Cyprus
International Conference on Enterprise Information Systems
Paphos 2006

ICEIS 2006

EIGHTH INTERNATIONAL CONFERENCE ON ENTERPRISE INFORMATION SYSTEMS

Proceedings

Information Systems Analysis and Specification

PAPHOS, CYPRUS · MAY 23-27, 2006

ORGANIZED BY

INSTICC

CO-ORGANIZED BY

University of Cyprus
Aristotle University of Thessaloniki
Athens University of Economics and Business
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Edited by Yannis Manolopoulos, Joaquim Filipe, Panos Constantopoulos and José Cordeiro

Printed in Portugal

ISBN: 972-8865-43-0

ISBN (13 digits): 978-972-8865-43-6

Depósito Legal: 240668/06

http://www.iceis.org

secretariat@iceis.org

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FOREWORD

This volume contains the proceedings of the Eighth International Conference on Enterprise Information Systems (ICEIS 2006), organized by the Institute for Systems and Technologies of Information, Control and Communication (*INSTICC*) in collaboration with the University of Cyprus, Aristotle University of Thessaloniki, Athens University of Economics and Business and Cyprus Computer Science.

ICEIS has become a major point of contact between research scientists, engineers and practitioners in the area of business applications of information systems. This year, five simultaneous tracks were held, covering different aspects related to enterprise computing, including: "Databases and Information Systems Integration", "Artificial Intelligence and Decision Support Systems", "Information Systems Analysis and Specification", "Software Agents and Internet Computing" and "Human-Computer Interaction". All tracks focus on real world applications and highlight the benefits of Information Systems and Technology for industry and services, thus making a bridge between the Academia and the Enterprise worlds.

Following the success of 2005, ICEIS 2006 also has a number of satellite workshops, related to the field of the conference. This year we collaborated in the organization of the following ten international workshops: 6th International Workshop on Pattern Recognition in Information Systems; 5th International Workshop on Wireless Information Systems; 4th International Workshop on Modelling, Simulation, Verification and Validation of Enterprise Information Systems; 3rd International Workshop on Natural Language Understanding and Cognitive Science; 3rd International Workshop on Ubiquitous Computing; 4th International Workshop on Security In Information Systems; 3rd International Workshop on Computer Supported Activity Coordination, the 4th International Workshop on Web Services and Grid Computing, the 2nd International Workshop on Model-Driven Enterprise Information Systems and the 1st International Workshop on Technologies for Collaborative Business Processes.

ICEIS 2006 received 429 paper submissions from more than 40 countries in all continents. 65 papers were published and presented as full papers, i. e. completed work (8 pages in proceedings / 30' oral presentations), 105 papers, reflecting work-in-progress or position papers, were accepted for short presentation and another 85 for poster presentation.

These numbers, leading to a "full-paper" acceptance ratio below 16%, and a total acceptance ratio below 60%, show the intention of preserving a high quality forum for the next editions of this conference. Additionally, as usual in the ICEIS conference series, a number of invited talks, including keynote lectures and technical tutorials were also held. These special sessions, presented by internationally recognized specialists in different areas have definitely contributed to increase the overall quality of the Conference and to provide a deeper understanding of the Enterprise Information Systems field.

A short list of papers will be selected for a book, entitled "*Enterprise Information Systems VIII*", to be published by Springer. It will be the eighth book in the series of ICEIS selected-papers books.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. Thirdly, we thank the invited speakers for their invaluable contribution and for taking the time to synthesise and prepare their talks. Fourthly, we thank the workshop chairs whose collaboration with ICEIS was much appreciated. Finally, special thanks to all the members of the local organising committee, especially Panicos Masouras, whose collaboration was fundamental for the success of this conference.

We wish you all an exciting conference and an unforgettable stay in the lovely city of Paphos. We hope to meet you again next year for the 9th ICEIS, to be held in Portugal, details of which are available at http://www.iceis.org.

