

Center for Information Services and High Performance Computing (ZIH)

# Trace analysis with Vampir

NLPE@HLRS – ZIH Tools Day

21 June 2024

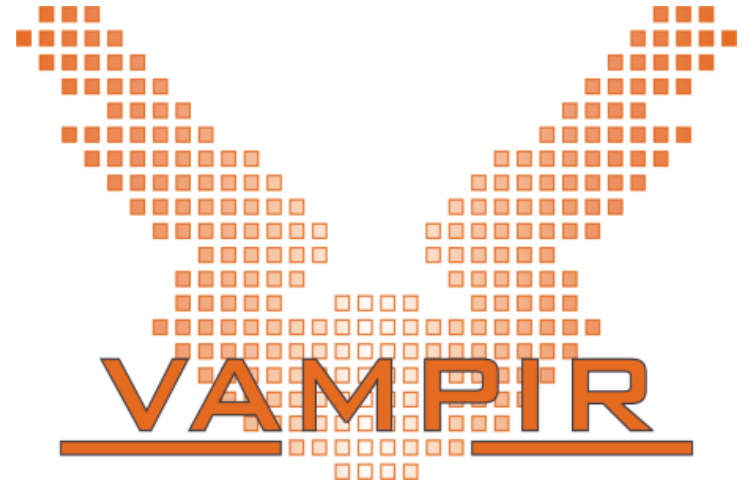
# Outline

## Part I: Welcome to the Vampir Tool Suite

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

## Part II: Vampir Demo

## Part III: Summary and Conclusion

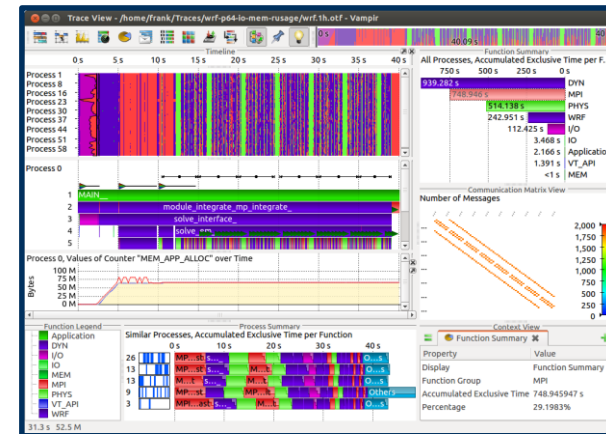


# Mission

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

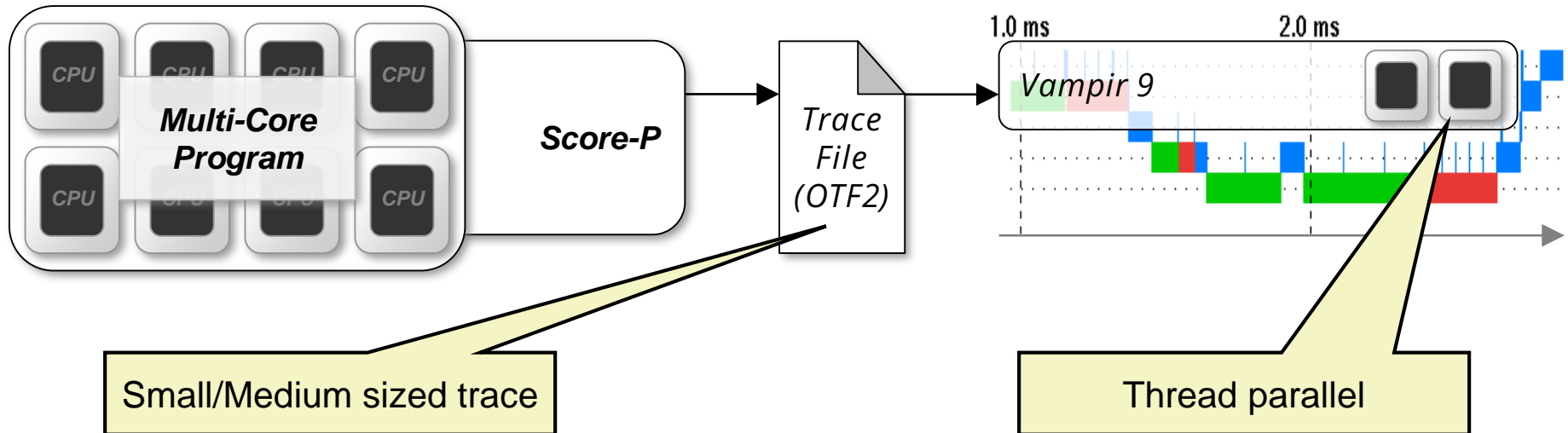
- Provide quantitative results for the currently selected time interval (e.g. Message Summary)



