EFFICIENT ANALYSIS METHODOLOGY
FOR HUGE APPLICATION TRACES

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TRACE THE APPLICATION EXECUTION

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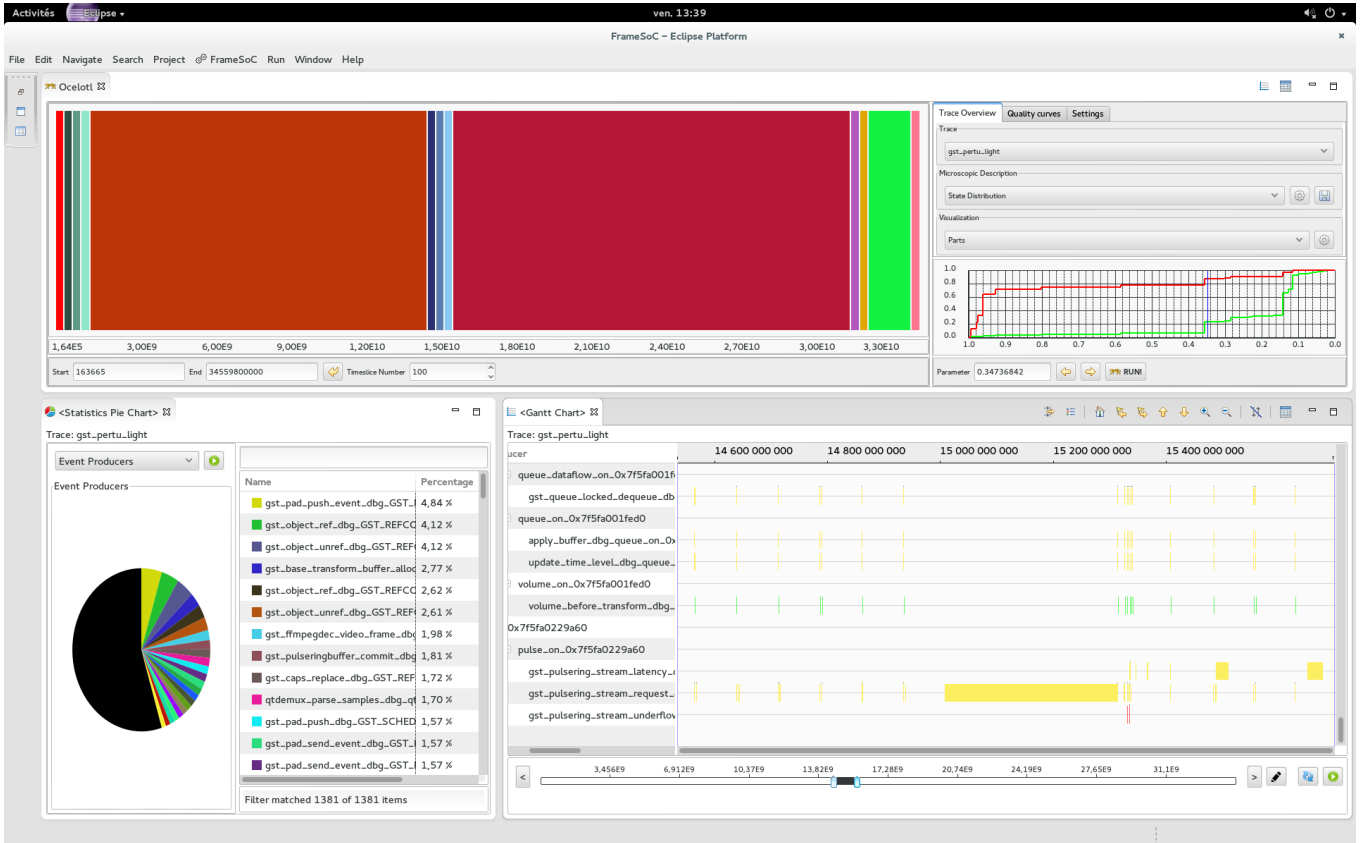
- Collect **information** about the **application behavior**
- **Structure**:
  - **hardware** components
    machines, cores, dedicated hardware
  - **software** components
    processes, threads, system, middlewares
- **Timestamped events**:
  function calls, synchronization, communications, CPU load, memory utilization, etc.
- **Trace formats**:
  OTF (Vampir), Tau, CTF (LTTng), KPTrace (STMicro), Pajé

