timeline showing all parallel processes/threads
- Process timeline focusing on a single process/thread

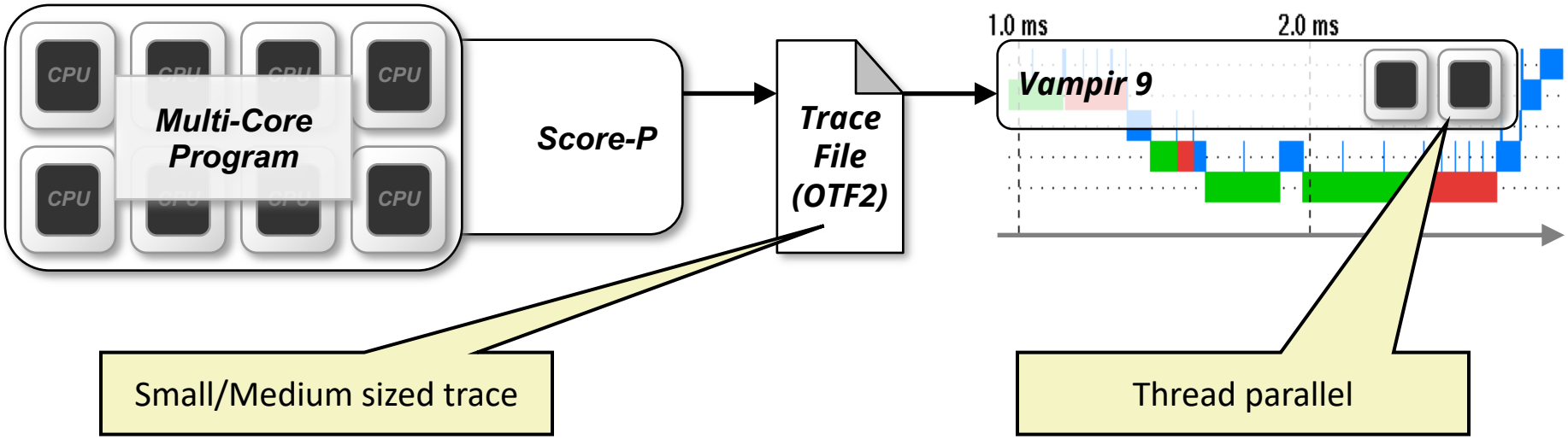
Summary charts

- Provide quantitative results for the currently selected time interval (e.g. Message Summary)

Vampir – Visualization Modes (1)

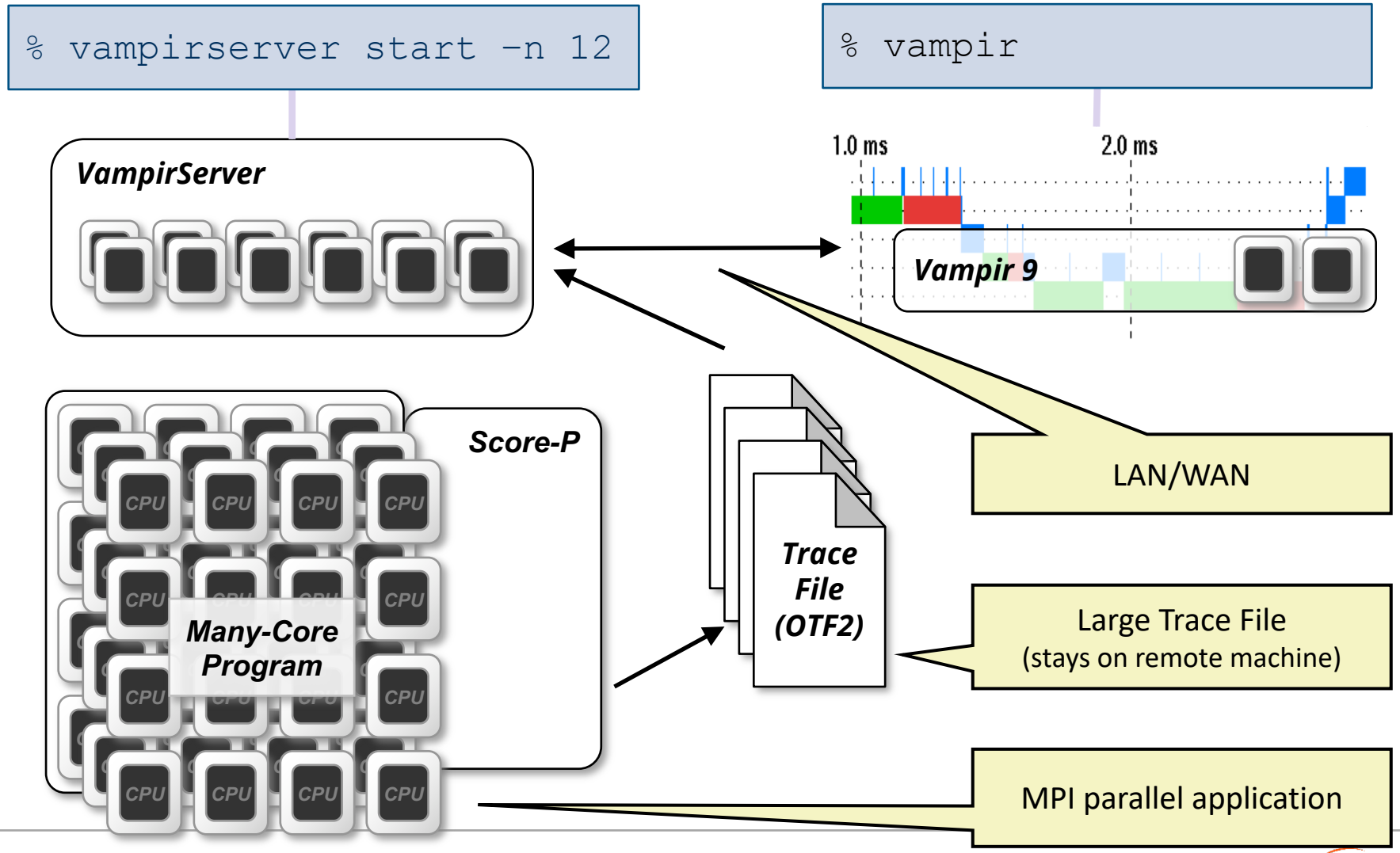
- Directly on front end or local machine

```
% vampir
```



Vampir – Visualization Modes (2)

