Documentos acreditativos de los méritos alegados en el historial académico, docente e investigador.

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Artículos

Static Fault Localization in Model Transformations

Loli Burgueño, Javier Troya, Manuel Wimmer, and Antonio Vallecillo

Abstract—As the complexity of model transformations grows, there is an increasing need to count on methods, mechanisms, and tools for checking their correctness, i.e., the alignment between specifications and implementations. In this paper we present a light-weight and static approach for locating the faulty rules in model transformations, based on matching functions that automatically establish these alignments using the metamodel footprints, i.e., the metamodel elements used. The approach is implemented for the combination of Tracts and ATL, both residing in the Eclipse Modeling Framework, and is supported by the corresponding toolkit. An evaluation discussing the accuracy and the limitations of the approach is also provided. Furthermore, we identify the kinds of transformations which are most suitable for validation with the proposed approach and use mutation techniques to evaluate its effectiveness.

Index Terms—Model transformation, transformation testing, model alignment

1 Introduction

Model transformations are key elements of model-driven engineering (MDE)[1]. They allow querying, synthesizing, and transforming models into other models or into code, and are essential for building systems in MDE. In this context, the quality of the resulting systems is therefore highly influenced by the quality of the model transformations employed to produce them. However, users of transformations have to deal with the problem that transformations are difficult to debug and test for correctness [2]. In fact, as the size and complexity of model transformations grow, manual debugging is no longer possible, and there is an increasing need to count on methods, mechanisms and tools for testing their correctness[2], [3].

In general, debugging is readily classified into three parts: the identification of the existence of a problem, the localization of the fault, and the actual correction of the problem [4].

In this paper, the existence of a problem is detected by the misalignment between the model transformation specification and its implementation. The former specifies the *contract* that determines the expected behavior of the transformation and the context in which such a behavior needs to be guaranteed, while the latter provides the actual behavior of the transformation. If the transformation does not behave as expected, a violation of the contract occurs.

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Here we use Tracts [5] for the specification of model transformations, which are a particular kind of *model transformation contracts* [6], [7] especially suitable for specifying model transformations in a modular and tractable manner. Tracts count on tool support for checking, in a black-box manner, that a given implementation behaves as expected—i.e., it respects the Tracts constraints [8].

Once a problem has been found (i.e., a constraint has been violated), we need to locate the fault [9]. One of the major shortcomings of model transformation specification approaches based on contracts is the lack of traceability links between specifications and implementations. In the case a constraint is not fulfilled, the elements involved in the constraint evaluation could provide valuable information to the transformation engineer, but the links to the transformation implementation are not available.

Based on first ideas which we outlined in previous work [10], this paper presents a solution to this problem. It uses a white-box and static analysis to find the location of the model transformation rules that may have caused the faulty behavior. It provides the first step of an iterative approach to model transformation testing, which aims at locating faults as early as possible in the development process. Although this step cannot fully prove correctness, it can be useful for identifying many bugs in a very early stage and in a quick and cost-effective manner [11]. It can also deal with industrial-size transformations without having to reduce them or to abstract away any of their structural or behavioral properties, and it can represent a very valuable first step before diving into more expensive and complex tests (such as model checking, formal validation, dynamic tests, etc. [12], [13], [14], [15], [16], [17]) which represent numerous challenges, mainly because of their inherent computational complexity [2], [6].

An evaluation discussing the accuracy and the limitations of the approach is also provided. The evaluation has been conducted on a number of transformations with the goal of quantitatively assessing the correctness (Are the

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A Linda-based platform for the parallel execution of out-place model transformations

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Context: The performance and scalability of model transformations is gaining interest as industry is progressively adopting model-driven techniques and multicore computers are becoming commonplace. However, existing model transformation engines are mostly based on sequential and in-memory execution strategies, and thus their capabilities to transform large models in parallel and distributed environments are limited.
Objective: This paper presents a solution that provides concurrency and distribution to model transformations.
Method: Inspired by the concepts and principles of the Linda coordination language, and the use of data parallelism to achieve parallelization, a novel Java-based execution platform is introduced. It offers a set of core features for the parallel execution of out-place transformations that can be used as a target for high-level transformation language compilers.
Results: Significant gains in performance and scalability of this platform are reported with regard to existing model transformation solutions. These results are demonstrated by running a model transformation test suite, and by its comparison against several state-of-the-art model transformation engines.
Conclusion: Our Linda-based approach to the concurrent execution of model transformations can serve as a platform for their scalable and efficient implementation in parallel and distributed environments.

1. Introduction

Model Driven Engineering (MDE) is an approach to software development where models and model transformations play a central role in all software engineering processes [1]. Models capture the aspects of interest of systems and behave as an abstraction of them representing reality for a given purpose. Thus, models are simpler, safer and/or cheaper than reality and allow users to deal with the interesting parts of the systems in a simplified and more focused way. In turn, model transformations are in charge of manipulating these models. They permit generating system implementations from high-level models, conducting model analysis, software migration and modernization [2] or even data integration [3].

To support such model transformation scenarios, a wide range of different transformation languages already exists, each of them comprising different characteristics [4]. However, the increasing size and complexity of models are challenging the existing model transformations languages and engines, whose performance and scalability need to be significantly improved as the industry is progressively adopting model-driven techniques [5]. In particular, most MDE solutions and tools are having problems for coping with models of only several millions of elements since most environments require the models to reside in memory. Their scalability is not sufficient either, and performance rapidly degrades as the size of the models grows beyond a few million elements. Furthermore, current model transformation engines are mostly based on sequential and in-memory execution strategies and thus they have limited capabilities to transform large models in acceptable time. This hinders the benefits of using models and model transformations in different application domains that use large models.

At the same time, parallel computing has become increasingly important as chipmakers are putting more and more processor cores on individual chips — which are mainly wasted if sequential engines are used. Similarly, distributed algorithms are gaining attention as computer communication is getting much faster, cheaper and more reliable, and the Cloud is taking over.