Yannis Manolopoulos,

Aristotle University of Thessaloniki, Greece

Joaquim Filipe

INSTICC/I.P.Setúbal, Portugal

Panos Constantopoulos,

Athens University of Economics and Business, Greece

José Cordeiro

INSTICC/I.P.Setúbal, Portugal

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TOWARDS A SUITE OF METRICS FOR BUSINESS PROCESS MODELS IN BPMN

Elvira Rolón
Engineering Fac. "Arturo Narro Siller", Autonomous University of Tamaulipas,
Centro Universitario Tampico-Madero, C.P. 89336 Tampico, Tams., México
erolon@proyectos.inf-cr.uclm.es

Francisco Ruiz, Félix García, Mario Piattini
Department of Information Technologies and Systems , UCLM-Soluziona Research and Development Institute
University of Castilla-La Mancha, Paseo de la Universidad Nº 4, 13071 Ciudad Real, Spain
{Francisco.RuizG, Felix.Garcia, Mario.Piattini}@uclm.es

Keywords: Business Process, BPMN, Metrics, Conceptual Models, Software Process.

Abstract In this paper we present a suite of metrics for the evaluation of business process models using BPMN notation. Our proposal is based on the FMESP framework, which was developed in order to integrate the modeling and measurement of software processes. FMESP includes a set of metrics to provide the quantitative basis necessary to know the maintainability of the software process models. This previously existent proposal has been used in this work as the starting point to define a set of metrics for the evaluation of the complexity of business process models defined with BPMN. To achieve this goal, the first step has been to adopt the metrics of FMESP, which can be directly used to measure business process models, and then, new metrics have been defined according to the particular aspects of the business processes and BPMN notation.

1 INTRODUCTION

Software processes and business processes present certain similarities. The most common is that both try of capturing the main characteristics of a group of partially ordered activities carried out to achieve a specific goal, that they are those of obtaining a product software (Acuña and Ferré, 2001) or a satisfactory results (generally a product or service) for the customer and other stakeholders of the process respectively (Sharp and McDermott, 2000).

Curtis et al., (1992) define some of the specific goals and benefits of modelling the software process, such as: 1. Ease of understanding and communication, 2. Process management support and control, 3. Provision for automated orientations for process performance, 4. Provision for automated execution support, and 5. Process improvement support.

On the other hand, some specific goals of business process modelling are (Erickson and Penker, 2000; Beck et al., 2005): 1. To ease the understanding of the key mechanisms of an existing business, 2. To serve as the basis for the creation of appropriate information systems that support the business, 3. To improve the current business structure and operation, 4. To show the structure of an innovated business, 5. To identify outsourcing opportunities and, 6. To facilitate the alignment of business specifications with the technical framework that IT development needs.

Something that particularly characterizes software and business processes is the fact that for more than one decade and, as result of the confrontation of the new technologies, more competitive markets, business environments in constant change and requirements for customer's satisfaction, the developers and software presidents, as well as people of business and the organizations in general have been focused in their processes like a reference point to survive and prosper (Florac et al., 1997). It has increased the necessity for analyzing, evaluating, measuring and improving the processes.

As a result of the situation outlined above, the modelling of business processes in particular is becoming increasingly popular in the last years. In this work, our target is to focus on the conceptual level of the business process modelling, since we believe that it is one of the point key to obtain models of quality that can serve as support for an effective maintainability and management of business processes.

Conceptual process models show what a system does or must do, they are independent of implementation and the language to perform it is usually a graphic language. This is the case of *Business Process Modeling Notation* (BPMN) (BPMI, 2004), which is the new standard for modeling business processes and Web services processes, proposed by the *Business Process Management Initiative* (BPMI). In this paper, we describe a proposal of metrics for business process models represented in BPMN.

2 STARTING POINT

In our work we have based on the FMESP (Framework for the Modeling and Evaluation of Software Processes) proposal (García et al., 2006), which consists of a framework for the modeling and measurement of software process. FMESP is based on the idea that it is necessary to carry out a good administration of the software processes with the purpose of obtaining software products with quality, and such management considers it in an integrated way by embracing two important aspects: the process modeling and process evaluation. As a result, it provides the conceptual and technological support for the modeling and measurement of software processes in order to promote their improvement.

For the evaluation of the software process, FMESP includes a set of metrics, which measures the structural complexity of software processes models (SPMs). The aim is to evaluate the influence of the structural complexity of the software process models on their maintainability. The FMESP metrics have been defined by analysing the SPEM (Software Process Engineering Metamodel) metamodel (OMG, 2002) at two different scopes and: model scope, to evaluate the overall structural complexity of the model and; core element scope, to evaluate the concrete complexity of the fundamental elements of the model, namely *activities*, *roles* and *work products*.