On local machine with remote VampirServer



The main displays of Vampir

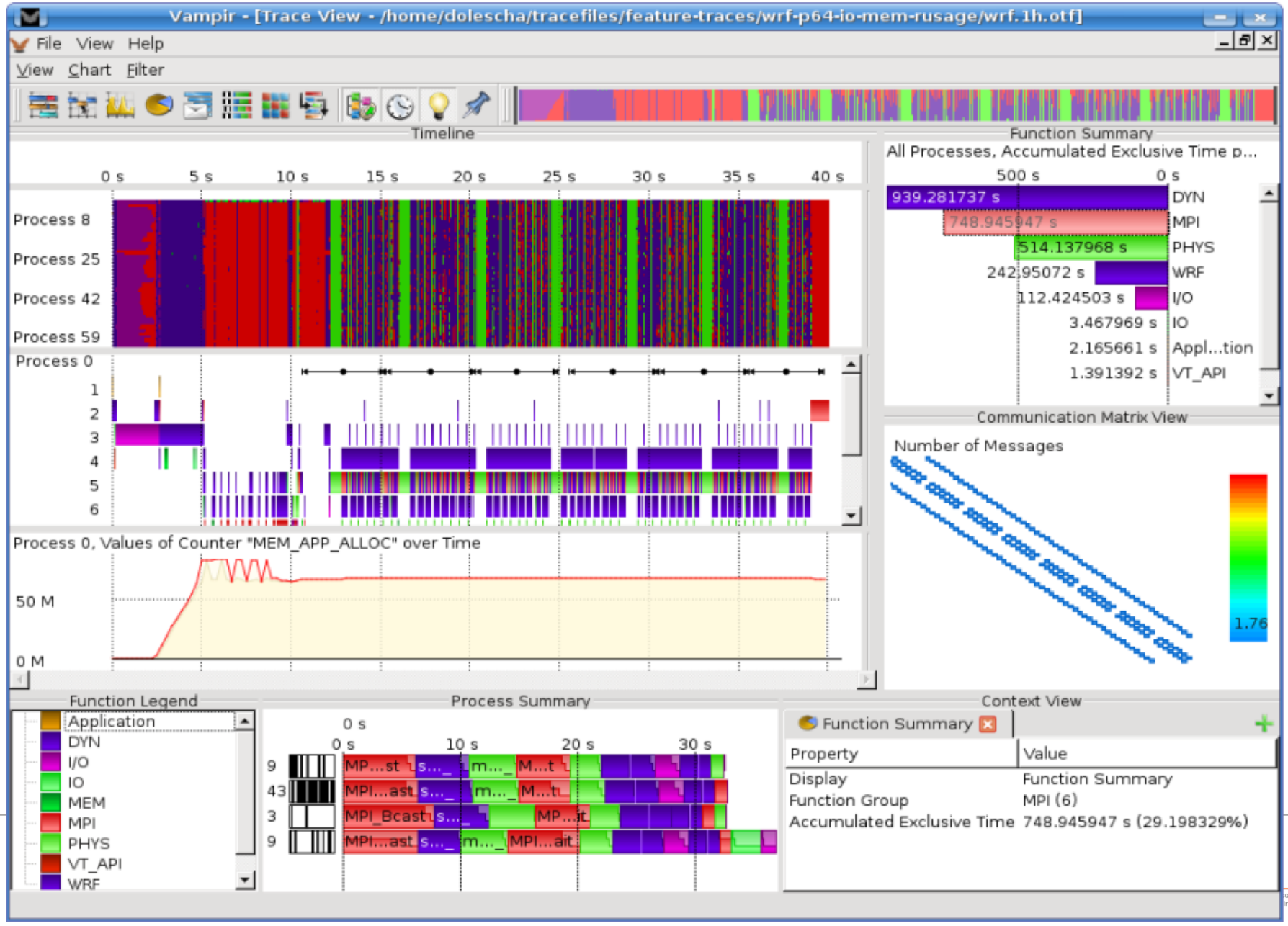
Timeline Charts:

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

Summary Charts:

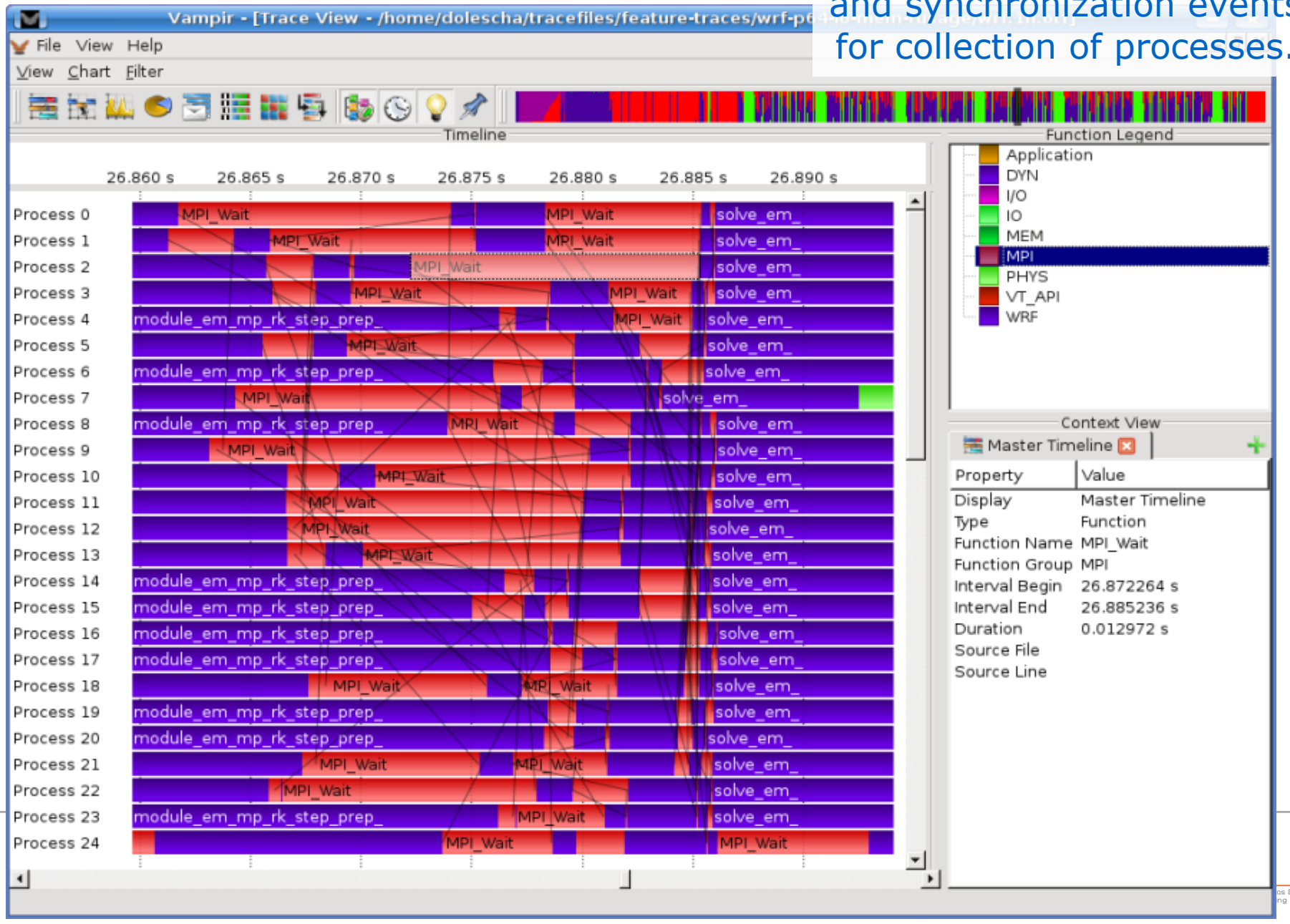
- Function Summary
- Message Summary
- Process Summary
- Communication Matrix View