COMMON ISSUES OF TRACE-BASED ANALYSIS

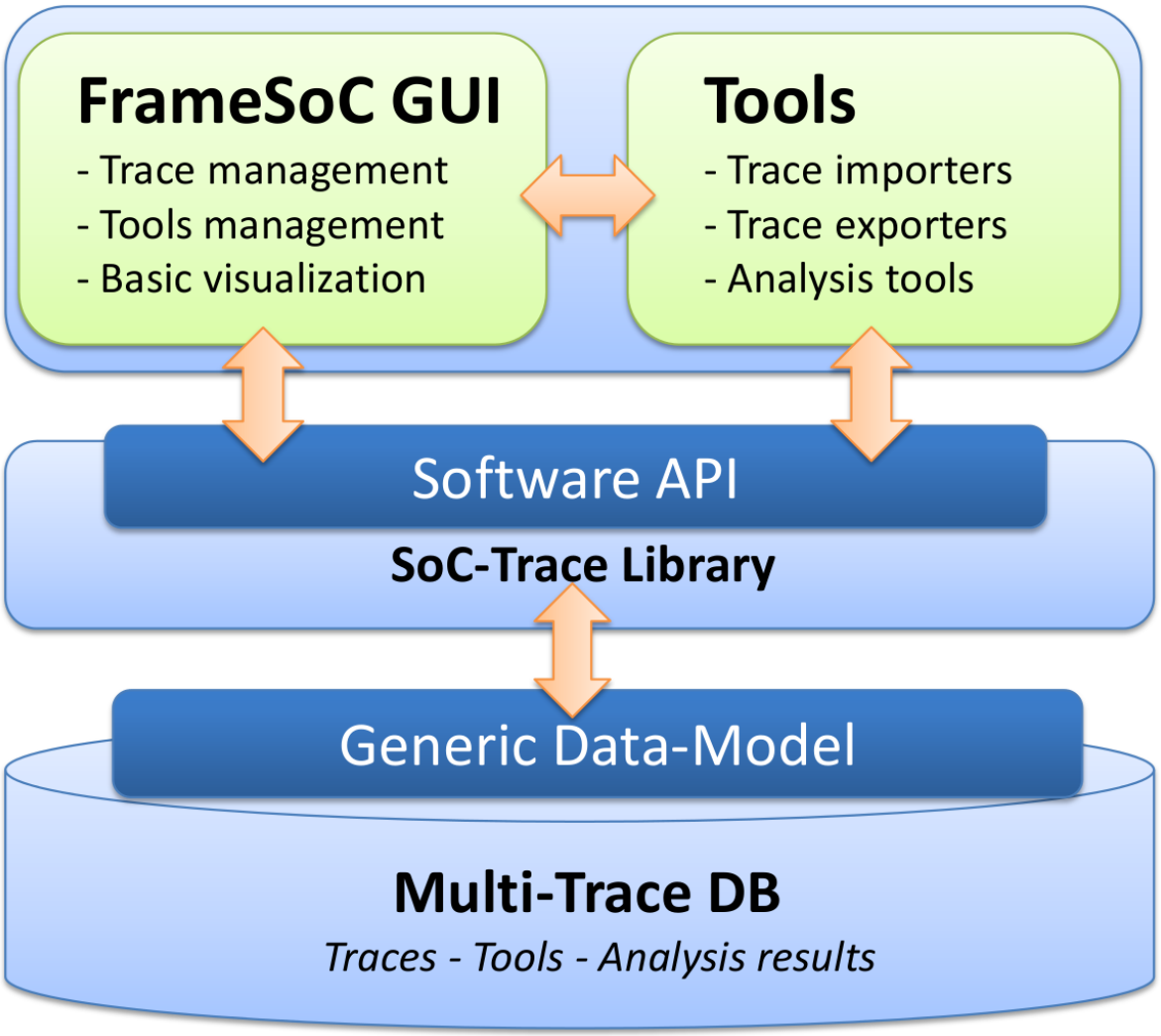
- **Trace/Data Volume**
  - 10 min video GStreamer playing: 8.7 GB, 30 million events
  - NAS Benchmark LU.C 700 cores: 15 GB, 200 million events
- **Tool and trace format dependency**
  - Conversion between trace formats
- **Analysis workflow**
  - Mainly based on interaction
  - No tool chaining and analysis result reusing
  - No generic way to add your own tool in the workflow
- **Entry point to the analysis**
  - Scalability of visualization techniques

FRAMESOC



- **FrameSoC** is developed within the **SoC-Trace Project**
  - Inria, UJF, STMicroelectronics, ProbaYes, Magillem

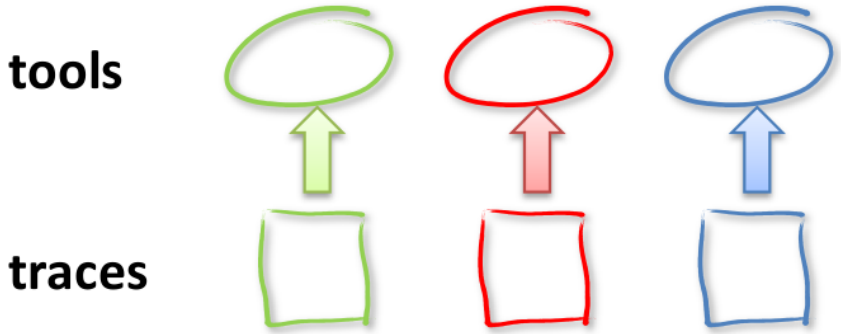
OVERVIEW


FrameSoC GUI
- Trace management
- Tools management
- Basic visualization
Tools
- Trace importers
- Trace exporters
- Analysis tools
Software API
SoC-Trace Library
Generic Data-Model
Multi-Trace DB
Traces - Tools - Analysis results