# Vampir – Visualization Modes (1)

- Directly on front end or local machine

```
% vampir
```

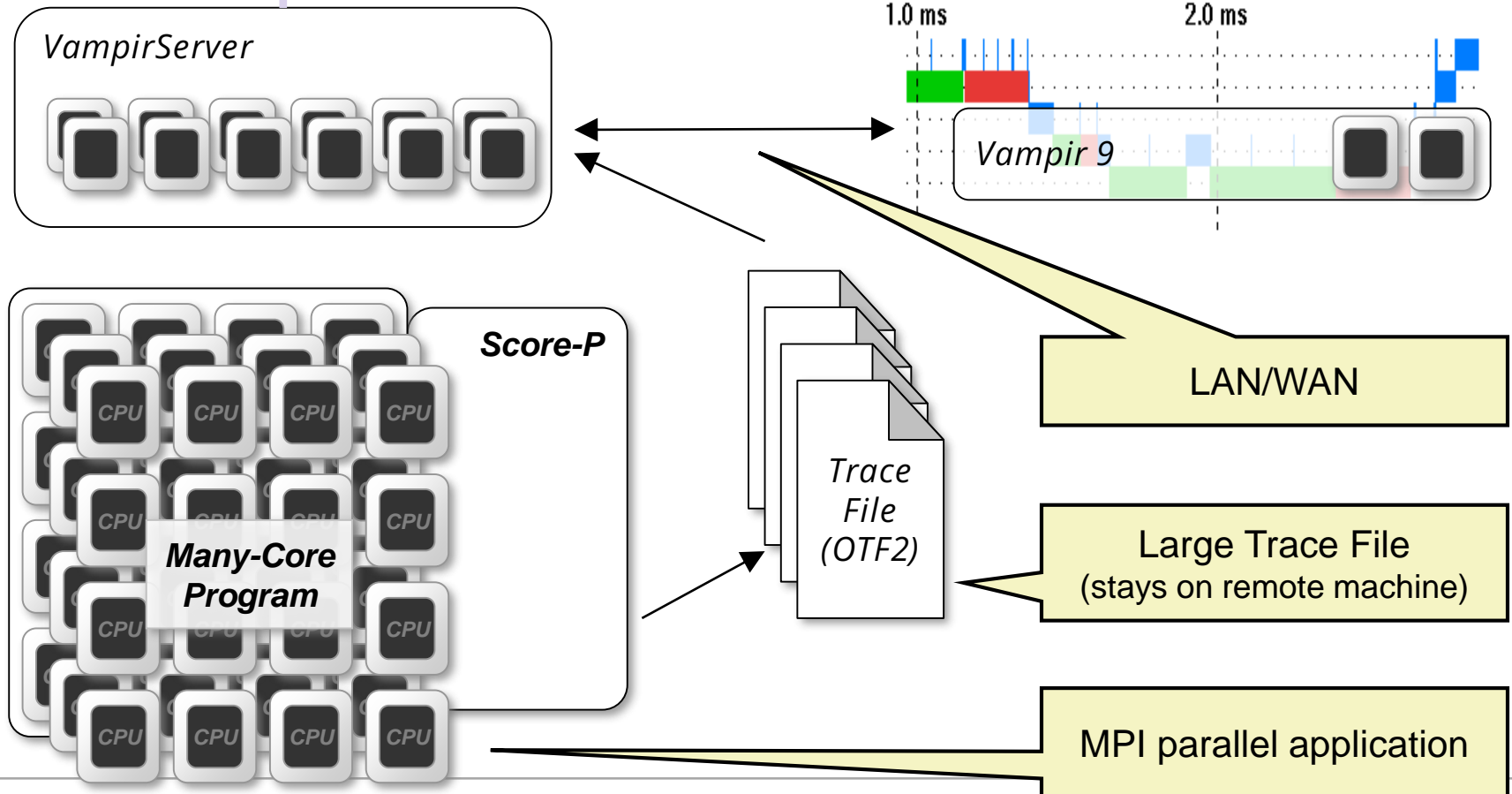


# Vampir – Visualization Modes (2)

On local machine with remote VampirServer

```
% vampirserver start -n 12
```

```
% vampir
```



# The main displays of Vampir

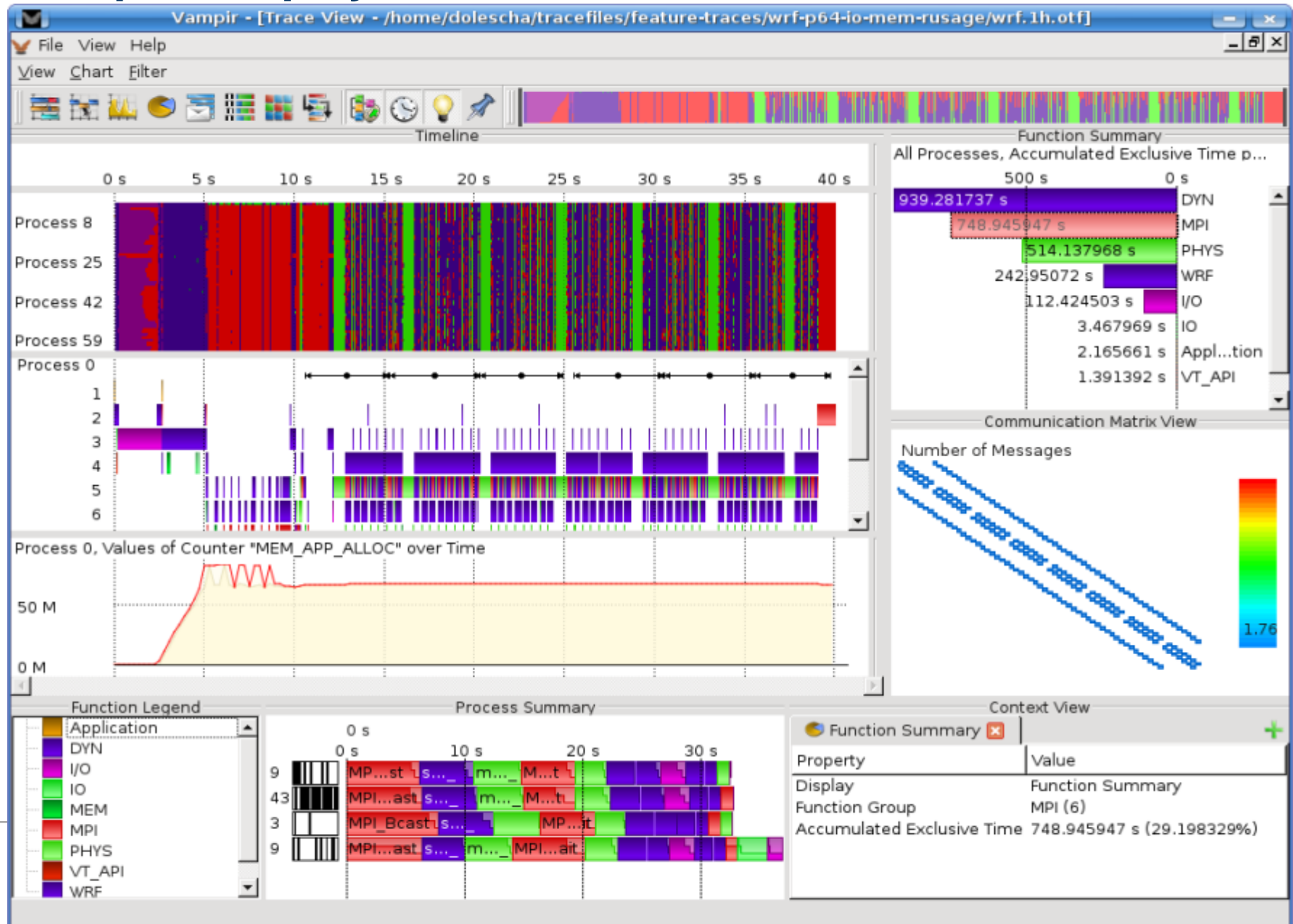
## Timeline Charts:

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

## Summary Charts:

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

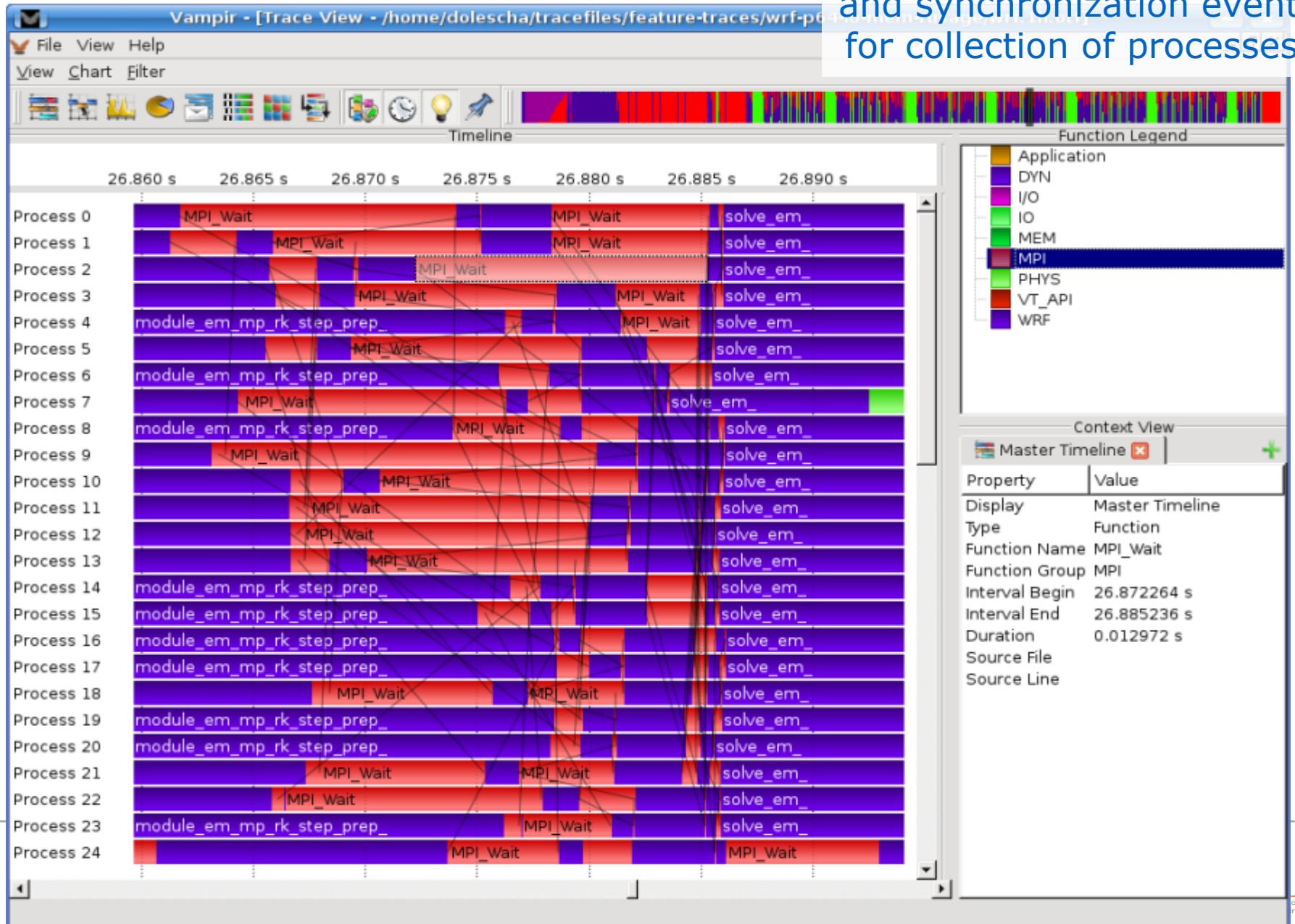
# Vampir: Displays for a WRF Trace with 64 Processes