Vampir: Displays for a WRF Trace with 64 Processes



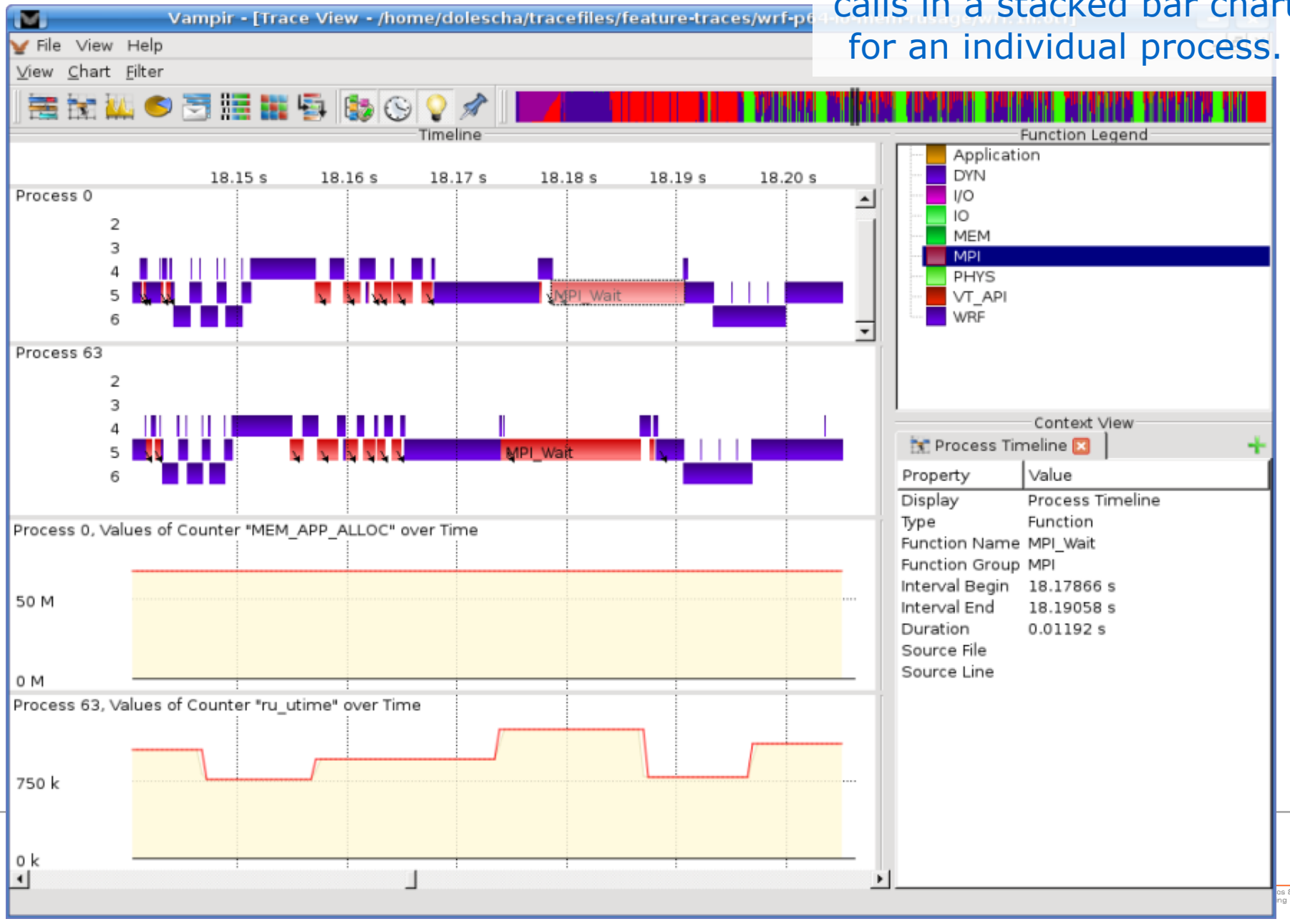
Master Timeline

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



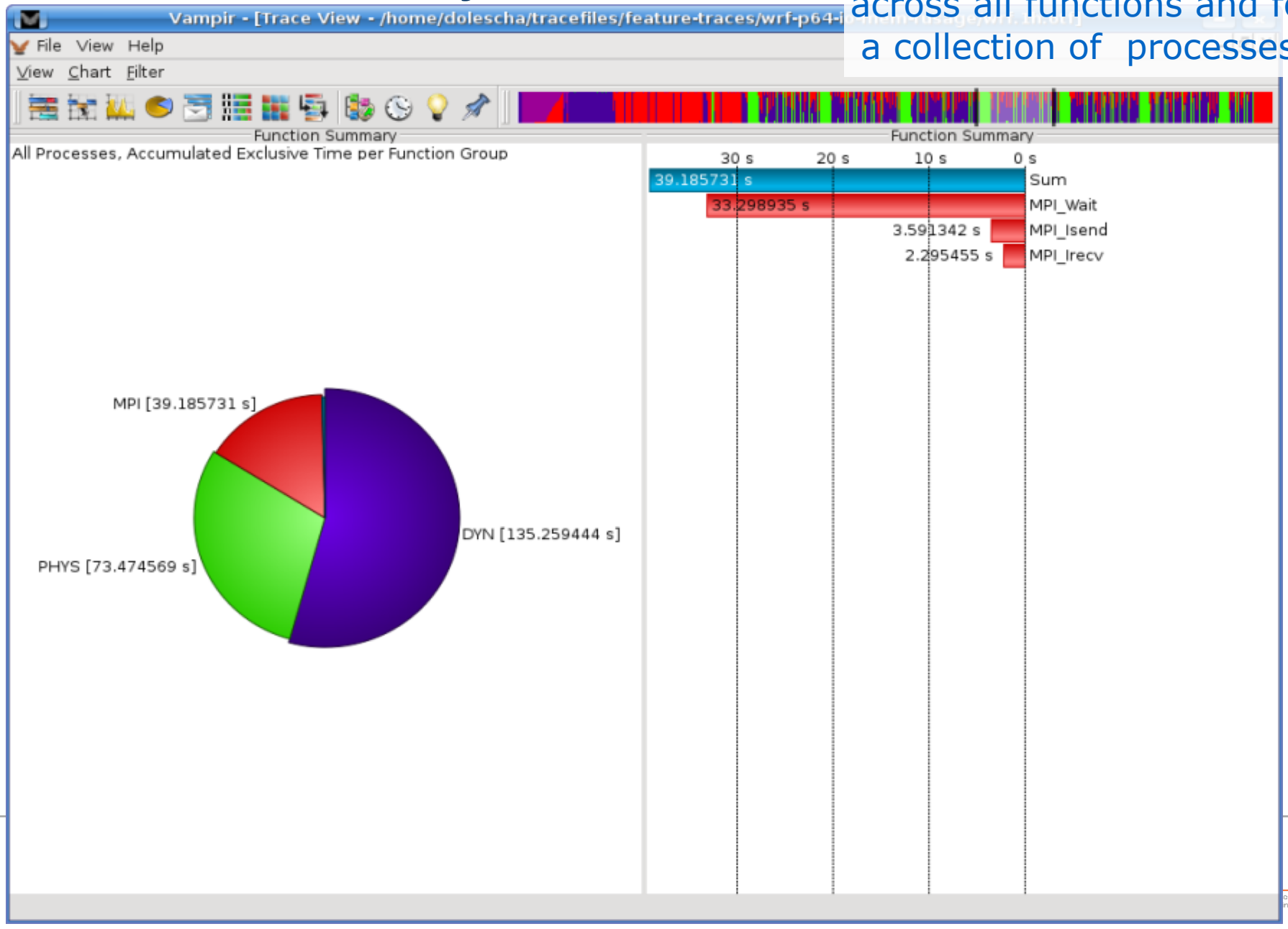
Process and Counter Timeline

