Center for Information Services and High Performance Computing (ZIH)

# Trace Analysis with Vampir

PoP CoE - Online

May 17-19, 2022
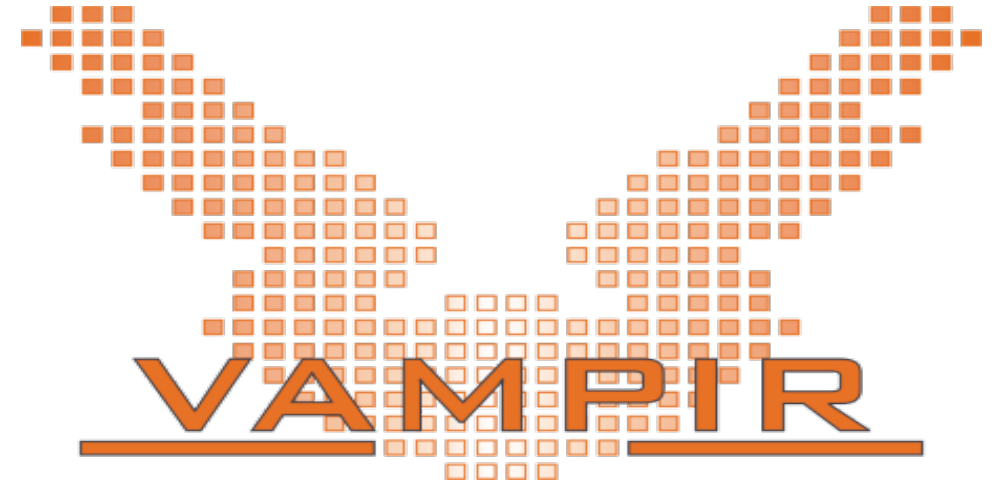
# Outline

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 an example

— Summary and Conclusion

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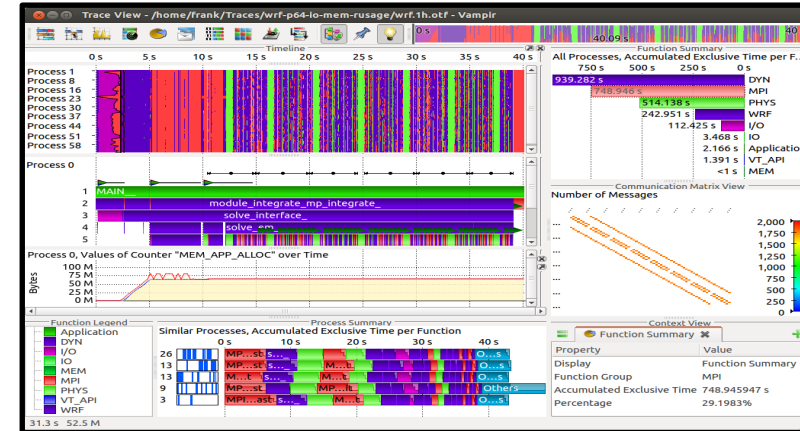High Performance Computing

# 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
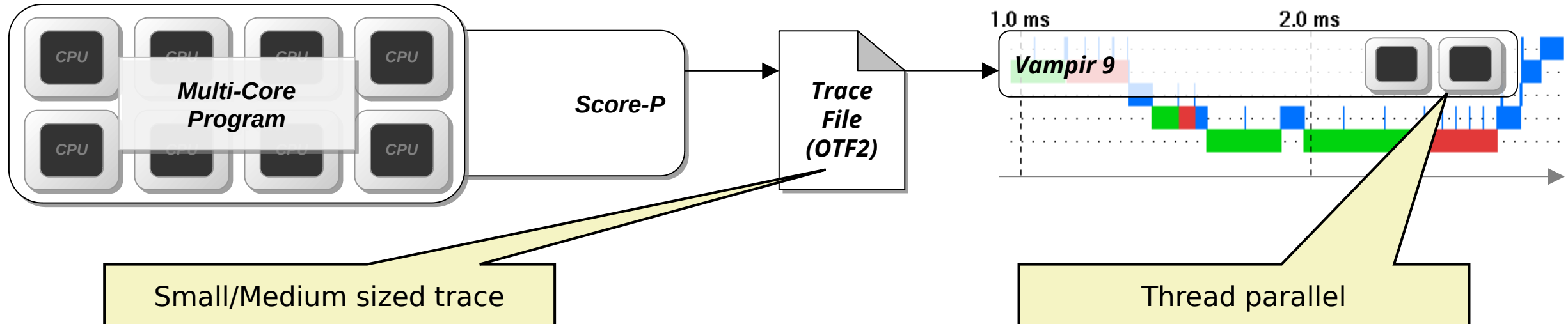
— Process timeline  focusing on a single process/thread