In this paper we present a framework, called LinTra, to achieve the parallel and distributed execution of transformations, providing significant performance and scalability improvements with regard

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SPECIAL SECTION PAPER

Testing models and model transformations using classifying terms

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Abstract This paper proposes the use of equivalence partitioning techniques for testing models and model transformations. In particular, we introduce the concept of classifying terms, which are general OCL terms on a class model enriched with OCL constraints. Classifying terms permit defining equivalence classes, in particular for partitioning the source and target model spaces of the transformation, defining for each class a set of equivalent models with regard to the transformation. Using these classes, a model validator tool is able to automatically construct object models for each class, which constitute relevant test cases for the transformation. We show how this approach of guiding the construction of test cases in an orderly, systematic and efficient manner can be effectively used in combination with Tracts for testing both directional and bidirectional model transformations and for analyzing their behavior.

Keywords Model transformations · Contract-based specifications · Equivalence partitioning

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1 Introduction

Model transformations (MT) are being increasingly used in many different contexts. From simple structural migration, model queries or pattern-based code-generation, they now have to cope with complex model synthesis, behavioral analysis and stream data processing. This has led to a significant increase in their complexity and, hence, to the need of *engineering* model transformations [33].

In this context, the specification and testing of model transformations become critical tasks to ensure the correctness of their implementations. Correctness is not an absolute property. It needs to be checked against a contract, or specification, which determines the expected behavior, the context in which such a behavior needs to be guaranteed, as well as some other properties of interest. The specification states what should be done, but without determining how. The problem, again, is that the specification of a model transformation can be as complex as the transformation itself. This is why modular techniques are needed for specifying and testing model transformations.

One of the problems of existing model transformation testing techniques lies in the difficulty of selecting effective test cases [6]. In this paper, we explore the use of *Equivalence Partitioning*, a software testing technique that divides the input data of a software unit into partitions of equivalent data from which test cases can be derived [9]. The fundamental concept of this technique is based on the use of equivalence classes and the selection of one representative element from each class. An advantage of this approach is the reduction of the total number of test cases to a finite set of testable test cases, still covering a maximum of requirements. Testing time is also significantly reduced, due to lesser number of test cases.

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Formalizing Complex Event Processing Systems in Maude

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ABSTRACT Complex event processing (CEP) is a cutting-edge technology for analyzing and correlating streams of information about events that happen in a system, and deriving conclusions from them. CEP permits defining complex events based on the events produced by the incoming sources, to identify complex meaningful circumstances and to respond to them as quickly as possible. Such event types and patterns are defined using event processing languages. However, as the complexity of CEP programs grows, they become difficult to understand and to prove correct. This paper proposes a formal framework for the specification of CEP applications, using rewriting logic and Maude, to allow developers to formally analyze and prove properties of their CEP programs. Several case studies are presented to illustrate the approach, as well as a discussion on the benefits of using Maude and its toolkit for modeling and analyzing CEP systems.

INDEX TERMS Formal modeling, complex event processing, event processing language, rewriting logic, Maude.

I. INTRODUCTION

Complex Event Processing (CEP) is gaining acceptance in real-time distributed environments as a powerful technology for analyzing and correlating streams of information about events that happen, and deriving conclusions from them [1]–[4]. CEP is becoming very relevant in many different contexts such as the Internet of Things [5], [6], where many applications should process and react to events arriving from various kinds of sources including distributed sensors, wireless sensor and RFID networks, GPS, social media, etc. Other examples of these kinds of applications include monitoring systems for critical infrastructures [7], health care systems [8], inventory control and manufacturing applications [9], environmental monitoring [10], [11], stock market analysis [12], network analysis and surveillance [13], or social media data aggregation [14], [15]. Unlike other stream processing systems, CEP permits defining complex events or patterns on top of the basic primitive events, to identify complex meaningful circumstances and respond to them as quickly as possible. Such event types and event patterns are defined using Event Processing Languages (EPLs).

The wide adoption of CEP systems has also introduced some challenges to these kinds of approaches. In the first place, the complexity of CEP programs is significantly growing, and hence they are becoming more difficult to understand, maintain and prove correct. There is the need to check for the occurrence of semantic errors in the event patterns definitions, and to validate that CEP programs behave as expected—e.g., they properly identify the events of interest to the system developer and no others, or that they do not miss any relevant event. The design of CEP programs still remains a challenging and error-prone task, since it requires developers to consider complex pattern dependencies and interactions [16]. The composition of CEP programs represents another challenge: what is the expected behavior of a CEP application when two or more programs are integrated to form a bigger one, or when new patterns are added to an existing CEP system? Finally, we also need to conduct some behavioral analysis on a CEP application prior to its deployment, such as simulation, to detect design errors and any other semantic anomalies so frequent in systems that exhibit stochastic behaviors.

In this paper, we investigate the use of rewriting logic [17], and its implementation in Maude [18], for giving semantics to CEP programs. Using Maude as a target semantic domain brings remarkable benefits, since Maude specifications are executable and permit multiple analyses,

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Managing Measurement and Occurrence Uncertainty in Complex Event Processing Systems

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ABSTRACT Complex event processing (CEP) is a powerful technology for analyzing streams of real-time events, coming from different sources, and for extracting conclusions from them. In many situations, these events are not free from uncertainty, due to either unreliable data sources and networks, measurement uncertainty, or inability to determine whether an event has actually happened or not. This paper presents a proposal for incorporating and managing different kinds of uncertainty that may happen in both events and rules of the CEP systems. We provide a library that enables the representation and propagation of uncertain values, which can be efficiently integrated with the existing CEP languages and engines to deal with uncertainty, and we show how the treatment of uncertainty can be smoothly added to two of them: Esper and Apache Flink. Five applications coming from various domains serve to evaluate the proposal and to analyze its performance and accuracy. The results show that the overhead introduced by the treatment of uncertainty is not high and good precision and recall are achieved.

INDEX TERMS Complex event processing, measurement uncertainty, stream processing.

