Symbolic Execution Projects from the Software Reliability Group

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# Symbolic Execution for Evolving Software

**Automated Chopped Symbolic Execution**

- Automatically skip parts of the code that are irrelevant to a patch
- Talk by Martin tomorrow

**Product Programs for Cross-Version Symbolic Execution**

- Leverages ideas from product program constructions (used to reason about non-interference)
- Reason about multiple versions in the same symbolic execution instance
Memoised Symbolic Execution

• Allow "forever" runs of symbolic execution by:
  • saving the current run to disk
  • incrementally bringing it back into memory

Deterministic Memory Allocation

• Effectiveness of memoised symbolic execution and other techniques depends on determinism across runs

• KDAlloc is a memory allocator specifically designed for symex:
  • is cross-run and cross-path deterministic
  • maximises the probability of finding memory-safety bugs
  • keeps a low memory and performance overhead

• Talk by Daniel just before lunch
Exploration Heuristics

Pending Constraints

• Aggressively prioritize paths whose constraints can be solved via caching or seeding
• Defer *pending constraints* until they really need to be solved
• Talk by Frank tomorrow

Confirming Static Analysis Reports

• Guide symbolic execution to follow the traces in SA reports
• If successful, the bug report is confirmed and an input produced
• Poster talk by Frank after lunch
Approximating Floating Point via Fixed Point

- SMT solvers for floating-point arithmetic are notoriously slow
- Would an approximation via fixed-point arithmetic be fast and precise enough?
- Our approach defers fixed-point reasoning as much as possible, with concrete operations staying in the floating-point domain
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- Automated Chopped Symbolic Execution
- Multi-Version Testing with Product Programs
- Confirming Static Analysis Bug Reports
- Memoised Symbolic Execution
- Deterministic Memory Allocation
- Pending Constraints
- Approximating Floating Point via Fixed Point