Summary charts

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

# Vampir – Visualization Modes (1)

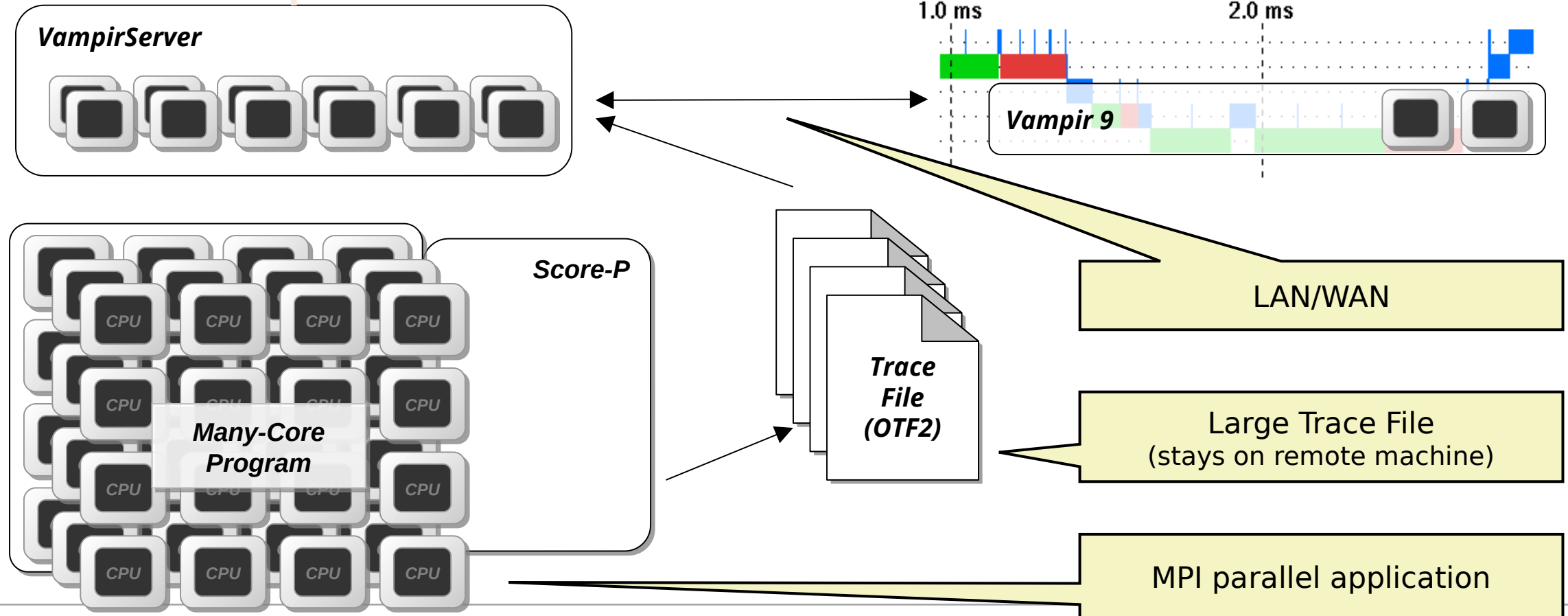- Directly on front end or local machine

```
% vampir
```



Small/Medium sized trace

Thread parallel

# Vampir – Visualization Modes (2)

## On local machine with remote VampirServer

```
% vampirserver start –n 12
```

```
% vampir
```

**VampirServer**

**Score-P**

**Many-Core Program**

CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU CPU

**Trace File (OTF2)**

1.0 ms    2.0 ms

*Vampir 9*

LAN/WAN

Large Trace File
(stays on remote machine)

MPI parallel application

# Usage of the Vampir Performance Analysis Toolset

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

      3. Start VampirServer on your HPC system

      4. Start your local Vampir

      5. Connect local Vampir with the VampirServer on the HPC system

      6. Load trace file from the HPC file system

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# The main displays of Vampir

Timeline Charts:
— Master Timeline
— Process Timeline
— Counter Data Timeline
— Performance Radar

Summary Charts:
— Function Summary
— Message Summary
— Process Summary
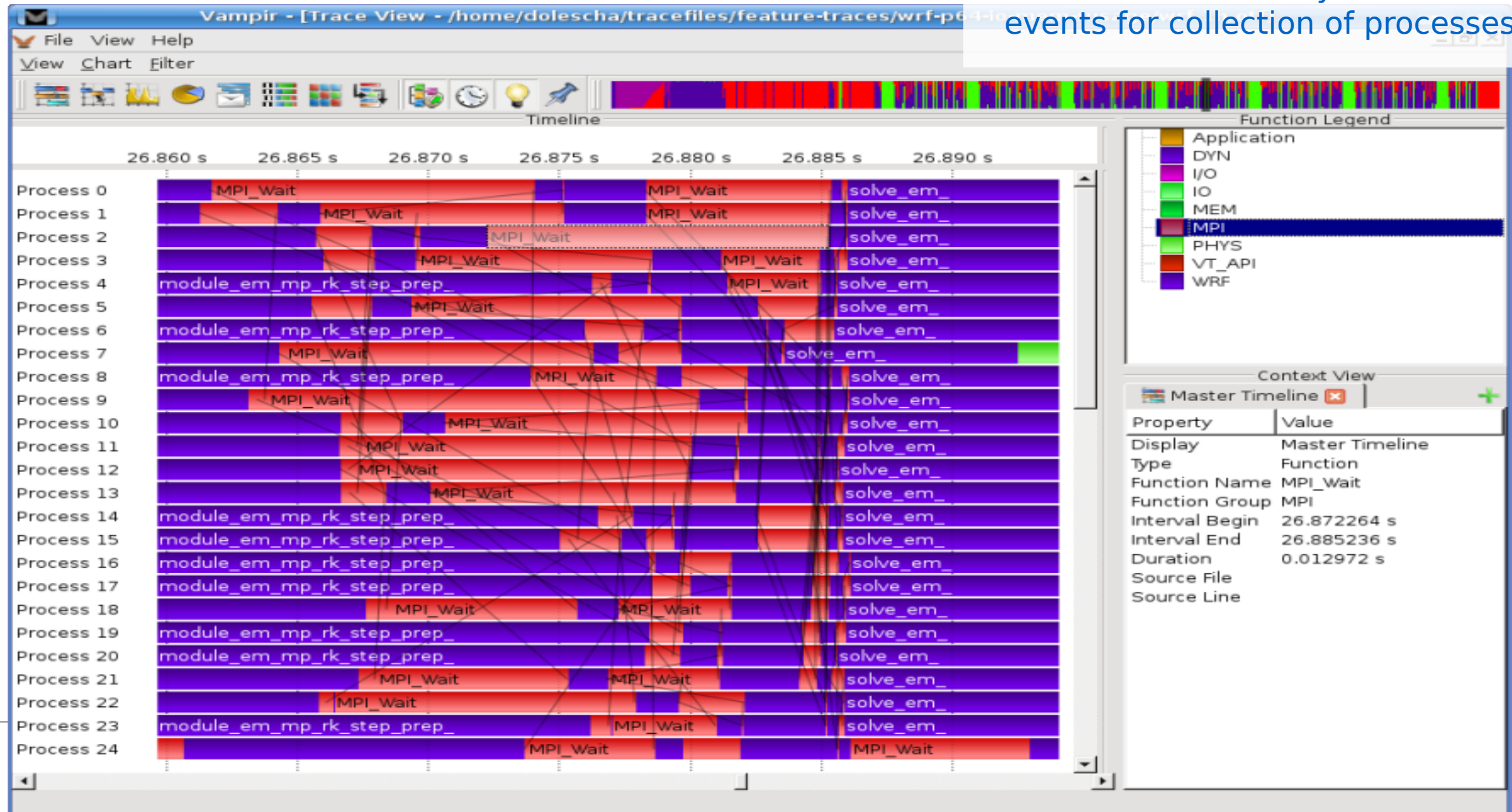— Communication Matrix View