I. INTRODUCTION

Complex Event Processing (CEP) systems are being widely adopted as they provide effective means for processing and analyzing the steadily growing number of information sources that continuously produce and offer data in many applications of interest. Examples of such applications include monitoring systems for critical infrastructures [1], environmental monitoring [2]–[4], stock market analysis [5], network analysis and surveillance [6], maritime vessels trajectory monitoring [7], and social media data aggregation [8], [9]. One domain where CEP is particularly relevant is the Internet of Things (IoT) [10], [11], where applications should process and react to events arriving from various kinds of sources including wireless sensor networks, RFID devices, GPS, etc.

In a nutshell, CEP is a stream-processing system for analyzing and correlating streams of data about real-time events that happen in a system, and deriving conclusions from them [12]–[15]. A distinguishing feature of CEP, not present in most stream-processing systems, is that it permits defining complex events on top of simple events (raw data), to identify meaningful circumstances and to respond to them as quickly as possible. Different domain-specific languages called Event Processing Languages (EPLs) and engines for processing events currently exist, such as Esper,[1] Apache Flink,[2] Microsoft Azure Stream Analytics,[3] or Tesla [16]. CEP programs are usually composed by a set of rules. Each rule defines a pattern and creates a complex event every time the pattern matches the events in the stream.

One particular aspect that cannot be neglected when dealing with physical systems and networks, is that the events are not free from uncertainty [17]. It may be due to different causes, including unreliable data sources and networks, measurement uncertainty, or the inability to determine whether an event has actually happened or not. Our CEP application code may also have some associated uncertainty, when we are not 100% confident on the rules. Some authors, e.g.

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Specifying quantities in software models

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A R T I C L E I N F O

Keywords:
Model-based engineering
Modeling physical quantities
Measurement uncertainty
Dimensions
Units

A B S T R A C T

Context: An essential requirement for the design and development of any engineering application that deals with real-world physical systems is the formal representation and processing of physical quantities, comprising both measurement uncertainty and units. Although solutions exist for several programming languages and simulation frameworks, this problem has not yet been fully solved for software models.

Objective: This paper shows how both measurement uncertainty and units can be effectively incorporated into software models, becoming part of their basic type systems.

Method: We introduce the main concepts and mechanisms needed for representing and handling physical quantities in software models. More precisely, we describe an extension of basic type Real, called Quantity, and a set of operations defined for the values of that type, together with a ready-to-use library of dimensions and units, which can be added to any modeling project.

Results: We show how our approach permits modelers to safely represent and operate with physical quantities, statically ensuring type- and unit-safe assignments and operations, prior to any simulation of the system or implementation in any programming language.

Conclusion: Our approach improves the expressiveness and type-safety of software models with respect to measurement uncertainty and units of physical quantities, and its effective use in modeling projects of physical systems.

1. Introduction

The formal representation of measurement uncertainty and units is an essential requirement for the design and development of any engineering application that deals with physical entities, e.g. in the automotive and aerospace domains. The failure to do so has led to disasters such as the Mars Climate Orbiter [1] and the Gimli Glider Incident [2]. Moreover, the emergence of Industry 4.0 [3] and the proliferation of Cyber-Physical Systems (CPS) [4] have made evident the need to faithfully represent and manipulate the key properties of physical world systems and their elements. These not only include units but also measurement uncertainty due to errors in physical measures or the tolerance of mechanical tools and devices.

Although different solutions exist for representing and manipulating units and measurement uncertainty in programming languages, this problem has not yet been fully solved in the case of software models [5]. Modeling notations that permit dealing with aspects of physical systems, such as the UML Profile for MARTE [6] or SysML [7], already incorporate some elements for representing units and measurement uncertainty. However, they only offer representation mechanisms, no means to perform computations. To be able to carry out computations with units and measurement uncertainty at model level it is important to, for instance, calculate the values of derived attributes, evaluate expressions that represent model invariants and pre-/postconditions of operations, and compute the accumulated measurement uncertainty that is propagated when values are aggregated. Without computation facilities, elements annotated with units and measurement uncertainty become mere descriptive (decorative) elements. Furthermore, measurement uncertainty and units have to be incorporated into the models' type systems if we are to statically detect unit mismatches when trying to combine values of two physical quantities or to compute the values and units of derived attributes—at model level, in other words, before any implementation is developed or a simulation is carried out, and ensuring that the high-level models are correct and free from any unit-mismatch errors.

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SPECIAL SECTION PAPER

Incorporating measurement uncertainty into OCL/UML primitive datatypes

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Abstract
The correct representation of the relevant properties of a system is an essential requirement for the effective use and wide adoption of model-based practices in industry. Uncertainty is one of the inherent properties of any measurement or estimation that is obtained in any physical setting; as such, it must be considered when modeling software systems deal with real data. Although a few modeling languages enable the representation of measurement uncertainty, these aspects are not normally incorporated into their type systems. Therefore, operating with uncertain values and propagating their uncertainty become cumbersome processes, which hinder their realization in real environments. This paper proposes an extension of OCL/UML primitive datatypes that enables the representation of the uncertainty that comes from physical measurements or user estimates into the models, together with an algebra of operations that are defined for the values of these types.

Keywords Measurement uncertainty · OCL · UML · Primitive datatypes

1 Introduction

The emergence of cyber-physical systems (CPSs) [9] and the internet of things (IoT) [29], which are examples of systems that must interact with the physical world, and the current industrial practices, such as the Industry 4.0 [50], have made evident the need to faithfully represent extra-functional properties in models of systems and their elements. This is an essential requirement for leveraging some of the potential benefits of model-based software engineering (MBSE) [8, 16,59] in industrial settings—particularly if MBSE is indeed going to become widely adopted in practice.

It has been claimed that the expressiveness of a model is as important as the formality of its expression [47]. This expressiveness is determined by the suitability of the language for describing the concepts of the problem domain or for implementing the design. Although in software engineering a variety of modeling languages are tailored to various problems, they may not be well suited for capturing key aspects of the real world [9,43,60] and, in particular, for managing data *uncertainty* in a natural manner. One relevant issue is related to the uncertainty of the attribute values of the modeled elements, especially when dealing with physical quantities such as lengths, times, weights, or other measurable elements.