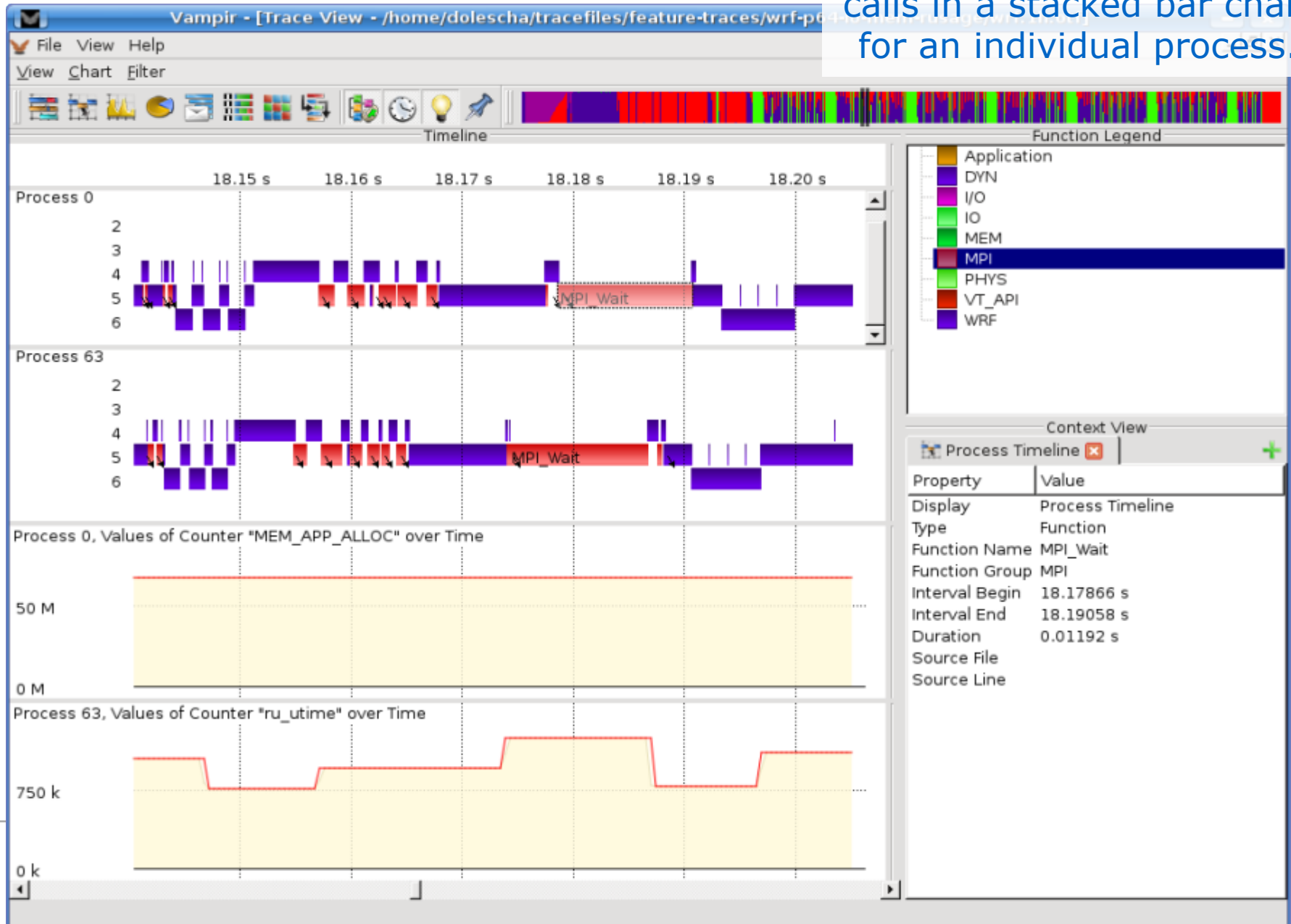
# Master Timeline

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



# Process and Counter Timeline

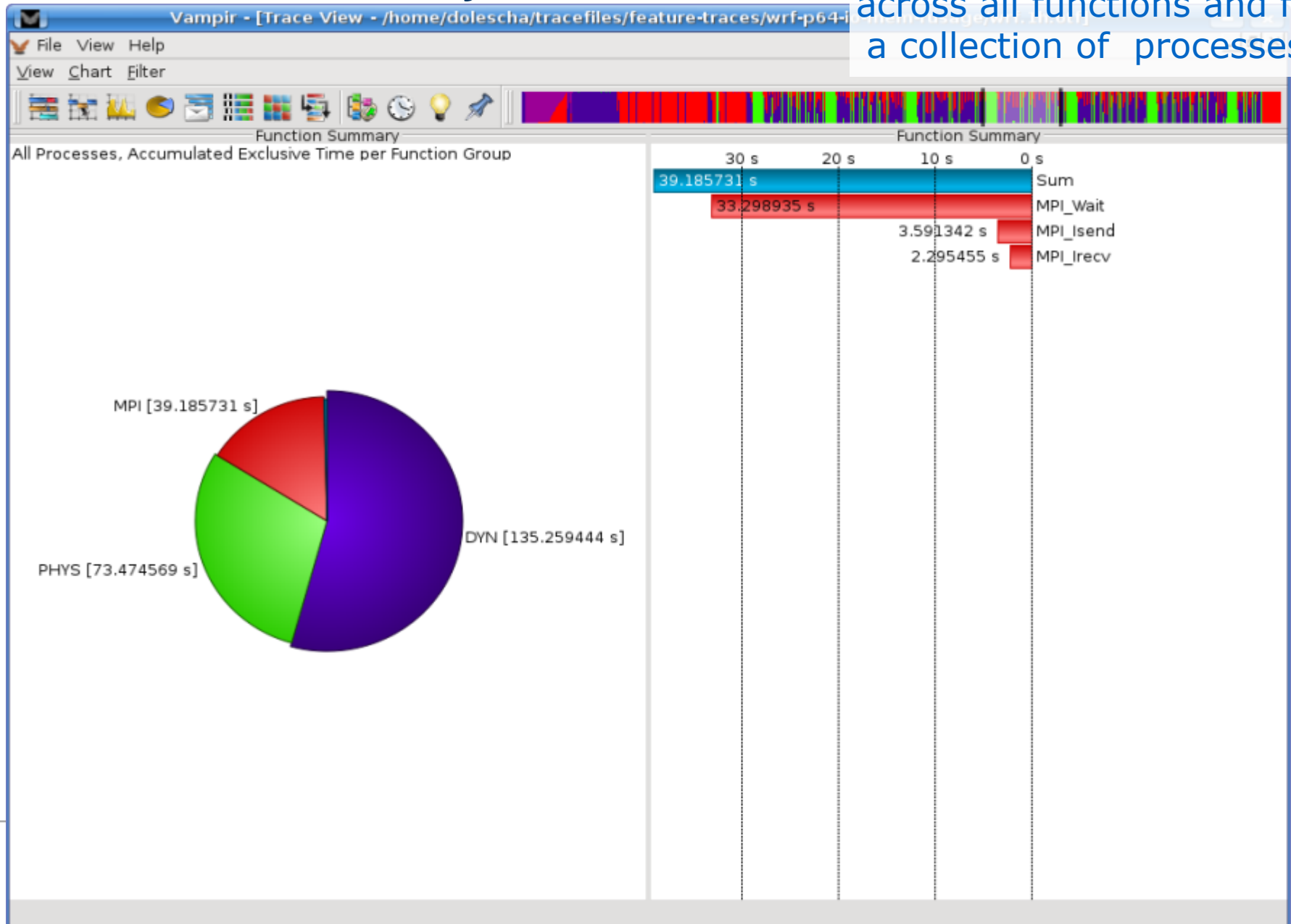
Detailed information about different levels of function calls in a stacked bar chart for an individual process.