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



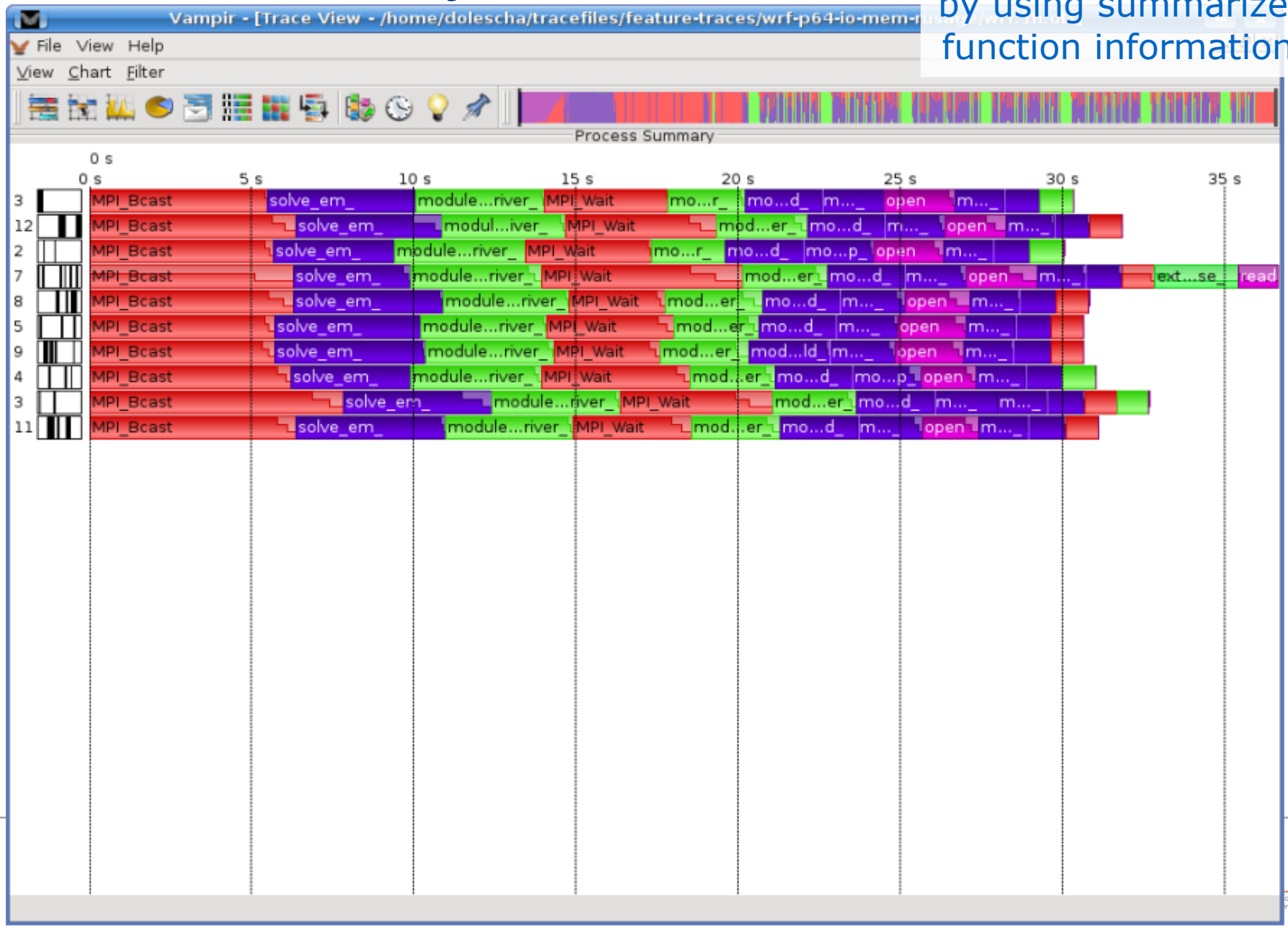
Function Summary

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



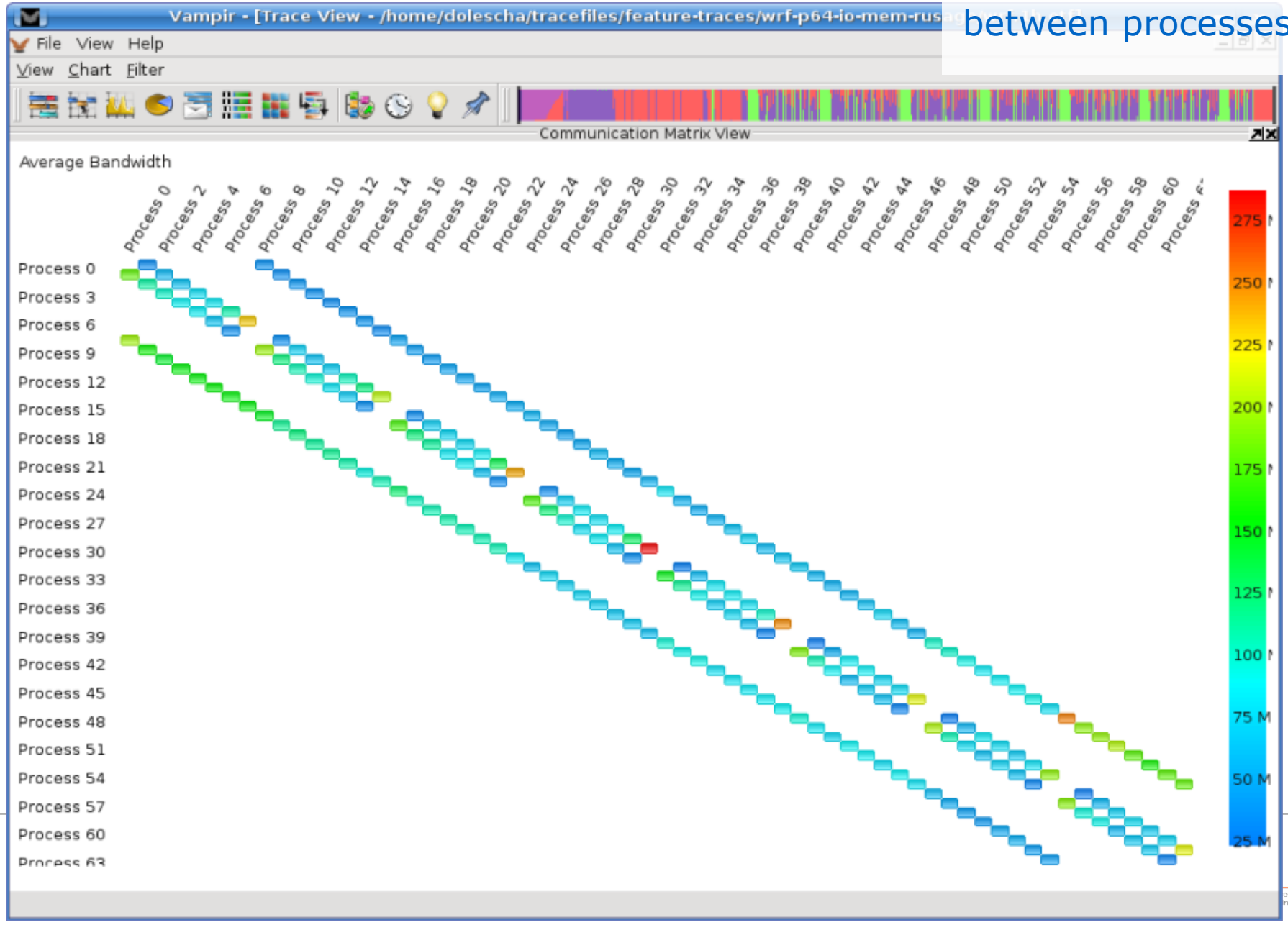
Process Summary

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