Data uncertainty can originate from various sources, including variability of input variables, numerical errors or approximations of parameters, observation errors, measurement errors and lack of knowledge of the true behavior of the system or its underlying physics [34]. On other occasions, estimates are needed because the exact values cannot be obtained since the associated properties are not directly measurable, or accessible or values are too costly to measure or are simply unknown.

Until recently, most software modeling notations have permitted only exact values to be used for representing system properties, which has limited their precision for modeling and

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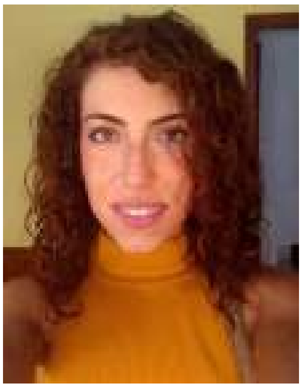

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EXPERT VOICE

Contents for a Model-Based Software Engineering Body of Knowledge

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Abstract

Although *Model-Based Software Engineering* (MBE) is a widely accepted *Software Engineering* (SE) discipline, no agreed-upon core set of concepts and practices (i.e., a Body of Knowledge) has been defined for it yet. With the goals of characterizing the contents of the MBE discipline, promoting a global consistent view of it, clarifying its scope with regard to other SE disciplines, and defining a foundation for the development of educational curricula on MBE, this paper proposes the contents for a Body of Knowledge for MBE. We also describe the methodology that we have used to come up with the proposed list of contents, as well as the results of a survey study that we conducted to sound out the opinion of the community on the importance of the proposed topics and their level of coverage in the existing SE curricula.

Keywords Model-Based Software Engineering · Body of Knowledge · Core concepts · Education

1 Introduction

Model-Based Software Engineering (MBE) is a widely accepted *Software Engineering* (SE) discipline that promotes

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Journal of Object Technology | **RESEARCH ARTICLE**

Extending OCL with Subjective Logic

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ABSTRACT The logic of the UML and OCL modeling languages is based on crisp values, e.g., true or false. However, when modeling systems that work in physical environments or where human actors are involved, different users may have subjective opinions about the reality that they perceive, and thus may need to assign different levels of confidence to the logic predicates of the models. These different views, or opinions, may also be subject to uncertainty when there is a lack of knowledge about the system, adding the dimension of ignorance to the traditional belief-disbelief dichotomy. This paper proposes an extension of the OCL/UML datatype Boolean that enables the representation of subjective uncertain opinions, together with a set of logical operators for reasoning with uncertain propositions in order to reach better informed decisions. The proposal has been implemented as an extension of the UML-based Specification Environment (USE) tool, and validated with several applications and case studies.

KEYWORDS OCL, uncertainty modeling, subjective logic.

1. Introduction

Conceptual modeling (Olivé 2007) enables engineers to represent a system at a level of abstraction that contains the relevant information for the purpose of the model, abstracting away irrelevant details. Despite the success of UML (Object Management Group 2015) and OCL (Object Management Group 2014) for modeling information systems, the birth of new paradigms such as the Internet of Things (IoT), Cyber-physical Systems (CPS), the advances in Robotics and Artificial Intelligence (AI), have raised the need to model systems that represent or interact with new environments (i.e., physical factors), which is challenging these notations. In particular, the basic datatypes and mechanisms that they provide are falling short for expressing behavioral aspects which are essential to these kinds of systems such as concurrency, units, precision, uncertainty or social behavior (Lee 2008; Selic 2015; Zhang et al. 2016; Bertoa et al. 2019; Burgueño, Mayerhofer, et al. 2019; Bucchiarone et al. 2020).

Focusing on *uncertainty*, it applies to physical measurements, estimations, predictions of future events, and unknown properties of a system. Uncertainty is defined as "the quality or state that involves imperfect and/or unknown information" (JCGM 2008). In this paper, we are interested in representing one particular kind of uncertainty, namely the uncertainty due to *imprecision and subjectivity of logical predicates*, whereby a user is not sure about a statement, i.e., a Boolean predicate, made about the system.

In UML, logic predicates are represented by OCL expressions of type `Boolean`. This datatype represents the binary logic values `true` and `false`, which fit very well with an ideal view of a perfect world. In many real situations, however, we cannot be completely sure about the truth of these predicates. For example, whether a sensor is working properly or not, or whether your favorite team will win the league this year.

Several extensions to Boolean logic allow dealing with this kind of uncertainty. A particular case is *probability theory* (Feller 2008; de Finetti 2017), which assigns probabilities to propositions, rather than truth values, and where formulas of probability calculus replace truth tables. In other words, they let Boolean values or predicates to be *partially* true. In (Bertoa et al. 2019), we proposed an extension of UML and OCL type `Boolean`, called `UBoolean` (Uncertain Boolean), which adds

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The Future of Model Transformation Languages: An Open Community Discussion

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Abstract Model transformations are the key element that brings life to model-driven engineering. Animation, simulations, VV, code-generation, etc. all depend on some kind of model transformation to work.

Model transformations are typically defined via specialized model transformation languages but this is now in question due to the lack of convincing evidence that specialised languages are substantially better than general-purpose languages for model transformation specification, and the rise of artificial intelligence. We report on the results of an open discussion with the model transformation community on the future of these languages, including whether such a future exists at all.

Keywords modeling, model transformation, domain-specific language, survey.

1 Introduction

Model-Driven Engineering (MDE) is a software development methodology in which models are first-class citizens driving the life of the project. These models need to be manipulated—for instance, to generate code, perform analyses or for data integration—and model transformations are the key element to achieve this.

The traditional way to tackle model transformation problems is to write a transformation program using a dedicated model transformation language (MTL) such as ATL [JABK08], QVT [OMG05] or ETL [KPP08]. Although many different and mature model transformation languages exist [SC12], they have never been massively adopted yet. Indeed, model transformation languages are popular in academia but, in practice, many companies still prefer to write their transformations directly in general-purpose languages like Java—probably, because there is no convincing evidence that dedicated MT languages are substantially better.

