TECHNISCHE UNIVERSITÄT DARMSTADT

DEEDS Group

Master's Thesis

Software Bugs as Program Variants

Background

Software Fault Injection (SFI) is a testing technique that deliberately introduces software bugs in correct code to assess if and how other parts of the system are affected by the resulting software failures. Among other use cases this is useful to assess the impact of residual software bugs, i.e., software bugs that escape testing, remain dormant in the deployed software and eventually get triggered in operation.

According to NASA code statistics, highly critical and very carefully tested code still contains 0.1 bugs per thousand lines of code (KLOC) on average. As modern software stacks comprise many million lines of code (Linux kernel: ~ 20 million, Windows: ~ 50 million, automotive systems: ~ 100 million) and are commonly less well tested than NASA's space mission programs, several thousand residual bugs are an optimistic estimate for these systems. Consequently, SFI tests need to account for that and test with different fault combinations. Unfortunately, this leads to a "combinatorial explosion" of the number of test cases.

Current approaches to deal with this complexity simply reduce the number of test cases to a manageable fraction, sadly often without providing an argument that the performed reductions preserve the conclusiveness of the analysis.

Objectives

Recent advances in data flow analyses of software product lines (SPLs) have led to significant reductions of analysis time by avoiding the repeated analysis of common code across the different variants. The goal of this thesis is to explore to which degree similar reductions apply for fault-based robustness analyses.

For this purpose, software faults need to be modeled as software "variants" using conditional compilation as provided by `#ifdef` preprocessor directives in C/C++.

Prerequisites

Candidates should be familiar with C/C++. Experience with static analyses or software (robustness) testing are beneficial. The thesis will be written in English.

Duration/Start

Immediate

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Literature	Analysis	Implementation	Awesomeness
			

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