Introduction of Configuration Awareness Into an Evaluation Framework for Fuzz Testing

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INTRODUCTION

Fuzzing is a key tool used to reduce bugs in production software

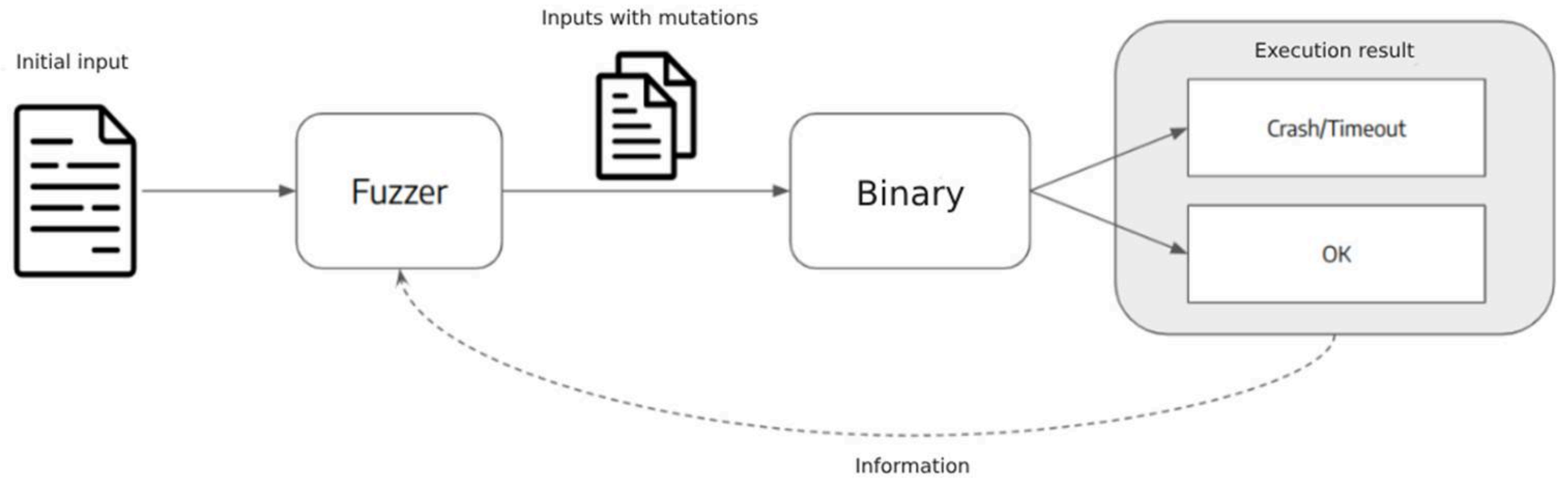


Fig. 1 The fuzzing process

Configuration-aware fuzzer actively analyzes and varies configuration options during fuzzing

The Problem
Existing fuzzing benchmarks, most notably FuzzBench, evaluate fuzzers on a single, fixed configuration.

Our Solution
We extend FuzzBench to support configuration-aware fuzzing by enabling runtime configuration control.

Motivation
The growing body of evidence demonstrating that configuration-aware fuzzers consistently outperform traditional fuzzers in both bug discovery and code coverage

