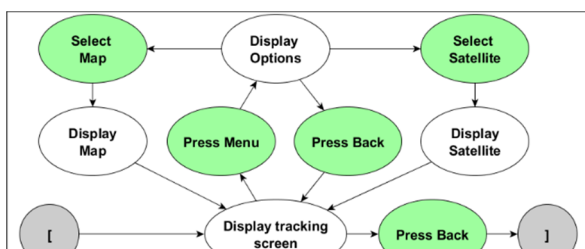


REUSE OF MODEL-BASED TESTS IN MOBILE APPS

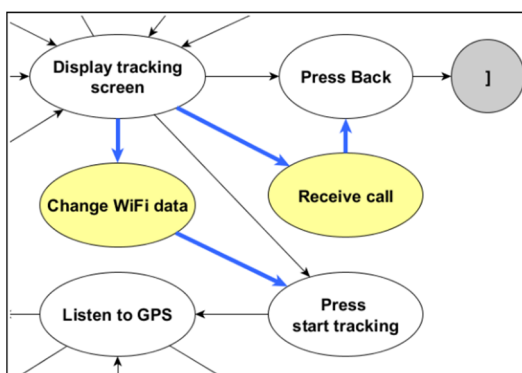
This briefing reports scientific evidence on effectiveness of an approach for mobile apps in which test models are reused to (i) reduce effort for concretization and (ii) test other characteristics of apps, such as device-specific events, unpredictable users' interaction, telephony events, and sensors and hardware.

FINDINGS

- The findings presented in this briefing consider the analysis of the adoption of an proposed approach to reuse test cases in the context of mobile applications based on the use of Model-Based Test (MBT) and Event-Sequence Graph (ESG);
- The experimental evaluation of the proposed approach was conducted collaboratively with a multinational IT company leader and from the use of three real mobile applications;
- The proposed approach aims to reuse test models so that (i) the effort of concretization could be reduced and (ii) specific characteristics of mobile apps would be tested;
- The approach is divided in strategies:
 - Method Template: focuses on associating stereotypes (templates) to reduce the effort for automation (test concretization);



- Edge Template: focuses on associating stereotypes to event pairs to consider characteristics that might influence the app behavior;



- A tool named MBTS4MA (Model-Based Test Suite For Mobile Apps) was developed using the Java technology, integrates to the Robotium framework, and aims to test native Android apps;

- Main features of MBTS4MA tool are:
 - Extract useful metainformation from Android SUT artifacts (such as XML files for labels, layouts, and other configurations);
 - Model ESGs with an interactive GUI;
 - Inject events on the original ESG;
 - Derive CESs (test sequences);
 - Generate test templates and adapters for Android apps;
- Concerning modeling, we noticed an increase on the effort when the Method Template strategy was employed – the increase of modeling time varied from 25% to 30%, in comparison with MBT (first iteration);
- The modeling effort also increased with Edge Template strategy by varying from 12% to 19%;
- As for concretization, the Method Template strategy helped to reduce effort and had a positive impact – a reduce varying from 38% to 48%, in comparison with MBT (first iteration);
- The concretization effort with the Edge Template strategy remained almost constant – thus, Edge Template strategy helps to test other characteristics of mobile apps, while the cost of manual concretization is close to null;
- By testing specific characteristics of mobile apps, we covered test cases beyond the goals initially defined for the test model – thus, we can increase the return on the effort spent to design the model;
- The proposed approach and tool were able to test different characteristics of mobile apps, increasing the return on investment over the effort spent – the tested scenarios were:
 - Incoming call when displaying offline map;
 - GPS coordinates are sent with reduced precision (few decimal points);
 - Sending data via Bluetooth when Bluetooth is not available;
- Five faults were found in the SUTs and it is important to emphasize that the mobile apps' versions were already in a production env.;
 - Two faults were detected using the approach with Method Template strategy;
 - Three faults were detected using the approach with Edge Template strategy by testing specific scenarios;
- The fact that faults were identified with proposed approach and the testing tool provides some evidence of fault detection capabilities;
- Our initiative helped to simplify and result in a partial generation of concrete test cases and the results also evince that our approach is able to uncover new faults by reusing designed models to test other characteristics of mobile apps;

Who is this briefing for?

Software engineering practitioners who want to make decisions about an **approach for mobile apps in which test models are reused to (i) reduce effort for concretization and (ii) test other characteristics of apps** based on scientific evidence.

Where the findings come from?

All findings of this briefing were extracted from the **experimental evaluation with three real-world mobile apps** conducted by **Guilherme de Cleve Farto et al.**

What is included in this briefing?

The main findings of the original **experimental evaluation conducted in cooperation with a multinational IT company leader.**

Evidence characteristics through a **brief description about the original experimental evaluation and the studies it analyzed.**

What is not included in this briefing?

Background information on Model-Based Testing (MBT) and its related concepts presented in the original paper.

Detailed discussions about the studies analyzed in the original experimental evaluation.

To access other evidence briefings on software engineering:

<https://dl.acm.org/citation.cfm?doid=3131151.3131160>

<http://www.lia.ufc.br/~cbsoft2017/xxxi-sbes/sbes-cfp/>

<https://github.com/guilhermefarto/MBTS4MA>

ORIGINAL RESEARCH REFERENCE

Guilherme de C. Farto, André T. Endo, Reuse of model-based tests in mobile apps, Proceedings of the 31st Brazilian Symposium on Software Engineering (SBES 2017), Brazil - September 2017, Pages 184-193, ISBN 978-1-4503-5326-7, <https://doi.org/10.1145/3131151.3131160>