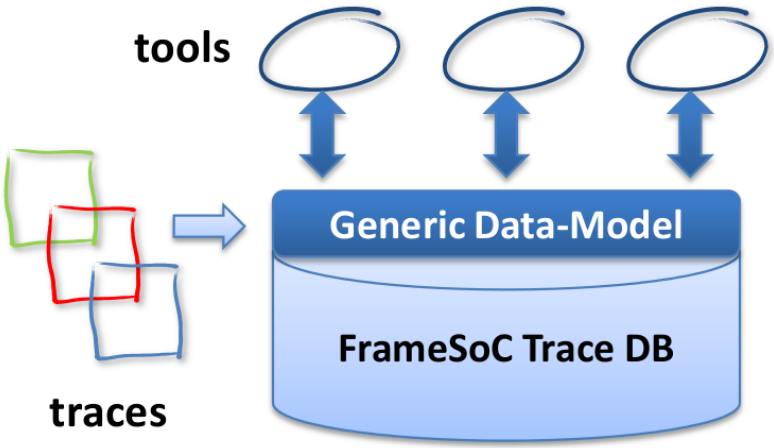
TRACE FORMATS AND PERFORMANCE

GENERIC DATA MODEL

Trace format and tool compatibility issues

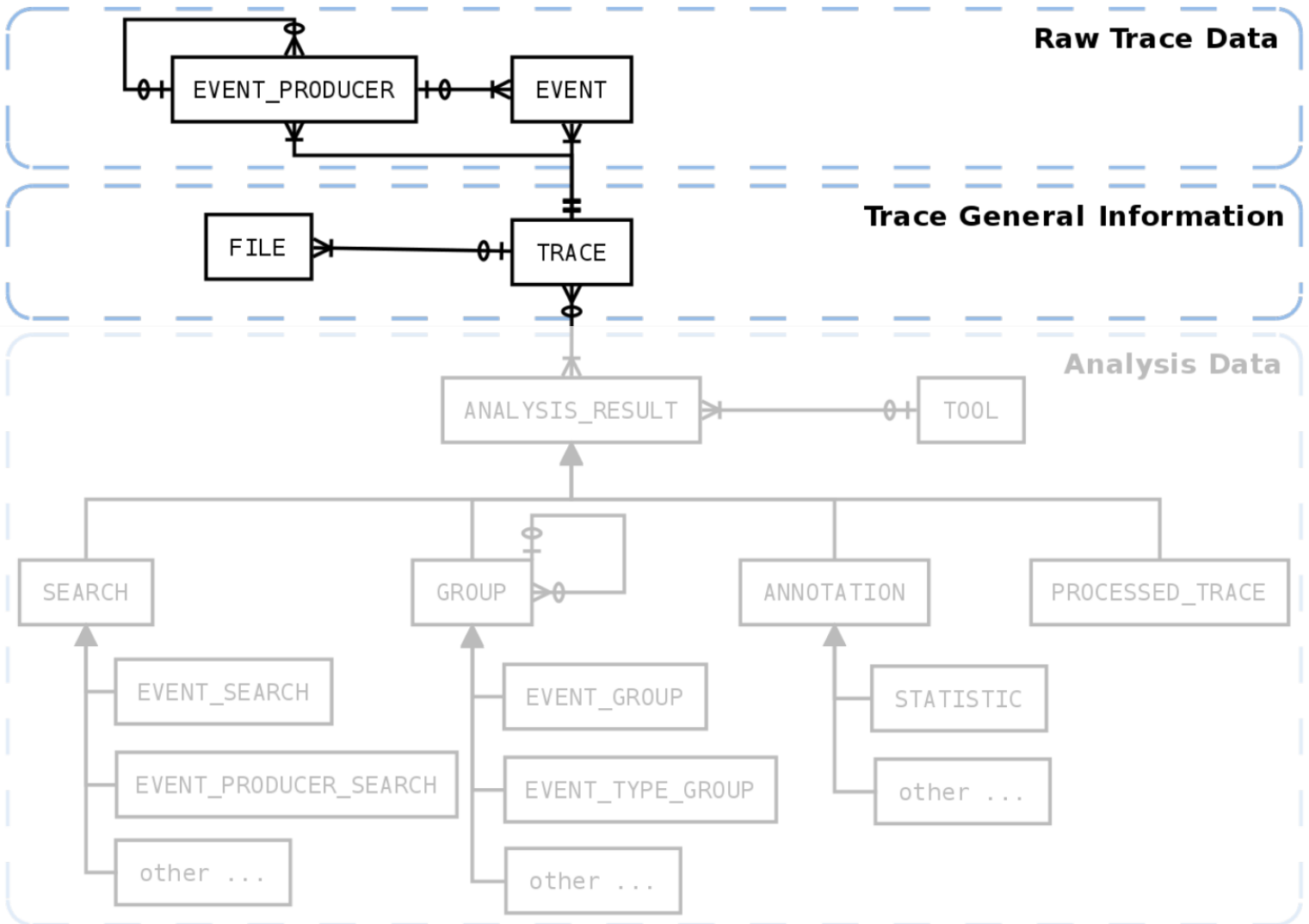


FrameSoC



- Enable to represent **different trace formats**
- Save trace **meta-data**, execution settings
- **Data-base** : performances

