Checking the consistency of states in case of lost events in a trace

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Agenda

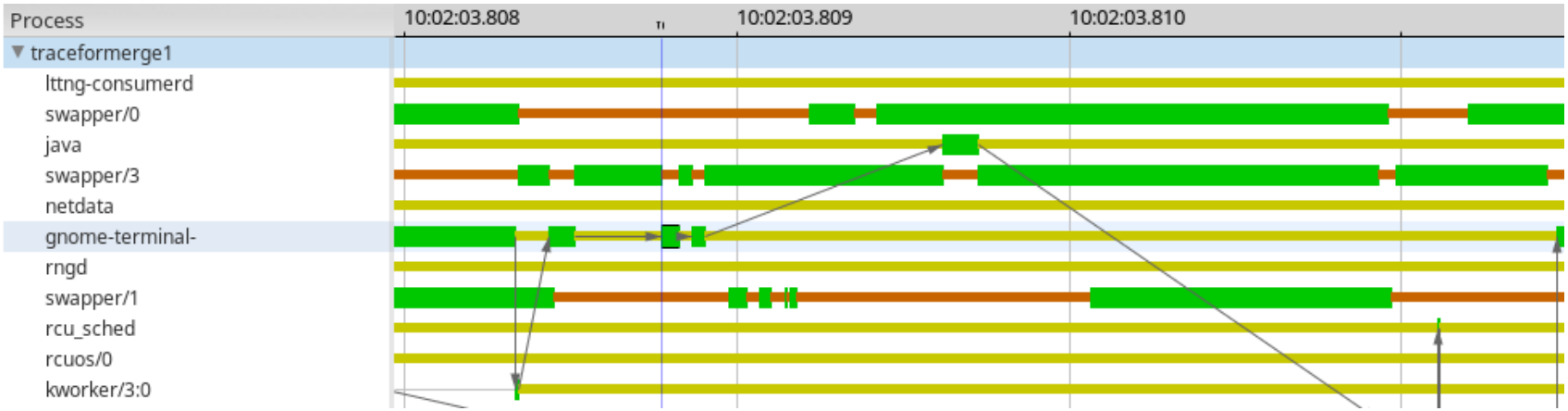
Context

Lost events during tracing
→ Discard & overwrite modes

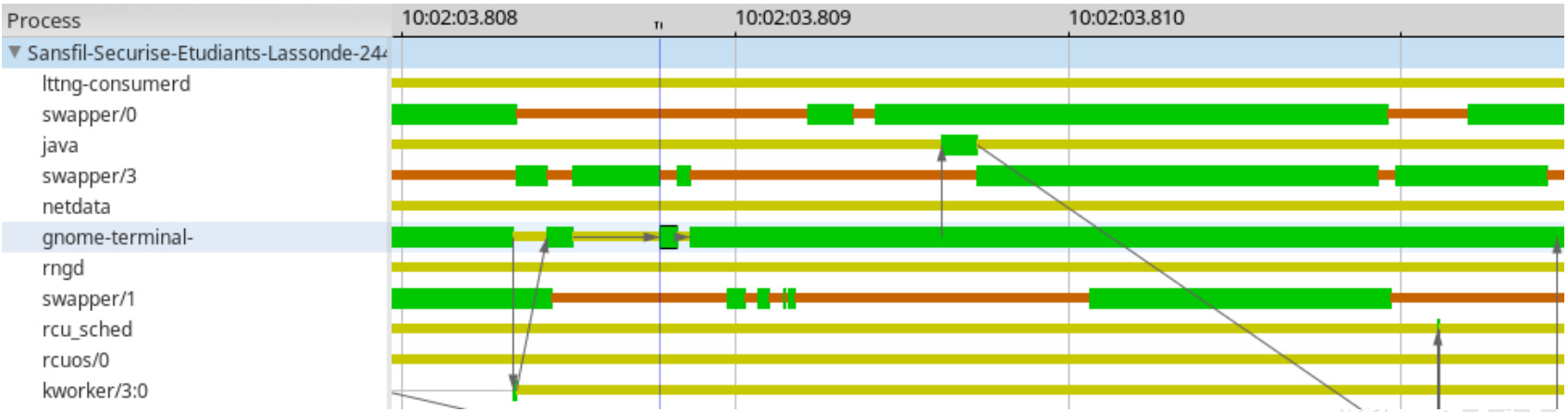
Parallel analysis of traces
→ No initial global state

What happens to the trace analysis ?

An example



Without missing events



With missing events

Objectives

1. Find incoherent events ;
2. Infer information about missing events ;
3. Show inconsistency and uncertainty.

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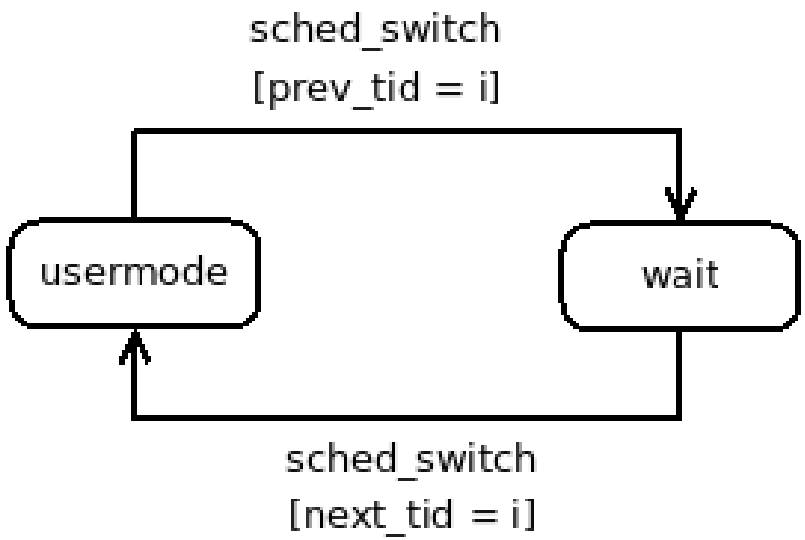
Consistency

Definition

Suppose we have read n events from a trace, so that the current state of a state machine F is S.
The $n+1$ event e is consistent with F, if there is a transition from S whose label is e, or no transition from any state at all.