Our Approach

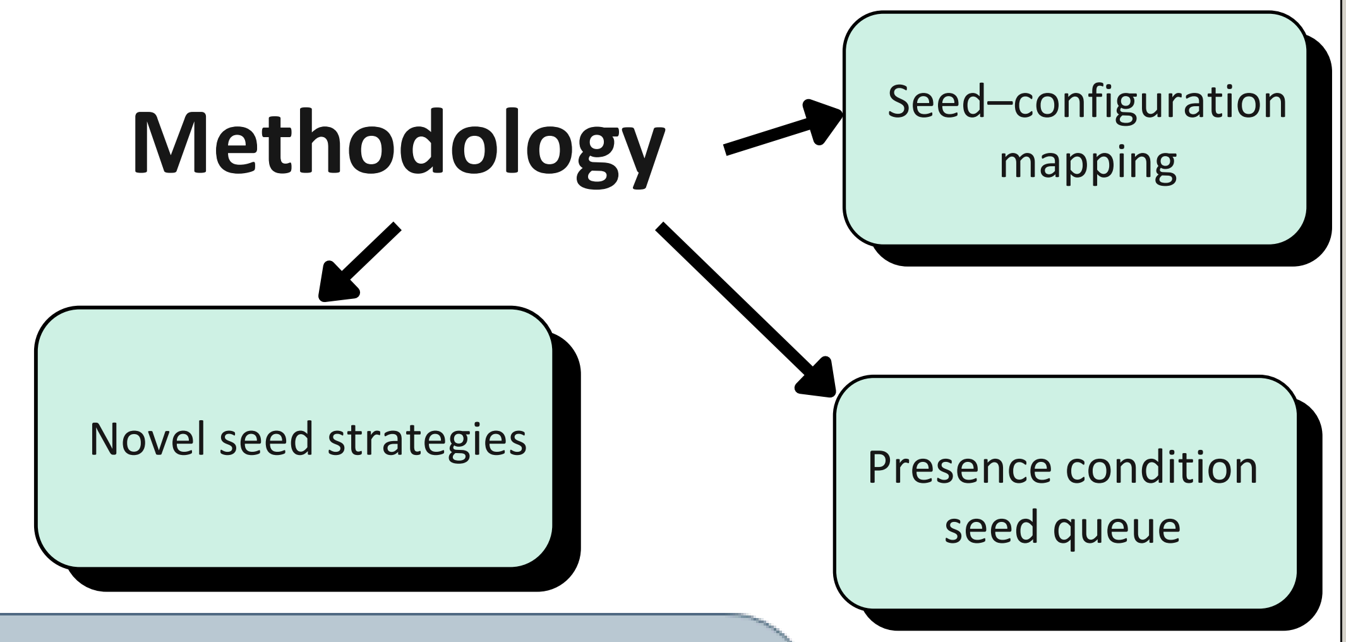
Modifications to existing framework → **Tests Configuration Aware Fuzzers** → **Produces relevant reports**

Key Goal
Allow fuzzers that manipulate configurations during fuzzing to be evaluated under standard, reproducible conditions.

Variability Aware Fuzzer (VAFuzz)

Overview
Development of **Variability-Aware fuzzer** to establish importance of the framework

A type of a **configuration aware fuzzer** where the fuzzer it explores multiple feature combinations to uncover bugs hidden across the configuration space and hence enhance configuration space exploration.



Methodology

- Seed–configuration mapping
- Novel seed strategies
- Presence condition seed queue