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# Vampir:  Displays for a WRF Trace with 64 Processes
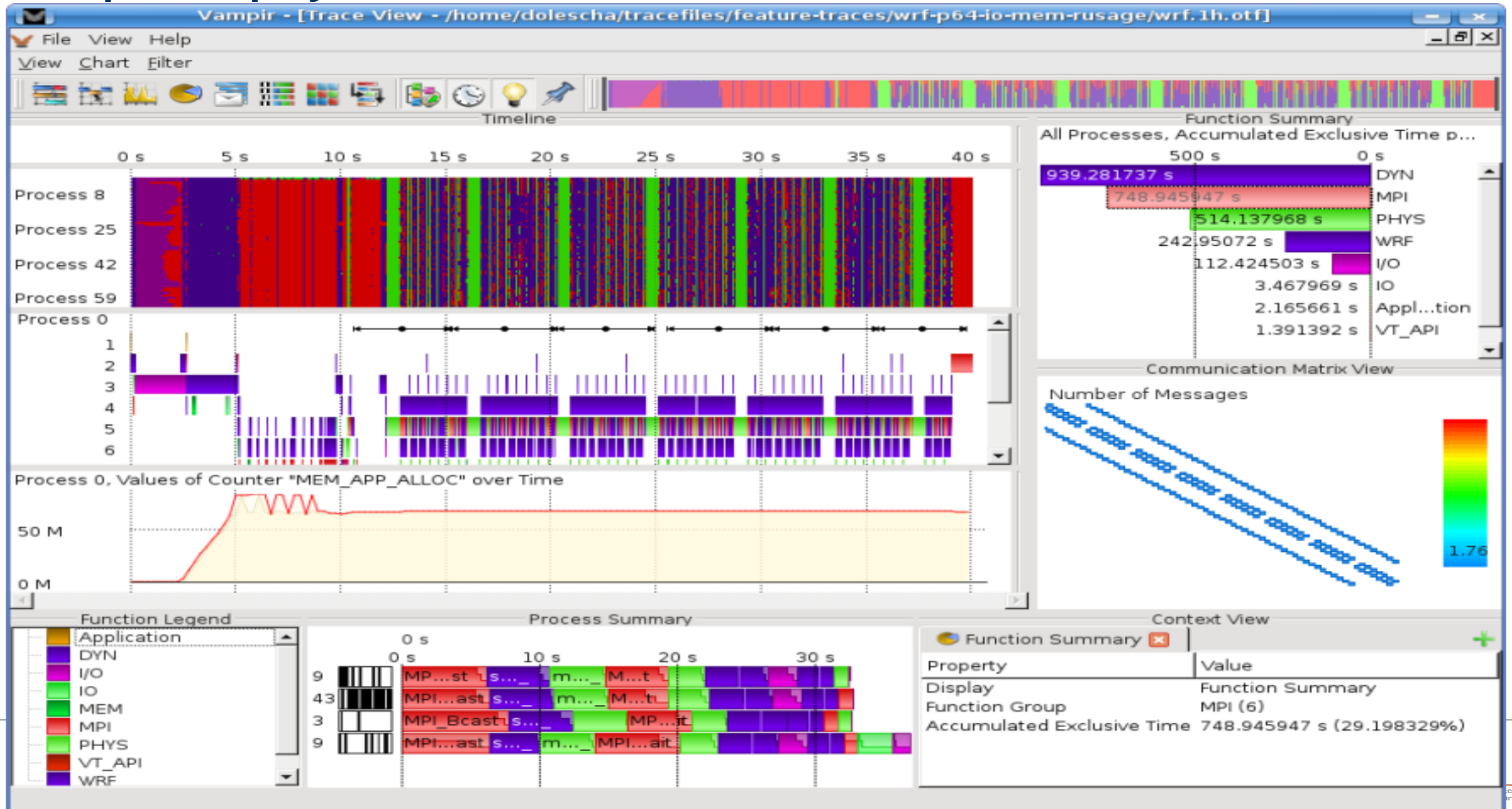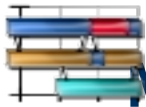
# Master Timeline



Detailed information about functions, communication and synchronization events for collection of processes.
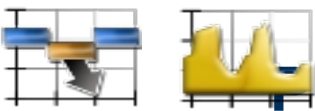
# Process and Counter Timeline

