International Workshop on Service Oriented Software Engineering (IW-SOSE’06)

Elisabetta Di Nitto
Politecnico di Milano
Milano, Italy
dinitto@elet.polimi.it

Robert J. Hall
AT&T Labs Research
Florham Park, NJ (USA)
hall@research.att.com

Jun Han
Swinburne University of Technology
Melbourne, Australia
jhan@ict.swin.edu.au

Yanbo Han
Institute of Computing Technology
Chinese Academy of Sciences
Beijing, China
yhan@ict.ac.cn

Andrea Polini
Istituto di Scienza e Tecnologie dell’Informazione (ISTI/CNR)
Pisa, Italy
andrea.polini@isti.cnr.it

Kurt Sandkuhl
Jönköping University
Jönköping, Sweden
Kurt.Sandkuhl@ing.hj.se

Andrea Zisman
City University
London, UK
a.zisman@soi.city.ac.uk

Categories & Subject Descriptors
A.0 [General] Conference proceedings, D.2 [Software Engineering]

General Terms
Algorithms, Design, Experimentation, Standardisation, Languages.

PREFACE
Software engineering practitioners and researchers continue to face huge challenges in the development, maintenance, and use of software systems. This has been even more prominent with the new paradigm of service oriented computing in which service integrators, developers, and providers need to create methods, tools, and techniques to support cost-effective development and use of dependable services and service oriented applications. From a technological point of view, recent years have seen the emergence of important standards enabling the Service Oriented vision; however, the engineering of complex and dependable service oriented software still lacks powerful, effective methods and tools.

The International Workshop on Service Oriented Software Engineering (IW-SOSE’06) is intended to provide a forum for presentation and discussion of a wide range of topics related to the new paradigm of service oriented software engineering. The aim of this workshop is to bring together researchers from academia and industry, and practitioners working in the areas of software system engineering and service-oriented computing to discuss existing issues, recent developments, applications, methods, techniques, experience reports, and tools to support the development and use of service oriented systems.

IW-SOSE’06 is a two-days workshop that includes (i) one invited key-note presentation, (ii) presentations of 13 papers rigorously selected by the Programme Committee, and (iii) open round table discussions of the topics of the various papers presented in the workshop. The 13 papers included in the programme of the workshop have been selected from a total of 27 papers submitted to the workshop. Each submitted paper was reviewed by three members of the Programme Committee.

The papers included in the programme of the workshop represent both industrial and academic perspectives of service oriented software engineering. The papers have been organised into five sessions covering a wide range of issues related to (a) service composition, (b) performance of service oriented systems, (c) service description, (d) service discovery and binding, and (e) service oriented system modelling and application. We present below a brief description of the various sessions together with the titles, author names, and abstract of each paper.

Session 1 - Service Composition

Service composition is certainly one of the most challenging activity in the WS arena. Orchestration and choreography languages, such as BPEL and WS-CDL respectively are im-
important aspects of service composition, as well as the definition and manipulation of domain ontologies. Indeed, technical and more conceptual issues need to be solved. Different approaches and languages have been proposed to define how services should be composed in an easier way.

In this session three papers will be presented focusing on different aspects of service composition. The first paper is a survey on semi-automated techniques to service composition in which the composition is partially derived by automatic techniques. The second paper focus on ontologies and introduces a semi-automatic approach, called DODO, to allow deriving ontologies for individual logic domains. The third paper uses Quality of Service (QoS) factors to support web services selection and composition.

PAPER 1
Mixed Initiative Use Cases for Semi-Automated Service: A Survey
Jan Schaffner

Semi-automated service composition with mixed initiative interactions, where both user and machine jointly contribute to the creation of composed services, is currently subject to intensive research. In this paper, we give an overview over recent research approaches by presenting three different semi-automated service composition tools. As the main contribution of this paper, we introduce three mixed initiative use cases characteristic for semi-automated composition, which we have extracted and generalized from the presented approaches and then extended. Based on these use cases and additional distinctive properties, we give a qualitative evaluation of the presented approaches.

PAPER 2
DODO: A Mechanism Helping to Dynamically Construct Domain Ontologies for Services Integration
Chen Liu, Yanbo Han

A challenging problem in forming virtual organizations by integrating standalone networked services is their semantic heterogeneity. Virtual organizations correspond to logic domains that vary, and it is often impossible to pre-construct a global and stable ontology. This paper proposes a semi-automatic mechanism called DODO, with which one can dynamically build up ontologies for individual logic domains, and discusses its working principles. In the context of some practical applications, DODO has been tested and evaluated.