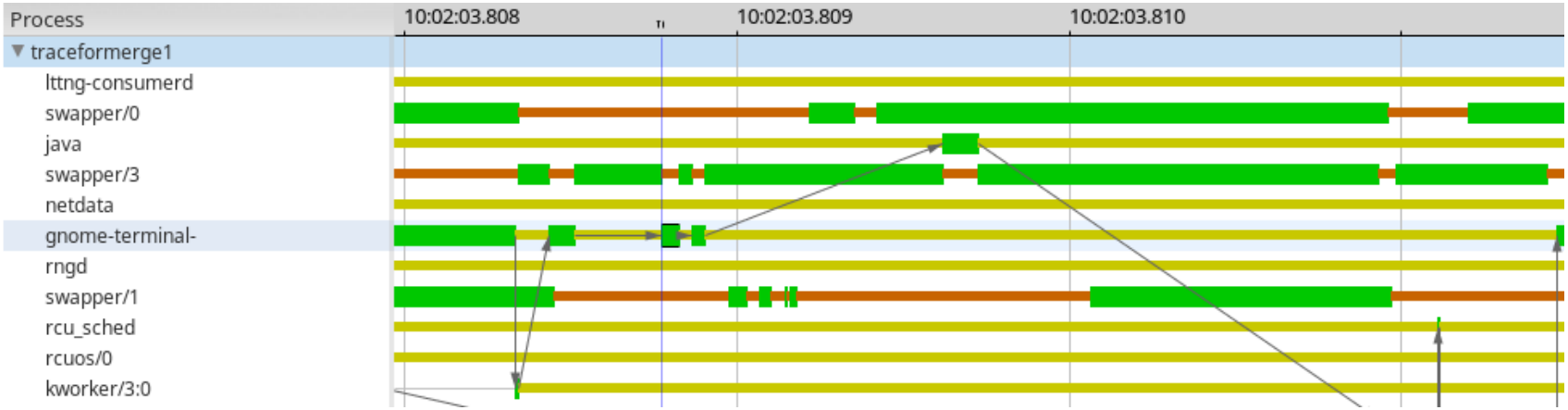
So, e is inconsistent if there is a transition in F whose label is e, from a state that is not S, and there is no possible transition from S with e as its label.