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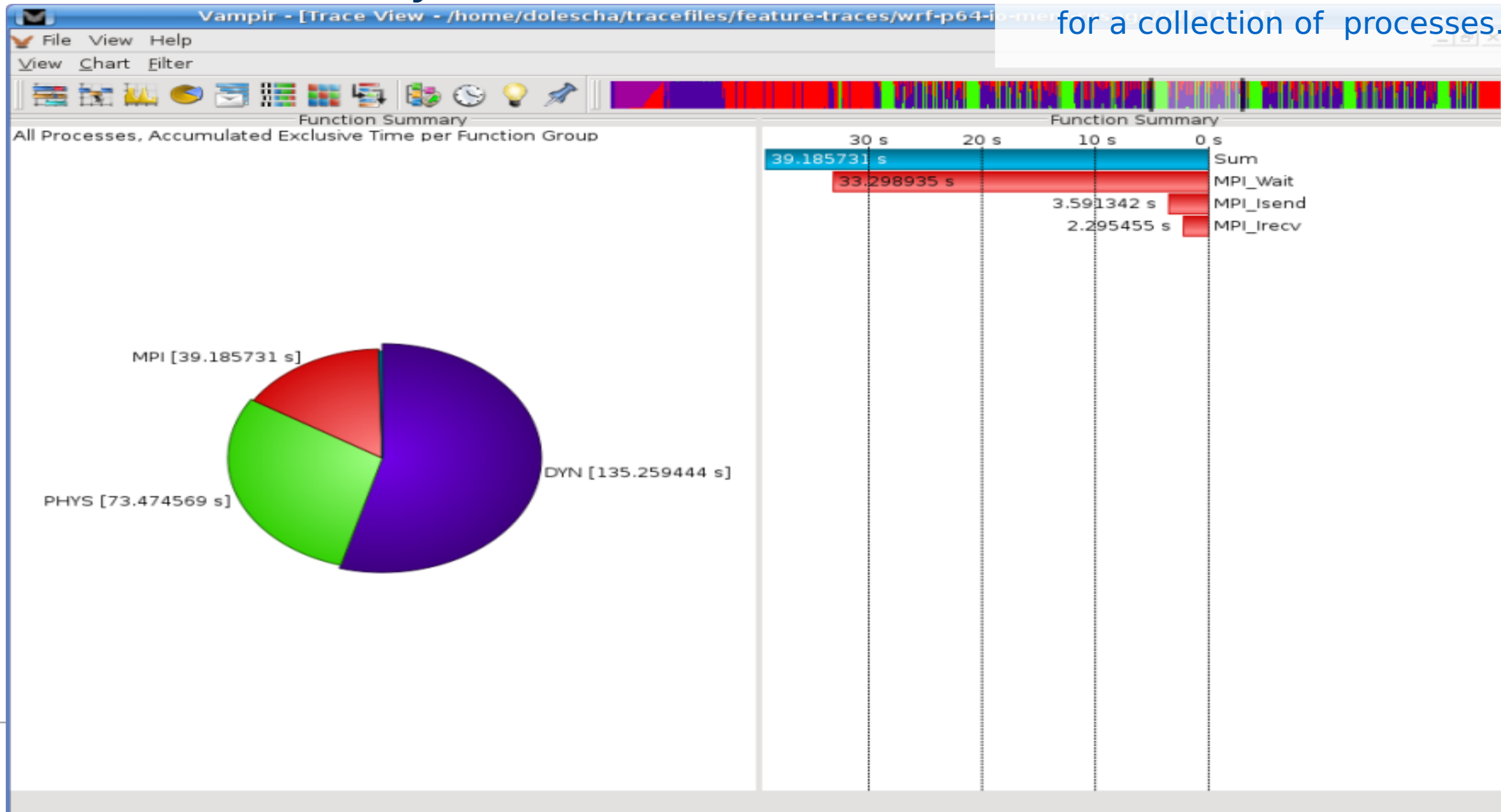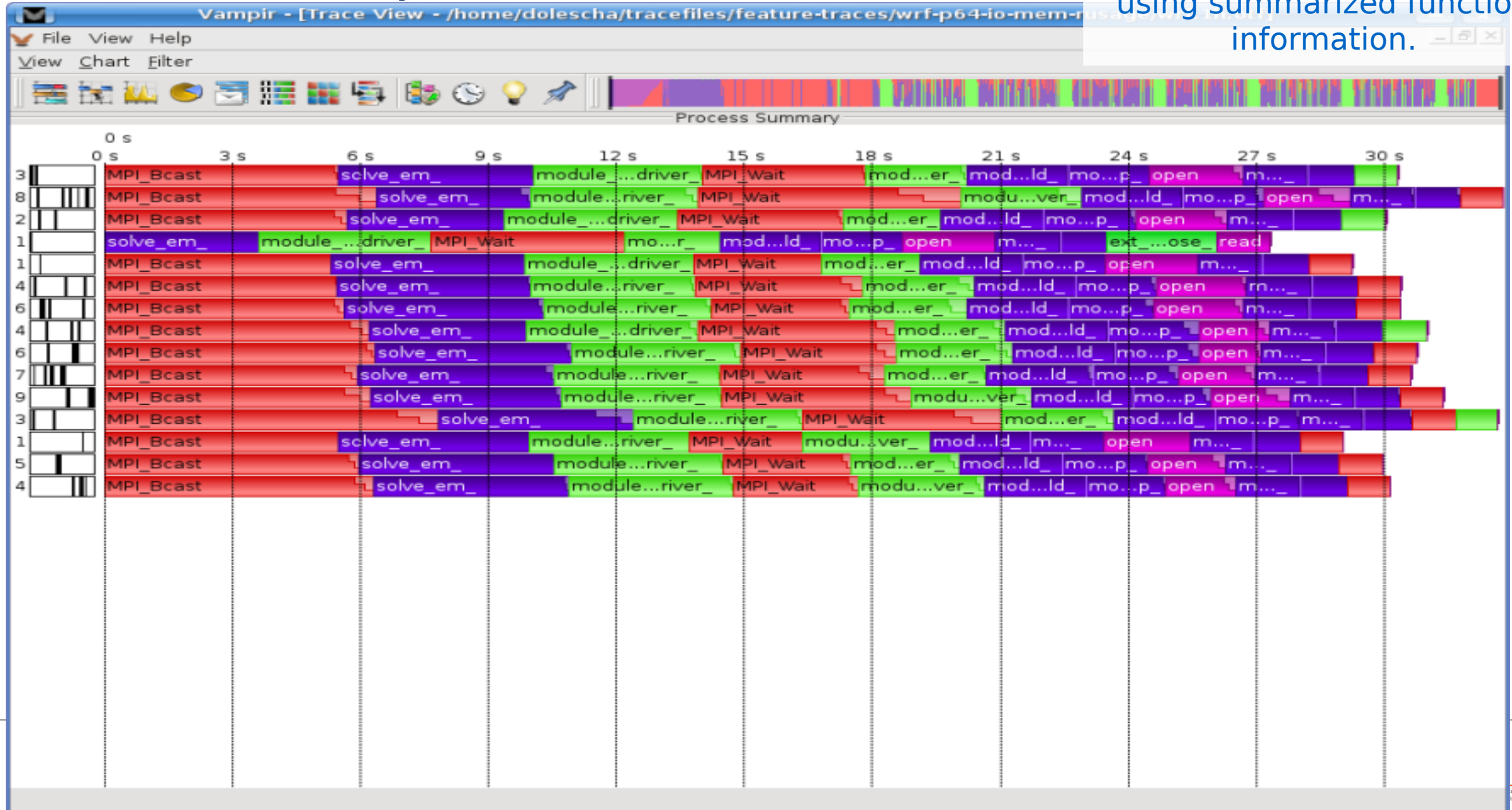
# Function Summary