# Function Summary

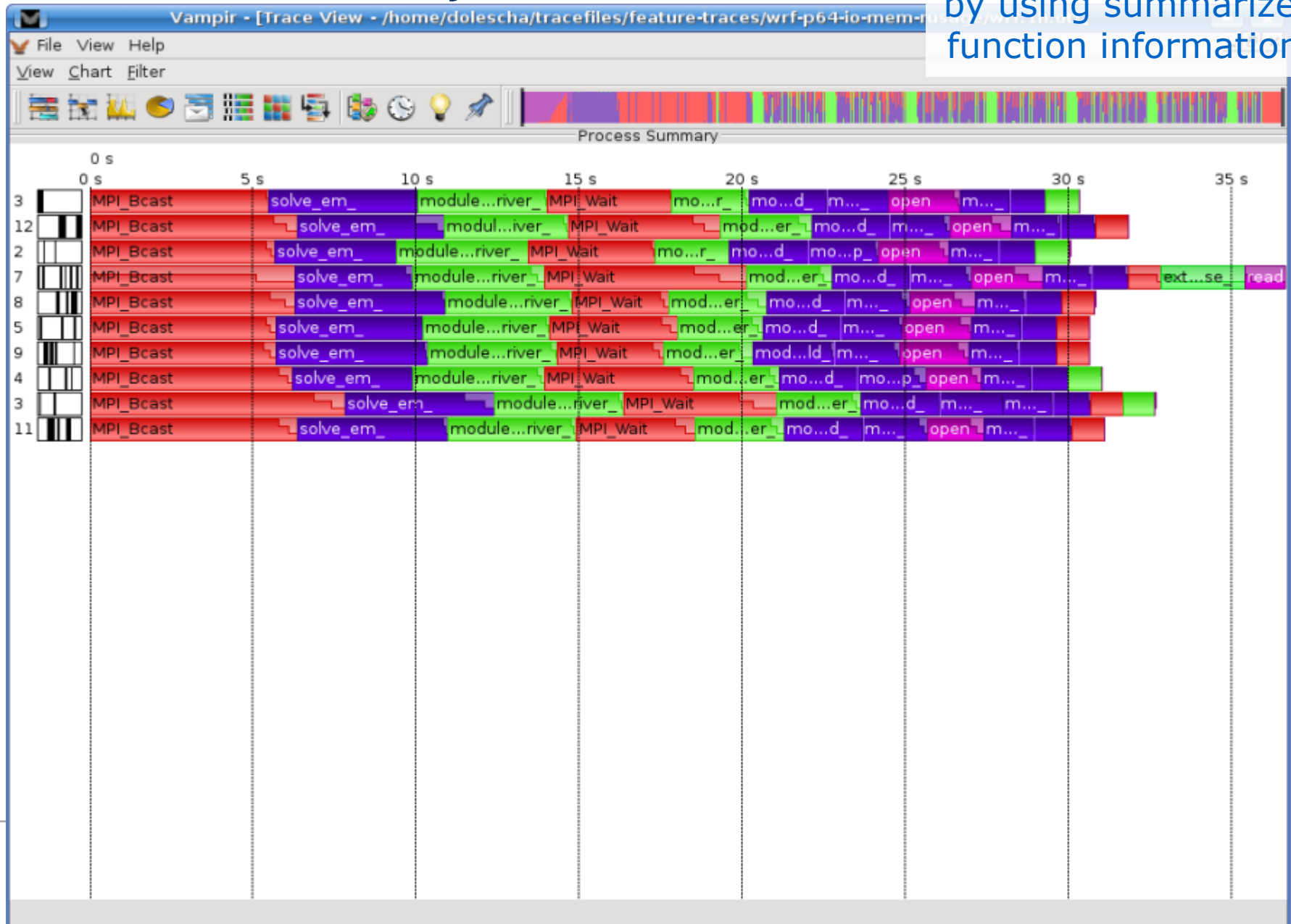
Overview of the accumulated information across all functions and for a collection of processes.