With the aim to establish which metrics are useful SPMs maintainability indicators, a family of experiments was carried out (Canfora et al., 2005). The FMESP metrics defined to evaluate the complexity of concrete elements in the software process model (activities, work products and process roles) are not described here due to they are out of the scope of this paper.

3 APPLICATION AND EXTENSION OF FMESP TO BPMN MODELS

The FMESP framework is based on the fact that the research on software process measurement had been focused on the study of the execution results and not in the repercussion that could have the structural complexity of the processes models in its quality. A similar situation happens in the area of business processes modelling. As a result of the research on the side of business people, in the literature we can find diverse proposals for the evaluation of processes but mostly from the point of view of the results obtained in their execution.

Considering our interest in evaluating the business process by starting from the model that represents it in a conceptual level, our work recaptures the FMESP proposal but adapting and extending it to business process models. To achieve it we have defined a set of metrics to evaluate the structural complexity of business process models in a conceptual level.

The goal is to have empirical evidence about the influence that the structural complexity of business models can have on their maintainability. It can provide companies with the quantitative basis necessary to develop more maintainable business process models. The first step to achieve this goal is to define a set of suitable metrics for the evaluation of the structural complexity of business models. This definition has been based on the elements that compose the BPMN metamodel. These metrics have been grouped in two main categories: Base and Derived Measures.

The base measures have been defined by counting the different kind of elements that compose a business process model represented with BPMN, and 43 base measures have been defined according to the main elements of BPMN metamodel. These are distributed, in accordance with the four categories of elements, in the following way: 37 base measures correspond with the *Flow Objects* category, 2 with the *Connecting Objects* category, 2 with the *Swimlanes* category and 2 with the *Artefacts* category. The first 37 base measures which correspond with the *Flow Objects* category, are grouped according to the common elements to which they correspond. In this way, 23 measures have been defined for the Event element**,** 9 for the Activity element and 5 for the Gateways element.

With the base measures, it is possible to discover how many significant elements there are in the business process diagram. Nevertheless, starting from the base measures a set of 14 derived measures has been defined (Table 1) which allows us to see the proportions that exist between the different elements of the model. With all measures defined, it is possible to evaluate the structural complexity of business process models developed with BPMN. In this way, when we structurally analyse the model, it is also possible for us to evaluate its quality.

Table 1: Derived Measure based on BPMN.

Name	Definition
TNSE	**T**otal **N**umber of **S**tart **E**vents of the Model **TNSE** = NSNE+NSTE+NSMsE+NSRE+NSLE+NSMuE
TNIE	**T**otal **N**umber of **I**ntermediate **E**vents of the Model **TNIE** = NINE+NITE+NIMsE+NIEE+NICaE+NICoE+NIRE+NILE+NIMuE
TNEE	**T**otal **N**umber of **E**nd **E**vents of the Model **TNEE** = NENE+NEMsE+NEEE+NECaE+NECoE+NELE+NEMuE+NETE
TNT	**T**otal **N**umber of **T**ask of the Model **TNT** = NT+NTL+NTMI+NTC
TNCS	**T**otal **N**umber of **C**ollapsed **S**ub-Process of the Model **TNCS** = NCS+NCSL+NCSMI+NCSC+NCSA
TNE	**T**otal **N**umber of **E**vents of the Model **TNE** = TNSE + TNIE + TNEE
TNG	**T**otal **N**umber of **G**ateways of the Model **TNG** = NEDDB+NEDEB+NID+NCD+NPF
TNDO	**T**otal **N**umber of **D**ata **O**bjects in the Process Model **TNDO** = NDOIn + NDOOut
CLA	**C**onnectivity **L**evel between **A**ctivities **CLA** = $\frac{TNT}{NSF}$
CLP	**C**onnectivity **L**evel Between **P**ools **CLP** = $\frac{NMF}{NP}$
PDOPIn	**P**roportion of **D**ata **O**bject like **In**coming **P**roduct and the total of Data Objects **PDOPIn** = $\frac{NDOIn}{TNDO}$
PDOPOut	**P**roportion of **D**ata **O**bject like **Out**going **P**roduct and the total of Data Objects **PDOPOut** = $\frac{NDOOut}{TNDO}$
PDOTOut	**P**roportion of **D**ata **O**bject like **Out**going Product of Activities of the Model **PDOTOut** = $\frac{NDOOut}{TNT}$
PLT	**P**roportion of Pools and/or **L**anes of the Process and Activities in the Model **PLT** = $\frac{NL}{TNT}$