# Process Summary



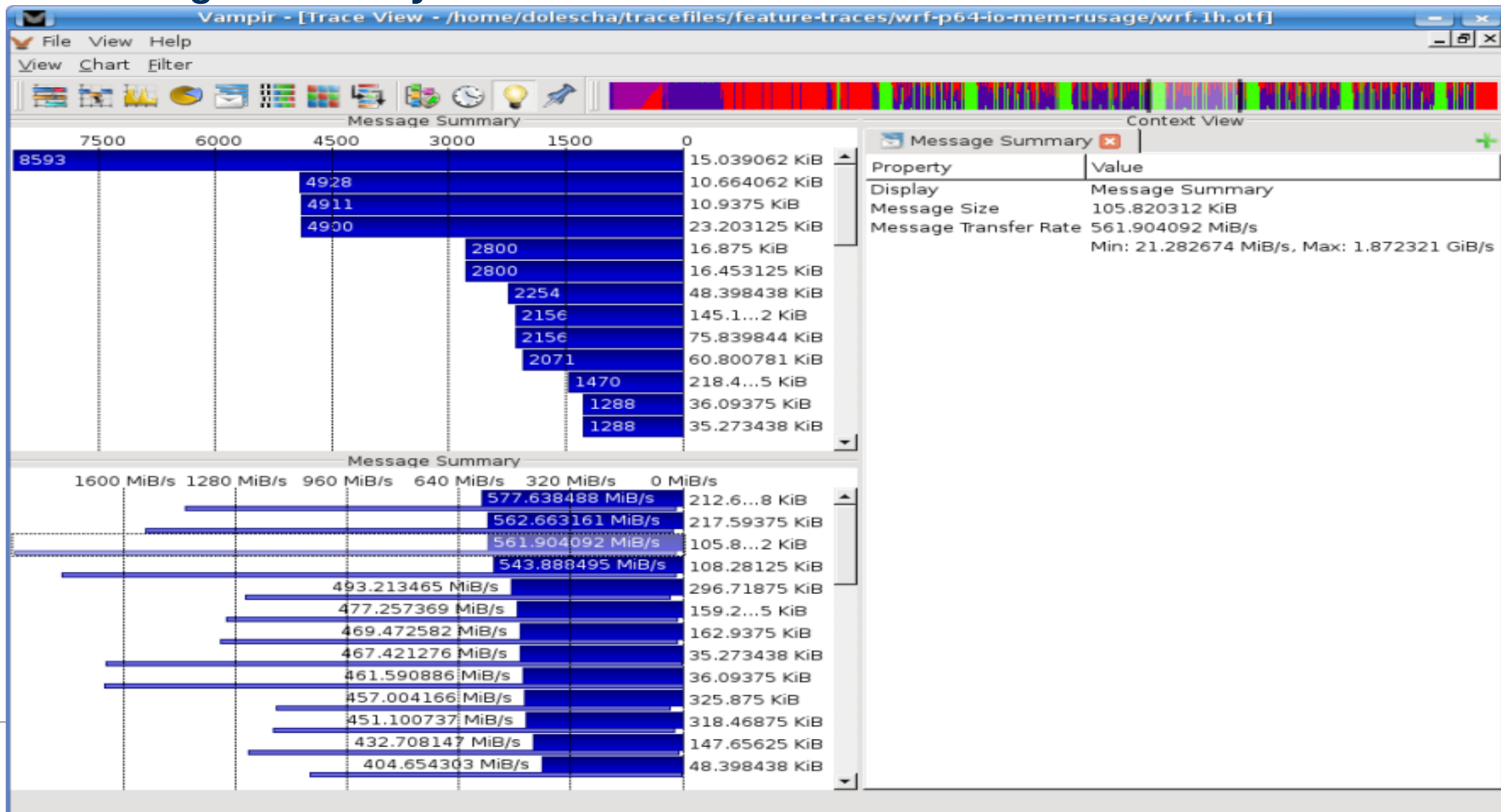Find groups of similar processes and threads by using summarized function information.