Example

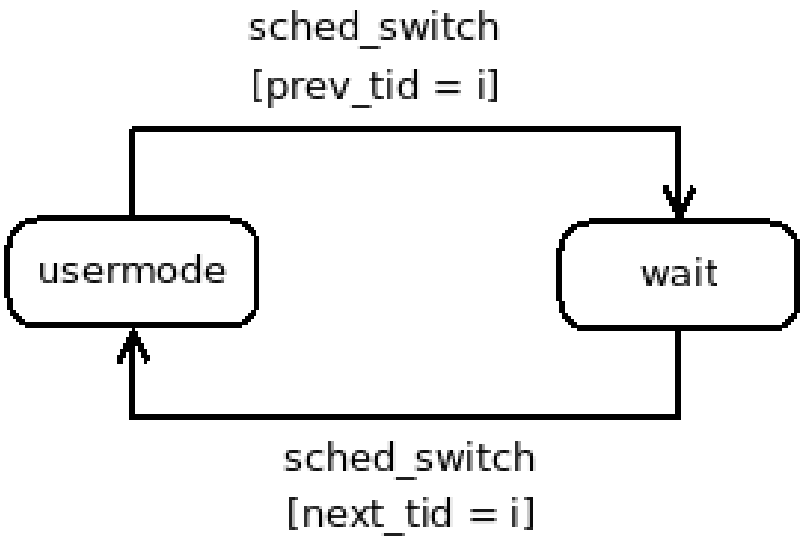


FSM for the process *i*

Example



Without missing events



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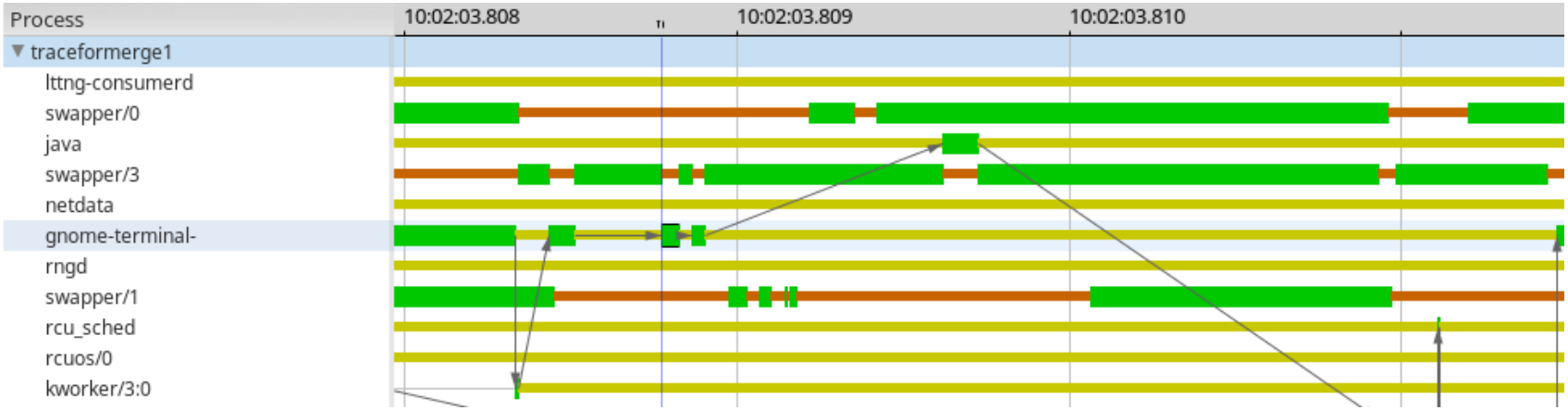
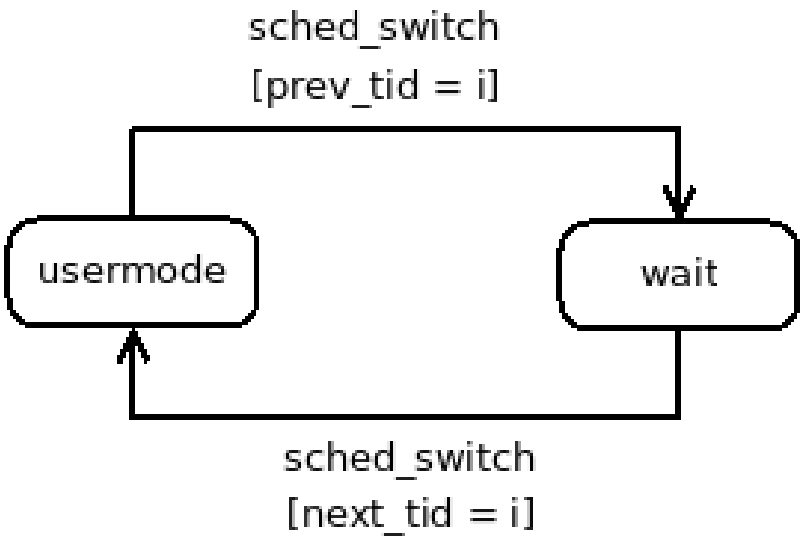
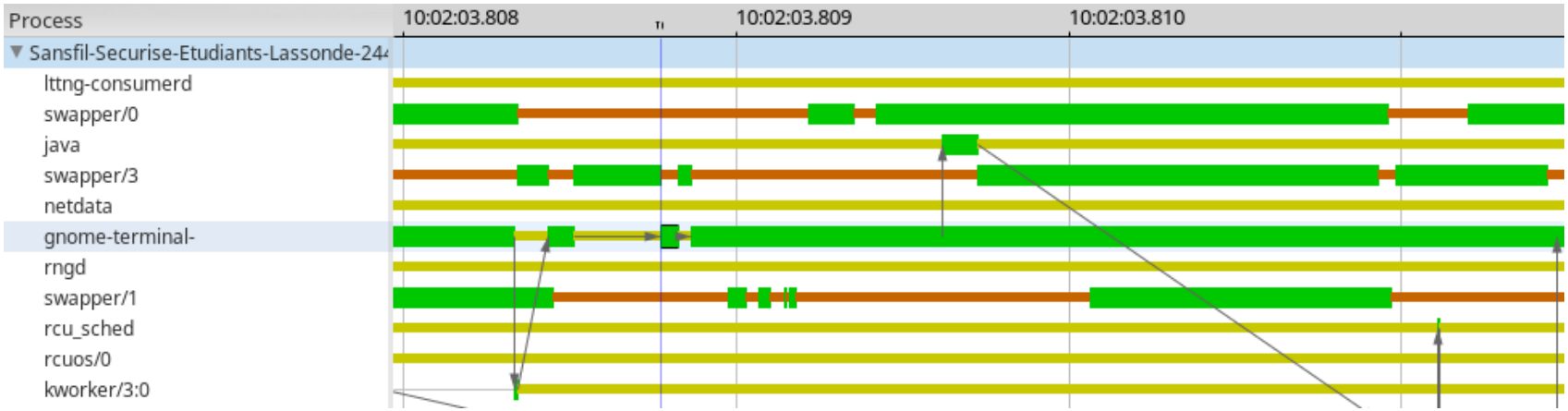