We have described two proposals of metrics to evaluate software process models and business process models respectively. These metrics have been defined on two different metamodels, namely SPEM for software processes and BPMN for business process models. It is important to highlight that SPEM is a generic metamodel, and the measures proposed can be applied to other process modelling languages, even not specific to software as BPMN.

On the other hand, being BPMN specifically focused on business processes it presents some aspects that are not contemplated for software processes and it means that new specific metrics are necessary.

According to the issues mentioned, in order to measure BPMN business process models the metrics of the framework FMESP for SPEM have been successfully applied, but new metrics (not defined in FMESP) have been necessary due to the specific notation of BPMN to model some particular aspects of business processes. Table 2 shows the modelling elements considered in SPEM and BPMN notations.

Table 2: Elements of SPEM and BPMN for metrics definition.

Element	SPEM	BPMN
Events		✔
Activities	✔	✔
Gateways		✔
Work Products (Data Objects)	✔	✔
Roles (Lanes)	✔	✔
Dependences (Sequence Flow)	✔	✔
Message Flow		✔
Pools		✔

As we can observe in Table 2, there are some elements useful in BPMN for the modeling of business process that SPEM does not contemplate, such as the Events, Gateways, Message Flow and Pools.

Since we have new base measures coming from the use of the metamodel of BPMN, a new group of derived measures is generated which has not been defined in FMESP. With all the metrics defined, the base ones as well as the derived ones, we believe that one could have information about the structural complexity of the model of business processes, allowing us to evaluate aspects like their understandability, coherence, completeness, modifiability and consistency in order to assure the quality of the model at conceptual level (Lindland et al., 1994).

4 CONCLUSIONS AND FURTHER WORK

In this paper, we have displayed how the proposal of FMESP can be applied in order to evaluate business process models at conceptual level. Taking into consideration that in the field of process engineering there are not metrics applicable to business process models at conceptual level, we make use of the philosophy of FMESP in order to evaluate the structural complexity of business process models. We have taken as our starting point a definition of base measures and derived measures following the BPMN terminology, which is the most recent standard notation defined by BPMI for the modeling of business process.

By integrating both proposals, we provide a more refined framework for evaluating business process models. This gives support to Business Process Management, which has as one of its stages the definition and modelling of the process being assessed. It will allow a more appropriate management of the business processes and can provide organizations with important profits.

Model metrics can be very useful to select the models with the most easiness of maintenance among various alternatives in companies with change their models to improve their business processes. Also, it can help to facilitate the business processes evolution in these companies by assessing the process improvement at conceptual level.

The business process model metrics provide companies with objective information about the maintainability of these models. More maintainable models can benefit the management of the business processes mainly in two ways: i) guaranteeing the understanding and the diffusion of the processes, as they evolve, without affecting their successful execution; ii) reducing the effort necessary to change the models with the consequent reduction of the maintenance.

Currently we are developing a family of experiments with the purpose of to evaluate quality aspects of the conceptual business process models. These experiments are been carried out with a population integrated by experts in business analysis and in software engineering in order to be able a comparison between results of both kinds of stakeholders and to determine the influence of these different points of view.

Participants receive a kit consisting of a set of business processes models represented with BPMN. Models has different characteristics and dimensions. A questionnaire is also provided for each one of the models including questions related with its understandability. In order to assess how influence the BPMN notation in the modifiability of models other additional section of the questionnaire asks about several modifications -specially studied- to the original model.

ACKNOWLEDGMENTS

This work has been partially financed by the ENIGMAS Project (Junta de Comunidades de Castilla-La Mancha, Consejería de Educación y Ciencia, reference PBI-05-058) and MAS Project (Ministerio de Ciencia y Tecnología, reference TIC 2003-02737-C02-02).

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