PAPER 3
Using Assumptions in Service Composition Context
Zheng Lu, Aditya Ghose, Peter Hyland, Ying Guan

Non-functional requirements represent a critical and difficult problem in requirement engineering, but are often ignored. Usually, these are articulated as statements of objectives, as opposed to propositional assertions. A key challenge in dealing with objectives is that there is no obvious means of deciding when they are satisfied. In effect, these objectives are never fully satisfied, but satisfied to varying degrees. In evaluating alternative design decisions, we need to trade-off varying degrees of satisfaction of potentially mutually contradictory non-functional requirements. One key contribution of this work is the use of the hierarchical constraint logic programming framework in dealing with Quality of Service(QoS) factors. We show how QoS factors can be formulated as soft constraints and how the machinery associated with constraint hierarchies can be used to evaluate the alternative trade-offs involved in seeking to satisfy a set of QoS factors that might pull in different directions. We apply also this approach to the problem of reasoning about web service selection and composition, and establish that significant value can be derived from such an exercise.

Session 2 - Performance of Service Oriented Systems

Performance is a key factor in the evaluation and success of software system projects. Performance engineering emerged in the last decade as a set of techniques, methodologies and tools to provide the software engineer with useful instruments to predict the performance behaviour of a composed complex system. However in a distributed setting, such as in the case of web service systems, it is generally difficult to predict performance behaviour.

In this session different aspects of performance engineering are discussed and practical approaches to performance prediction of composed web services are introduced. In particular, the first paper presents an approach for the evaluation of service oriented architectural models based on the application of performance test-bed generation techniques. In the second paper, the authors describe an approach for generating customized benchmark suites for web services applications from a software architecture description following a Model Driven Architecture (MDA) approach. Finally, the third paper discusses the negative influences of performance derived from XML based protocol stack used web service domain. A paradigm and tool for improving performance behaviour of Java based web services is also proposed.

PAPER 4
Performance engineering of service compositions
John Grundy, John Hosking, Lei Li, Na Liu

While a service-oriented approach to software engineering has become popular in recent times, the actual performance of systems composed from many distributed parts is still largely unpredictable. We describe our recent research applying performance test-bed generation techniques to service-oriented architectural models as an advance on the state of the art in performance engineering of service-oriented software. We outline our related research on tools for business process composition, performance engineering and dynamic system architectures.

PAPER 5
Model Driven Benchmark Generation for Web Services
Liming Zhu, Ian Gorton, Yan Liu, Ngoc Bao Bui

This paper describes an approach for generating customized benchmark suites for Web services applications from a software architecture description following a Model Driven Architecture (MDA) approach. A Web service core benchmark application is modeled in UML and then generated by taking advantage of existing community-maintained Web service generation “cartridges”. We have provided a performance-tailored version of the UML 2.0 Testing Profile so architects
can model a flexible and reusable load testing architecture, including test data, in a standards compatible way. We extended our MDABench tool to provide a Web service performance testing “cartridge” associated with the tailored testing profile. A load testing suite and automatic performance measurement infrastructure are generated using the new cartridge. Best practices in Web service testing are embodied in the cartridge and inherited by the generated code. Executing the generated benchmark application produces performance data in an analysis friendly format, along with automatically generated performance graphs. This greatly reduces the effort needed for Web service performance benchmarking while being fully MDA compatible. We illustrate the approach using a case study on the Apache Axis platform.

**PAPER 6**
**Performance SOAP Processing Driven By Data Mapping Template**  
Wei Jun, Hua Lei, Niu Chunlei

Web Services, with loosely-coupled, high-interoperable and platform-independent characteristics, is gaining popularity in distributed computing. However, web services suffers performance penalty because its protocol stack is based on XML. SOAP is used to specify wire message format in web services, and SOAP processing largely determines the performance of web services. In this paper, we first analyze the performance of web services on Java platform, and identify that data model mapping between XML data and Java data is the main impact factor on performance. Therefore, we propose a new paradigm of data model mapping - “Dynamic Early Binding” which enables to improve SOAP processing by avoiding Java reflection operations and proactively generating processing codes. This dynamic early binding is realized by Data Mapping Template (DMT), which is specified by extended context free grammar and implemented by pushdown automaton with output. We illustrate the effectiveness by applying it into a high performance SOAP engine - SOAPExpress, and yielding over 100% speedups compared to Apache Axis 1.2 in our benchmark.

**Session 3 - Service Description**

In the last years, various languages have been proposed to support different aspects of service descriptions ranging from interface descriptions (WSDL) to choreography (WS-CDL) and orchestration (BPEL4WS) descriptions. Activities like service discovery and composition require better semantic characterisation of services. In this session, two different papers propose enhancement of service descriptions. The first paper proposes a new specification approach that includes sequences of the methods provided by a service. The approach advocates that this information should be directly related to a WSDL description and not only provided by choreography description (e.g. in WS-CDL). The second paper proposes a language for functional service descriptions and knowledges (rules) that uses first-order logic formulae to grasp in a straightforward and natural way the semantic of services.

