Tracing and Sampling for Real-Time partially simulated Avionics Systems

Progress Report Meeting
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Introduction

What is the status of real-time tracing?

- Tracing with low latency is possible
- Views exist to analyze specific real-time behaviors
- But what about automatic analysis?
  - CAE suggested to verify applications' execution using specifications
  - Ericsson is working towards programming at model level
  - **Why couldn't we do both?**

Introduction

Develop new algorithms and techniques for automatic trace analysis of real-time applications using user-defined requirements and constraints given as a state machine.

First step towards the tracks of the new project between DORSAL, Ericsson, EfficiOS and Queen's University about "*Advanced analysis*" and "*Model-Driven Engineering support*".

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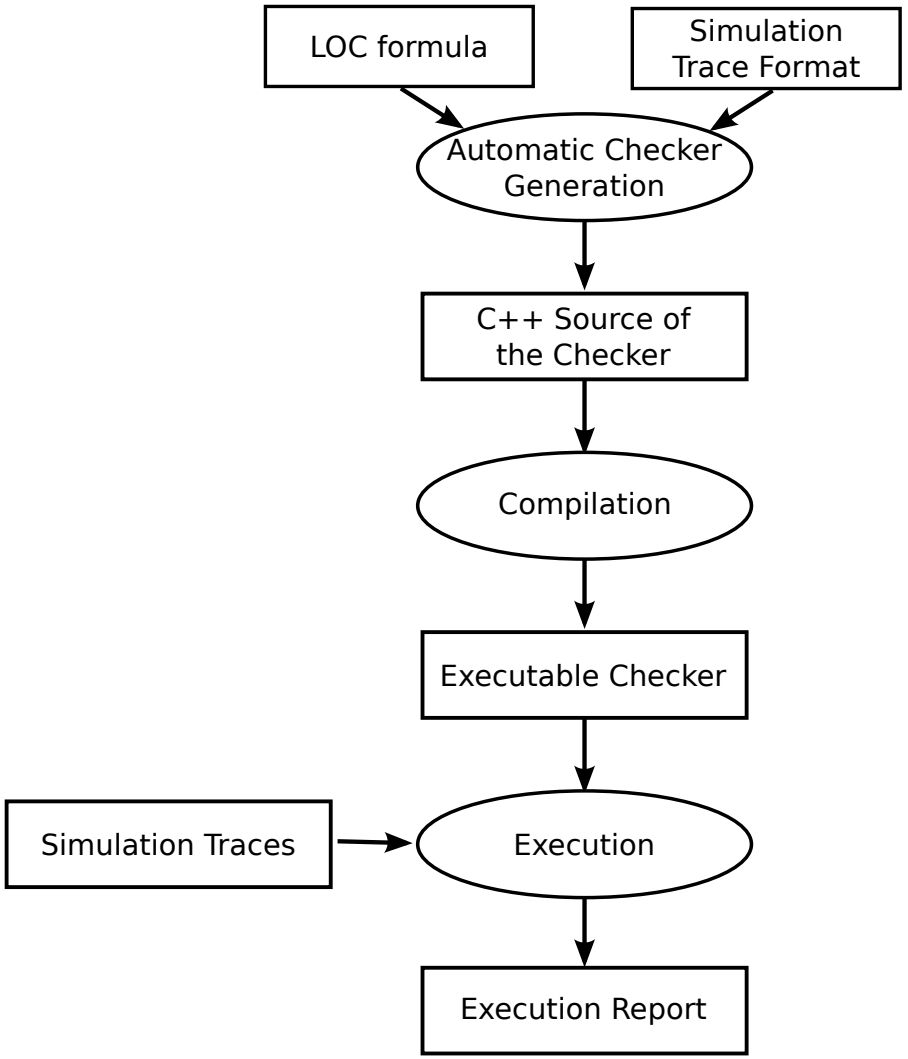


Trace analysis

Model checking oriented analysis tools

- Tango
  - Aims to validate protocol specifications
  - Not possible to validate system constraints (only working with workflows)
  - Lots of user's actions needed
  - Not a lot of information on the infringement's location

- Logic of Constraints checker
  - Better user experience than with Tango
  - Only information about constraint violation or not, nothing about the reason

Trace analysis

Data extraction tools

What are they offering?