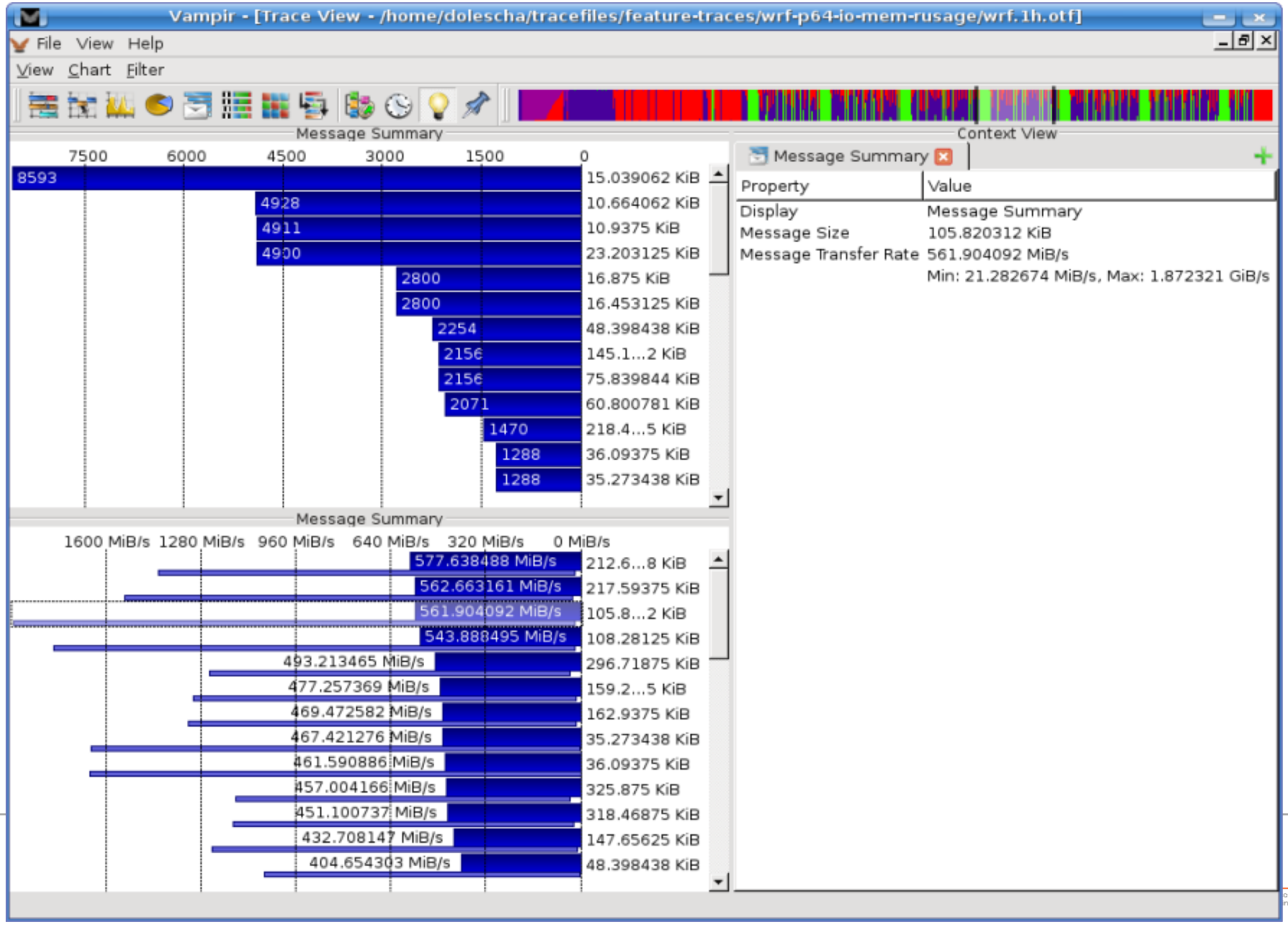


Communication Matrix

Information about messages sent between processes.

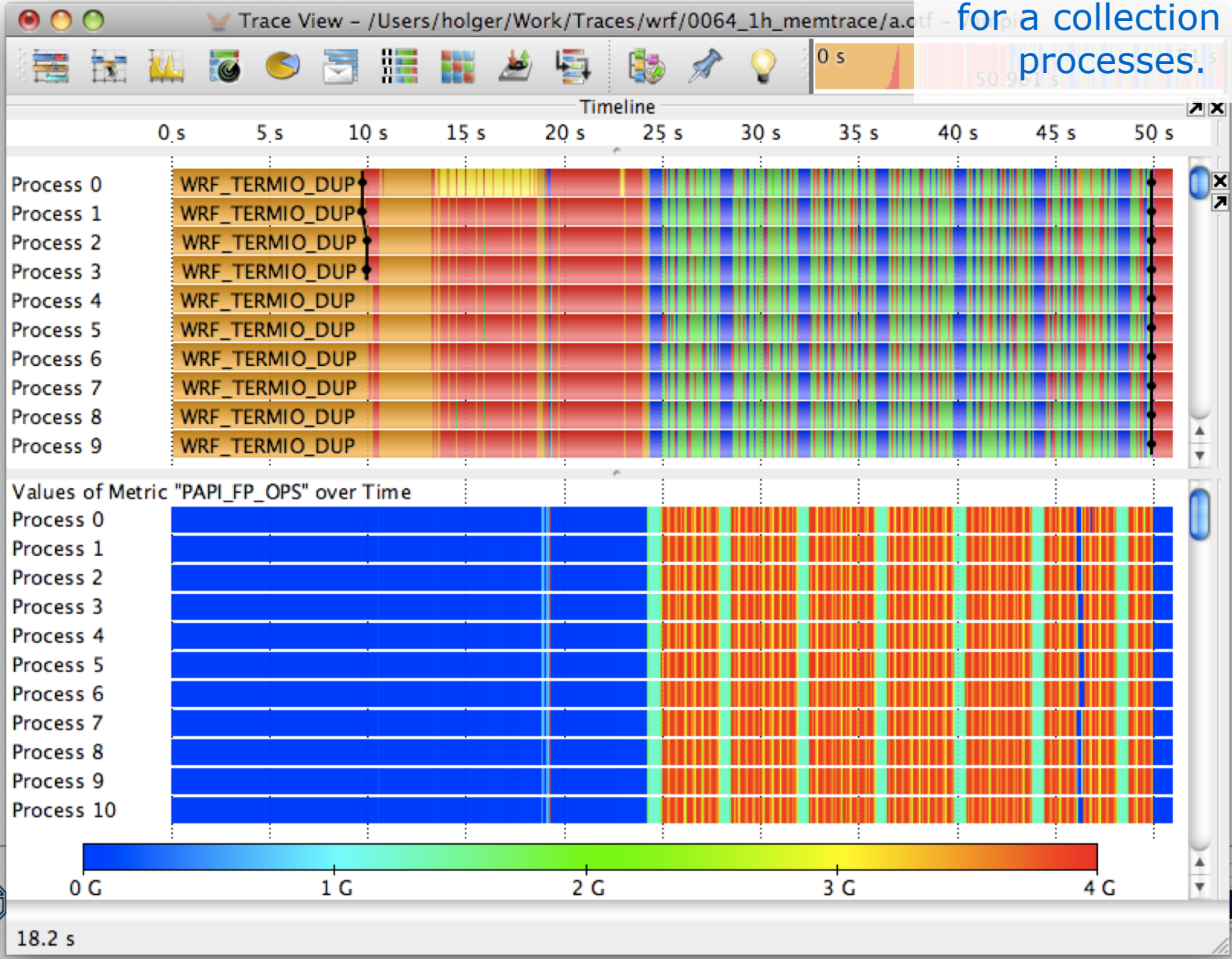


Message Summary



Performance Radar

Detailed counter information over time for a collection of processes.