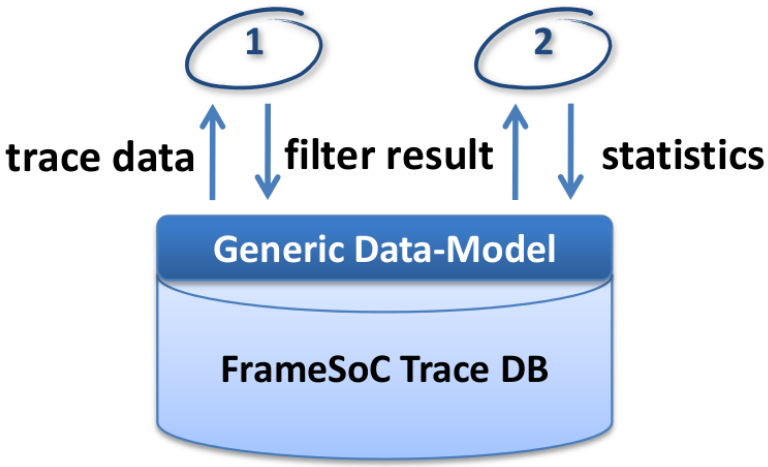
GENERIC DATA MODEL



ANALYSIS WORKFLOW

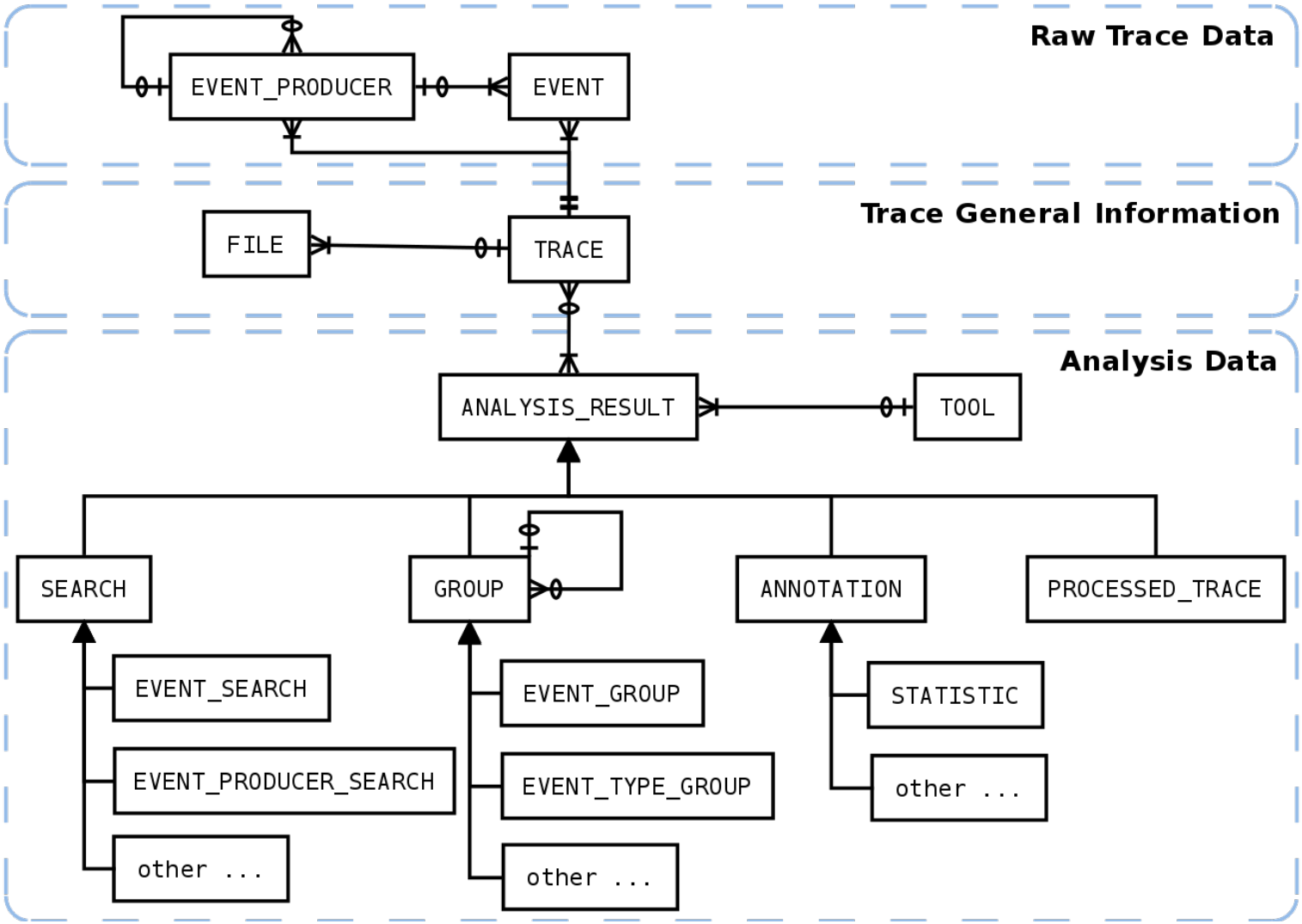
HOW TOOLS CAN COOPERATE EFFICIENTLY?