- Extract data from traces
- Provide a limited automatic analysis to organize the data
- Give different views to the user to explore the trace data

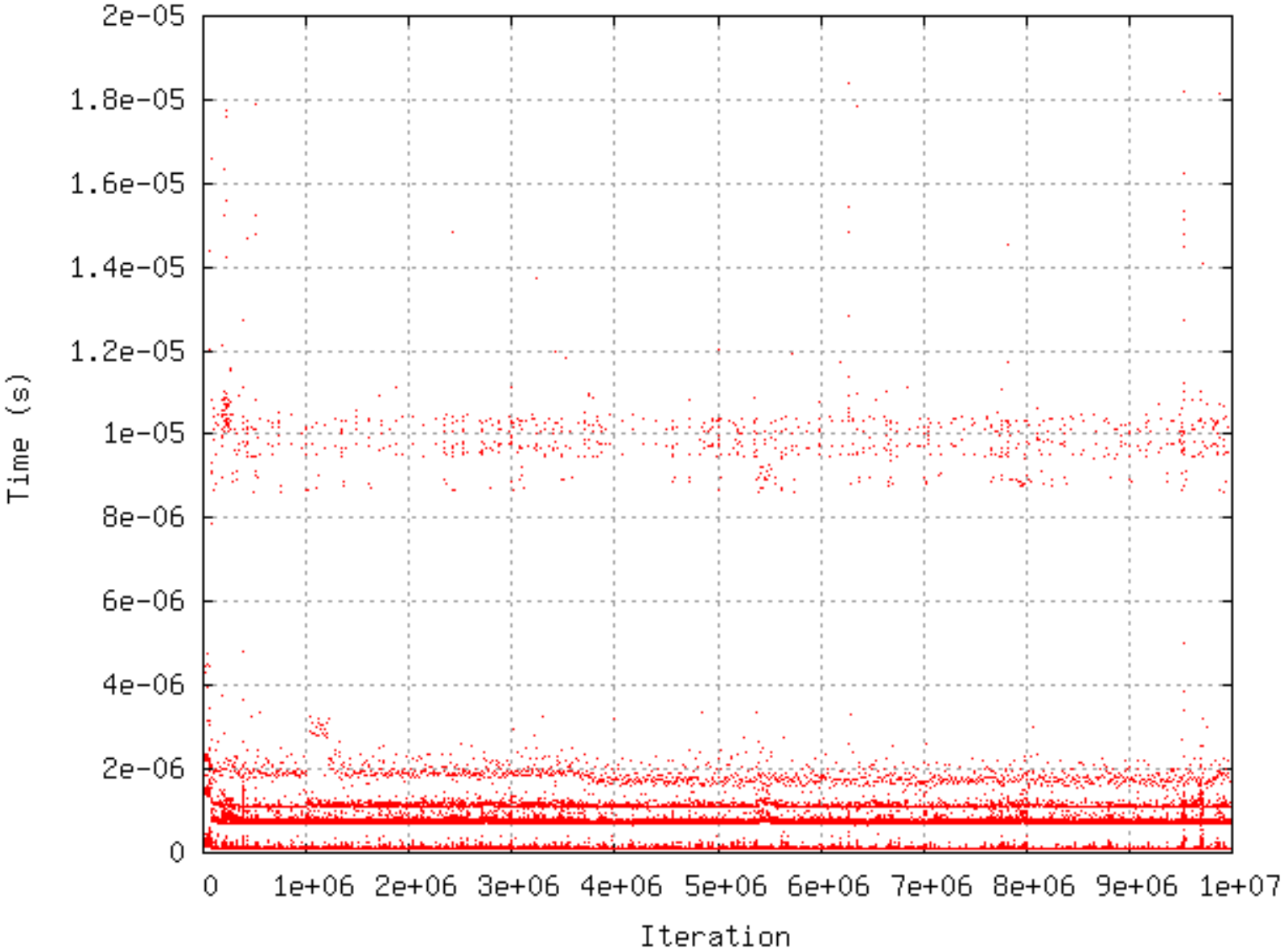
What are the limitations?

- Limited automatic analysis
- No knowledge of what the user is expecting
- Aims mid-expert to expert users that can navigate a trace

