VAST 2011 Workshop Summary

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Abstract

The purpose of this article is to report about the first international workshop on Variability-intensive Systems Testing, Validation & Verification (VAST) which was held as part of the IEEE International Conference on Software Testing, Verification & Validation in Berlin on March 21st, 2011.

Introduction

Variability is key enabler for most systems throughout their development and evolution. Customer demand and continuously changing context (environment, legal and business settings, technology, etc.) call for more adaptability in software engineering. This major trend impacts the whole engineering process, with emerging key paradigms such as Software Product Lines, Service-oriented Systems, Dynamically Adaptive Systems and Aspect-Oriented Modelling. All these paradigms aim at providing solutions to introduce and manage variability at different stages of the lifecycle. Combinatorial explosion due to variability is a common problem spanning over all these paradigms.

Testing and verifying variability-intensive systems thus becomes a key issue that is gaining increased attention in practice. To date, specific techniques such as combinatorial interaction testing and modular checking have been proposed to tackle it. However, the field is still in its infancy. Although first results showing promising outcomes, they need to be fully developed and their practical applicability has to be demonstrated. The integration and combination of V&V techniques is a possible direction to address the aforementioned challenges. Questions concerning the scalability, quality and usability of the results as well as integration during the development lifecycle still have to be answered. Furthermore, being scattered across several communities, some general advances may be difficult to share and spread widely.

The objective of the 1st International Workshop on Variability-intensive Systems Testing, Validation and Verification was to provide a forum for practitioners and researchers to share their ideas and results and to start discussions on a common research agenda for testing, verification and validation of variability-intensive systems. The workshop was held on March 21st, 2011, in Berlin, co-located with ICST, the IEEE International Conference on Software Testing, Verification & Validation.

VAST featured six paper presentations, involving authors from Germany, Sweden, Norway and Italy. Those presentations were organized in four sessions and are detailed below. The workshop was opened by a keynote presentation.

Keynote

The keynote presentation focused on Service Testing: Achievements and Future Research Directions and was given by Massimiliano Di Penta from the University of Sannio. Massimiliano first explained the motivations behind service testing which could be summarized in one sentence: “Services are everywhere and everybody uses them”. This implies that such systems have to be thoroughly and carefully tested. Yet, there are specific challenges; involved stakeholders have often conflicting needs, source code is not always available (allowing for black-box testing only), the environment is constantly evolving, and the boundaries of the system are not easy to define. Massimiliano presented how to address such challenges by means of genetic algorithms trained to generate test cases that could challenge the system under test. Other search-based techniques were applied to the problem as well. The choice of these approaches was motivated by the fact that current search-based software works “out of the box” and avoids “reinventing the wheel”.

Software Product Line Testing

Emelie Engstrom presented the results on Decision Support for Test Management and Scope Selection in a Software Product Line Context [ER11]. Various challenges of testing a software product line at multiple levels have been discussed. Emelie proposed regression testing as a means to address these challenges and presented three techniques, namely prioritization, selection and reduction, to deal with the vast amount of artifacts to test. She also emphasized the use of visualization tools as a support for these activities.

In Survey of Empirics of Strategies for Software Product Line Testing [JHF11], Martin Fagereng Johansen reported on a literature survey on the empirical evidence provided for software product line testing approaches. The main message of the presentation was that it is difficult to find evidence for such techniques that are complete and concern applications actually running in production. This is in line with other surveys on the application of variability management techniques in practice, highlighting the need for more empirical studies.

Formal Verification and Testing

In Proof Composition for Deductive Verification of Software Product Lines [TSKA11], Thomas Thüm demonstrated how
it is possible to benefit from proof composition to save the human effort for writing them. In particular, he proposed a novel verification technique called feature-based verification which enable to write reusable proofs for each feature of the SPL based on Java Modeling Language (JML) contracts and showed how these proofs can be composed by means of addition/refinement operations.

In Calculating prioritized interaction test sets with constraints using binary decision diagrams [SRG11], Elke Salecker presented an approach based on Binary Decision Diagrams (BDDs) to support both the selection of test cases using CIT and their prioritization according to user-defined weights. She developed the various steps of the generation algorithm and presented encouraging preliminary comparative evaluation of the approach.

Model and SOA Validation

In Automated Detection of Discontinuities in Models Inferred from Execution Traces [MNT11], Alessandro Marchetto showed us how to infer useful models (e.g. for testing purposes) from dynamically adaptive web applications by observing their execution traces. In particular he focused on the detection of discontinuities based on the similarities between behaviours: when the new model differs by a certain amount from the former, this suggests that the system has adapted itself to its environment, in turn suggesting that new validation activities have to be performed. Initial experiments indicate that this approach is quite accurate in practice.

In Validating Service Value Propositions Regarding Stakeholder Preferences [WZ11], Erik Wittern introduced the problem of taking into account user preferences in the selection of features from a feature diagram. By combining both functional and non-functional preferences from the stakeholders and prioritizing them, the goal of the approach is to automatically select the relevant features. This approach uses a constraint solver to ensure that these preferences are compatible with the feature model.

Investigating in how far product line verification techniques can thus be applied in the services setting has been perceived an interesting line of research by participants. With high-quality presentations and lively discussions, the first edition of the VAST workshop was definitely a success. The main goal of the workshop was achieved by allowing different communities to share their experiences on the verification and validation of variability-intensive systems. We hope that the outcomes will stimulate further research in this area and look forward to the next edition of the workshop.

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References


Discussions and Outcomes

After individual paper presentations, each session continued with informal discussions on key topics of the workshop. Specifically, those discussions revolved around the differences and similarities between product line and service V&V. The participants discussed potential synergies and key differences between these two fields. The essential difference was perceived to be the fact that service-oriented systems need to work in an “open world” where services can change and evolve dynamically and without control by the service user. It has been observed, that V&V techniques can address the combinatorics faced in product lines, as – even though the number of products might be high – it is still limited, which is in stark contrast to “open world” service-oriented systems.