**PAPER 7**
**Enhancing Service Specifications with Sequencing Information**  
Hilmar Acker, Colin Atkinson, Peter Dadam, Markus Lauer, Manfred Reichert, Dietmar Stoll

Service-oriented architecture is predicated on the availability of accurate and universally-understandable specifications of services which capture all the information that a potential user needs to know to use the service. However, WSDL the most widely used service specification standard, only allows the syntactic signatures of the operations offered by a service to be described. Information about the acceptable invocation sequences for these operations is not provided, but is essential if a service is to be used successfully. The current thinking is that this information should be described in an accompanying choreography description (e.g. in WS-CDL) which captures interaction scenarios with abstract roles and participants. However, this approach only decouples the sequencing information from the core WSDL specification, it also describes it in terms of abstractions which may match those used (implicitly or explicitly) by the service. In this paper we investigate this issue in greater depth, explore the different solution patterns and propose a new specification approach which rectifies the identified problems.

**Session 4 - Service Discovery and Binding**

Service discovery and binding have been recognised as important activities for service oriented systems. The discovery of services can support different phases of service oriented system development and can encompass both static and dynamic approaches. Associated to service discovery is the notion of service binding to support service composition. In this session, two papers concerned with service discovery and one paper concerned with service binding will be presented. The first paper advocates the integration of service centric system engineering processes with existing development methods and proposes an approach to service discovery driven by requirements of service centric system integrated with Rational Unified Process. The second paper presents a service discovery approach to identify services.
that can provide the functionality and satisfy constraints of systems as specified in the design phase of the system development. The approach is based on a two-stage process based on similarity analysis algorithms. The third paper presents a framework for allowing dynamic binding and re-binding of service composition based on functional and non-functional constraints.

**PAPER 9**
Seamlessly Integrating Service Discovery into UML Requirements Processes
Konstantinos Zachos, Xiaohong Zhu, Neil Maiden, Sara Jones

In this paper we argue that processes, techniques and tools for service-centric systems engineering need to be integrated into existing development methods to ensure their uptake and use. This paper reports a new service discovery tool designed to integrate with the Rational Unified Process and UML and offer seamless generation of service queries from requirements specifications. It describes tool features that overcome research challenges for seamless integration. It demonstrates these features from an example of a real-world, service-based automotive application.

**PAPER 10**
A Framework for Architecture-driven Service Discovery
A. Kozlenkov, V. Fasoulas, F. Sanchez, G. Spanoudakis, A. Zisman

Service discovery has been recognised as an important aspect in the development of service centric systems; i.e. software systems that are constructed based on the composition of web services. In order to develop service centric systems it is necessary to identify web services that can be combined to fulfill the functionality and quality criteria of the system being developed. In this paper we present a framework to support architecture-driven service discovery that is the discovery of services that can provide the functionalities and satisfy properties and constraints of systems as specified during the design phase of the development lifecycle. Our framework assumes an iterative design process and allows for the (re-)formulation of the design models of service-centric systems based on the discovered services. A prototype tool has been developed and includes two main components: a UML 2.0 integration module, which derives queries from behavioural and structural UML design modules and integrates the results of the queries; and a query execution engine, which performs the queries against service registries. The execution of the query is a two-stage process based on a similarity analysis algorithm.

**PAPER 11**
WS Binder: a Framework to enable Dynamic Binding of Composite Web Services
Massimiliano Di Penta, Raffaele Esposito, Maria Luisa Villani, Roberto Codato, Massimiliano Colombo, Elisabetta Di Nitto

The rapid diffusion of service-oriented systems is becoming a reality in today's software engineering. In particular, an aspect that is gathering the interest of researchers and practitioners is the possibility to create compositions of dynamically bound services. This paper describes WS Binder, a framework for enabling dynamic binding of service compositions according to some functional and non-functional preferences and/or constraints. The framework is also able to support run-time recovery actions, by performing service re-binding. The paper describes the framework's architecture and highlights its features by describing an example of its usage for the binding and re-binding of a service composition related to the tourism domain.

**Session 5 - Service Oriented System Modeling and Application**

Technologies enabling description and execution of web services have reached a level of maturity that allows setting up and running web service-based applications. However, more work needs to be developed to assist with complex web services modeling. This is certainly a precondition for the development and establishment of meaningful and reliable analysis methodologies.

The first paper in this session presents a web service executable architecture model that incorporates Predicate Transition Nets and a validation mechanism for this model. The second paper presents a service-based application for spatial data repositories for geographic applications. The application is based on an ontology that acts as a service broker.