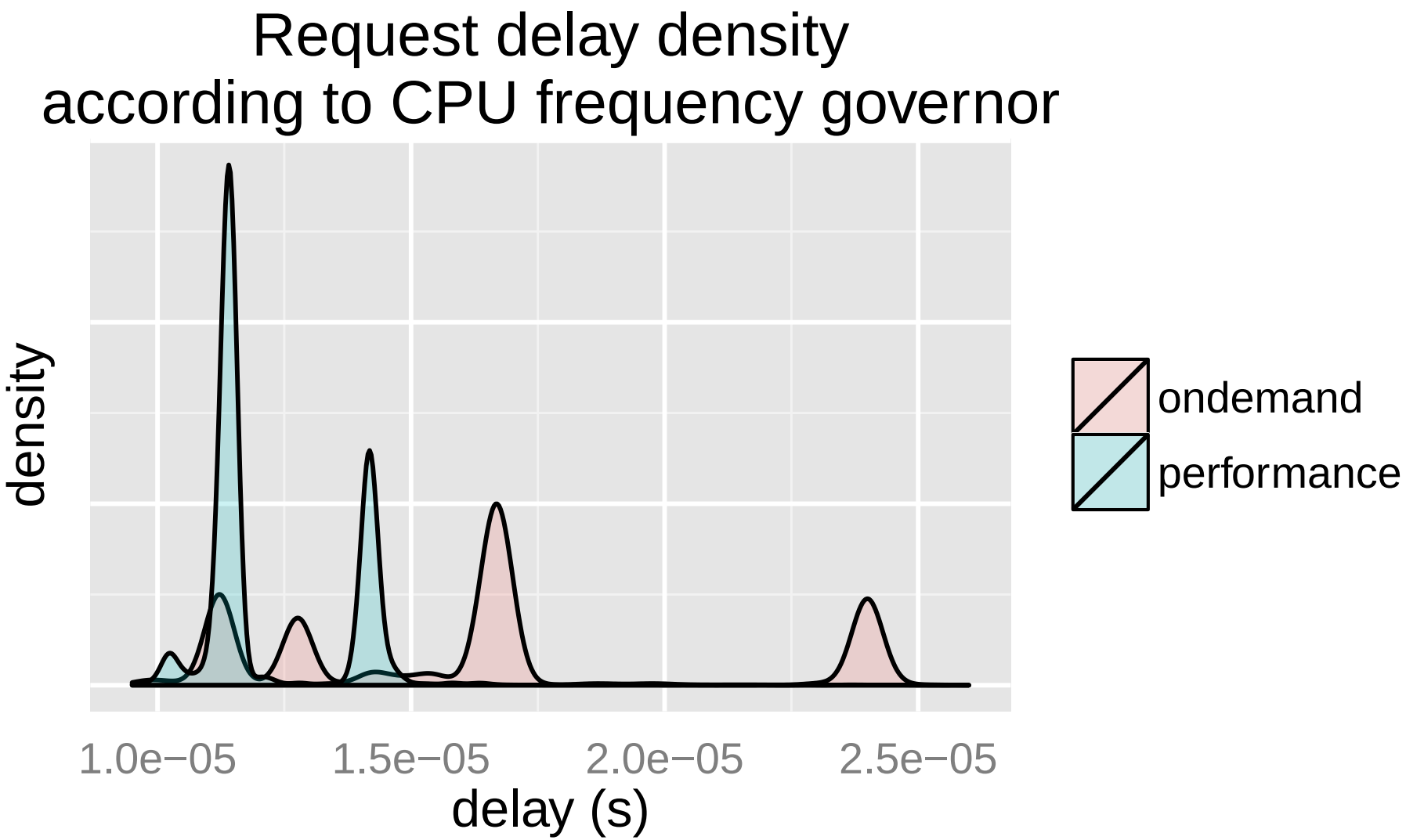
Example of problem

- `evfreq` tool of `workload-kit`
- Function that reads one 0 from `/dev/zero`
- 10 million iteration calling that function
- During each iteration, we store the current time in RAM
- We compute the time spent for each iteration
- What would the results look like?

Example of problem



Other example of problem



Track 1

Focus

- Advanced and automatic trace analysis using model-defined constraints
- Patterns and metrics of higher-level behavior identification
- Pinpoint the origin of the problem

Methodology

1. Constraints definition
2. Pattern identification
3. Constraints categorization
4. Constraints verification
5. Problem identification

Track 2

Focus

- Provide information on how to optimize the OS and application execution

Methodology

1. Pattern identification
2. Advices on the optimization

Track 3

Focus

- Automatic model-defined constraints construction using traces of valid instances of a task

Methodology

1. State machine construction
2. Constraints definition

Impact

- **Aim?** tracing community and its (current and future) users
- **How?** Better access to tracing tools for non-expert users
- **Consequences?**
  - Increased productivity for developpers and end-users
  - Faster marketing of the products
  - Tracing community growth

Thank you.
Any question?

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Slides:
www.dorsal.polymtl.ca/~rbeamonte/dorsal-pm-dec2014.pdf