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EXPERT VOICE

Opportunities in intelligent modeling assistance

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Abstract

Modeling is requiring increasingly larger efforts while becoming indispensable given the complexity of the problems we are solving. Modelers face high cognitive load to understand a multitude of complex abstractions and their relationships. There is an urgent need to better support tool builders to ultimately provide modelers with intelligent modeling assistance that learns from previous modeling experiences, automatically derives modeling knowledge, and provides context-aware assistance. However, current intelligent modeling assistants (IMAs) lack adaptability and flexibility for tool builders, and do not facilitate understanding the differences and commonalities of IMAs for modelers. Such a patchwork of limited IMAs is a lost opportunity to provide modelers with better support for the creative and rigorous aspects of software engineering. In this expert voice, we present a conceptual reference framework (RF-IMA) and its properties to identify the foundations for intelligent modeling assistance. For tool builders, RF-IMA aims to help build IMAs more systematically. For modelers, RF-IMA aims to facilitate comprehension, comparison, and integration of IMAs, and ultimately to provide more intelligent support. We envision a momentum in the modeling community that leads to the implementation of RF-IMA and consequently future IMAs. We identify open challenges that need to be addressed to realize the opportunities provided by intelligent modeling assistance.

Keywords Model-based software engineering · Intelligent modeling assistance · Integrated development environment · Artificial intelligence · Development data · Feedback

1 Introduction

Over the last decades, modeling activities have been applied across the whole life-cycle of complex software-intensive systems to support all stakeholders involved in software development, mostly thanks to the use of abstractions—provided by general-purpose and domain-specific modeling languages—and separation of concerns. Modeling is continually requiring larger efforts and it is often indispensable in tackling the constantly increasing intrinsic complexity of such systems [11,13]. Owing to (i) the ever-increasing complexity of the problems that modelers are trying to solve, (ii) the growing number of stakeholders whose needs have to be addressed, and (iii) the increase in domain-specific modeling abstractions used by these stakeholders, modelers face higher and higher cognitive load. Modelers need to handle a multitude of specific abstractions, their use across the software life-cycle, and their relationships with other abstractions to ensure global consistency of the modeling activities and resulting modeling artifacts [44]. There is an urgent need to better support tool builders to ultimately provide modelers with more intelligent modeling assistance.

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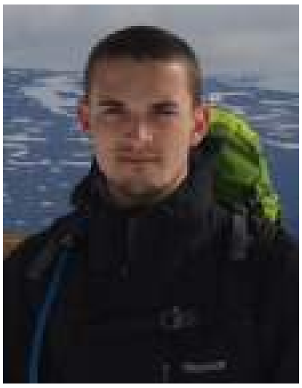

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Efficient execution of ATL model transformations using static analysis and parallelism

Jesús Sánchez Cuadrado, Loli Burgueño, Manuel Wimmer, and Antonio Vallecillo

Abstract—Although model transformations are considered to be the heart and soul of Model Driven Engineering (MDE), there are still several challenges that need to be addressed to unleash their full potential in industrial settings. Among other shortcomings, their performance and scalability remain unsatisfactory for dealing with large models, making their wide adoption difficult in practice. This paper presents A2L, a compiler for the parallel execution of ATL model transformations, which produces efficient code that can use existing multicore computer architectures, and applies effective optimizations at the transformation level using static analysis. We have evaluated its performance in both sequential and multi-threaded modes obtaining significant speedups with respect to current ATL implementations. In particular, we obtain speedups between 2.32x and 38.28x for the A2L sequential version, and between 2.40x and 245.83x when A2L is executed in parallel, with expected average speedups of 8.59x and 22.42x, respectively.

Index Terms—Model transformation, MDE, ATL, Performance, Scalability, Parallelization

1 Introduction

The progressive adoption of Model-Driven Engineering (MDE) [1] approaches for developing better and more efficient software is posing different kinds of challenges to current MDE methods and tools. Despite the potential benefits of MDE technologies to significantly reduce time to market and improve product quality, they still suffer from some limitations that may hinder their full adoption by industry (see, e.g., [2]–[4]). In particular, the scalability, usability and performance of model transformations (MT) are crucial issues that need to be tackled if they are to be effectively used to address scenarios such as model-driven modernization of legacy systems and the engineering of large and complex applications in, e.g., the automotive, biology or aerospace domains.

At this moment, ATL [5] and QVT [6] are the most widely-used model transformation languages [7]. Although they provide powerful abstractions to specify and implement transformations between models and to generate model views, their implementations have limited scalability, and thus the execution time of transformations may become prohibitive with large input models (e.g., in the order of millions of elements), or even medium-size input models if the transformation has complex model navigations. One reason for this lack of scalability is due to the fact that most transformation engines are implemented as simple interpreters and they barely use static analysis information to apply compile time optimizations or to improve their scheduling. Moreover, although multicore computers are widely available, there are very few engines that implement parallel transformation algorithms.

The contribution presented in this paper addresses the engineering of an efficient model transformation engine for the particular case of the ATL model transformation language. We have developed a new compiler for ATL, called A2L, which provides several novel features with respect to state-of-the-art approaches, namely:

- A2L uses static analysis information provided by AnATLyzer [8] to compile ATL transformations to the Java Virtual Machine (JVM), applying optimizations for OCL expressions and for transformation rule handling.
- We present a novel algorithm which enables the parallel execution of the transformation, using data parallelism. This allows A2L to achieve an effective distribution of the parallel jobs, thus outperforming other parallel ATL engines which are based on task parallelism [9], [10].
- A2L is integrated with the ATL/AnATLyzer IDE and Eclipse Java Development Toolkit (JDT), which enables the development of transformations using the facilities provided by AnATLyzer, e.g., quick fixes [11] and visualizations [12]. Moreover, the compiled code can be seamlessly integrated with existing Java code.

