

FutureApp

Novel Development, Verification, and Validation Techniques for Apple Apps

– Start in Winter Semester 2013/2014 –

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2013-01-16

1 Background

The ubiquitous utilisation of smartphones and tablet computers has increased the significance of App development in an impressive way. The resulting competition in App development and the users' dependency on their trustworthy operation leads to an increasing demand for effective high-quality development, verification and validation (V&V) methods and integrated development and V&V environments. As of today, two App development paradigms are of specific importance.

- App development for the Android platform based on Linux and Java, and
- App development for Apple Mac and iOS platforms based on the Darwin operating system core, the Cocoa framework and Objective C, supported by the Xcode IDE.

2 Project FutureApp

This project focuses on novel development and V&V methods for App development in the Apple framework, with iPad and iPhone as target platforms. The project is structured into 2+2 semesters; the first year is a bachelor project with a well-defined (sub-)project objective, and the second year is a master project.

Bachelor Project Objectives. The first year Bachelor project has the following objectives.

- Become familiar with the existing development and V&V paradigms and supporting tools.
- Develop and verify new Apps in the existing framework.
- Make a critical assessment of the framework as is, with respect to development efficiency and quality assurance through V&V, as well as to the properties of Objective C in comparison to Java and C++.

Apple provides an attractive IDE through their Xcode toolset, including support for development, test, and static analysis. The IDE is connected to state-of-the-art configuration management, such as Github. This environment will be comprehensively explored and assessed in a critical way during the first year. App development will focus on applications using “interesting” interfaces to other functions and the outside world, such as Maps and GPS.

Master Project Objectives. The second year focuses on two novel areas in the field of App development.

- Model-based development for Apps of specific domains,
- Automated testing of Apps.

In domain-specific model-based development code is no longer developed in a manual way, but generated instead from models developed in so-called domain-specific languages (DSL). This approach increases productivity and quality of application development in a significant way, in particular if target systems can be classified according to well-defined application domains. We will use the MetaEdit+ tool to elaborate a DSL for a specific App domain and develop code generators transforming models into the Cocoa domain framework.

On the V&V side, the existing Xcode testing framework will be extended by test automation tool components: test data for maximising code coverage can be automatically calculated and wrapped into unit test procedures. Based on DSL models, HW/SW integration tests can be automatically derived. For both tasks, the test generation algorithms developed in our research group can be used as a starting point and adapted, refined, and improved during the project.

3 Project Infrastructure

A project room is available. Latest hardware and software platforms for development (Mac computers), as well as target platforms (iPad) will be available. Project members are welcome to bring their own Apple equipment, but this is not mandatory.

The project will be supervised by Jan Peleska and his assistant Blagoy Genov.

4 Recommended Lectures

The following lectures are of interest for the project – note that only a subset of this list is mandatory.

- Systems of high quality, safety, and security (Systeme hoher Qualität und Sicherheit)
- Specification of embedded systems (Spezifikation eingebetteter Systeme)
- Test Automation (Testautomatisierung)
- Theory of Reactive Systems (Theorie reaktiver Systeme)
- Operating Systems (Betriebssysteme)
- Development of Operating Systems (Entwicklung von Betriebssystemen)

5 Bachelor and Master Theses and More

The topics covered in this project present a wide range for Bachelor and Master Theses, from simple to sophisticated. The model-based testing approach, while being well-understood for test objectives of medium complexity, offers a wide variety of research challenges, giving the opportunity to work on exciting doctoral and habilitation theses.