Without missing events

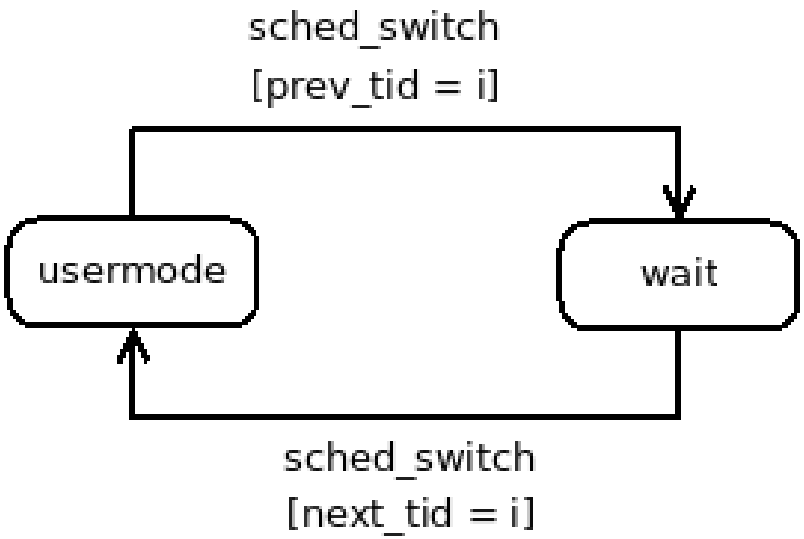


event is **consistent**

Example



With missing events



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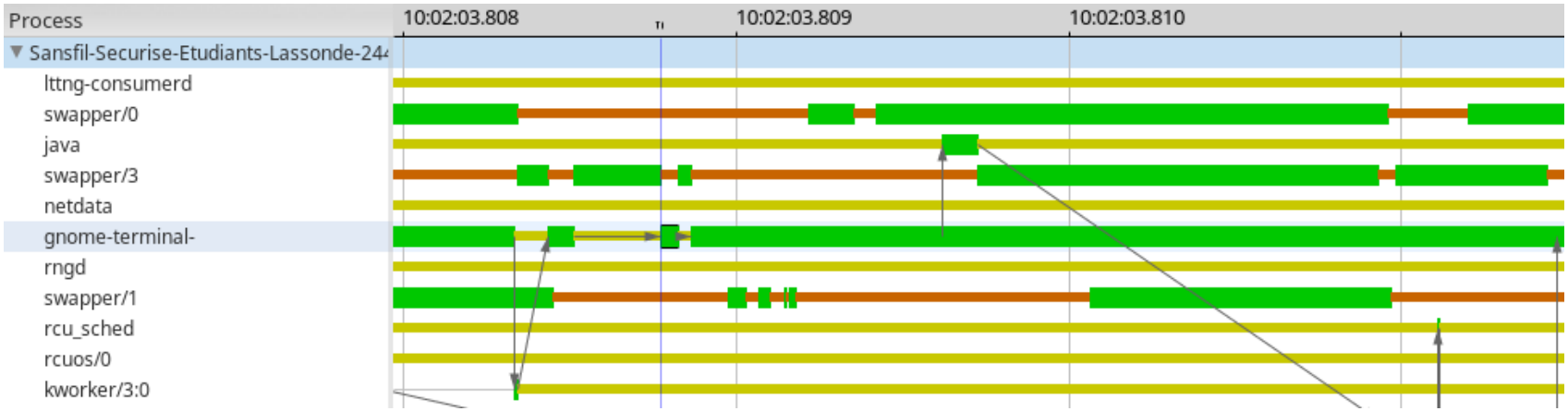
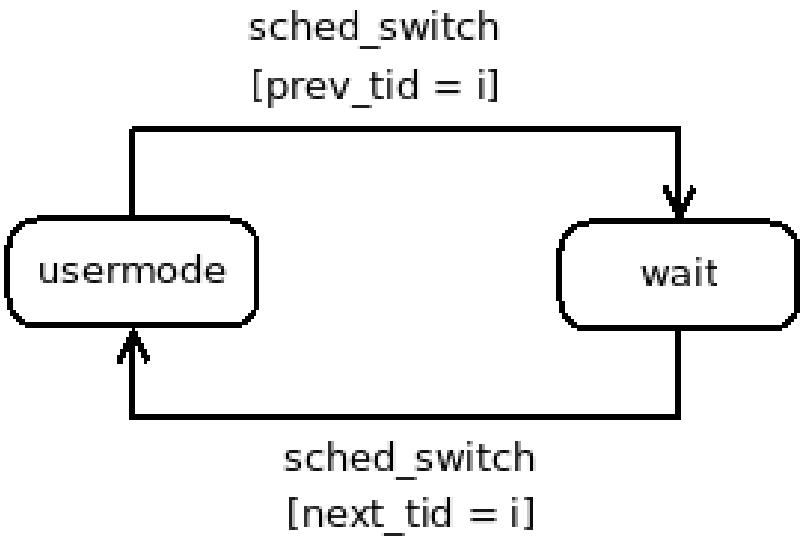


With missing events



event is **inconsistent**

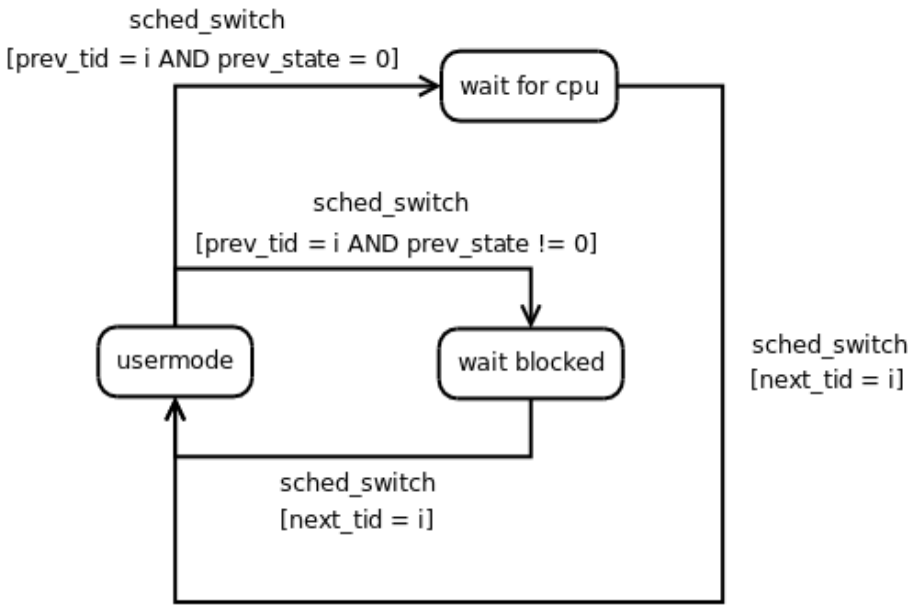
Certainty

Definition

An event e triggers a **certain** state S if e labels only transitions to S.