FrameSoC



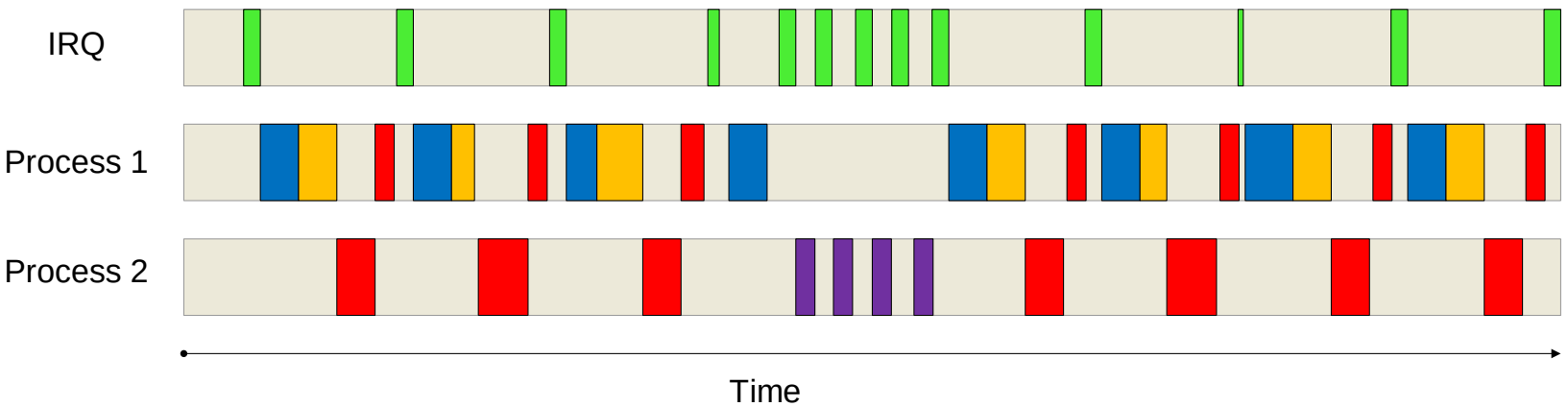
- Save and centralize **analysis results**
  - Same result data model for all tools
  - Avoid long recomputations
- Add your **own tools**