A2L has been validated for correctness using the regression tests defined for the ATL virtual machine [13] and supports the majority of the constructs of ATL, including all types of rules (matched, lazy and called), module and context helpers, imperative blocks, all datatypes including collections, maps and tuples, and the standard OCL library. We have run several benchmarks that show significant performance improvements when compared with the existing ATL engines.

This paper is organized as follows. Sect. 2 introduces the ATL model transformation language and describes the limi-

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Dealing with Non-Functional Requirements in Model-Driven Development: A Survey

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Abstract—*Context*: Managing Non-Functional Requirements (NFRs) in software projects is challenging, and projects that adopt Model-Driven Development (MDD) are no exception. Although several methods and techniques have been proposed to face this challenge, there is still little evidence on how NFRs are handled in MDD by practitioners. Knowing more about the state of the practice may help researchers to steer their research and practitioners to improve their daily work. *Objective*: In this paper, we present our findings from an interview-based survey conducted with practitioners working in 18 different companies from 6 European countries. From a practitioner's point of view, the paper shows what barriers and benefits the management of NFRs as part of the MDD process can bring to companies, how NFRs are supported by MDD approaches, and which strategies are followed when (some) types of NFRs are not supported by MDD approaches. *Results*: Our study shows that practitioners perceive MDD adoption as a complex process with little to no tool support for NFRs, reporting productivity and maintainability as the types of NFRs expected to be supported when MDD is adopted. But in general, companies adapt MDD to deal with NFRs. When NFRs are not supported, the generated code is sometimes changed manually, thus compromising the maintainability of the software developed. However, the interviewed practitioners claim that the benefits of using MDD outweight the extra effort required by these manual adaptations. *Conclusion*: Overall, the results indicate that it is important for practitioners to handle NFRs in MDD, but further research is necessary in order to lower the barrier for supporting a broad spectrum of NFRs with MDD. Still, much conceptual and tool implementation work seems to be necessary to lower the barrier of integrating the broad spectrum of NFRs in practice.

Index Terms—Model-Driven Development, Non-Functional Requirements, Quality Requirements, Requirements Engineering, Survey.

1 Introduction

Model-Driven Development (MDD) refers to the systematic use of models as first-class entities throughout the software engineering lifecycle [1], [2]. Its objective is to increase productivity, portability and reuse, and to reduce time to market by enabling complex systems development using models. Models are defined with concepts that are much less bound to the underlying implementation technology, thus abstracting from unnecessary details. This favours the transformation of such models into "real things" [2].

The confidence in the practical relevance of MDD is strengthened by ongoing technology projects (*e.g.,* the Eclipse Modelling Project[1]), industrial practices [3], [4], and reported success stories [5]. Obstacles and challenges to be surpassed have also been studied [6].

When analysing the literature related to the industrial adoption of MDD, one aspect becomes evident. While Non-Functional Requirements (NFRs) are becoming more and more important in industry (*e.g.,* in relation to quality assurance, or when checking compliance to security regulations) and MDD is being used in critical domains such as automotive, defence, and aerospace, there is still a lack of evidence on how NFRs are managed and fullfilled by MDD processes. In other areas, such as Service-Based Systems, there is scarce NFRs support [7]. This knowledge gap was already reported in 2010 [8] and the situation has not improved significantly since then.

Under the premise that practitioners need to consider NFRs regardless of the concrete software development approach they follow, we conducted an industrial survey based on interviews to better understand: 1) the importance given to NFRs in comparison to functional requirements and the NFRs expected to be satisfied when MDD is adopted, 2) the NFRs really satisfied when MDD is adopted, the development stages in which they are addressed and the techniques used, and if the companies need to tailor their MDD approaches to guarantee those NFRs, and 3) the strategies used by the companies when NFRs are unsupported by MDD approaches. The interview-based survey follows Ciolkowski *et al.* guidelines [9]. We interviewed practitioners from 18 companies that use MDD in their software projects (5 medium-sized and 13 large companies) in 6 European countries, recruited by researchers of each participating country. The analysis of the answers reveals that: 1) NFRs are less important than or equally important as functional requirements, 2) productivity, maintainability and reusability are the NFRs most expected to be improved before adopting MDD, 3) the expectations are met for productivity and maintainability when MDD is adopted, 4) modelling, transformation functions and MDD adaptations are used for specifying and satisfying NFRs and 5) manual

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REGULAR PAPER

A generic LSTM neural network architecture to infer heterogeneous model transformations

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Abstract
Models capture relevant properties of systems. During the models' life-cycle, they are subjected to manipulations with different goals such as managing software evolution, performing analysis, increasing developers' productivity, and reducing human errors. Typically, these manipulation operations are implemented as model transformations. Examples of these transformations are (i) model-to-model transformations for model evolution, model refactoring, model merging, model migration, model refinement, etc., (ii) model-to-text transformations for code generation and (iii) text-to-model ones for reverse engineering. These operations are usually manually implemented, using general-purpose languages such as Java, or domain-specific languages (DSLs) such as ATL or Acceleo. Even when using such DSLs, transformations are still time-consuming and error-prone. We propose using the advances in artificial intelligence techniques to learn these manipulation operations on models and automate the process, freeing the developer from building specific pieces of code. In particular, our proposal is a generic neural network architecture suitable for heterogeneous model transformations. Our architecture comprises an encoder–decoder long short-term memory with an attention mechanism. It is fed with pairs of input–output examples and, once trained, given an input, automatically produces the expected output. We present the architecture and illustrate the feasibility and potential of our approach through its application in two main operations on models: model-to-model transformations and code generation. The results confirm that neural networks are able to faithfully learn how to perform these tasks as long as enough data are provided and no contradictory examples are given.

