

# PRACTICAL CONCURRENCY MODEL AGNOSTIC RECORD & REPLAY

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## Problem

- Multiple concurrency models in one application
- Non-deterministic bugs are hard to reproduce
  - Record & replay can help

## Basic Idea

- Use abstraction for concurrency models
  - **Activities** model processing power
  - **Passive Entities** are used by activities for communication and synchronization
- Identify and instrument relevant nondeterministic operations in each model
  - record operations as events with ordering information

| Model                              | Activities  | Passive Entities | Non-determinism                       |
|------------------------------------|-------------|------------------|---------------------------------------|
| Actors                             | Actor       | Promise, Message | Message order per actor               |
| Threads & Locks                    | Thread      | Lock, Condition  | Order of lock acquisitions            |
| Communicating Sequential Processes | Process     | Channel          | Order of reads/writes from/to channel |
| Software Transactional Memory      | Transaction | -                | Commit order                          |

## Concurrency Model Agnostic Framework

- Uniform event representation and infrastructure
  - Natively support cross-model interactions
- Provides basic functionality for instrumentation
  - Simple event recording
  - Poll and peek event sequence
- Uniformly handles
  - Management of thread-local buffers
  - Persisting traces
  - Retrieving events from trace files