RESULTS DATA MODEL

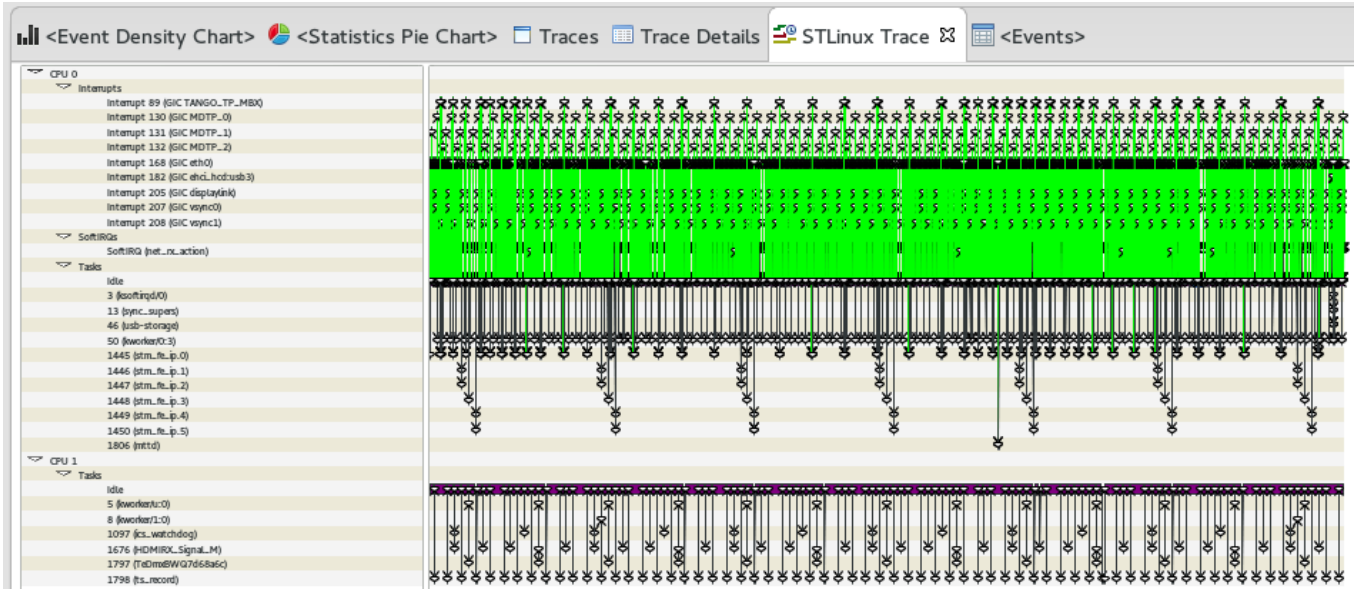


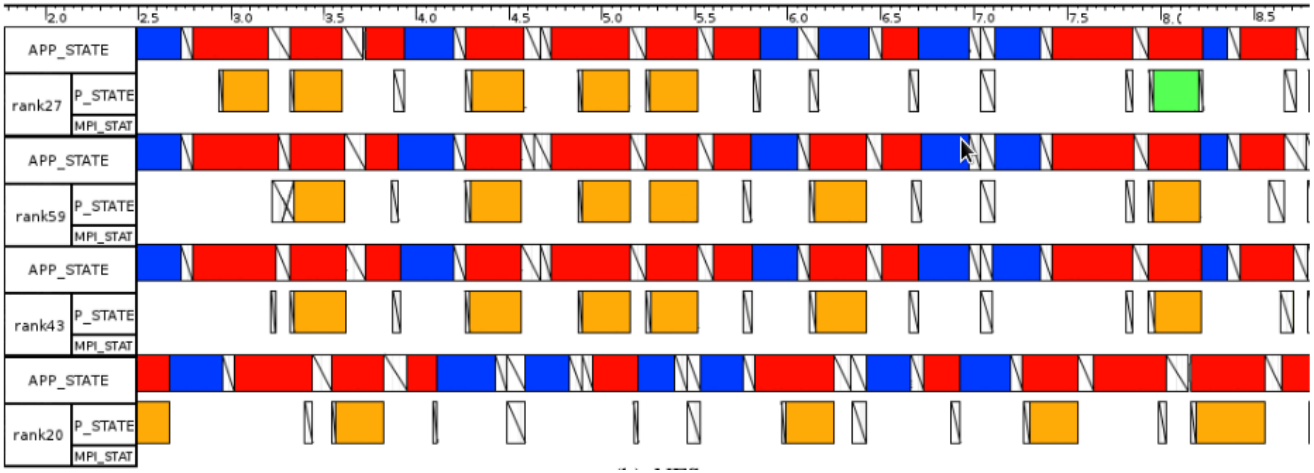
VISUAL ENTRY POINT TO THE ANALYSIS

EXAMPLE OF TEMPORAL VISUALIZATION: GANTT CHART



EXAMPLE OF GANTT CHART ISSUES



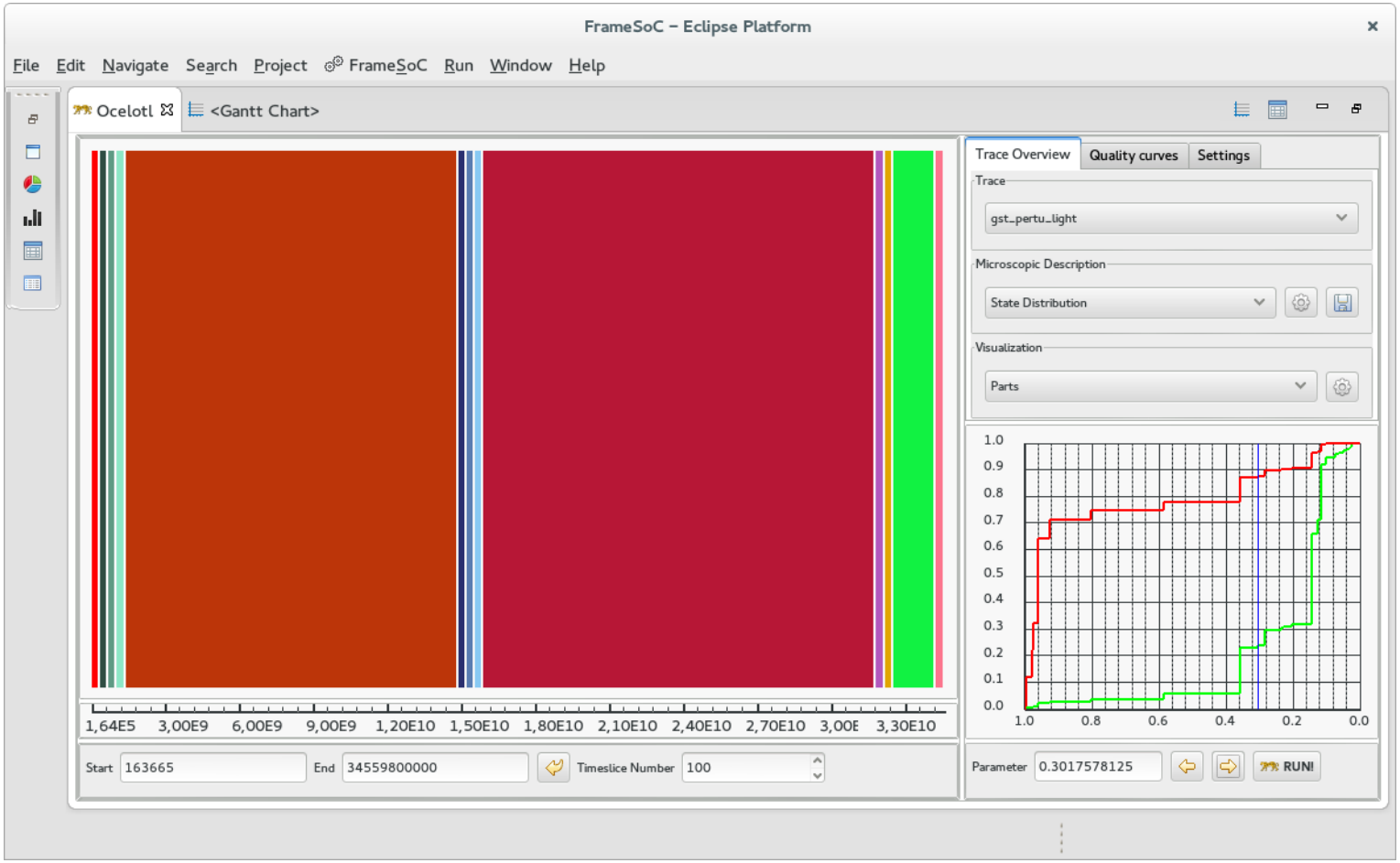


OCELOTL, A FRAMESOC VISUALIZATION MODULE

A temporal aggregation technique that provides an overview over time

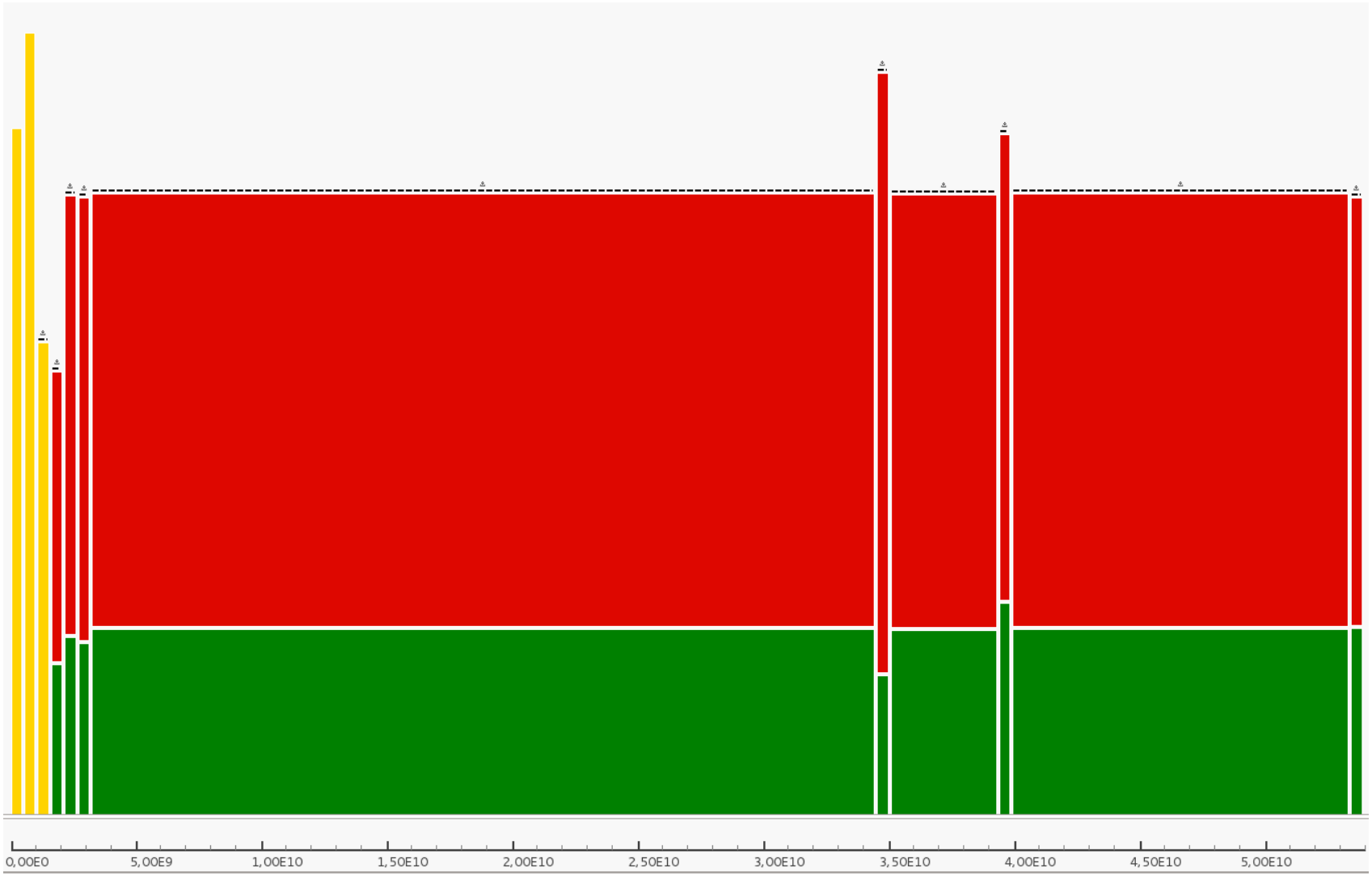
- We use a **meaningful aggregation** algorithm that gathers temporal parts of the trace where the behavior is similar
- The user chooses the **aggregation strength**
- He is aware of the **information loss**
- He can **interact**

EXAMPLE OF OCELOTL VISUALIZATION



GStreamer application perturbed by a CPU stress

OCELOTL APPLIED ON A PARALLEL APPLICATION



Grid'5000 Rennes, 64 Cores, NASBP CG, class C

EXAMPLE OF AN ANALYSIS WORKFLOW

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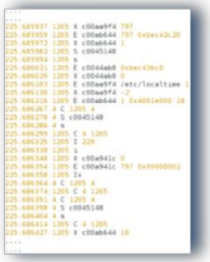
10 min video