# Process Summary

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

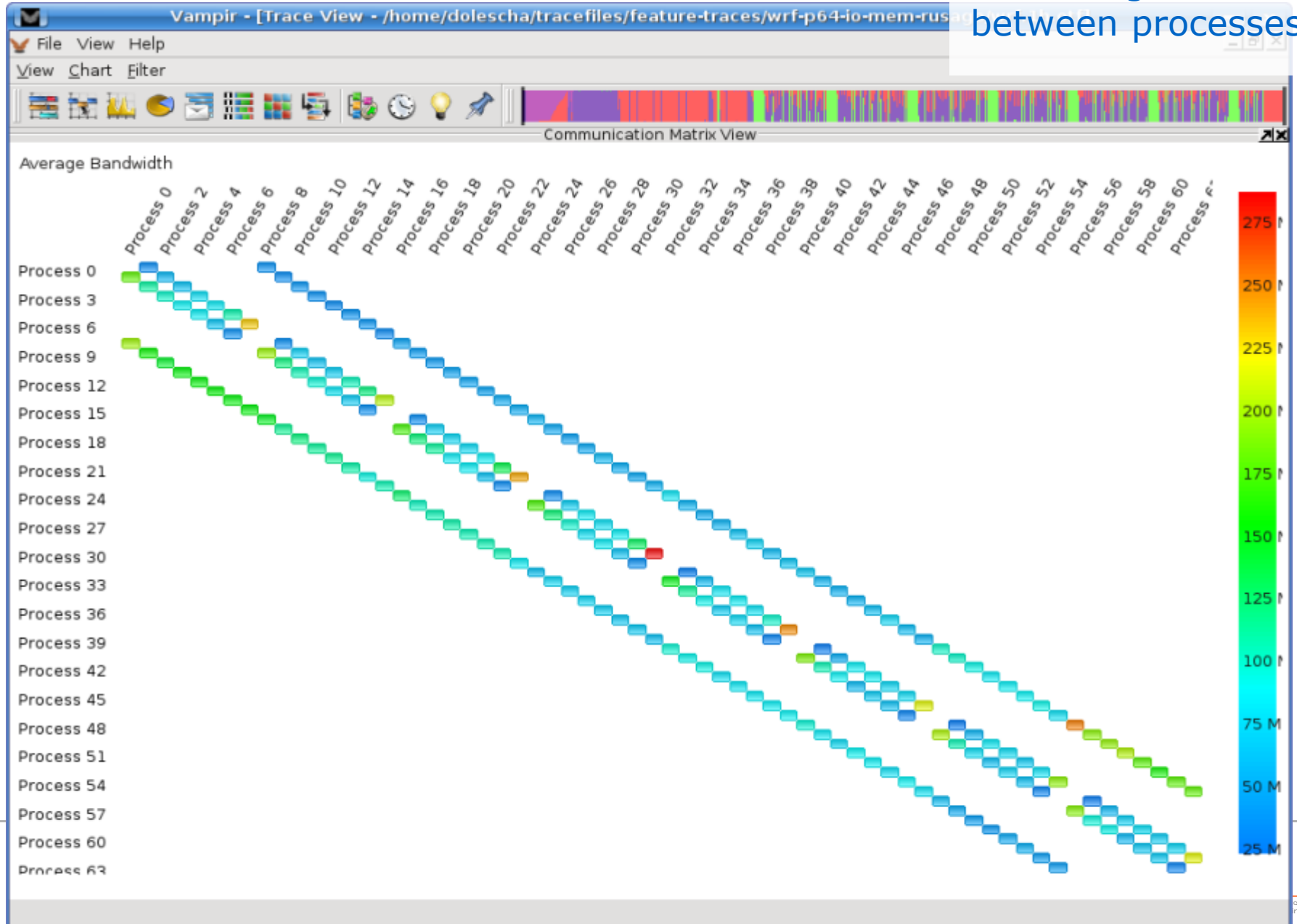






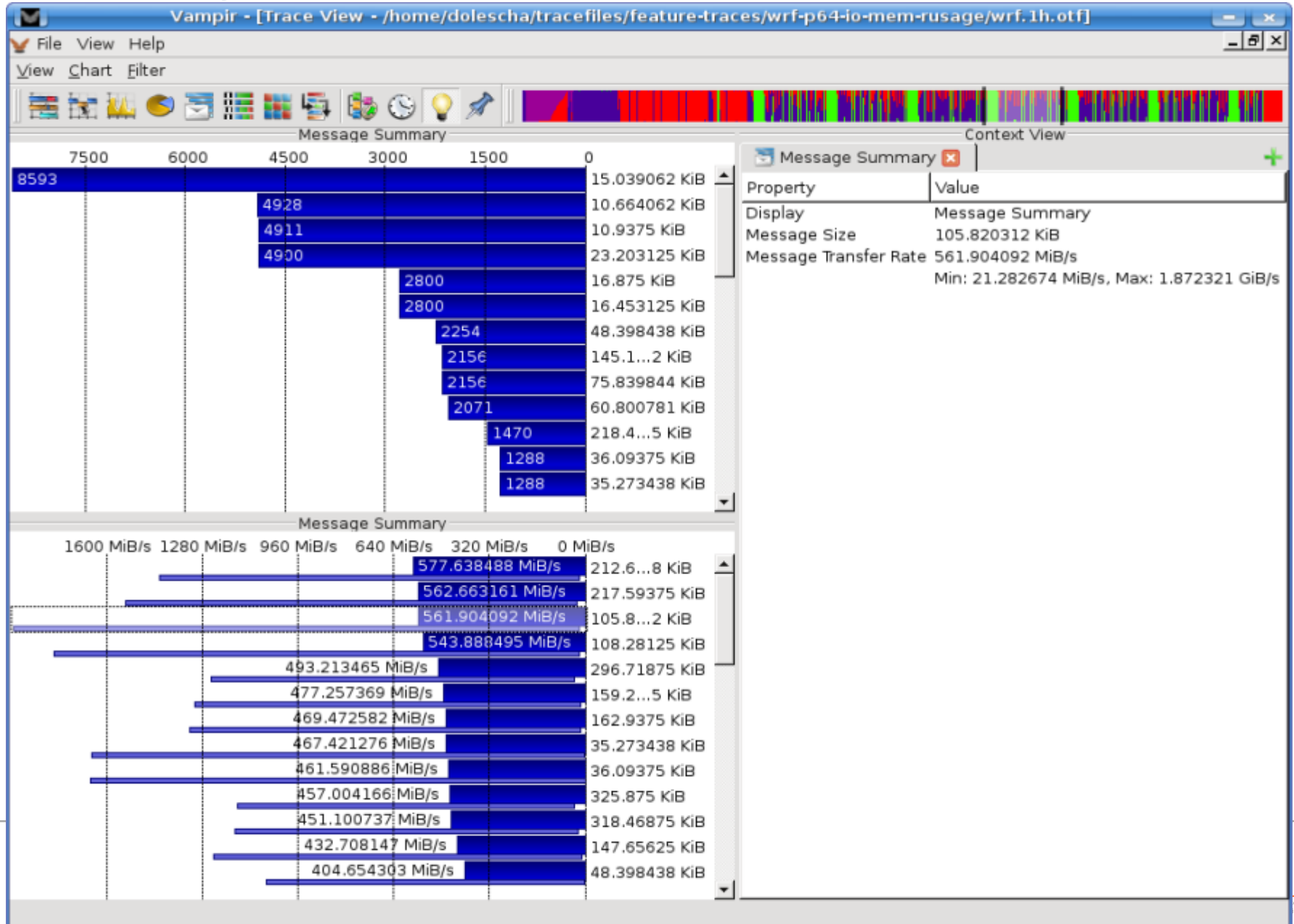
# Communication Matrix

Information about  
messages sent  
between processes.



