

Preface

Software reuse and integration has been described as the process of creating software systems from existing software rather than building software systems from scratch. Whereas reuse solely deals with the artifacts creation, integration focuses on how reusable artifacts interact with the already existing parts of the specified transformation. As a consequence, every integration can be seen as consisting of an analysis of the parts and of their subsequent synthesis into the new whole.

Although significant progress has been made on software reuse and integration, some important issues remain to be fixed. One of these addresses scalability by showing how to make best use of reusable components for very large systems. “[Cloud-Based Tasking, Collection, Processing, Exploitation, and Dissemination in a Case-Based Reasoning System](#)” proposes a novel computational intelligence methodology, which can learn to map distributed heterogeneous data to actionable meaning for dissemination. This approach provides a core solution to the tasking, collection, processing, exploitation, and dissemination problem. The expected performance improvements include the capture and reuse of analyst expertise, and, for the user, prioritized intelligence based on the knowledge derived from distributed heterogeneous sensing. “[Simulation-Based Validation for Smart Grid Environments: Framework and Experimental Results](#)” describes a simulation-based approach to understanding and examining the behavior of various components of a Smart Grid in the context of verification and validation. To achieve this goal, it adopts the discrete event system specification methodology, which allows the generalization and specialization of entities in the model and supports a customized simulation with specific scenarios.

Another issue is how to do sufficient formal specifications to support reliable construction and functioning of very large and complex systems. High-level representation mechanisms, including rigorous techniques for specification and verification, are needed. “[An Institution for Alloy and Its Translation to Second-Order Logic](#)” deals with the Alloy formal method for which it lays out the foundations to fully integrate the formalism in a platform which supports a huge network of logics, logic translators, and provers. This makes possible for Alloy specifications to borrow the power of several, nondedicated proof systems. “[A Framework for Verification of SystemC Designs Using SystemC Waiting State Automata](#)” presents the SystemC waiting-state automaton which is a compositional abstract

formal model for verifying properties of SystemC. It is first shown how to extract automata for SystemC components. Next, an approach is proposed to infer relations between predicates generated during symbolic execution. The correctness of the abstract analysis is proven by model checking. “[Formal MDE-Based Tool Development](#)” proposes a rigorous methodology to create formal tools for GUI-based domain-specific languages. It aims at providing a productive and trustworthy development methodology to safety critical industries. The methodology combines metamodel-based GUI generators with executable backends automatically generated from formal specifications. As for “[Formal Modeling and Analysis of Learning-Based Routing in Mobile Wireless Sensor Networks](#),” it presents a formal model for a learning-based routing protocol specific to wireless sensor networks. The model is based on a Bayesian learning method, using a Structural Operational Semantics style. It is analyzed by means of the rewriting logic tool Maude.

Reuse and integration are key concepts in information retrieval and data mining. They structure and configure the stored information in a way to facilitate its extraction and enhance its usefulness. “[On the Use of Anaphora Resolution for Workflow Extraction](#)” addresses the problem of workflow extraction from textual process descriptions and presents a framework to support the development of extraction applications. Resolution approaches are presented, and syntactic and semantic evaluation functions are developed. These functions which are based on precision, recall, and F-measure are used to assess the quality of the data-flow. Furthermore, the data mining community has turned a significant fraction of its attention to time series data. Virtually, the availability of plentiful labeled instances is assumed. However, this assumption is often unrealistic. Semi-supervised Learning seems like an ideal paradigm, because it can leverage the knowledge of both labeled and unlabeled instances. “[A Minimum Description Length Technique for Semi-Supervised Time Series Classification](#),” first, demonstrates that in many cases a small set of human annotated examples are sufficient to perform accurate classification. Second, it provides a novel parameter-free stopping criterion for semi-supervised learning. The experimental results suggest that the approach can typically construct accurate classifiers even if given only a single annotated instance.

Another key element in the success of reuse is the ability to predict variabilities. “[Interpreting Random Forest Classification Models Using a Feature Contribution Method](#)” presents an approach to show how feature contributions measure the influence of variables/features on the prediction outcome and provide explanations as to why a model makes a particular decision. It demonstrates how feature contributions can be applied to understand the dependence between instance characteristics and their predicted classification and to assess the reliability of the prediction.

In reuse, there is also a need for a seamless integration between the models output from domain analysis and the inputs needed to for domain implementations such as components, domain specific languages, and application generators. “[Towards a High Level Language for Reuse and Integration](#)” proposes a language

which gathers specialization and composition properties. The language is designed in a way to be specific to complex system domains. It supports, on the other hand, a component-based structure that conforms to a user-friendly component assembly. It is conceived in the spirit of SysML concepts and its programs generate Internal Block Diagrams.

Aspect orientation is a promising solution to software reuse. By localizing specific features in code aspects, not only a modular separation of concern is devised, but software development can also be incrementally transitioned to improve productivity and time-to-market. “[An Exploratory Case Study on Exploiting Aspect Orientation in Mobile Game Porting](#)” critically examines how aspect orientation is practiced in industrial-strength mobile game applications. The analysis takes into account technical artifacts, organizational structures, and their relationships. Altogether these complementary and synergistic viewpoints allow to formulate a set of hypotheses and to offer some concrete insights into developing information reuse and integration strategies.

Another area of potentially interesting research in reuse and integration is to identify what should be made reusable and which reusable corporate artifacts and processes will give the highest return on investment. “[Developing Frameworks from Extended Feature Models](#)” proposes an approach to develop a framework based on features defining its domain. The approach shows developers how to proceed, making them less prone to insert defects and bad smells in the outcome frameworks. It allows that even subjects with no experience in framework development can execute this task correctly and spending less time.

Researchers also argue for better methods to support specification and reasoning on knowledge component depositories. In “[About Handling Non-conflicting Additional Information](#)” the focus is on logic-based Artificial Intelligence systems that must accommodate some incoming symbolic knowledge that is not inconsistent with the initial beliefs but that however requires a form of belief change. First, the study investigates situations where the incoming piece of knowledge is both more informative and deductively follows from the preexisting beliefs. Likewise, it considers situations where the new piece of knowledge must replace or amend some previous beliefs, even when no logical inconsistency arises.

Safety and reliability are important issues which may be adequately addressed by reuse and integration. “[A Multi-Layer Moving Target Defense Approach for Protecting Resource-Constrained Distributed Devices](#)” proposes a Moving Target Defense approach for protecting resource-constrained mobile devices through fine-grained reconfiguration at different architectural layers. It introduces a coverage-based security metric to identify the configuration that best meets the current requirements. Likewise, in “[Protocol Integration for Trust-Based Communication](#)” a secure scheme based on trust is proposed to protect against packet dropping in mobile ad hoc networks. For this purpose, four already existing methods are integrated in a complementary way to the basic routing protocol in order to provide the required security.

Currently, most reuse research focuses on creating and integrating adaptable components at development or at compile time. However, with the emergence of ubiquitous computing, reuse technologies that can support adaptation and reconfiguration of architectures and components at runtime are in demand.

This edited book includes 15 high-quality research papers written by experts in information reuse and integration to cover the most recent advances in the field. These papers are extended versions of the best papers which were presented at IEEE International Conference on Information Reuse and Integration and IEEE International Workshop on Formal Methods Integration, held in San Francisco in August 2013. They have been selected among 111 accepted papers and have been accepted for publication in this book after they have been extended and have undergone a peer review process.

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Integration of Reusable Systems

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2014, X, 342 p. 121 illus., Softcover

ISBN: 978-3-319-04716-4