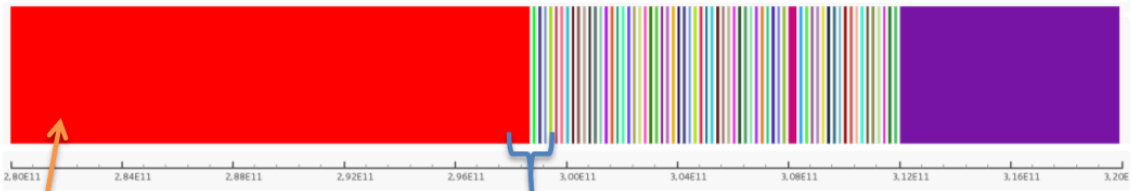


10 GB
30 M events

1

FrameSoC
Trace DB

2

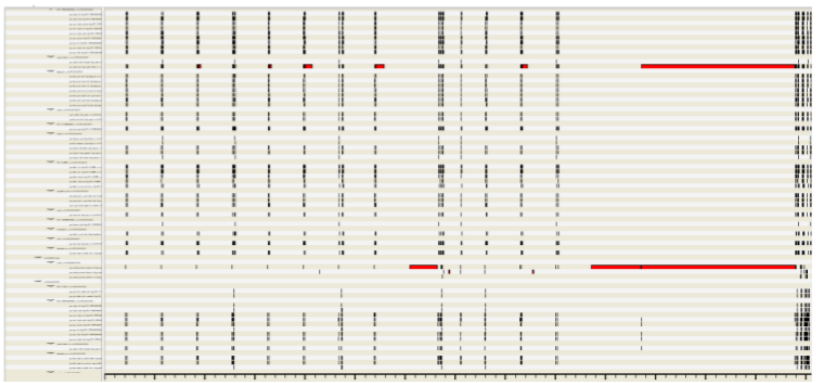


3

Event Filter

90 k events

4



FRAMESOC PERFORMANCES

- **Trace imported**
  - Able to manage huge traces (up to 100 GB)
  - Import time relatively short (15 s for 100 MB)
- **Event filtering**
  - Less than 0.1 s to retrieve 100,000 events
  - Depending only on the result-set size (not on trace size)
- **Ocelotl**
  - Preprocess (trace reading and abstraction) depends on trace size
  - Interaction is quick (<1s)

CONCLUSION

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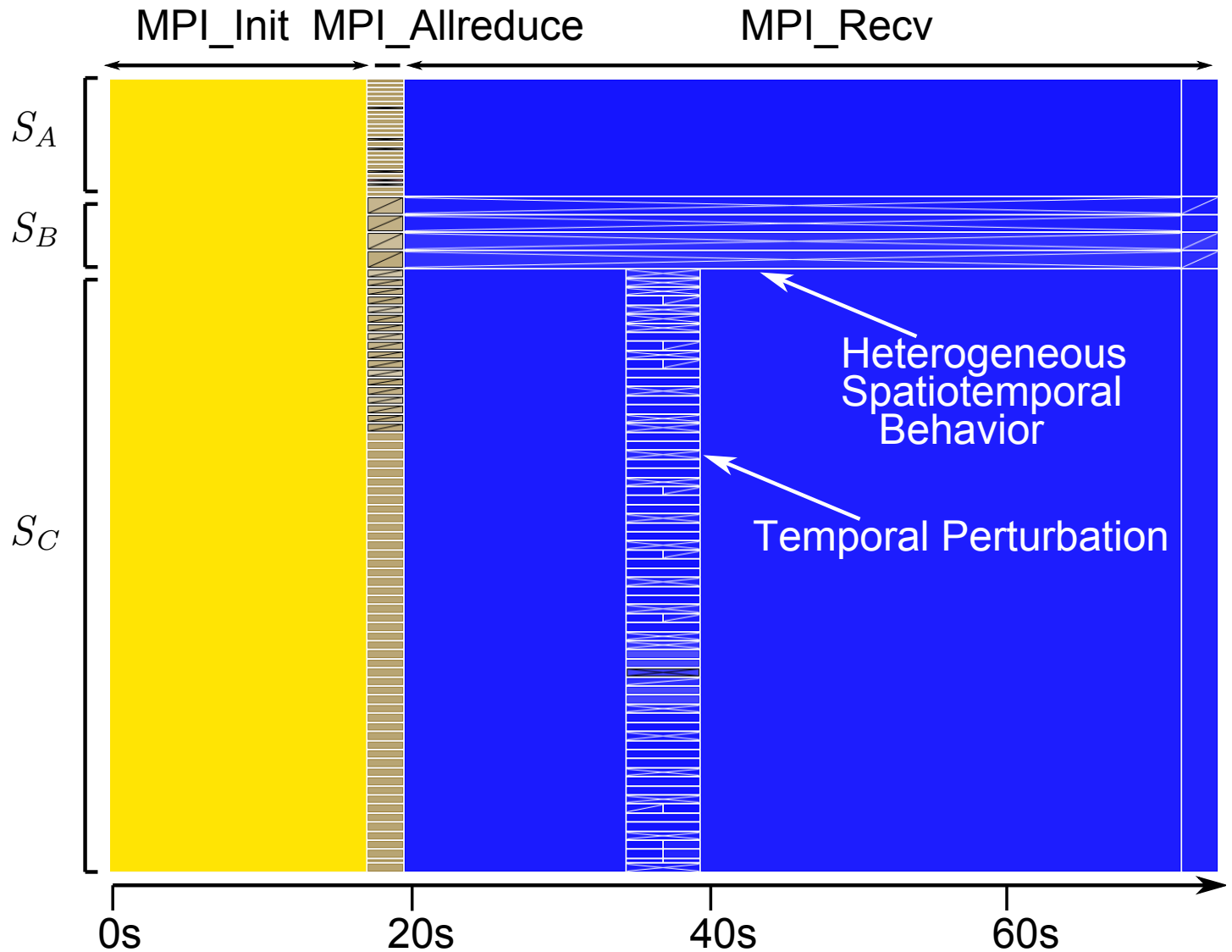
- **FrameSoC**
  - **Rich and generic data model**
    - Solve the problem of format heterogeneity
    - Improve the access to trace events
  - **Support for analysis result storage**
    - Allow rich workflows via tool cooperation
    - An analyst can plug is own tool easily
- **Ocelotl**
  - Innovative aggregated visualization
  - Synthetic view of the whole trace behavior

FUTURE WORK: OCELOTL SPATIOTEMPORAL



Grid'5000 Nancy, 700 Cores, NASBP LU, class C

THANK YOU FOR YOUR ATTENTION