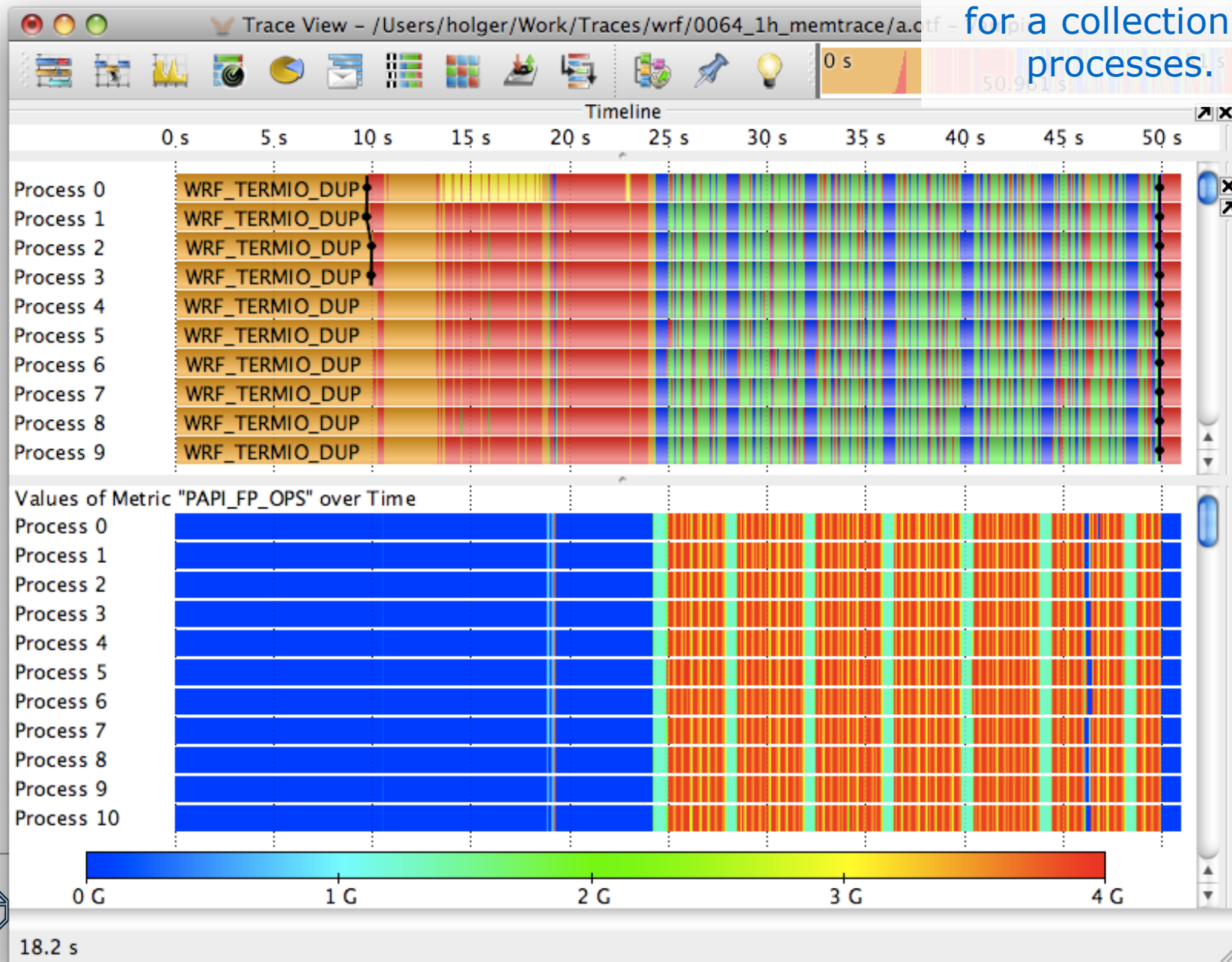


# Message Summary



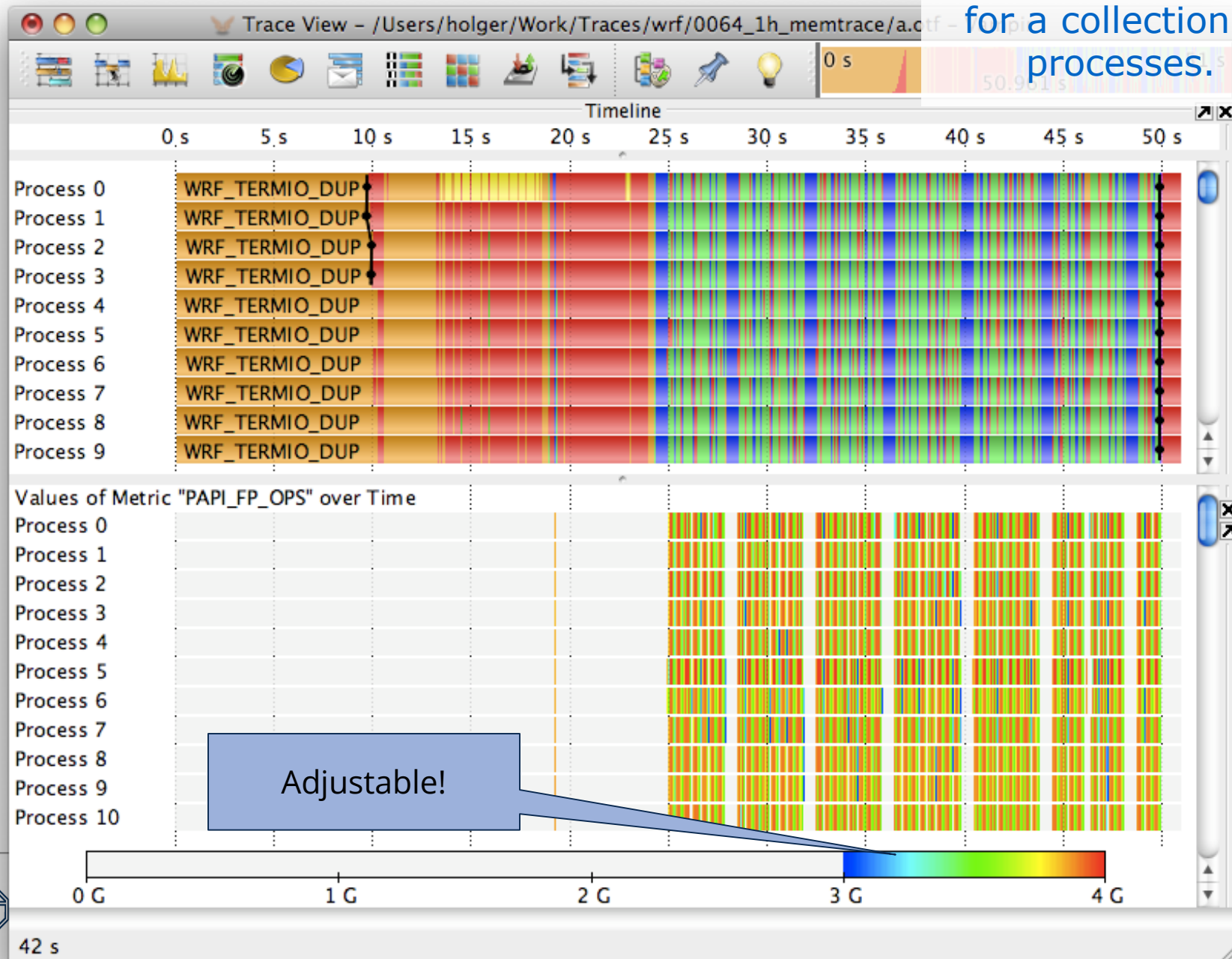
# Performance Radar

Detailed counter information over time for a collection of processes.



# Performance Radar

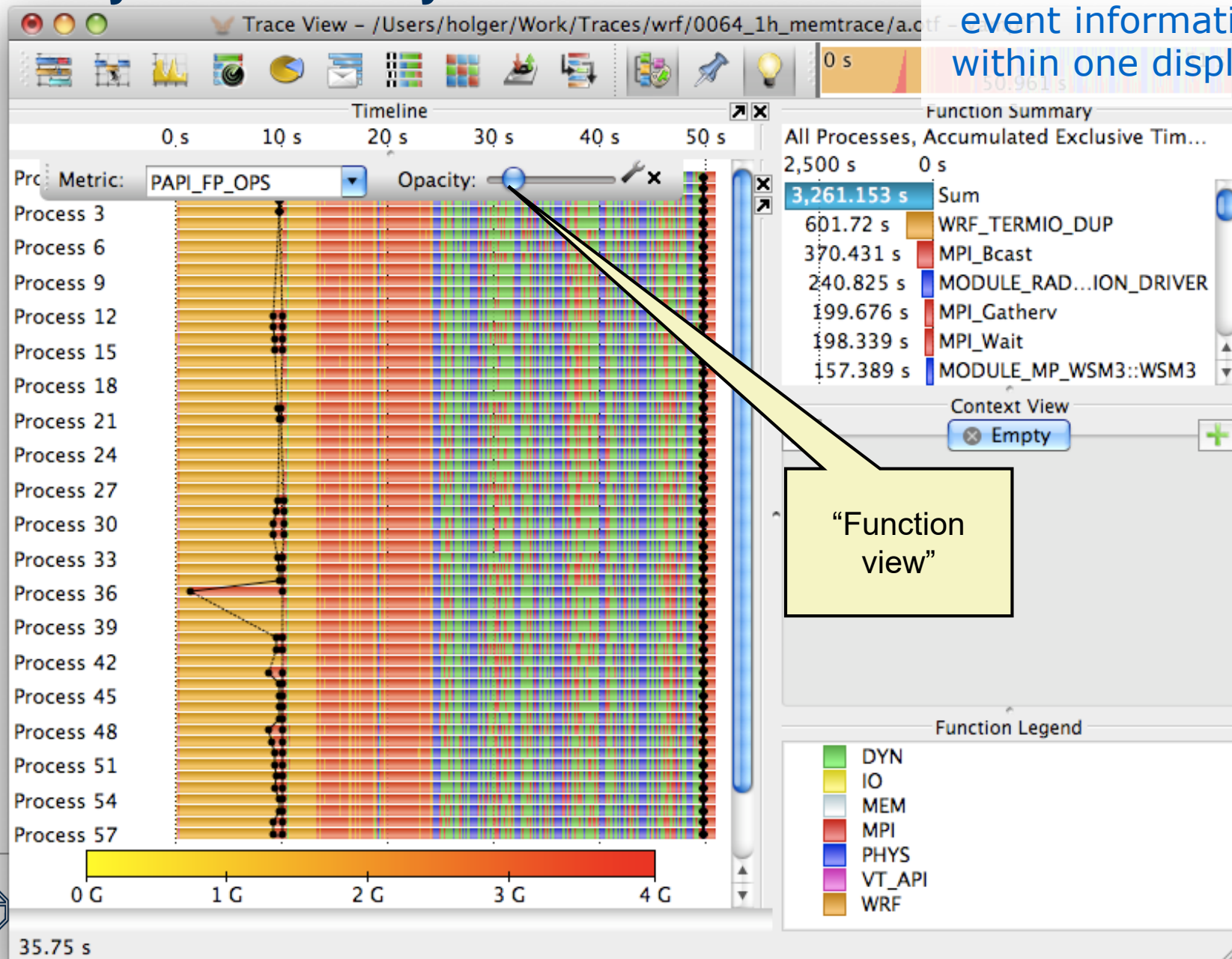
Detailed counter information over time for a collection of processes.