So, no transition to states other than S are labeled by e.

Example



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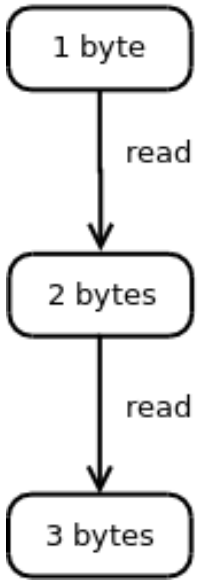
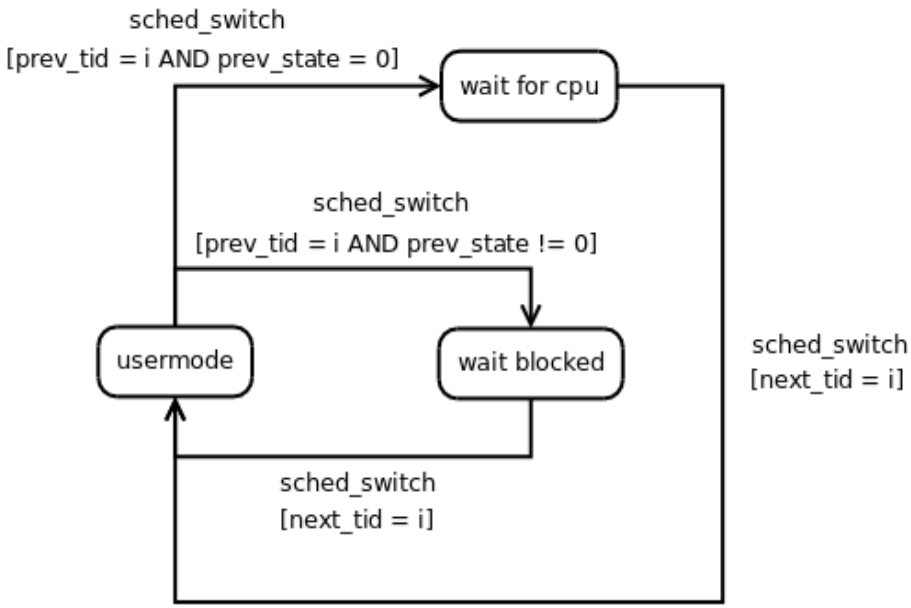


FSM for reading in a file

Example



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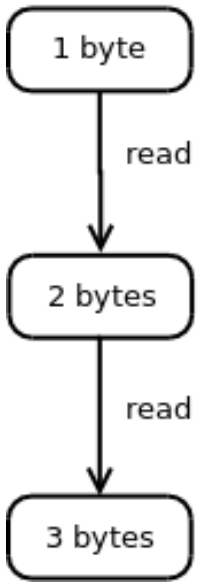
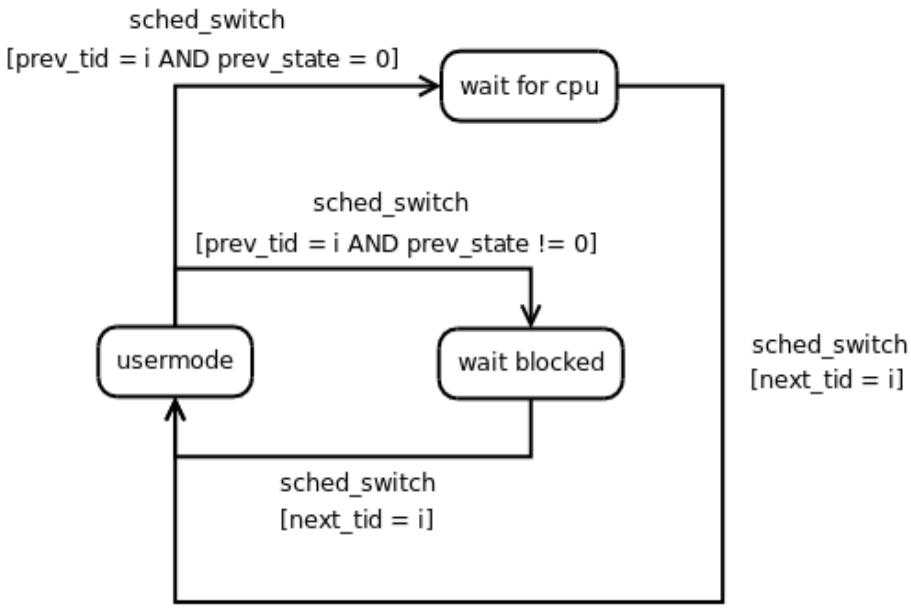


FSM for reading in a file

sched_switch triggers **certain** states

Example



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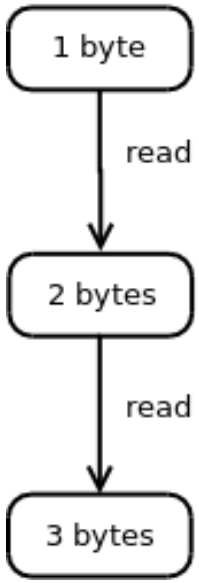


FSM for reading in a file

sched_switch triggers **certain** states

read triggers **uncertain** states

Architecture

XML state machine

→ Unique attribute

→ Non-consuming

Scenario observer

→ Created if the trace contains 'Lost event'

