Editorial

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Biographical notes: Dr Lorna Uden teaches computing in the Faculty of Computing, Engineering and Technology at Staffordshire University. Her research interests include technology learning, HCI, activity theory, knowledge management, web engineering, multimedia, e-business and problem-based learning. She has published widely in conferences, journals and chapters of books.

Introduction

Welcome to this issue of *IJWET*, and a special 'Thank you' to our six selected authoring teams whose papers appear within. We have a diverse and interesting selection this time, which I am sure you will enjoy.

Web applications are on the increase and a rigorous modelling approach is needed to cope with their complexity. The approach should be capable of addressing code mobility issues to enable dynamic reconfiguration of the binding between software components and their physical locations. While mobile agent systems and programming languages support the implementation of code mobility with features such as applets or mobile agents, Reinhartz-Berger, Dori and Katz believe the existing system analysis and design methods lack the facilities to model code mobility at a satisfactory level. According to these authors, current techniques for modelling code mobility and migration require determining the operation targets separately from the transferring stage (e.g. by class services) and do not specify how the code is to migrate. The description of code migration is scattered in the object-oriented approach. In their paper, 'Modelling code mobility and migration: an OPM/web approach', Reinhartz-Berger, Dori and Katz propose a generic object process methodology (OPM)/web model for common code design paradigm. The OPM/web model is an extension of the object process methodology (OPM) for modelling distributed systems and web applications that enables intuitive modelling of code mobility concepts in a single framework. This approach provides a technology-independent model where triggers, preconditions and post conditions for the migration process are specified generically. According to these authors, once the mobile application is modelled, a solid skeleton of the technology-independent implementation can be automatically generated and simulated by the object-process CASE tool (OPCAT). This skeleton includes not only the structure of the application, but also its behaviour, enabling design verification and leaving to the implementer only the coding at the bottom level. Reinhartz-Berger, Dori and Katz demonstrate their approach using a mobile application that handles requests for quality of service (QOS) over the internet. In this QOS system, software components from multiple parties collaborate to provide a particular service to end users. The service users

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access service provider hosts via a web interface. These authors found that OPM/web is significantly better in modelling the dynamics of web applications than using an extension of UML to web applications. The benefit of UML's use of multiple views may help system architects focus on a specific aspect of a system and answer questions about it when the needed information is fully contained in a single diagram type, such as a class or an interaction diagram. Those types of question may be more difficult to answer using the OPM/web model since the information might reside in several OPDs at different levels of detail. To overcome this limitation, these authors are working on a UML to OPM/web generator. It will be interesting to see how this new development will address the current limitation. No doubt more research will be needed to verify its effectiveness.

From the design of web applications we move on to the modelling and simulation of the web graph. As the content of the web increases in size, it is very difficult to locate information. It is also very difficult for researchers to obtain and manage real world data. According to Kogias, Anagnostopoulos and Nikolaidou, it is important to have web models that can be used to create a WWW-like representation upon which new algorithms and applications for searching, indexing and comparison can be validated. Models are also needed for understanding the sociology of content creation on the web, prediction of its evolution and the emergence of important new phenomena. Kogias, Anagnostopoulos and Nikolaidou suggest that the WWW can be viewed as a graph, known as a web graph, where each static HTML page is a vertex and each hyperlink an edge of this graph (either direct or undirected). These authors believe that development of a realistic and accurate stochastic model of the web graph is a challenging task. There are several typical random graph models for the web, including evolving network with preferential attachment, the general copying model, evolving copying models, randomly grown graphs, ACL models, growth and redirection model, multilayer model and ready state model, etc. This paper, 'Modelling and simulation of web graph: evaluating an exponential growth copying model' by Kogias, Anagnostopoulos and Nikolaidou evaluates the behaviour of the Exponential Growth Copying (EGC) model that has been explicitly designed to model the WWW. These models have the advantage over other models because of the large number of complete bipartite sub-graphs, as evidenced in the crawls. According to these authors, it has been proven analytically that the graphs created by the EGC model follow some power law for in degree with a bounded exponent. EGC also contains a large number of bipartite cliques. In this paper, a simulation-based evaluation of the EGC model for the web graph is presented. The validation was accomplished by measuring the capability of the model to appropriate the in–out degree. Weak points of EGC are indicated and appropriate parameter values for delivering a realistic model of the web graph are suggested by the authors. According to Kogias, Anagnostopoulos and Nikolaidou, the EGC model provides a good approximation of the in degree distribution, but is not efficient when approximating the out degree. The conclusion from the evaluation is rather fuzzy. More evaluations are needed to validate the effectiveness of this model.