# Communication Matrix
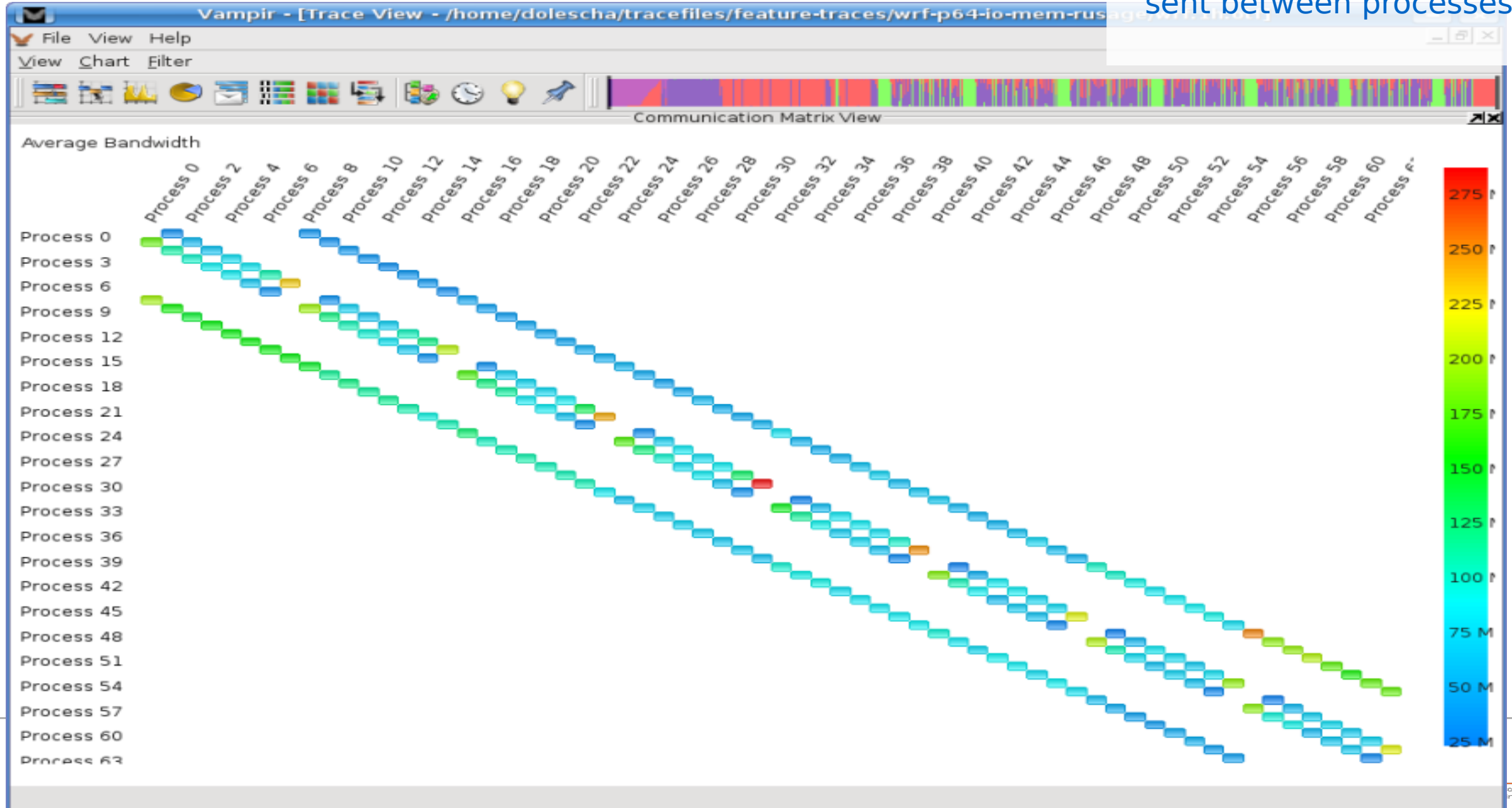
# Message Summary

# Performance Radar

# Performance Radar

Adjustable!

# Overlay Functionality of Master Timeline

Correlate counter information with event information within one display.
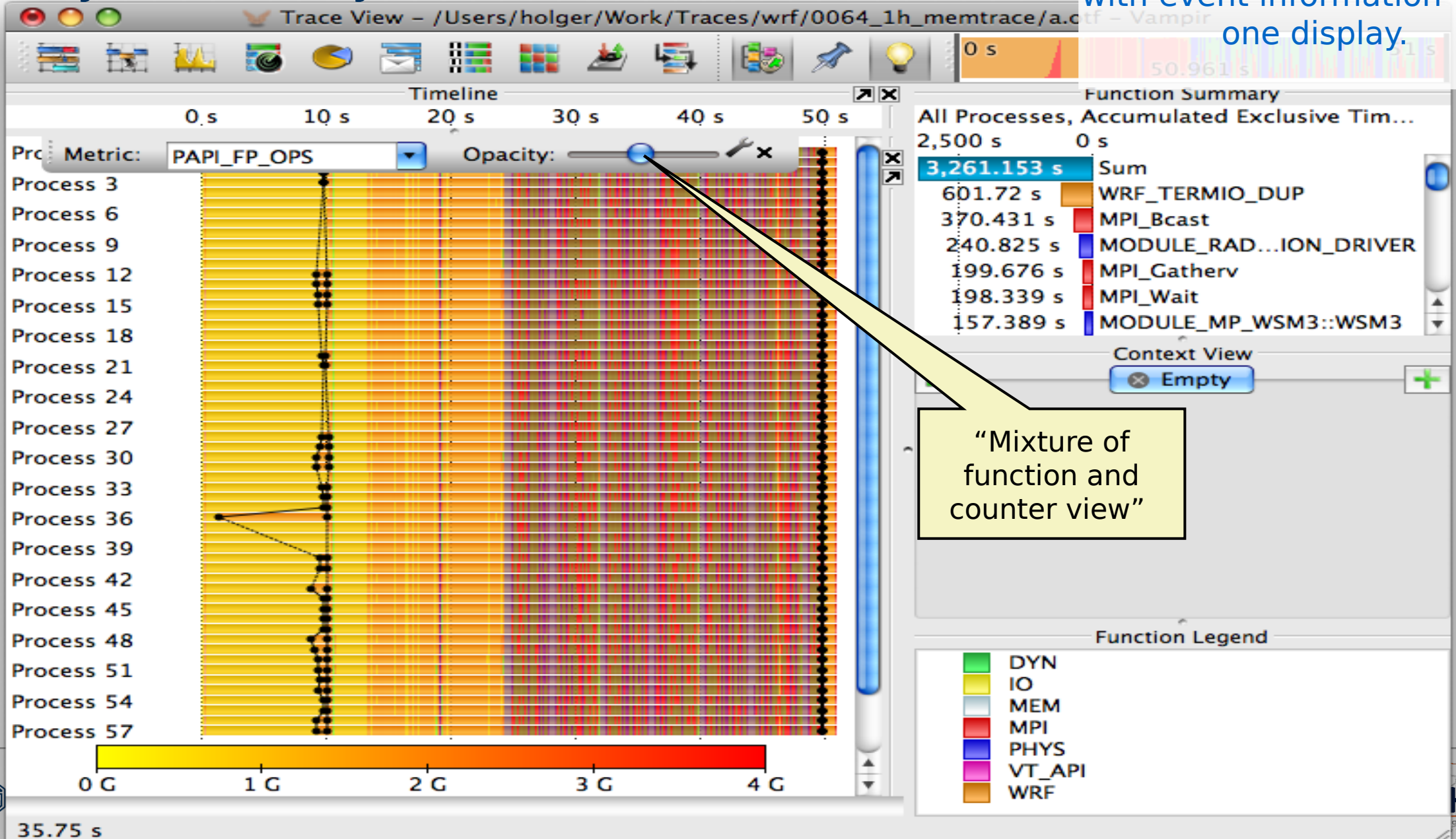


"Function view"

# Overlay Functionality of Master Timeline



Correlate counter information with event information within one display.

"Mixture of function and counter view"