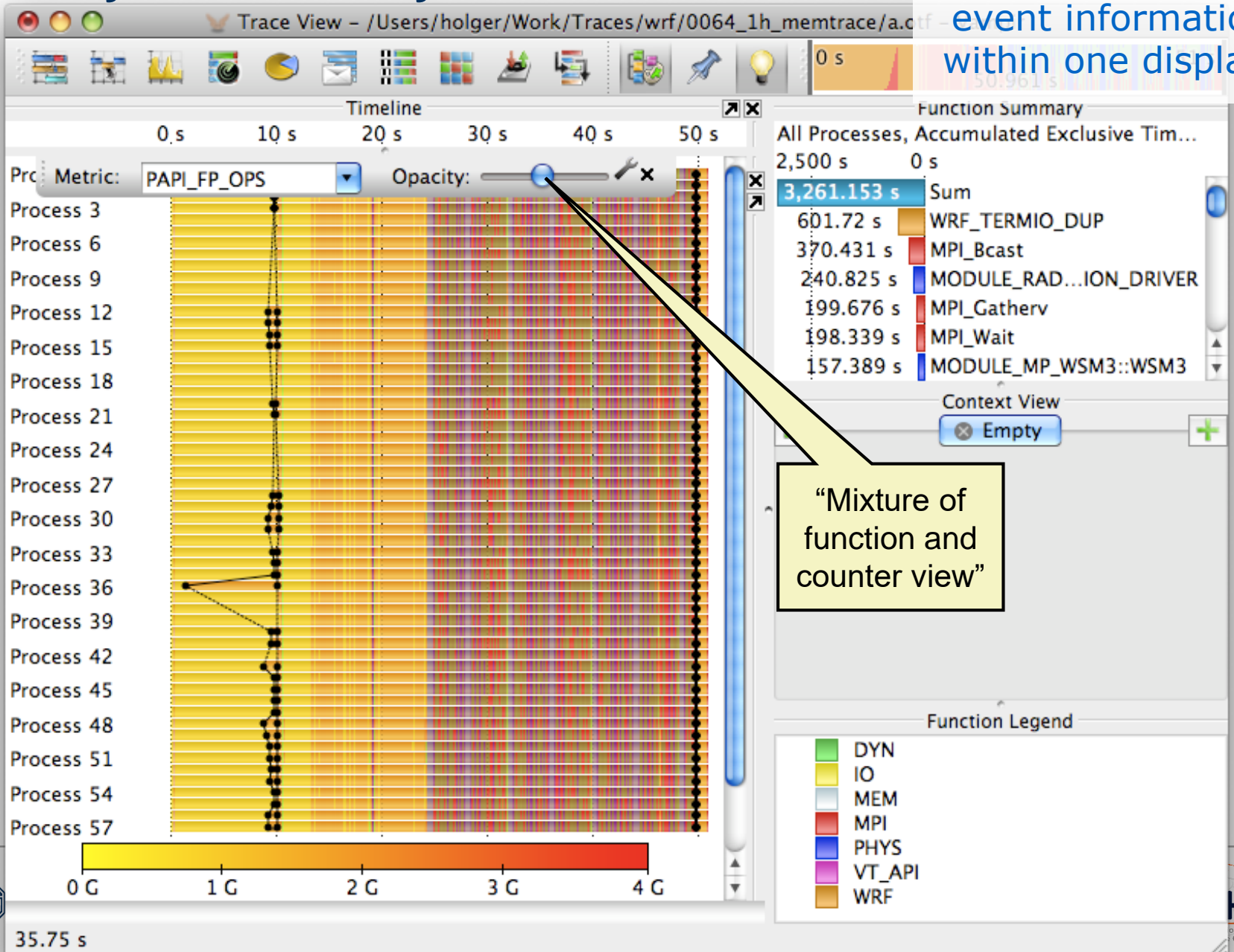
# Overlay Functionality of Master Timeline

Correlate counter information with event information within one display.



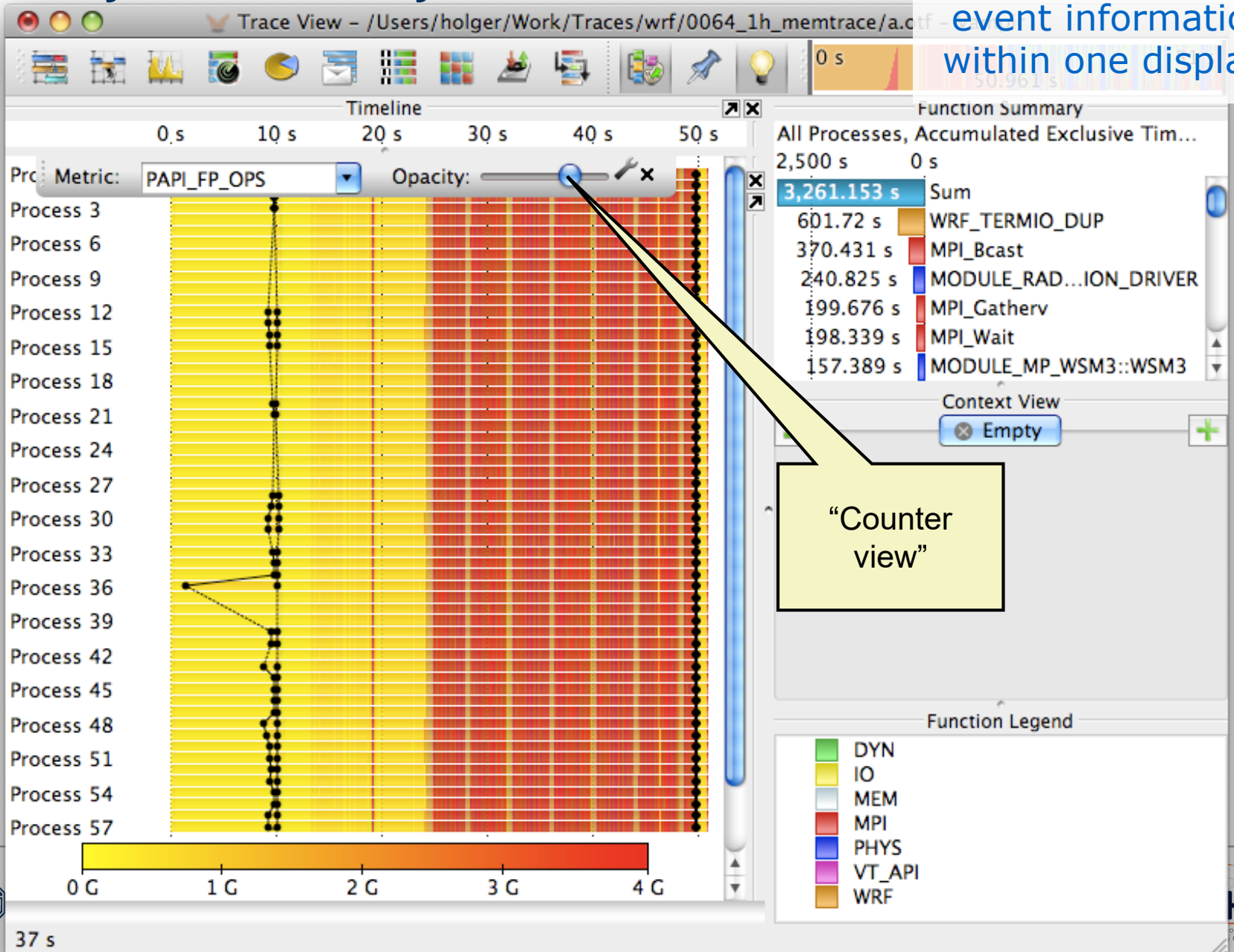
# Overlay Functionality of Master Timeline