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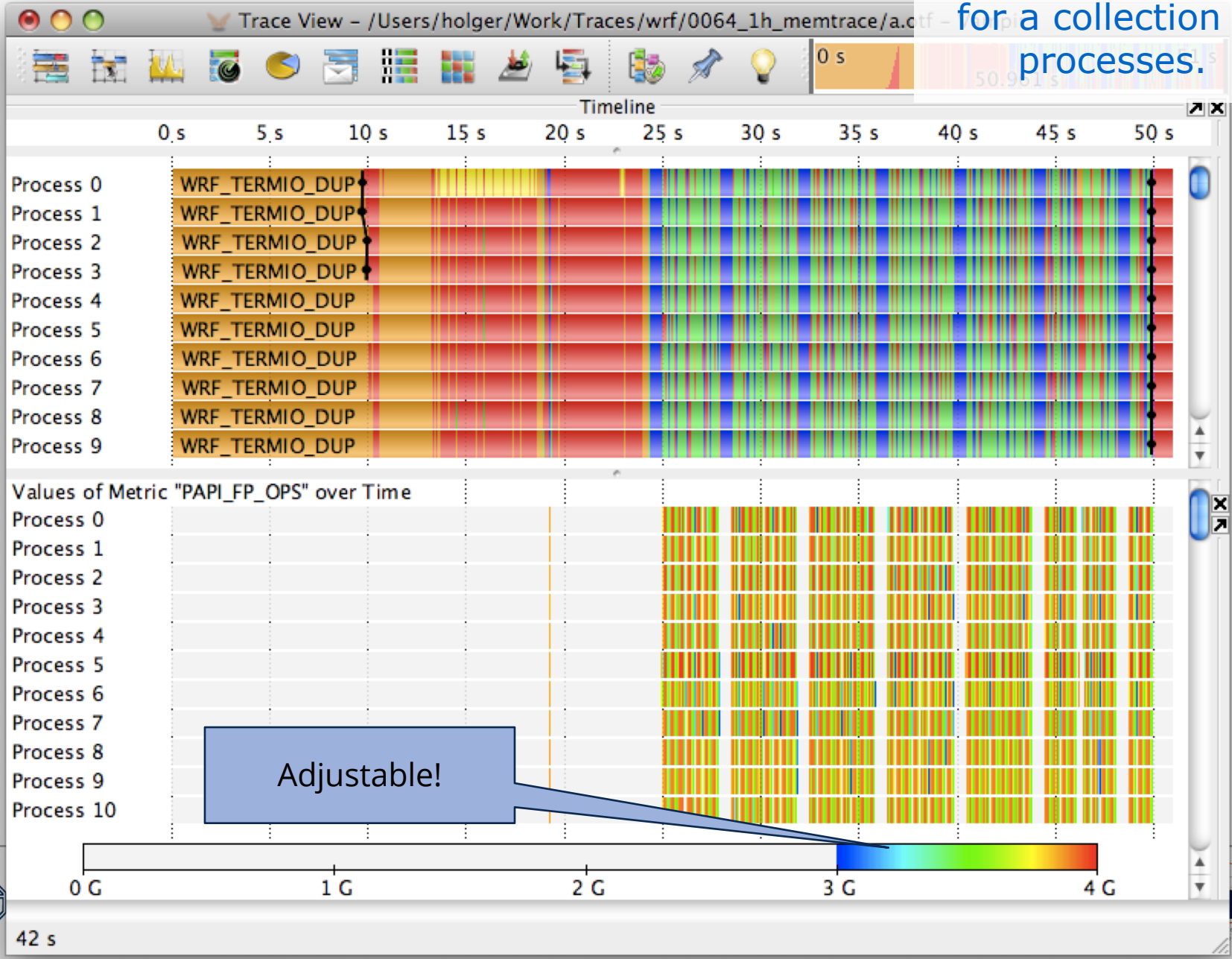
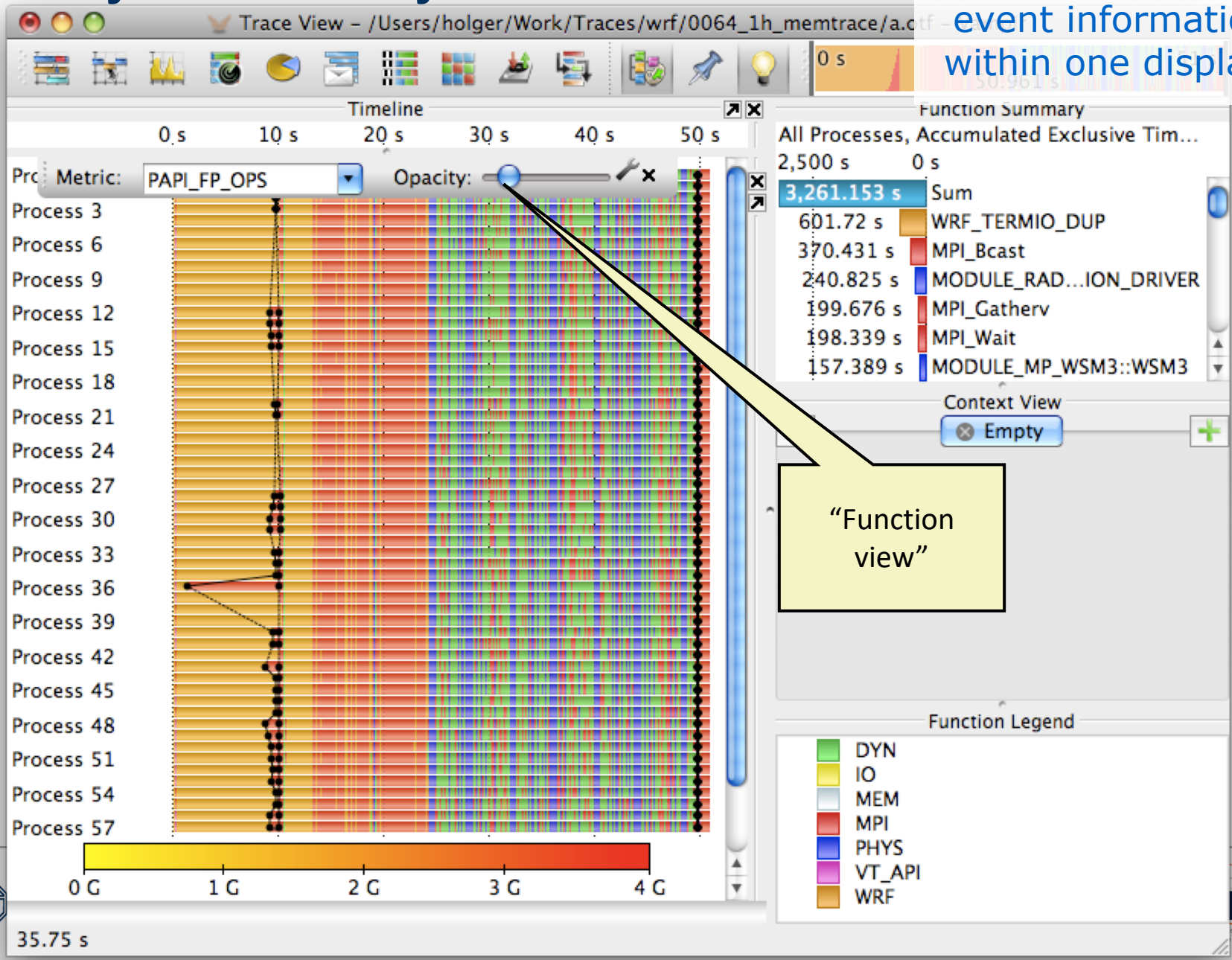