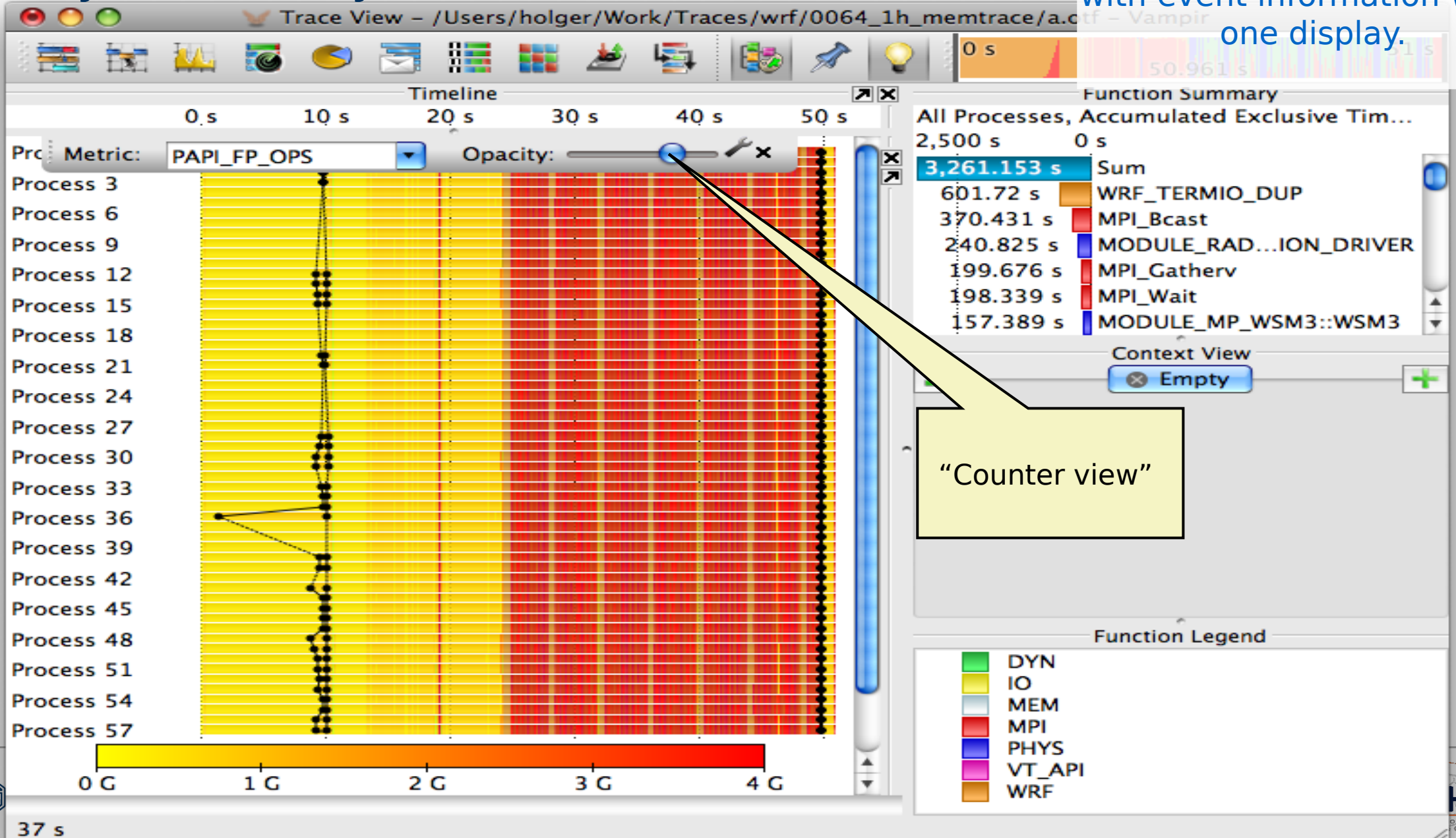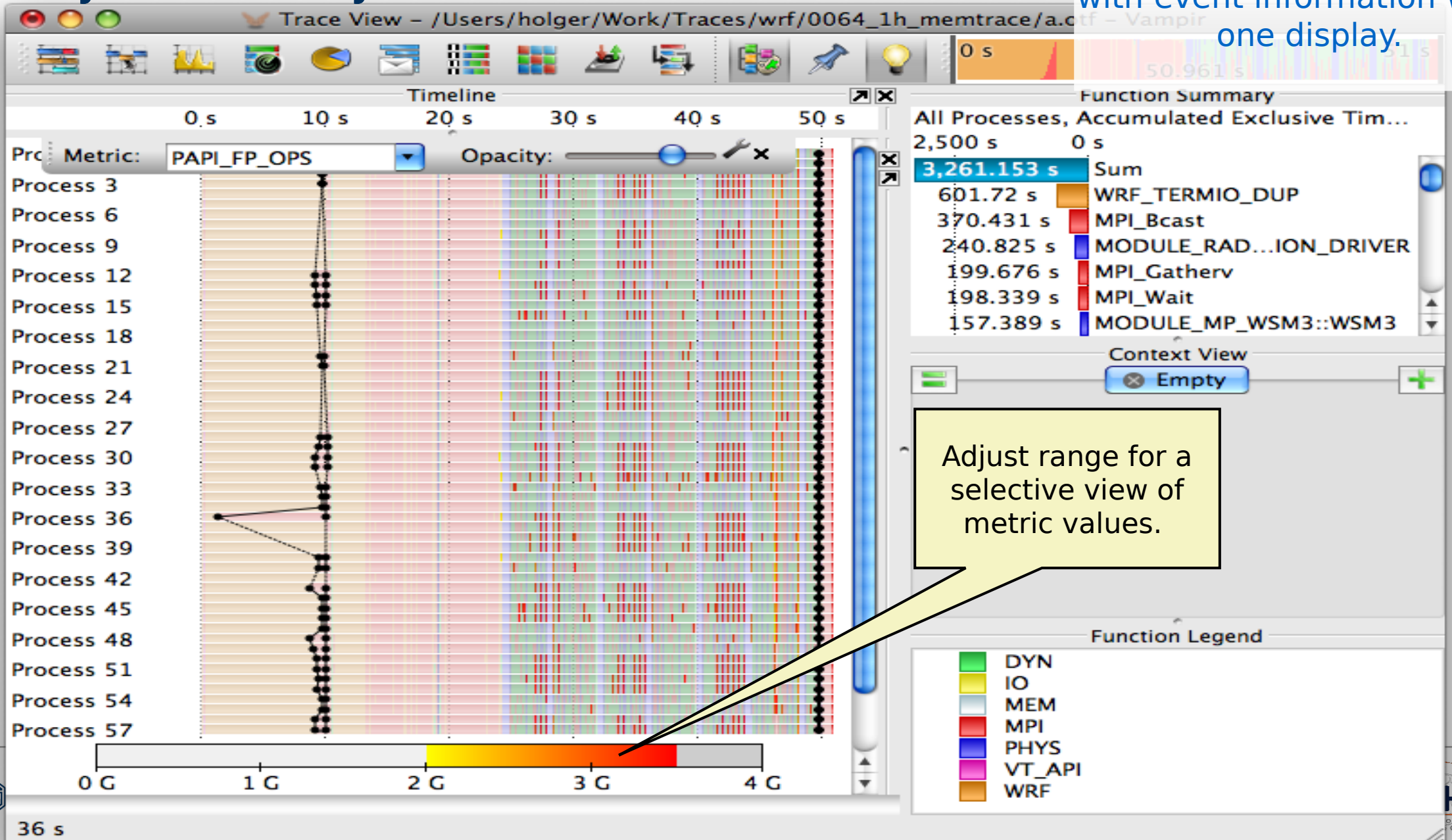# Overlay Functionality of Master Timeline



Correlate counter information with event information within one display.