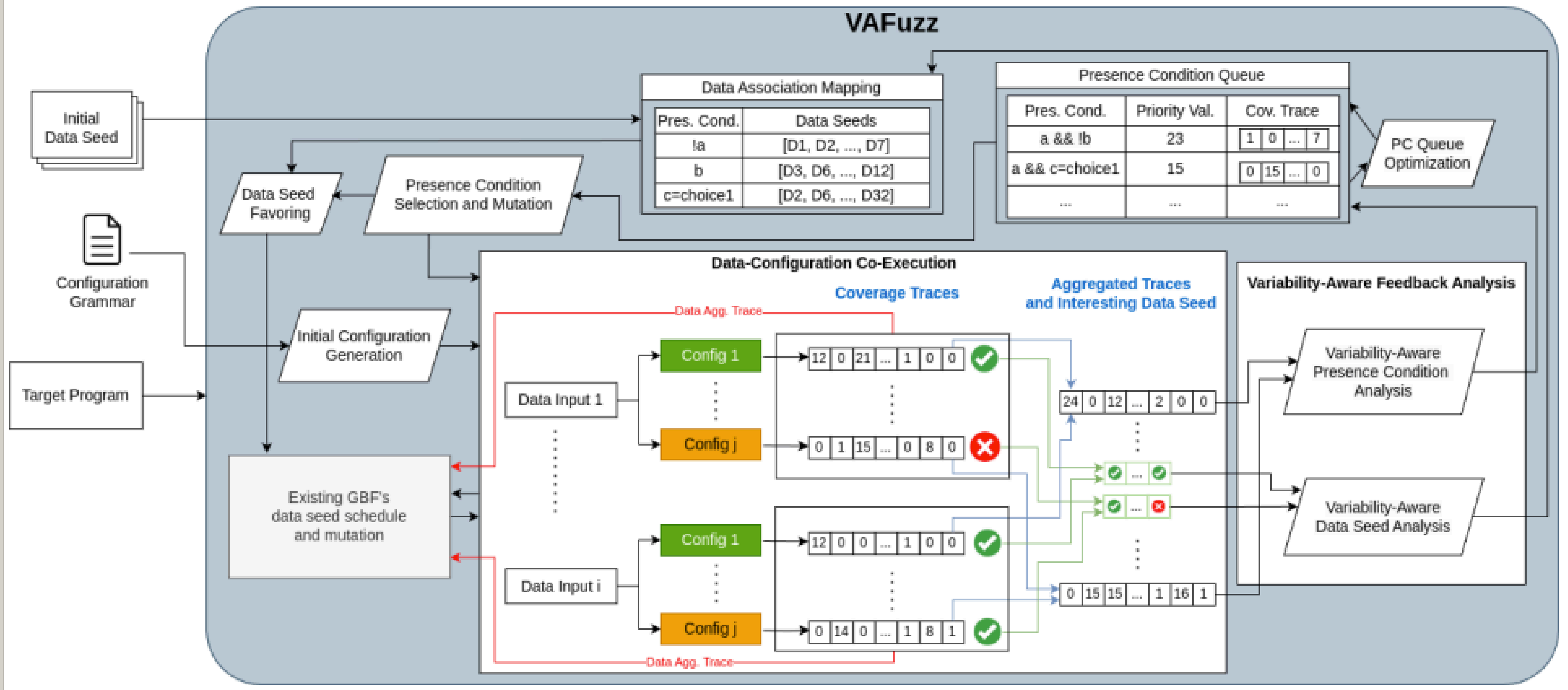


Fig. 2
Workflow of VAFuzz

Results

Programs	VAFuzz		ZigZagFuzz		AFL++	
	Coverage	Bugs	Coverage	Bugs	Coverage	Bugs
cjpeg	4162	0	3680	0	1143	0
jpegtran	5292	0	2254	0	1302	0
fax2ps	2275	1	1903	1	1835	0
fax2tiff	1586	0	1485	0	821	0
tiff2pdf	2087	0	1592	0	1075	0
tiff2ps	1522	0	1380	0	1179	0
tiffcp	2648	0	207	0	1050	0
gif2png	414	2	413	2	320	2
nasm	4268	3	3388	0	750	0
ndisasm	877	1	808	0	385	0
nm	291	2	287	0	101	0
objdump	2951	7	2652	0	1302	0
xmlcatalog	4271	0	3821	1	1778	0

