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The Center for Education and Research in Information Assurance and Security

ALEXKIDD-FUZZER: Kernel Fuzzing Guided by Symbolic Information

(Working in Progress)

Kyungtae Kim and Byoungyoung Lee

Department of Computer Science and CERIAS, Purdue University

PROBLEMS

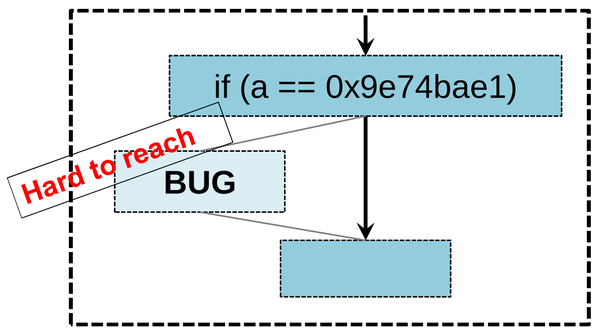
- Unexplored paths and low code coverage due to low quality of inputs

OBJECTIVE

- Find more BUGS/CRASHES on various system software (i.e. OS kernel)
- Maximize kernel code coverage

MOTIVATION

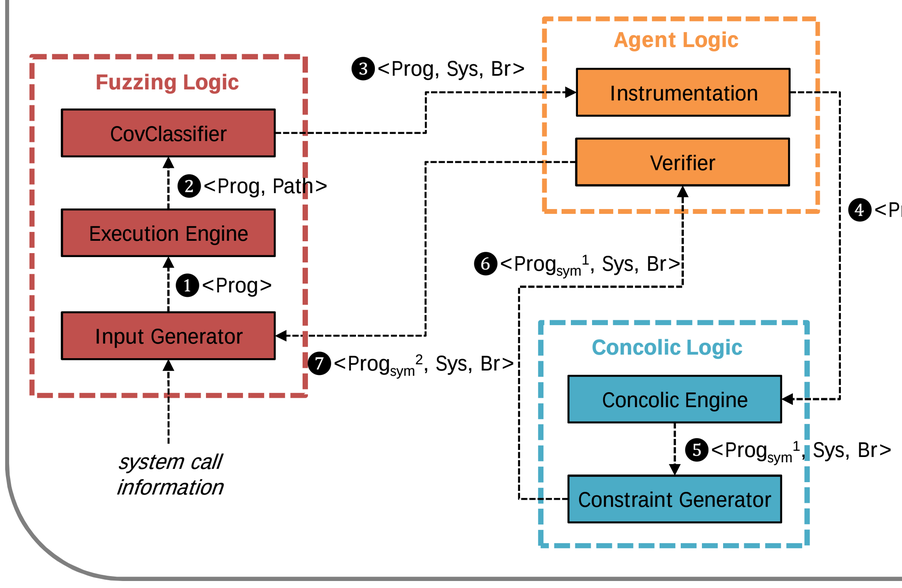
- Black-box fuzzing and white-box fuzzing (i.e. symbolic execution) are both getting popular for software testing
- Black-box fuzzing has limitation of handling constant values whereas such a random testing is fast and efficient
- Symbolic execution suffers from state explosion and performance overhead of constraint solver although it can generate high quality inputs which lead to all feasible paths



PROPOSED SOLUTION

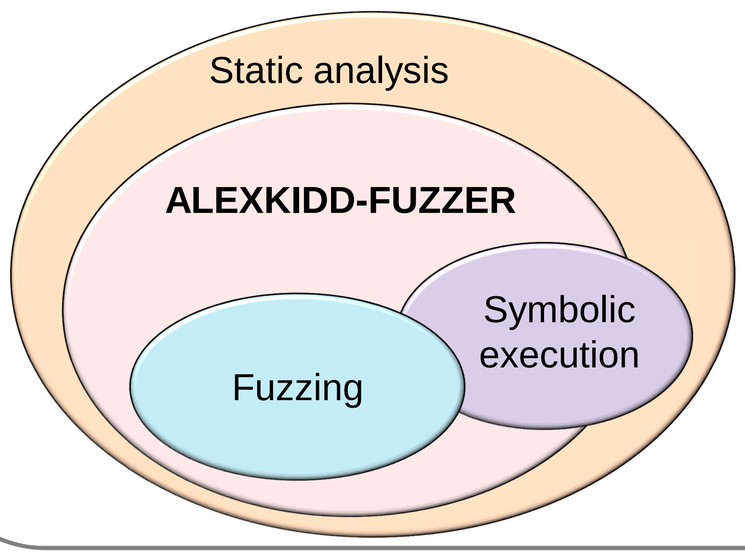
- We design ALEXKIDD-FUZZER, which overcomes limitation of fuzzing and symbolic execution.
- We first employ general fuzzing mechanism such that feasible execution paths are explored at a rapid pace.
- Furthermore, during fuzzing execution, we allow concolic engine to guide the fuzzer to make unreachable-code reachable.

PROJECT OVERVIEW



- ***Fuzzing logic*** generates and mutates input programs depending on various sources and transfer particular inputs that need to be further analyzed by agent logic
- ***Concolic logic*** records path constraints and solve them during concrete execution of input programs
- ***Agent logic*** glues between fuzzing and concolic logics by symbolizing input programs and verifying constraints

EXPECTED CODE COVERAGE



IMPLEMENTATION

- All implementation is on Ubuntu-14.04 LTS
- Main fuzzing logic is built upon Google syzkaller
- Concolic logic leverages S2E symbolic execution framework
- Agent logic is written in python 2.7

CHALLENGES

- How to handle nondeterministic behaviors caused by global state
- How to generate valid sequences of system calls in user programs

FUTURE WORK

- Measure code coverage and performance overhead
- Find real-world bugs/crashes and analyze them.

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