"Counter view"

# Overlay Functionality of Master Timeline



Correlate counter information with event information within one display.

Adjust range for a selective view of metric values.
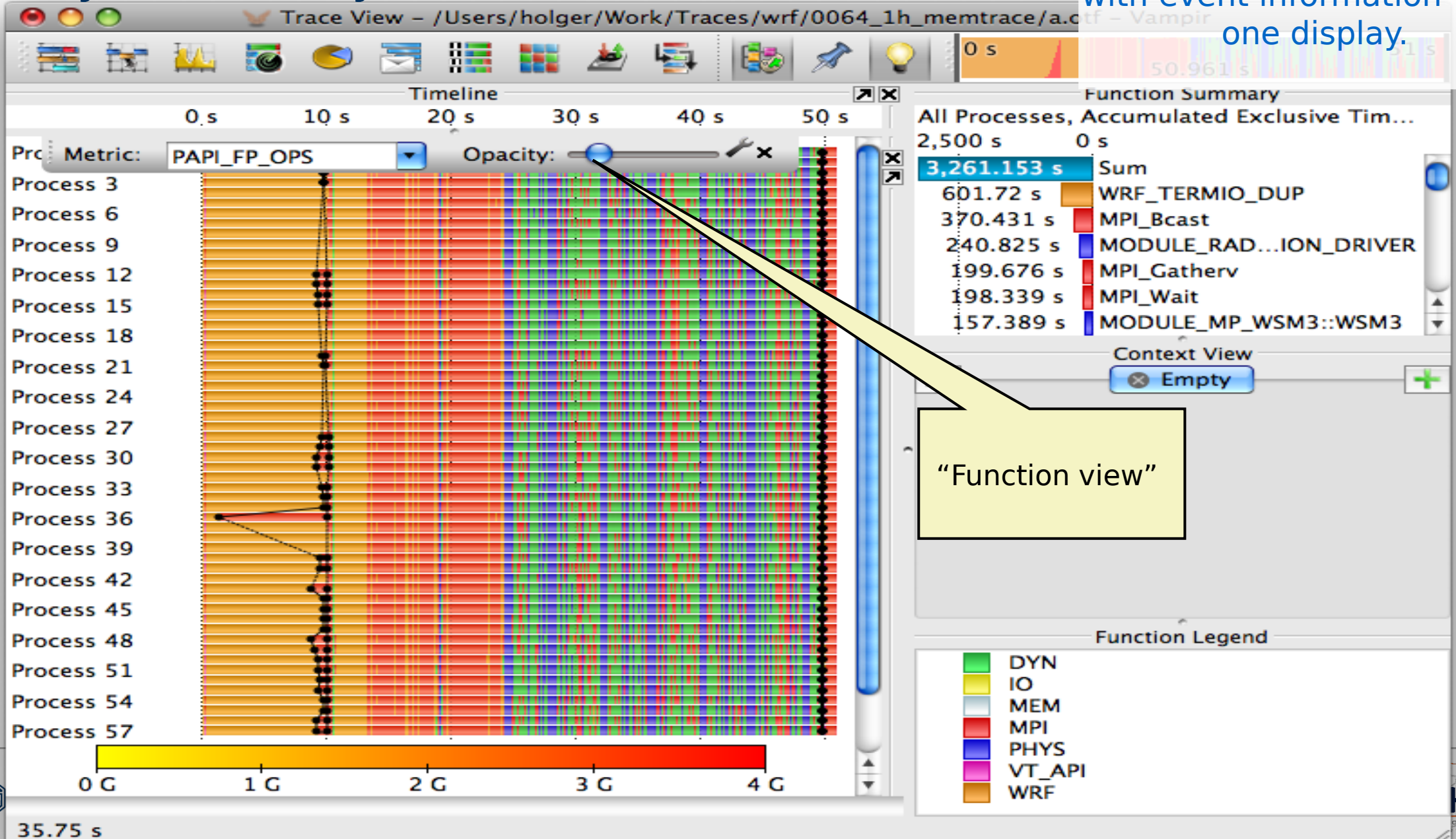
# Summary

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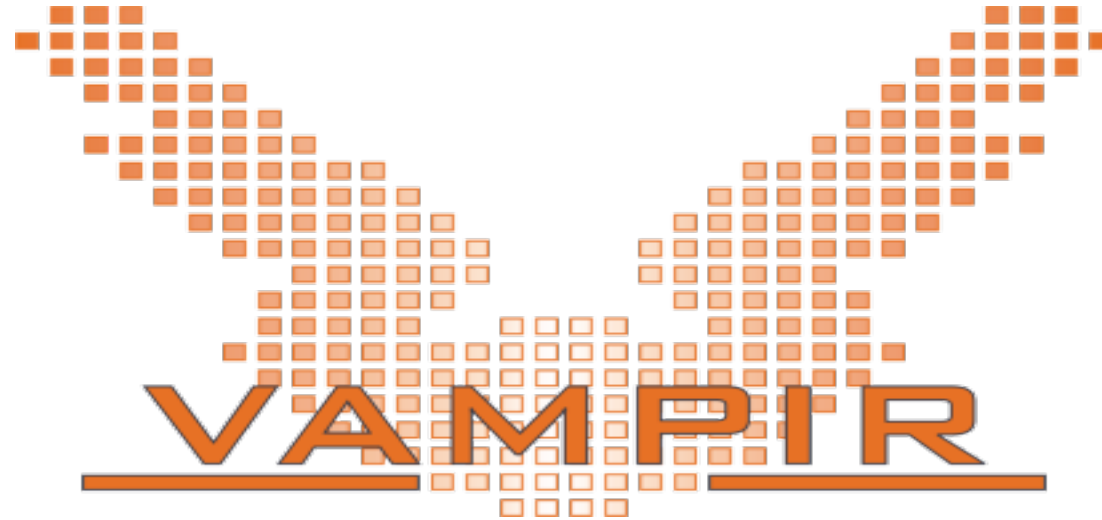
Vampir is available at http://www.vampir.eu,
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