There is currently much excitement about web services. These are services that allow us to replace applications running on individual computers with services provided on the internet. According to Silva and Rocha, web services are emerging as a major paradigm for the semantic web implementation of business process, promotion of B2B and e-commerce. To achieve web services, it is important to develop mechanisms capable of

mediation and alignment between distinct data models. The ability to semi-automatically hop between different knowledge bases and answer queries from different agents becomes crucial to the success of truly dynamic and autonomous business. Negotiation and argumentation between partners becomes a major requirement for ontology-mapping systems.

Ontology-mapping systems, as defined by Silva and Rocha, are the process whereby semantic relations are defined between two ontologies at conceptual level, which in turn are applied at data level transforming source ontology instances into target ontology instances. Although there are several approaches that provide for ontology mapping, Silva and Rocha believe that none of them provide automation of the semantic relation specification. That is, there is no connection existing between the automation of the mapping processes and the representation of semantic relations. In order to address this problem, Silva and Rocha in their paper 'Multi-dimensional service-oriented ontology mapping' describe a mapping framework, a conceptual description of the ontology mapping process. The ontology mapping technology is developed to increase the interoperability between artificial agents operating in the semantic web. This paper focuses on the automatic specification and representation of semantic bridges between ontology entities. Silva and Rocha describe Semantic Bridging Ontology (SBO) to represent their conceptualisation of the ontology mapping problem, describing the inputs, outputs, components, their dependencies and constraints. According to these authors, the architecture of the system is based on the notion of service, representing not only the system transformation capabilities, but also the expertise in manipulation of specific semantic relations. These authors suggest that the process of choosing, applying, validating evolving or negotiating a semantic relation is dependent on both the ontology's content and the transformation available in the system. The new architectures and mapping processes are being tested and validated in a specific implementation of MApping FRAmework (MAFRA), the MAFRA toolkit that has been applied in a number of European-funded projects. Although the new architecture has been tested and validated in some European projects, there are other phases of the process that need to be addressed, such as the automation of the bridging phase. It would be nice to see the service extended to encompass other features related to the bridging process.

The design and development of web services often involves the use of electronic forms. As the web is increasingly being used for business and public services, the use of electronic forms is an essential part of most web applications. Filling in forms on the web is a central activity for most electronic or online users. However, forms used in most transactions can range from simple documents with less than ten fields to highly complex documents such as tax returns or social benefit claims. Form layout and field placement play a significant role for users if high usability is to be achieved. This is particularly so when it involves users having to enter data items interrelated by business rules. In such situations, it is crucial to provide optimal form layouts so that the users can use the facility with ease.

However, according to Vassilakis, Lepouras, Rouvas and Georgiadis, the design and development of these layout forms for electronic systems is complex, consisting of interrelated components, with one component addressing a particular aspect of service delivery. These authors believe that the design and implementation of those services typically include the following four phases:

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- identification of the data that the electronic service should collect

- validation check

- input form

- back-end code.

Each of these phases often uses a stand-alone tool for their development. This is rather inefficient because the same information has to be entered several times. For example, validation checks have to be entered both in the programming language used in the service delivery platform and in the tool supporting the optimisation phase. In order to overcome this, these authors, in their paper, 'Exploiting form semantics and validation checks to improve e-form layout' have presented an integrated environment for supporting the four phases of e-service form development. The development environment allows for the definition of data items that pertain to the electronic service and the definition of validation checks. It also provides facilities for defining the thematic categories or semantic axes to which the service data items may be assigned for the input forms, thus aiding the system to compute feasible partitioning of the data items to forms that are meaningful to the end user. The development environment also allows for the defining of layout components, e.g. what is the maximum number of input areas that may be placed on a single page. Combining information from validation checks and semantic axes, the system generates HTML form drafts that can then be customised for use. For the back-end code, the development environment provides facilities for generating code for validation checks, which must be integrated with the code database storage or any other storage-specific code crafted by the IT staff.