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# Overlay Functionality of Master Timeline

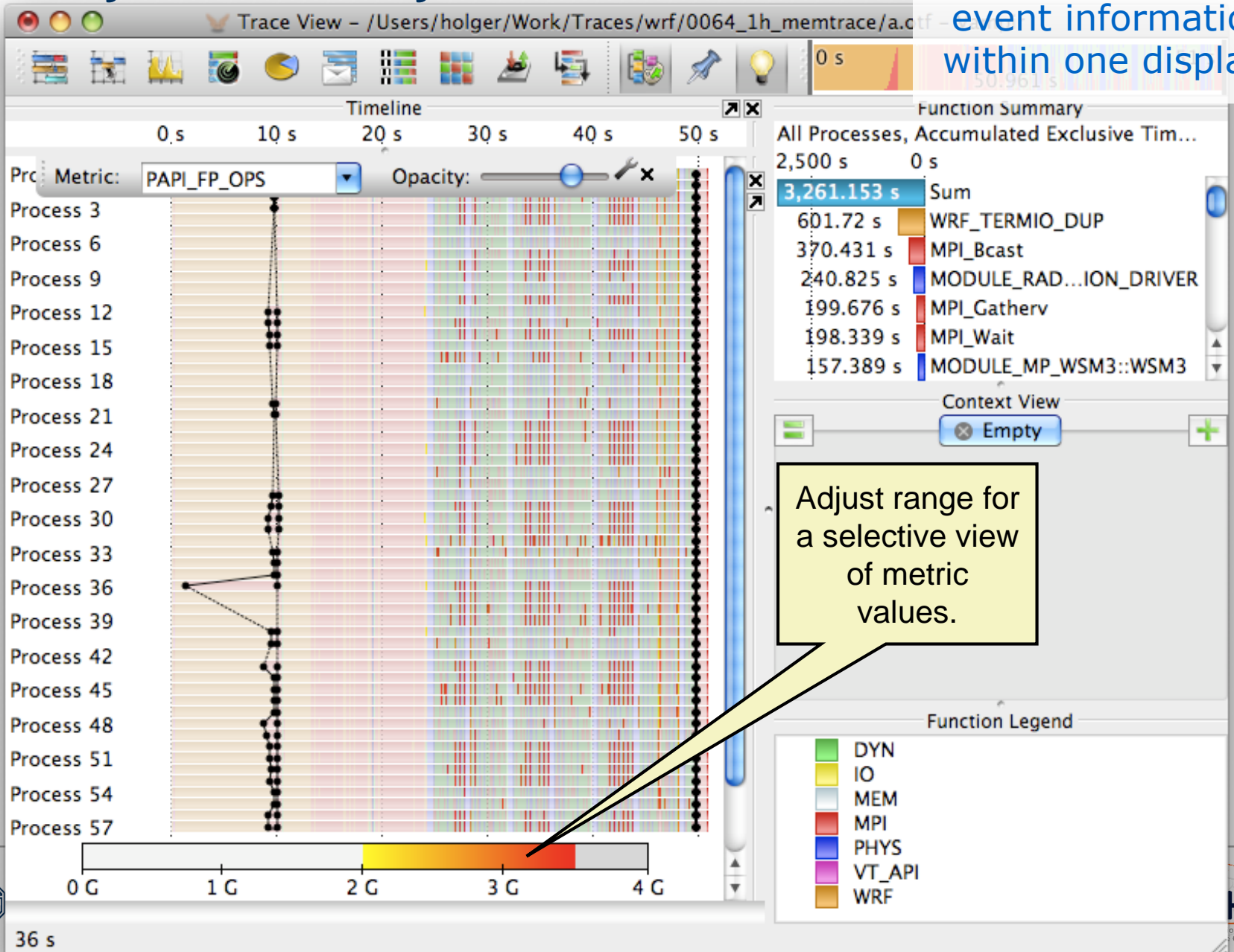
Correlate counter information with event information within one display.





# Overlay Functionality of Master Timeline

Correlate counter information with event information within one display.





# Summary

## Vampir & VampirServer

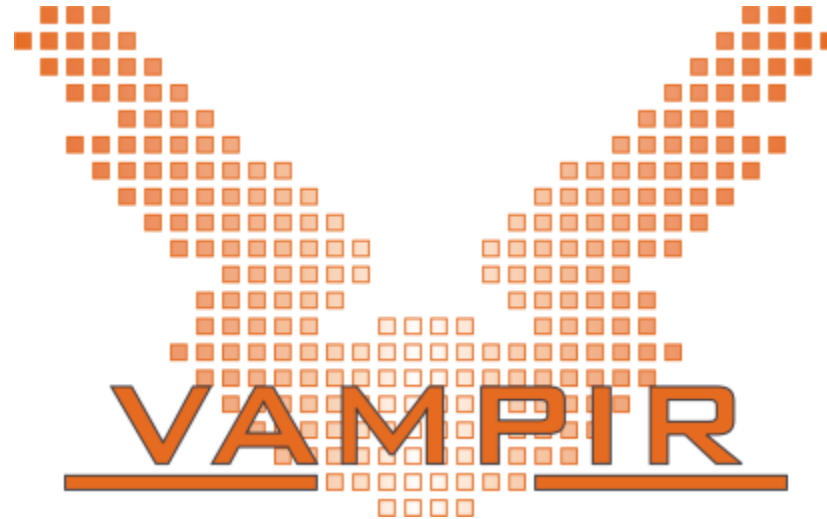
- Interactive trace visualization and analysis
- Intuitive browsing and zooming
- Scalable to large trace data sizes (20 TByte)
- Scalable to high parallelism (200000 processes)

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: vampirsupport@zih.tu-dresden.de](mailto:vampirsupport@zih.tu-dresden.de)



Vampir is available at <https://www.vampir.eu>,  
get support via [service@vampir.eu](mailto:service@vampir.eu)