Abstract. Reactive systems may be composed of a number of concurrent processes and network distributed services, where interruptions in a flow of execution can occur at any time. These systems are very difficult to test. One of the reasons is that the possible number of combinations of allowed interruptions at different points of a flow of execution is huge. This makes exhaustive specification of each possibility infeasible. Without a specification, automated test case generation and selection is compromised. This work presents a strategy for testing interruptions in reactive systems that covers modelling (devoted to testing) of systems with interruptions, generation and selection of sound test cases. The strategy is supported by the LTS-BT tool. A case study is presented to illustrate its applicability in the mobile phone application domain.

1 Introduction

Reactive systems interact with their environment by accepting inputs and producing outputs. Apart from being inherently non-terminating, these systems are becoming more and more complex, for instance, by incorporating features such as interruptions that are caused by concurrent processes and network distributed services that demand instant execution in a given device. In this case, the process running in foreground is instantly suspended to release resources for the interrupting process. After the interruption, the interrupted process should resume from the point where it stopped. As an example, when a user is composing an e-mail by using a mobile phone device and an incoming call arrives in this device, the call feature interrupts the e-mail feature that must successfully resume later.

Considering that any interruption can occur at any point of a flow of execution, there are infinite possibilities of occurrences. This makes the exhaustive specification of each possibility infeasible and, consequently, automatic test case generation and selection is compromised. Effective testing requires a systematic investigation of all possibilities and, consequently, automation.

To provide an effective solution for interruption testing, it is crucial to define a model capable of representing such interruptions, and consequently, make the automatic test case generation process possible. In addition, the model has to be composable, allowing interruptions to be combined at different points of possibly different flows of execution. Moreover, due to the huge amount of possible test cases, selection strategies need to be applied to reduce the size of test suites.
The particular problem of evaluating if a system implementation is in accordance with its specification by experimentation is referred to as conformance testing. Considerable progress has already been made in this area from both theoretical and practical point of view. The AGEDIS project [1] is an outstanding initiative. Nevertheless, to the best of our knowledge, approaches that handle applications with interruptions are practically nonexistent.

This paper presents a strategy for conformance testing of reactive systems with interruptions that covers modelling (devoted to testing), generation and selection of sound test cases. The model adopted is named Annotated Labelled Transition System (ALTS). This kind of Labelled Transition System (LTS) has special descriptions inserted into the model in order to make the test case generation process feasible. LTSs are good models for representing functional testing models because all information needed is the observable interactions between applications and environment and between applications. Also, they are the underlying formalism of most formal notations for reactive applications. The proposed model is implemented by the LTS-BT tool [2]. A case study illustrates the benefits of the strategy when compared to manual selection.

The remainder of this paper is structured as follows. Section 2 presents the general test process considered. Section 3 presents the ALTS behavioural model structure used to model interruptions. The interruption test case generation algorithm and a selection strategy based on test purposes are introduced in Section 4. In Section 5, some properties of the interruption test cases generated by LTS-BT are discussed. A case study is presented in Section 6. Finally, Section 7 presents related work and Section 8 concluding remarks.

2 Context

In general, the test process in the context of this work starts with the specification of the System Under Test (SUT) and interruptions. Given the high level specifications, an ALTS model is automatically generated. Finally, the ALTS model is combined with test purposes for interruption test case generation. The interruption test process uses test purposes in order to test at specific points of interest. A general view of this test process is presented in Figure 1.

The interruption test process considers the test architecture presented in Figure 2. In this test architecture, two elements are important: the SUT and