Editorial

Special Issue on Web Site Evolution (WSE 2006)

This special issue features extended versions of selected papers from the 8th IEEE International Symposium on Web Site Evolution (WSE 2006) that was held in Philadelphia PA, on 23–24 September 2006. The symposium was co-located with the 22nd IEEE International Conference on Software Maintenance (ICSM 2006).

Since its inception in 1999, the Web Site Evolution (WSE) series of events have provided a forum for researchers and practitioners from the communities of Software Maintenance and Evolution and Web Engineering to present original work and discuss subjects related to the disciplined evolution of large-scale Web sites. Researchers and practitioners working in the areas of Web application design, development, maintenance, and evolution attend WSE to discuss results and exchange experiences about models, methods, tools, and technologies related to the above-mentioned areas. In particular, the last editions of WSE have represented a significant step in making the WSE community more and more interdisciplinary, building bridges with various areas such as communication, HCI, usability, and quality and maintenance. We wish to maintain and enrich this multi-faceted spirit of the community, as well as to reach and involve other researchers and practitioners in this effort.

WSE began as a one-day workshop, but, thanks to the success in terms of attendance and number of submissions, in 2006 it expanded into a two-day symposium to include keynote presentations, technical sessions, working sessions, and panels discussions. Out of 31 submissions, 13 excellent papers were selected to be presented at the symposium. The accepted papers covered a broad range of topics of the whole life cycle of Web systems, from design to implementation, evaluation, and maintenance, including: Modeling and Architecture, Web Trends and Technology, Accessibility and User Behavior, Comprehension, Testing and Security. The WSE 2006 program also included two inspiring keynotes: 'Model Driven Evolution of Network-Centric Applications: Perspectives, Applications, and Issues' by Kostas Kontogiannis, and 'Knowing Your Online Readership, Organizing Your Communication' by Lorenzo Cantoni.

After the symposium, five outstanding papers were selected by the program chairs for invitation to this special issue of the *Journal of Software Maintenance and Evolution*: *Research and Practice*. The authors of the selected papers were asked to prepare a significant extension on the symposium version of their papers. Each paper underwent a rigorous reviewing process, involving three independent reviewers and two rounds of revisions. Eventually, four papers were accepted for inclusion in this special issue, covering four different topics of Web systems maintenance and evolution: Comprehension, Testing, Empirical Studies, and Patterns.

During Web application re-engineering, a common activity is to identify similar content located in different static and dynamically generated Web pages, so that the content can be more effectively reused. The paper 'Identifying Similar Pages of Web Applications using a Competitive Clustering

Algorithm' by De Lucia, Scanniello, and Tortora presents an approach to this identification problem based on a competitive clustering algorithm called 'Winner Takes All'. The approach first computes the distance between the structure of the static and dynamic Web pages and then identifies groups of similar pages. The page structure is encoded into a string and the distance between Web pages is then computed using the Levenshtein string edit distance algorithm. The result is used to group similar pages at the structural level. A prototype to automate the identification of similar pages was implemented. The approach and the prototype have been evaluated in two case studies. The results show that the clustering algorithm used suggests heuristics to easily identify the best partition of Web pages into clusters among the possible partitions.

Web services are becoming increasingly important to many businesses, especially as an enabling technology for systems that adopt a Service-oriented Architecture (SOA) approach to their development. However, testing Web services poses significant challenges. The paper 'The Design and Use of WSDL-test: A Tool for Testing Web Services' by Sneed and Huang describes the design and use of WSDL-test, a tool designed specifically for this purpose. A key feature of WSDL-test is its ability to simulate the actual usage of Web services in a controlled environment. This enables WSDL-test to generate requests and validate responses in a rapid and reliable manner. To illustrate the use of WSDL-test, the paper also discusses our experience in using the tool on a real-world online eGoverment application.

One of the themes of WSE 2001 was migrating to multi-lingual Web sites. In the intervening five years, the translation, localization, and management of such complex Web systems continue to be a significant challenge, particularly with the growth of the Web outside of the western world. In the paper 'Mining Evolutionary Dependencies from Web-localization Repositories' by Kagdi and Maletic, an approach for mining repositories of Web-based user documentation for patterns of evolutionary change in the context of internationalization and localization is presented. Localized Web documents that are frequently co-changed (i.e. an evolutionary dependency) during the natural language translation process are uncovered to support future evolution of the system. A sequential-pattern-mining technique is used to uncover patterns from version histories. Such patterns help in providing insight into the effort required in retranslation due to a change in the documentation. The approach was validated on the open-source KDE system, which maintains documentation for over 50 different natural languages and presents an excellent example of the problem. Kagdi and Maletic's approach accurately predicts which documents in KDE are retranslated or updated in future versions.

Web application design requires the modeling of different concerns such as the navigational structure, the business logic, and the data persistence. This makes it necessary to use proper modeling notations during the analysis and design phases. However, the benefit of these notations in the development and maintenance tasks is questionable and has not been empirically assessed yet. The paper 'How Design Notations affect the Comprehension of Web Applications', by Ricca, Di Penta, Torchiano, Tonella, and Ceccato, reports and discusses the results from a controlled experiment aimed at investigating the usefulness of the Web Application Extension (WAE) notation when comprehending a Web application design during maintenance tasks. Results indicated that the use of the WAE notation significantly improves the level of comprehension with respect to basic UML models, although it does not significantly increase the time needed to perform the comprehension task.

We hope that readers will enjoy this special issue and gain useful insights from the four papers presented. We would like to thank all the authors who submitted a paper to the symposium and

to this special issue, as well as the WSE 2006 program committee and the external reviewers who helped making this special issue possible. Finally, we would like to thank the editorial board of the *Journal of Software Maintenance and Evolution* and the publisher 'Wiley' for providing us with the opportunity to devote an issue of this journal to WSE 2006.

DAVIDE BOLCHINI
TECLAB—University of Lugano, Switzerland

THOMAS DEAN
Queen's University, Canada

DAMIANO DISTANTE
RCOST—University of Sannio, Italy

SCOTT TILLEY
Florida Institute of Technology, U.S.A.