→ Activated when the first 'Lost event' is observed

→ Implements algorithm to check the event consistency

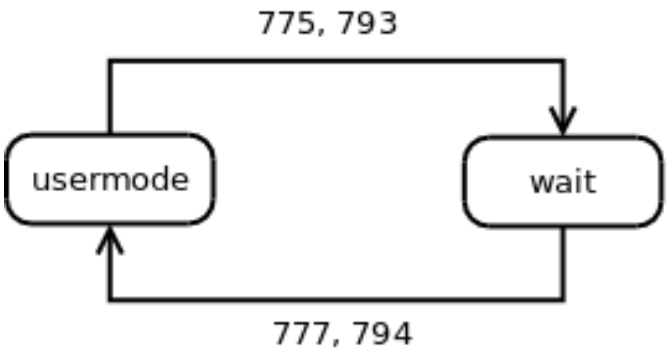
Methodology

1. Definition of the FSM in XML
2. Deletion of chosen events from a 'real-world' trace
3. Execution of the analysis in Trace Compass
4. Comparison of computed inferences with deleted events

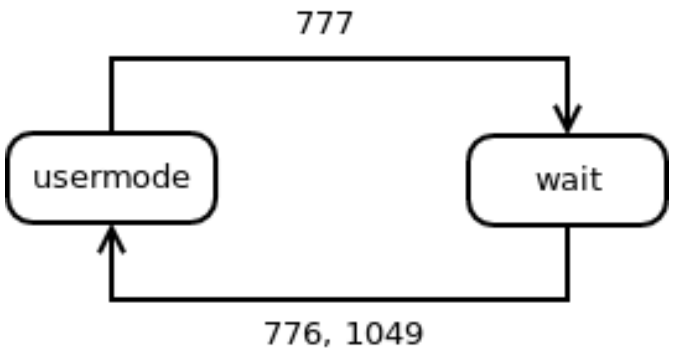
Example

Trace with sched_switch events enabled
Deletion of event 777

Index	Timestamp	Event type	Contents
775	17:24:27.005 208 877	sched_switch	prev_comm=cinnamon, next_comm=swapper/1
776	17:24:27.005 256 573	sched_switch	prev_comm=swapper/1, next_comm=netdata
777	**17:24:27.005 304 716**	**sched_switch**	**prev_comm=netdata, next_comm=cinnamon**
793	17:24:27.006 616 553	sched_switch	prev_comm=cinnamon, next_comm=swapper/1
794	17:24:27.006 631 608	sched_switch	prev_comm=swapper/1, next_comm=cinnamon
1049	17:24:27.025 320 963	sched_switch	prev_comm=swapper/2, next_comm=netdata