Vassilakis, Lepouras, Rouvas and Georgiadis have used a case study based on the Greek tax return form to demonstrate their development environment. The results show that the process of form-filling and error correction are significantly facilitated by the layout optimisation procedure. Although the integrated development environment has helped with optimisation of the e-form layout, there are many other issues that need to be considered. For example, the design of any user interface surely must be based upon principles of human–computer interaction (HCI). These involve issues such as usability, design principles and the psychology of everything. While domain experts may be able to ensure that the placement of items is meaningful, it is the users who are the people who should be involved with the design and their tasks. No matter how good the domain expert's design is, for high usability, surely it is the user and the tasks that we should be considering rather than trying to project our own design onto the user's mental models, which may be very different from that of the domain expert.

Recently there has been increased interest in the convergence of web browsing, phone browsing and voice browsing in both academic and industrial settings. This convergence has led to multimodal approaches that support several modalities applied to the same tasks. According to Polymenakos and Soldatos, despite the recent advances in mark-up languages, in content generation and content generation tools, and in the architecture of multimodal browsers, the design and implementation and deployment of multimodal web applications is still very complex. The reason given by these authors is the lack of an end-to-end solution dealing with all aspects of multimodal web application development. In order to address the problem, Polymenakos and Soldatos in their paper, 'Multimodal web applications: design issues and implementation framework' propose a framework for

building multimodal web applications. The framework involves a unified architecture for multimodal applications enabling access to dynamic web content. It consists of a rich set of components that can be reused in a variety of multimodal access applications. According to these authors, application developers can make use of this architectural framework and the design guidelines to produce robust multimodal applications. Two prototype multimodal web applications enabling user access to information were implemented, based on the framework. Polymenakos and Soldatos claim that the framework can significantly minimise the time to develop a multimodal web application. According to these authors, user evaluation of these prototypes revealed that they are happy with using the multimodal applications. Although there may be an improvement made for the implementation of multimodal web applications, further research would be warranted to verify the effectiveness of the proposed framework.

An issue that is not very common, but equally important, is that of web cost estimation. There are several approaches to software cost estimation. Most approaches focus on expert opinion and algorithmic models. Besides these two approaches, there is the use of machine learning approaches to effort estimation. According to Mendes and Mosley in the paper 'Exploring case-based reasoning for web hypermedia project cost estimation', the estimation by analogy method can provide comparable accuracy and is better than the algorithmic methods. Estimation by analogy (EA) is a form of analogical reasoning where cases stored on the case base and the target case are instances of the same category. Mendes and Mosley suggest that an effort estimate for a target case is obtained by searching one or more similar cases, each representing information about finished software projects. These authors also suggest that besides the technique itself, other factors should be taken into consideration when comparing cost estimation approaches. Data set checklists (number of variables, data distribution, existence of collinearity and outliers, type of relationship between effort and cost drivers) influence the effectiveness of cost estimation techniques. In this paper, Mendes and Mosley investigate the use of estimation by analogy for web hypermedia effort estimation. They use adaptation rules as a contributing factor to better estimation accuracy by focusing on two types of adaptation rule where estimated effort is in some way adjusted to the estimated size for a new web hypermedia application. Two data sets of web hypermedia application projects we employed in their study – DS1 and DS2. These different types of data sets were used to investigate the relationship between data set characteristics and prediction accuracy based on EA. Results obtained indicate that the best predictions were obtained for the data set that presented a continuous cost function, reflecting a strong linear relationship between size and effort. Although the result is an interesting one, further investigation using different data sets will be necessary in order to further issues such as, 'Will similar data sets exhibit continuous cost function for projects developed in industry?' 'Will smaller data sets always show worse predictions than larger data sets in a cost function', etc. Further research is required in this area.

As you will have noticed from the above outlines of the papers, there are several upon which I have inserted a comment to the effect that more research is required in a particular area. I trust that some of you may feel challenged to pursue these further research opportunities and add something to the body of knowledge these authors have opened up. Meanwhile, please keep those papers coming in.