Advanced Trouble-Shooting of Critical Real-Time Systems

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About this Presentation

➢ Intro: Why am I here?
➢ Real-Time Problems
➢ Proposed Solutions
➢ Demos
➢ Q/A?
About Matthew

- Coder
- Worked on Trace Compass since before Trace Compass existed. ;)
- Works at Ericsson, with Efficios and École Polytechnique de Montréal.
- Not a Hurricane.
About ERICSSON

➢ Working in Open Source
➢ Over 100k Employees, open source saves a lot of money
➢ Speeds up developer time (reduces time to market)
➢ No vendor lock-in
Eclipse Trace Compass

“The single greatest piece of software ever”
- Bribed Eclipse Trace Compass Developer

➢ Trace viewer
➢ Plays well with LTTng
➢ Can read many large traces and bring it all together
Real-Time Problem

➢ Late data is bad data
➢ Timing analysis finds and predicts problems
➢ 3 major problems:
  – Intermittent missed deadlines
  – Understanding in general
  – Regular missed deadlines
How to solve rt issues?

1. Collect
2. Locate
3. Analyze
4. Conclude
How we help

➢ Every event has a timestamp
➢ **Events** alone can find missed deadlines.
➢ **Event Patterns** can predict missed deadlines
➢ **Event Structures** can isolate the root cause of missed deadlines
➢ **Event Models** reflect why the bugs were written
Systemic Thinking

THE ICEBERG
A Tool for Guiding Systemic Thinking

EVENTS
What just happened?
Catching a cold.

PATTERNS/TRENDS
What trends have there been over time?
I've been catching more colds
when sleeping less.

UNDERLYING STRUCTURES
What has influenced the patterns?
What are the relationships between the parts?
More stress at work, not eating well, difficulty
accessing healthy food near home or work.

MENTAL MODELS
What assumptions, beliefs and values do people hold
about the system? What beliefs keep the system in place?
Career is the most important piece of our identity,
healthy food is too expensive, rest is for the unmotivated.

React
Anticipate
Design
Transform
Examples
Example 1:

➢ Bug in RT System:
   - Cyclic test with 3ms period/deadline “high” priority
   - IRQs on threads with “medium” priority
➢ Let's see what happens when trigger an IRQ
Demo
Example 1 (cont)

➢ Reason: KsoftIrqD wakes up cyclic test, it is a lower priority than the IRQ.
➢ The IRQ has a long service provider for HDMI handshakes.
➢ The system was misconfigured.
Example 2:

- Rover: A collaboration between Ericsson, École Polytechnique de Montréal, and the Canadian Space Agency

- An open source example:
  - To test robotic solutions for space at a reduced cost
  - To allow access to the full stack for a small fee
  - To have fun with tracing and debugging
Example 2 (cont)

➢ Objective: Understanding what's going on.
➢ I2C contention model
Demo
Example 2 (cont)

➢ It is important to model shared resources in simulation

➢ More aggressive locking may be desirable for predictable performance at the cost of peak throughput
Problem 3: (no example)

➢ Regular missed deadlines are easier to spot due to their regularity
  - Observe CPU usage
  - Observe I/O usage

➢ Typically misconfiguration or CPU overload
Take Aways

➢ Eclipse Trace Compass is able to correlate many trace sources and process the data.
➢ Anything Eclipse Trace Compass can do, a simple command line viewer can do to, but it requires much more expertise.
➢ The rover allows Eclipse Trace Compass developers to explore user experience opportunities.
➢ The priorities view can be used for more than finding inversions.