Overlay Functionality of Master Timeline

Correlate counter information with event information within one display.



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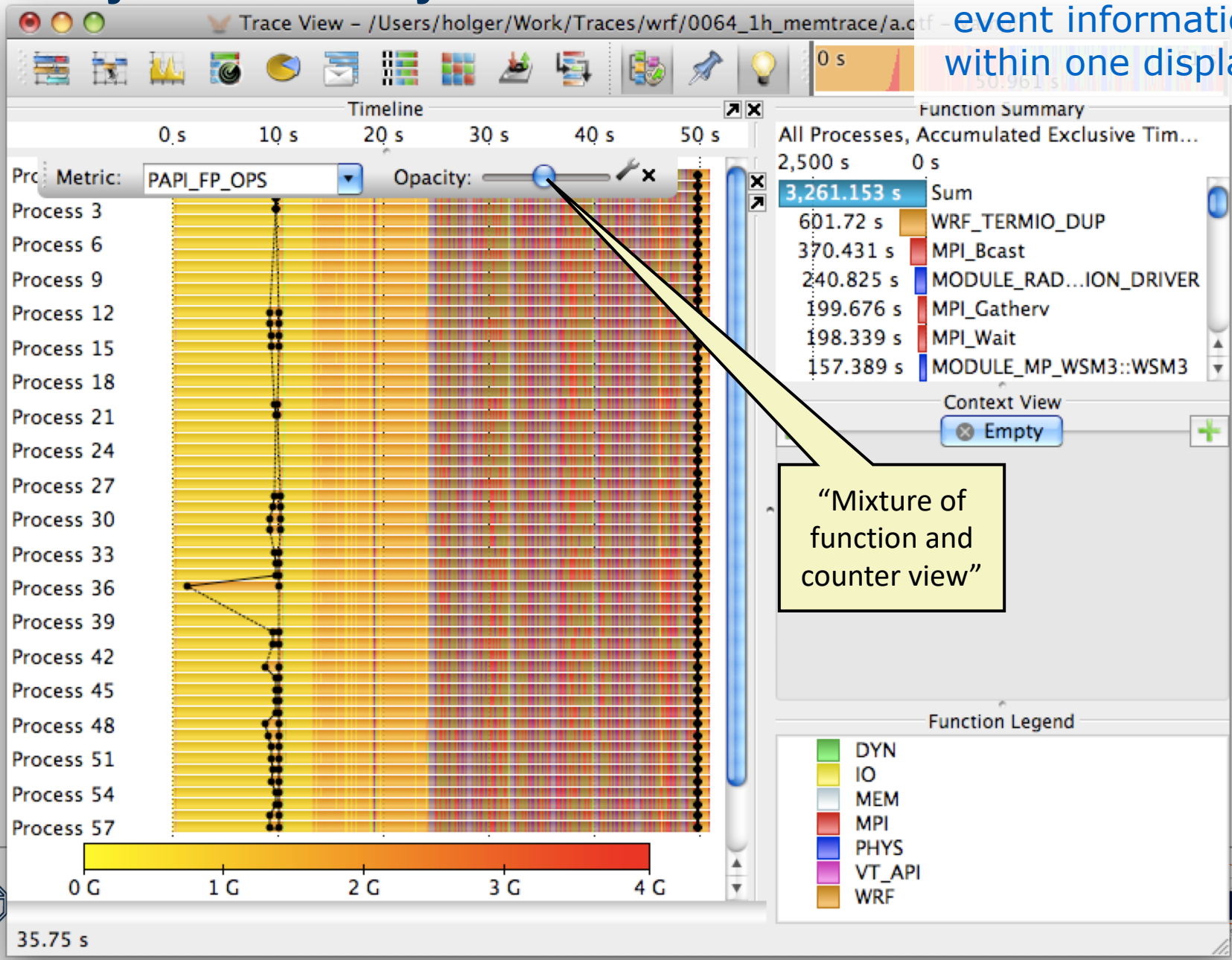

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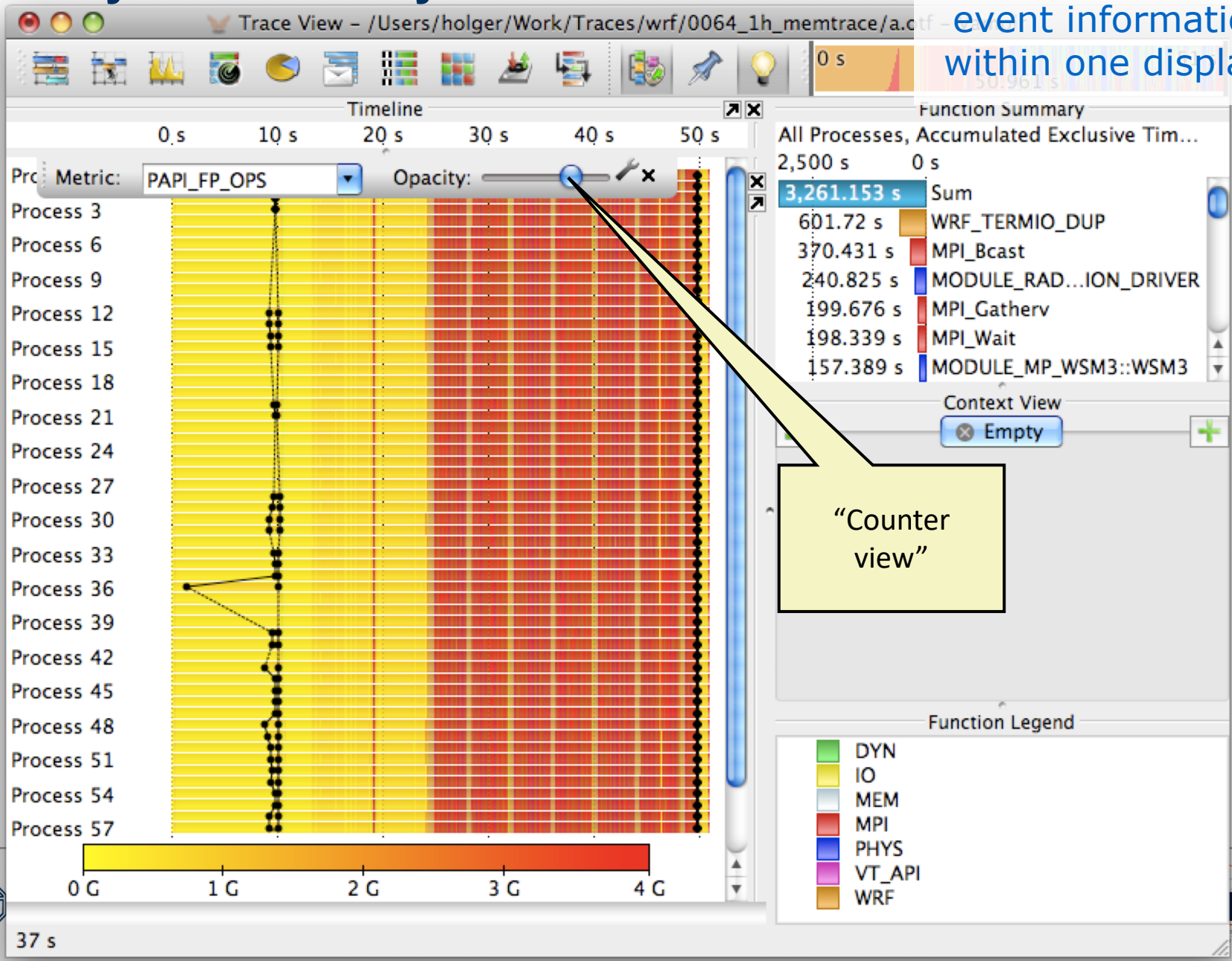