Keywords Model manipulation · Code generation · Model transformation · Artificial intelligence · Machine learning · Neural networks

1 Introduction

In software development, data, structured as models, are manipulated on a daily basis through systematic model manipulation operations. Automating such operations, typically in the form of model transformations, can reduce the time-to-market of project development and improve its quality. Usually, a model-driven project involves several consecutive transformations. Intermediate steps are often implemented as model-to-model transformations, each one taking as input the output of the previous step as part of a continuous refinement process from high-level models to platform-specific ones. One last step consists in a model-to-text transformation that takes this low-level models and generates a textual output, i.e., the final code, as a result.

This automatic code generation step aims to limit tedious tasks, reduce the chances of programming errors, and improve the quality of the code, hence minimizing the main-

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Software and Systems Modeling

Theme Issue:

AI-enhanced Model-Driven Engineering

Over the past years, we have witnessed a substantial rise of Artificial Intelligence (AI) successfully applied to different domains and, whether we are aware of it or not, impacting our daily lives through its presence in almost every device we use. More recently, AI is also starting to impact all aspects of the system and software development lifecycle, from upfront requirements elicitation to their specification, design, testing, deployment, operation and maintenance, with the main goal of helping engineers produce systems and software faster and with better quality while being able to handle the increasing complexity.

At the same time, Model-Driven Engineering (MDE), which aims to reduce the accidental complexity of system and software development as well as to make the intrinsic complexity of software-intensive systems more manageable, has proven to improve software development and is being used increasingly in the software industry.

The integration of AI components may increase the current benefits of MDE processes and tools, pushing the limits of "classic" MDE and providing software systems engineers with the right techniques to develop the next generation of highly complex model-based systems.

The ***Journal of Software and Systems Modeling*** (SoSyM) invites original, high-quality submissions for its theme issue on "AI-enhanced Model-Driven Engineering" focusing on topics related to the application of AI to enhance MDE processes and tools, including:

- AI planning applied to modelling, meta-modelling, and model management;
- AI-empowered model-based testing, validation and verification;
- Modeling assistants such as bots, chatbots and virtual recommenders supporting modeling tasks;
- (Semi-)automatic model inferencers and generators;
- Self-adapting model transformations and code generators;
- AI-based user interface adaptation for modeling tools;
- AI with human-in-the-loop for modeling;
- Semantic reasoning platforms over domain-specific models;
- Semantic integration of design-time models with runtime data;
- Perception AI and modeling;
- Data, process, and model mining and categorization;
- Integration of search-based approaches for modelling support and automatic modelling;

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Further information

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Guest Editorial to the Theme Section on AI-enhanced Model-Driven Engineering

Lola Burgueño · Jordi Cabot · Manuel Wimmer · Steffen Zschaler

Received: date / Accepted: date

Abstract This theme section brings together the latest research at the intersection of Artificial Intelligence (AI) and Model-Driven Engineering (MDE). Over the past years, we have witnessed a substantial rise of AI successfully applied to different domains, including software development and MDE. Dedicated events at the intersection of AI and MDE have been created, too, such as the MDE Intelligence workshop series co-located with the MODELS conference. This theme section covers research contributions integrating AI components into MDE approaches—increasing the current benefits of MDE processes and tools and pushing the limits of "classic" MDE with the goal to provide software and systems engineers with the right techniques to develop the next generation of highly complex model-based systems—and applications of MDE to the development of AI components. In total, nine submissions were accepted in the theme section after a thorough peer-reviewing process.

Keywords Artificial Intelligence · Model-Driven Engineering · Software Engineering · Systems Engineering

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1 Introduction

Artificial Intelligence (AI) has become part of everyone's life. It is used by companies to exploit the huge amounts of data they collect to improve their products, processes, and services, and, as a consequence, it is present in almost every device around us. Lately, AI is also starting to impact all aspects of the system and software development lifecycle, from their upfront specification to their design, testing, deployment, operation, and maintenance, with the main goal of helping engineers produce systems and software faster and with better quality while being able to deal even with more complex systems. The hope is that AI will help dealing with the increasing complexity we face in software and systems engineering.

Model-Driven Engineering (MDE) is an established engineering paradigm to tame until now part of this complexity. However, its adoption by industry still relies on their capacity to manage the underlying methodological changes including among other things the adoption of smart tools and learning new skills. To go one step further, we believe there is a clear opportunity for AI-empowered MDE, which will push the limits of "classic" MDE and provide the right techniques to develop the next generation of highly complex model-based software-intensive systems engineers will have to design tomorrow.

At the same time, AI is software (and complex software, in fact). We believe that AI-powered MDE will also benefit the design of AI artifacts themselves, and specially, to face the challenge of designing "trustable" AI software.

This theme section brings together nine papers representing the latest research at the intersection of AI and MDE.

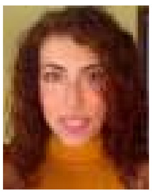
2 Selected papers for this theme section

As the final outcome of a thorough peer review process, nine papers were selected for this theme section. These can be roughly categorised into three groups:

