Develop an explicit state model checker for the Actor Model of computation using JPF, called 'Basset.'

Discover bugs in actor-based systems that would otherwise jeopardize the safe and reliable execution of the given program.

Preserve actor semantics while efficiently exploring the state space for property violations.

Parallel programming is becoming more widespread as multi-core systems become common, but parallel programming is hard. The Actor Model is a model of parallel computation, conceptually based on message passing and no shared state.

Java PathFinder (JPF) is an extensible, open-source explicit state model checker for programs compiling to Java bytecode.

Research Plan

Implement a general framework for testing actor programs on top of JPF.

Explore various possible interleavings of message delivery.

Reduce the state space by partial order reduction and state comparison.

Instantiate the system for two Java-based actor implementations: ActorFoundry and Scala.

Goals

Develop an explicit state model checker for the Actor Model of computation using JPF, called 'Basset.'

Discover bugs in actor-based systems that would otherwise jeopardize the safe and reliable execution of the given program.

Preserve actor semantics while efficiently exploring the state space for property violations.

Related Work/Interaction with Other Projects


Fundamental Questions/Challenges

How to avoid testing the underlying implementation of the Actor Model while testing the program of interest?

Actor libraries themselves built on top of complex multi-threaded architectures.

What heuristics lead to effective exploration of actor programs?

Decrease search time and memory usage.

What properties of the Actor Model must be maintained to preserve integrity in testing? Which can be simplified/discarded for efficiency?