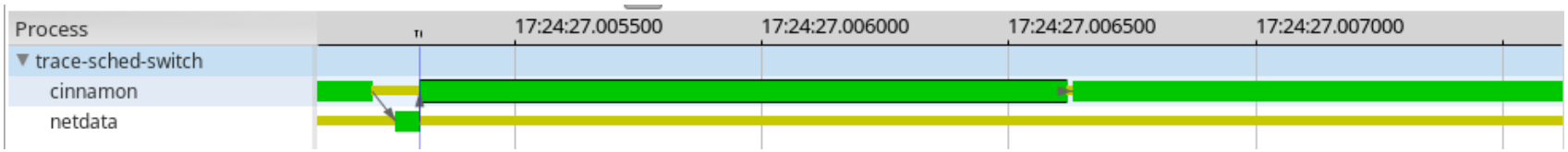


Process cinnamon

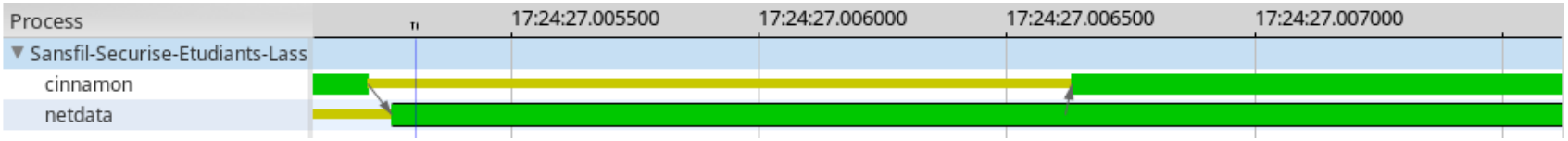


Process netdata

Example



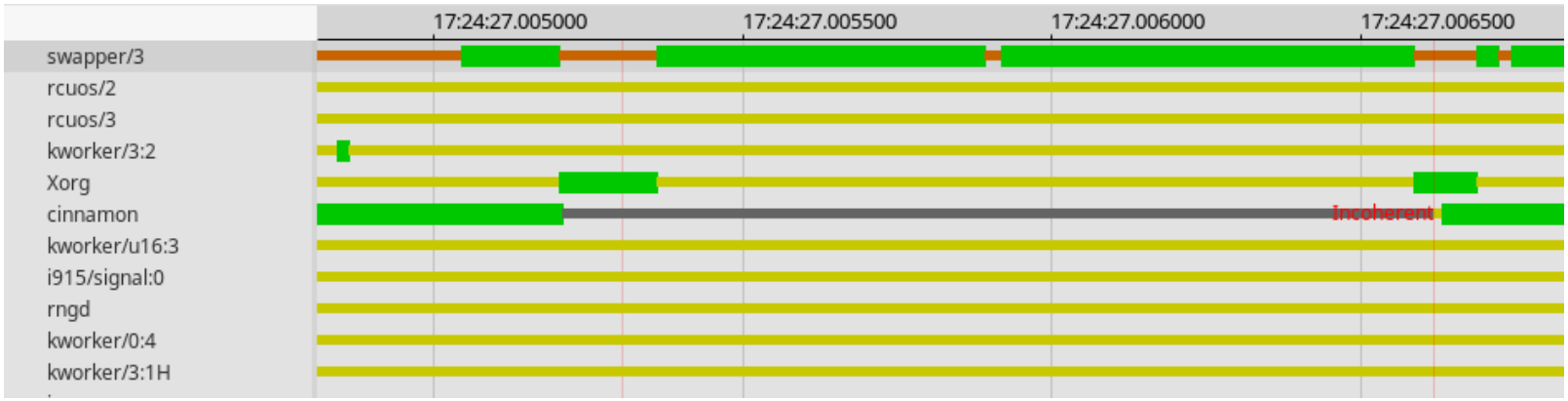
Before deletion



After deletion

View

- Markers ;
- Uncertainty areas ;
- Incoherent states.



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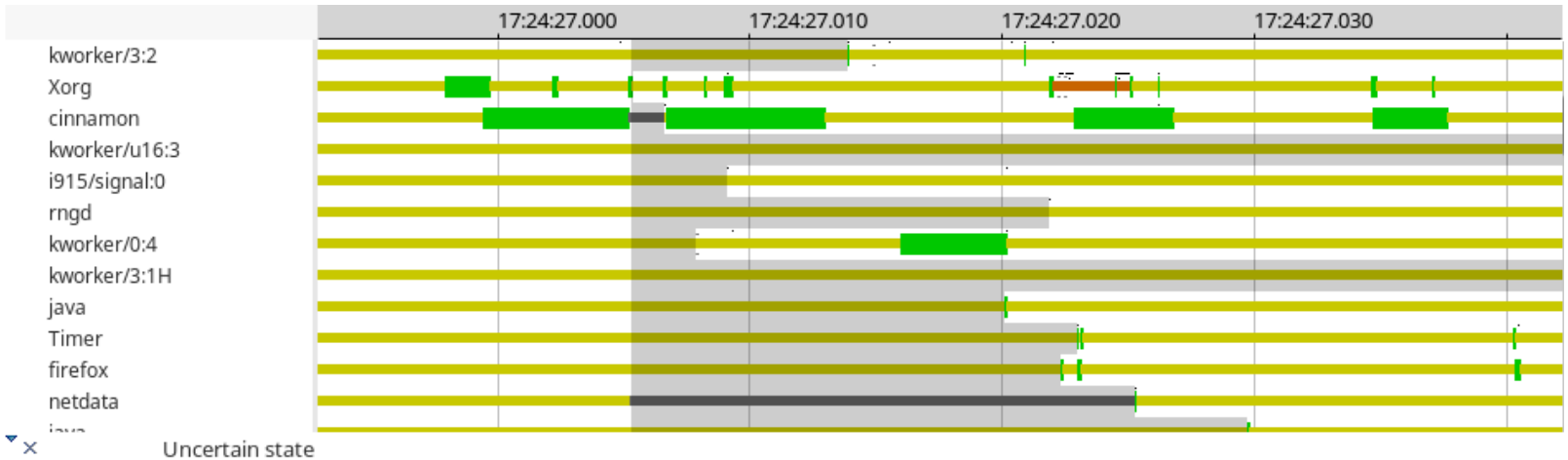

