Software Failure Replay Webinar

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Undo

View the recording at
https://www.it-cisq.org/webinars/software-failure-replay.htm
How to accelerate software defect diagnosis with Software Failure Replay

Greg Law, co-founder & CTO
In the beginning

I well remember [...] the realization came over me with full force that a good part of the remainder of my life was going to be spent in finding errors in my own programs.

Sir Maurice Wilkes, 1913-2010
In Relay
Relays changed

Started Cosine Tape (Sine ch

Started Mult + Adder Test

Relay #70
(moth) in relay

First actual case of bug
ant was tangled started
closed down.
Computers are hard
cadence
Everyone knows that debugging is twice as hard as writing a program in the first place. So if you're as clever as you can be when you write it, how will you ever debug it?

Brian Kernighan
What happened?
What makes bugs really hard?

- Time between the root cause and effect being noticed
- Repeatability
What happened?

What was the previous state?

Two options:

1. Save it.
2. Recompute it.

\[ a = a + 1 \quad \checkmark \]

\[ a = b \quad \times \]
Event log

- *Event Log* captures non-deterministic state
- Stored in memory
- Efficient, diff-based representation

- *Recorded* during debug (or Live Recording)
- *Replayed* to reconstruct any point in history
- *Saved* to create a recording file for later use
Snapshots

- Maintain snapshots through history
- Resume from these - run forward as needed
- Copy-on-Write for memory efficiency
- Adjust spacing to anticipate user’s needs
In-process Virtualization

Record
- Captures all state changes in a running process
- 100% reproduction of execution history

LiveRecorder
- Record

Linux System

Recording

Replay
- Replay & analyze the recording
- Detect root cause of bug
- Reverse debug and resolve

Application

Linux Process

Application

Linux Process

Multiple implementations

For Linux:
- Undo LiveRecorder (C++, Go, Java)
- rr (C++, Go)
- gdb process record

For Windows:
- Microsoft’s Time-Travel Debugger (C++, C#, Chakracore JS)
- RevDebug (C#, Java)