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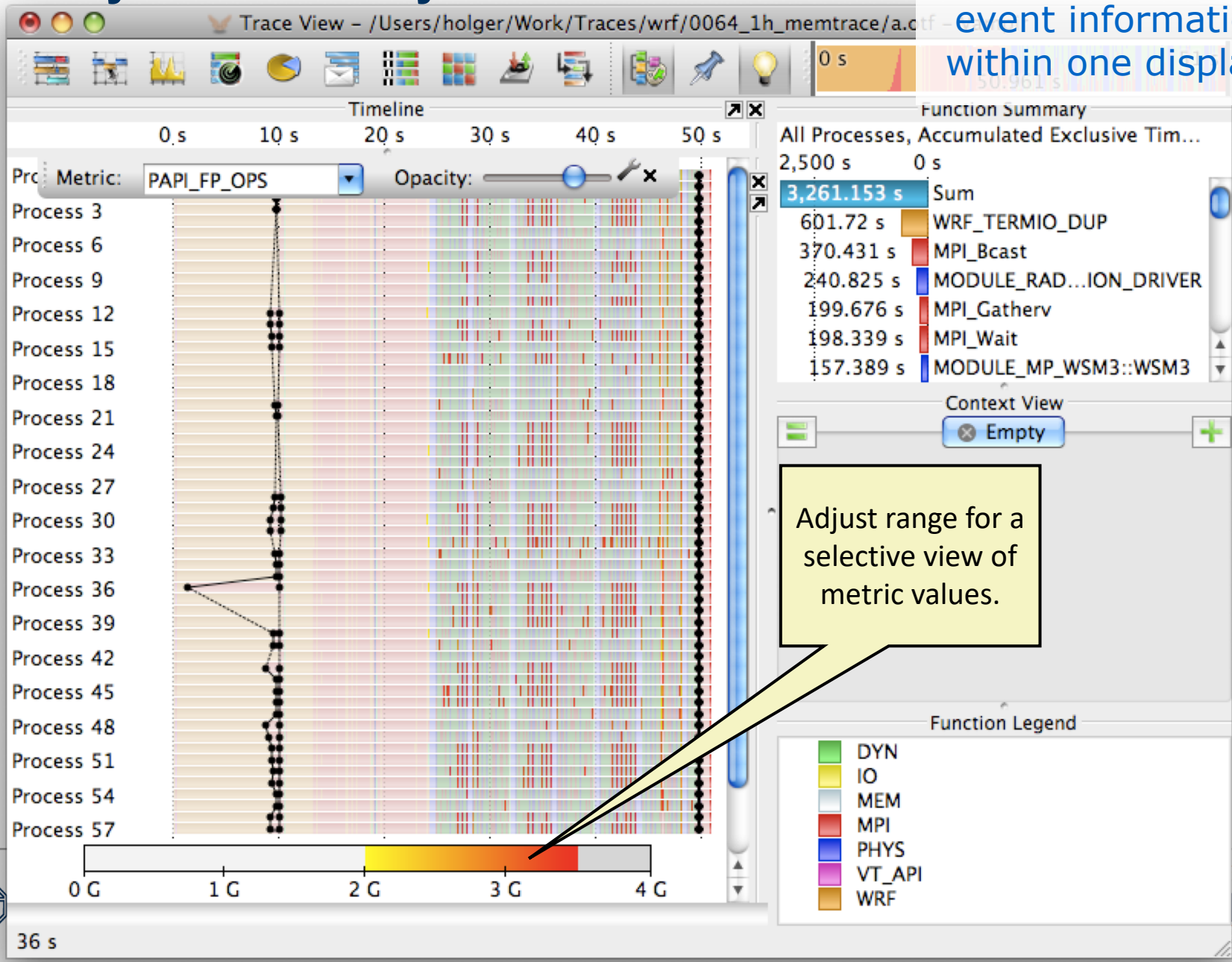


Summary

Vampir & VampirServer

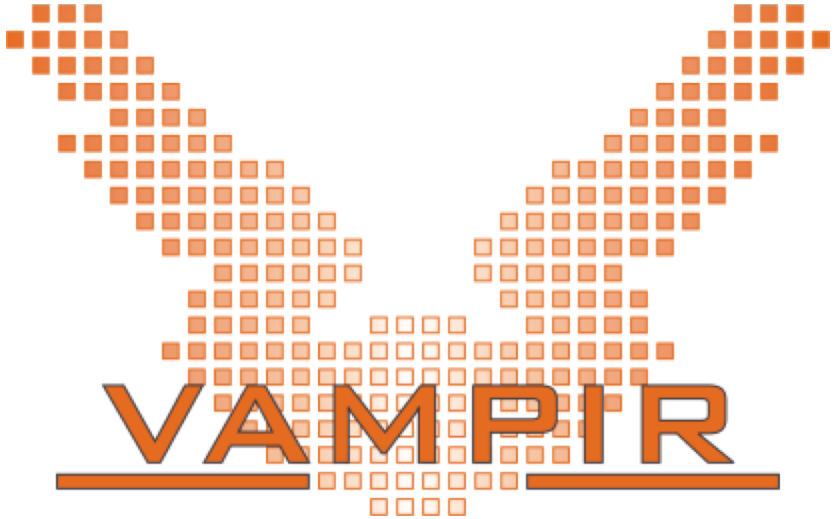
- Interactive trace visualization and analysis
- Intuitive browsing and zooming
- Scalable to large trace data sizes (20 TByte)
- Scalable to high parallelism (200000 processes)

Vampir is available for Linux, Windows, and macOS

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.

Conclusion

- Performance analysis very important in HPC
- Use performance analysis tools for profiling and tracing
- Use tracing tools with some precautions
  - Overhead
  - Data volume
- Let us know about problems and about feature wishes
- mailto: service@vampir.eu



Vampir is available at http://www.vampir.eu,

get support via service@vampir.eu