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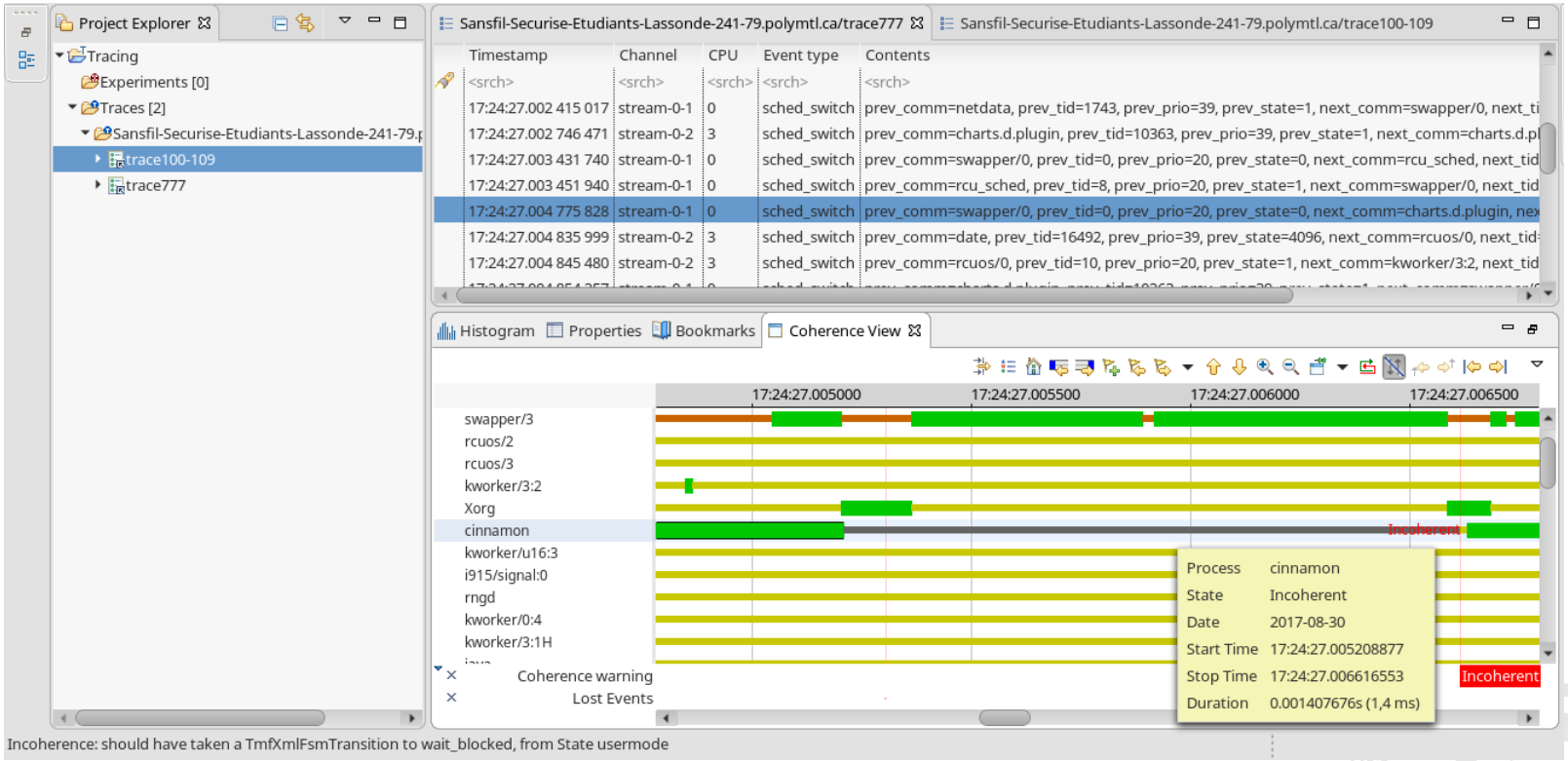
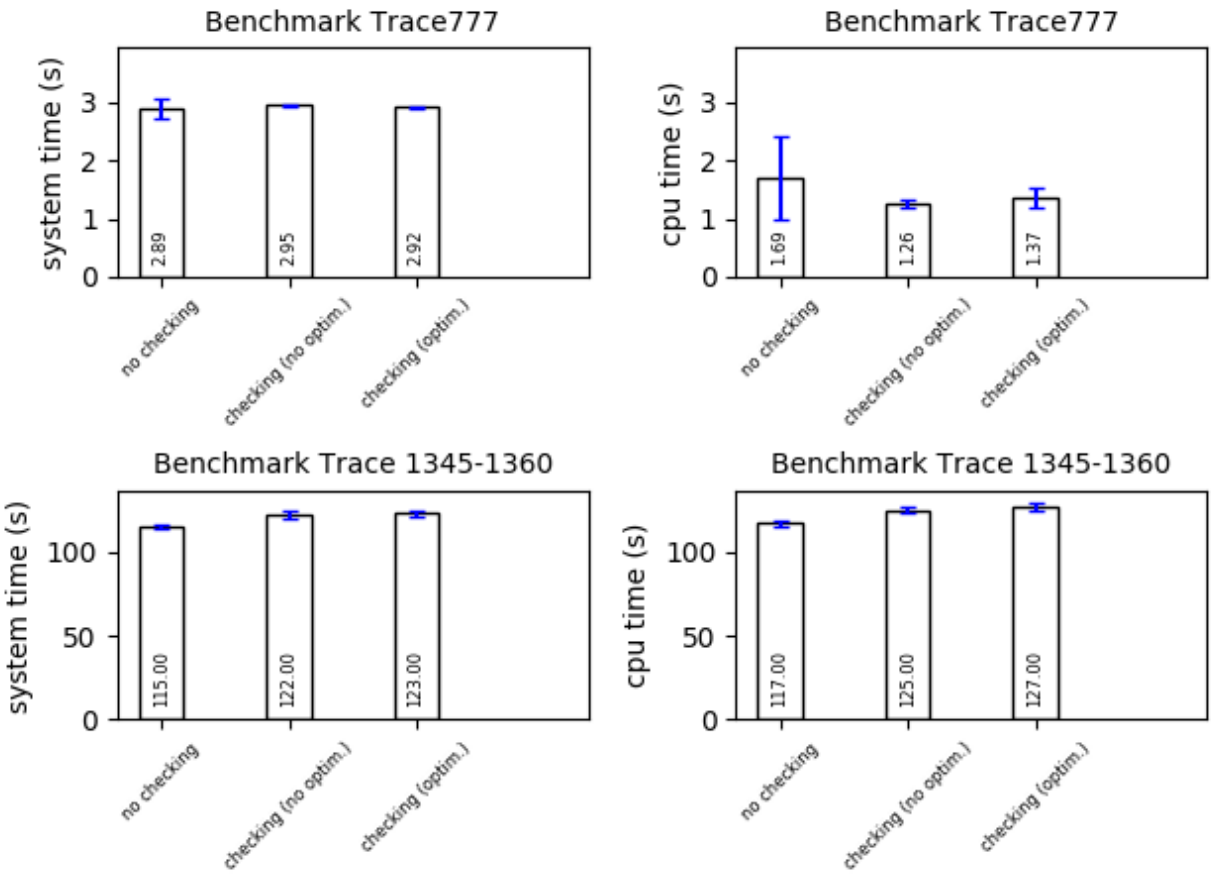


Performance

Averaged on 25 executions of the analysis module
Trace777 : 2179 events, 1 lost event (164KB)
Trace1345-1360 : 40918 events, 16 lost events (2.6M)



Conclusion

New informative elements displayed on the view

Help user be aware of the uncertainty of the results

No need for special tools

Future work

Event reconstruction

Probabilistic model of events

Assess the solution on realistic use cases

Continuous work on improving the algorithms and the view
→ scalability

Any questions?

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