**PAPER 12**
An Approach to Web Services Oriented Modeling and Validation
Yujian Fu, Zhijiang Dong, Xudong He

Web services provide a language-neutral, loosely-coupled, and platform-independent way for linking applications within organizations or enterprises across the Internet. Web services communicate with each other via XML format messages. This paper presents a web service architecture model, Service-Oriented Software Architecture Model (SO-SAM), which is an extension of SAM (Software Architecture Model) to the web service applications, as well as a validation of the model and a case study. SO-SAM is an executable architectural model incorporating Predicate Transition Nets with the style and understandability of component-based concepts. SO-SAM describes each web service in terms of component and service composition in terms of connector separately. We believe that SO-SAM facilitates the verification and monitoring of web services integration since SO-SAM fits the distributed nature of modern composite web services. In order to validate the model against system properties, we translate the SO-SAM into the Maude programming language, a high level language and high performance executable specification with the componentized and object-oriented design. Finally, a case study of the validation of the model is demonstrated.

**PAPER 13**
An Approach for Service Oriented Discovery and Retrieval of Spatial Data
Manoj Paul, S. K. Ghosh

Successful information integration and sharing data across disparate systems and designs are required for fast access to and interpretation of many types of geospatial information. Spatial data are highly heterogeneous - not only they differ from data representation and storage methods, but they also differ in the way of querying the data. Finding
and accessing spatial data in an environment like this is a crucial task. Enterprise geographic information system (E-GIS) is an organization-wide approach to GIS implementation, operation, and management. The main focus of the paper is to integrate diverse spatial data repositories for geographic applications using service-based methodology. We have adopted service-oriented architecture (SOA) for the discovery and retrieval of geospatial data. The architecture uses a central ontology as metadata information, which acts as service broker. Ontology-based discovery and retrieval of geographic data solves the problem of semantic heterogeneity, the major bottleneck for spatial interoperability. The implementation is in compliant with the Web Map Service (WMS) and Web Feature Service (WFS), the web service standards proposed by OGC. The need for loosely coupled service-based access of data in the spatial domain has been exploited. A query processing mechanism in distributed environment of spatial data sources has been discussed at the end. The implemented system has been fully tested and reviewed.

Organising Committee

- Elisabetta Di Nitto (Politecnico di Milano, Italy)
- Robert J. Hall (AT&T labs Research, UK)
- Jun Han (Swinburne University of Technology, Australia)
- Yanbo Han (Institute of Computing Technology, China)
- Andrea Polini (Information Science and Technologies Institute – ISTI/CNR, Italy)
- Kurt Sandkuhl (Jonkoping University, Sweden)
- Andrea Zisman, (City University, UK)

Program Committee

- Mikio Aoyama (Nanzan University, Japan)
- Doo-Hwan Bae (Korea Advanced Institute of Science and Technologies, Korea)
- Luciano Baresi (Politecnico di Milano, Italy)
- Boualem Benatallah (University of New South Wales, Australia)
- Tevfik Bultan (University of California, Santa Barbara, USA)
- Fabio Casati (HP Labs, Palo Alto, USA)
- Ricky W.K. Chan (University of Hong Kong, Hong Kong)
- S.C. Cheung (University of Science and Technology, Hong Kong)
- Peter Dadam (University of Ulm, Germany)
- Massimiliano Di Penta (University of Sannio, Italy)
- Dieter Fensel (DERI, Ireland)
- Paul Grefen (Eindhoven University of Technology, The Netherlands)
- John Grundy (University of Auckland, New Zealand)
- Reiko Heckel (University of Leicester, UK)
- Ryszard Kowalczyk (Swinburne University of Technology, Australia)
- Shonali Krishnaswamy (Monash University, Australia)
- Bruno Lefever (CA, Belgium)
- Chengfei Liu (Swinburne University of Technology, Australia)
- Heiko Ludwig (IBM Watson Research Center, USA)
- Neil Maiden (City University, UK)
- Massimo Mecella (Università di Roma La Sapienza, Italy)
- Raffaela Mirandola (Politecnico di Milano, Italy)
- Mike P. Papazoglou (Tilburg University, The Netherlands)
- Bala Ramesh (Georgia State University, USA)
- Ian Sommerville (Lancaster University, UK)
- George Spanoudakis (City University, UK)
- Andreas Ulrich (Siemens, Germany)
- Jian Yang (Macquarie University, Australia)
- Y.T. Yu (City University of Hong Kong, Hong Kong)
- Yanchun Zhang (Victoria University of Technology, Australia)
- Hong Zhu (University of Oxford Brookes, UK)

We would like to take this opportunity to thank the members of the Programme Committee, who have helped in reviewing and selecting the papers submitted to the workshop, the authors of the submitted and selected papers, the ICSE 2006 workshop co-chairs, and the students from the Chinese Academy of Sciences who will help during the workshop.

China, May 2006
IW-SOSE’06 Organising Committee