Table 1 Coverage and bug detection results for different fuzzers

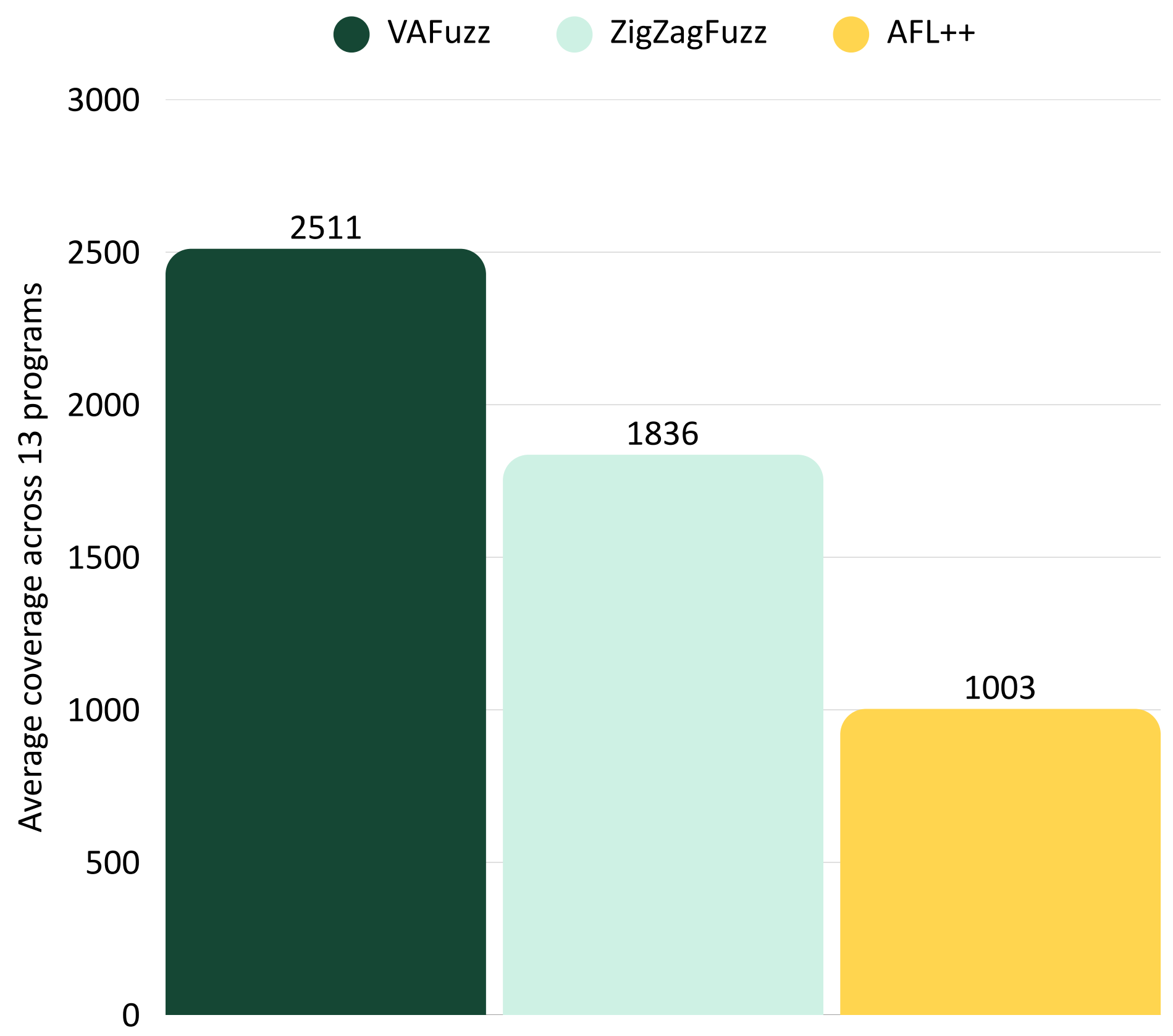
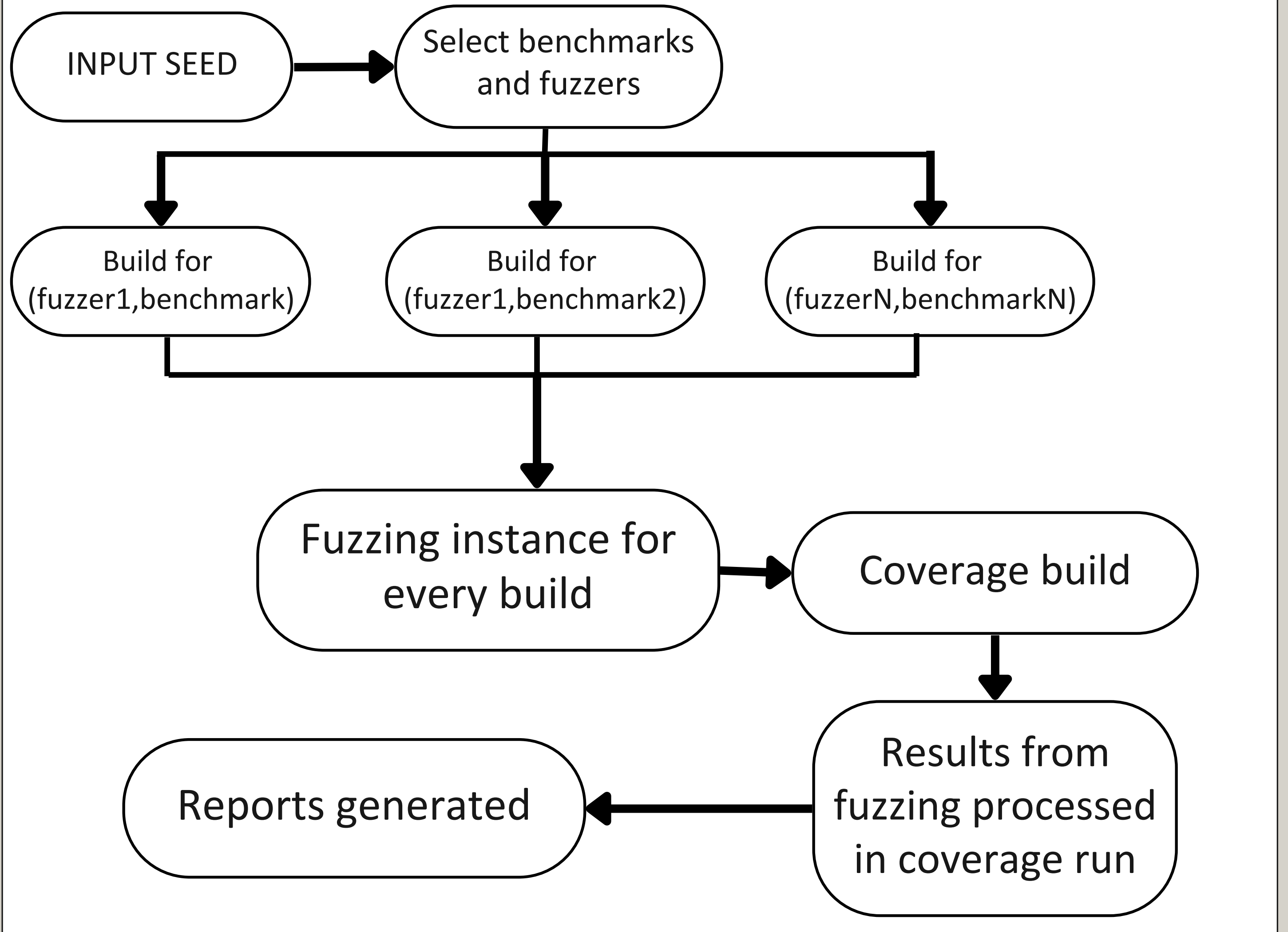


Fig. 3 Average coverage of the 3 tested fuzzers

Conclusion
VAFuzz and ZigZagFuzz (configuration-aware fuzzers) outperforms AFL++ (traditional non-configuration-aware fuzzer)

INTEGRATION OF CONFIGURATION AWARENESS INTO THE FRAMEWORK



INPUT SEED → Select benchmarks and fuzzers

Build for (fuzzer1,benchmark)
Build for (fuzzer1,benchmark2)
Build for (fuzzerN,benchmarkN)

Fuzzing instance for every build → Coverage build

Results from fuzzing processed in coverage run → Reports generated

Fig. 4 Detailed design of the evaluation framework

Key Changes

- Benchmarks with targets which changed from LibFuzzer harness and Clang to AFL++ compiler to allow compatibility with configuration aware fuzzers

Future work

Completing the implementation with full functionality including multiple configuration aware fuzzers and the option to add a new configuration fuzzers to be tested on a large benchmark set with the choice of compile time strategy

Contact

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