- Works with a focus on machine learning include:
  - José Antonio López, Javier Luis Canovas Izquierdo and Jesús Sánchez Cuadrado, in their paper "ModelSet: a dataset for machine learning in model-driven engineering", provide a labelled dataset of software models and tool support in order to stimulate the application of machine learning algorithms to tackle model-driven engineering problems.
  - Armin Moin, Moharram Challenger, Atta Badii and Stephan Günnemann, in their paper "A model-driven approach to machine learning and software modeling for the IoT" present an approach called ML-Quadrat to support the development of IoT systems with machine learning capabilities.
- Works on supporting modellers with AI based tools, such as recommender systems, include:
  - Rijul Saini, Gunter Mussbacher, Jin Guo and Jörg Kienzle, in their paper "Automated, and traceable domain modelling empowered by artificial intelligence" present an approach to facilitate the interactions between modeling bots and human modelers by searching for alternative configurations of domain models which can be interactively selected by the modelers and automatically integrated in the domain models.
  - Sagar Sunkle, Krati Saxena, Ashwini Patil and Vinay Kulkarni, in their paper "AI-driven streamlined modeling: Experiences and lessons learned from multiple domains" present five case studies where AI has been used in different modeling activities together with a discussion on how AI and modeling interact, a comparison with existing work, and a discussion of their experiences and lessons learned.
  - Martin Weyssow, Houari Sahraoui and Eugene Syriani, in their paper "Recommending metamodel concepts during modeling activities with pre-trained language models" present a deep learning model that is able to abstract and recommend domain concepts by learning from a corpus of thousands of independent metamodels.
- Works on reinforcement learning and search-based approaches include:
  - Juan Parra-Ullauri, Antonio García-Domínguez, Nelly Bencomo, Changgang Zheng, Chen Zhen, Juan Boubeta-Puig, Guadalupe Ortiz and Shufan Yang, in their paper "Event-driven temporal models for explanations - ETeMoX: explaining reinforcement learning" present ETeMoX, an event-driven infrastructure for representing information generated during model-based reinforcement learning which can then be used to explain learning outcomes.
  - Shekoufeh Kolahdouz-Rahimi, MohammadHadi Dehghani, Massimo Tisi and Dalila Tamzalit, in their paper "Facilitating the migration to microservice architecture via model-driven reverse engineering and reinforcement learning" present a framework that help architects to remodularize legacy systems by leveraging reverse engineering techniques (to obtain a model from the source code of the system) and reinforcement learning (to recommend a mapping from the legacy model to a set of microservices).
  - Angela Barriga, Adrian Rutle and Rogardt Heldal, in their paper "AI-powered model repair: an experience report - Lessons learned" present their experience in applying reinforcement learning approaches to the model repair problem.
  - Edouard Batot and Houari Sahraoui, in their paper "Promoting social diversity for the automated learning of complex MDE artifacts" present a new diversity measure, called Social Diversity, for genetic programming algorithms, which is applied to learning well-formedness rules in MDE.

Acknowledgements We would like to thank all authors who submitted papers. We would also like to thank our reviewers for their efforts and high-quality reviews, which greatly contributed to improving the selected papers. Finally, we would like to express our gratitude to the SoSyM editorial office, specifically to Martin Schindler and Bernhard Rumpe who were always very helpful and supportive.

Theme Section Editor Biographies



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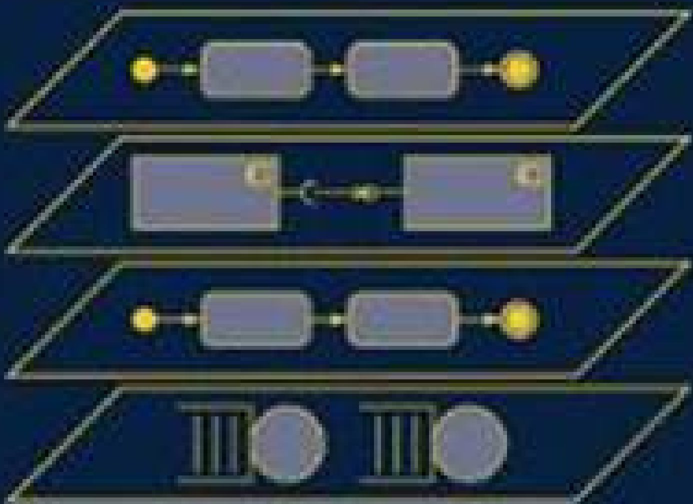
12th International School on Formal Methods for the Design of Computer, Communication, and Software Systems, SFM 2012
Bertinoro, Italy, June 2012, Advanced Lectures



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Formal Methods for Model-Driven Engineering

This book presents 11 tutorial lectures by leading researchers given at the 12th edition of the International School on Formal Methods for the Design of Computer, Communication and Software Systems, SFM 2012, held in Bertinoro, Italy, in June 2012.

SFM 2012 was devoted to model-driven engineering and covered several topics including modeling languages; model transformations, functional and performance modeling and analysis; and model evolution management.

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12th International School
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Bertinoro, Italy, June 18-23, 2012
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Springer

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Table of Contents

Formal Specification and Testing of Model Transformations

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Abstract. In this paper we present some of the key issues involved in model transformation specification and testing, discuss and classify some of the existing approaches, and introduce the concept of *Tract*, a generalization of model transformation contracts. We show how Tracts can be used for model transformation specification and black-box testing, and the kinds of analyses they allow. Some representative examples are used to illustrate this approach.

1 Introduction

Model transformations are key elements of Model-driven Engineering (MDE). They allow querying, synthesizing and transforming models into other models or into code, and can also be composed in chains for building new and more powerful model transformations.

As the size and complexity of model transformations grow, there is an increasing need to count on mechanisms and tools for testing their correctness. This is specially important in case of transformations with hundreds or thousands of rules, which are becoming commonplace in most MDE applications, and for which manual debugging is no longer possible. Being now critical elements in the software development process, their correctness becomes essential for ensuring that the produced software applications work as expected and are free from errors and deficiencies. In particular, we do need to check whether the produced models conform to the target metamodel, or whether some essential properties are preserved by the transformation.

In general, correctness is not an absolute property. Correctness needs to be checked against a *contract*, or *specification*, which determines the expected behaviour, the context whether such a behaviour needs to be guaranteed, as well as some other properties of interest to any of the stakeholders of the system (in this case, the users of a model transformation and their implementors). A specification normally states *what* should be done, but without determining *how*. An additional benefit of some forms of specifications is that they can also be used for testing that a given implementation of the system (which describes the *how*, in a particular platform) conforms to that contract.

M. Bernardo, V. Cortellessa, and A. Pierantonio (Eds.): SFM 2012, LNCS 7320, pp. 399–437, 2012.

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e. CONGRESOS

TIPO DE PARTICIPACIÓN: Participación en comité científico El siguiente documento muestra las conferencias en las cuales la candidata ha servido como miembro del comité de programa. Sirva como justificante el hecho de que la candidata aparece en la web del congreso bajo "Program Committee", para ello, para cada congreso se proporciona el link a la web del congreso.

Lola Burgueño has served as a **Program Committee Member** for the following conferences:

Conference	Link with proof
MODELS'23 Workshops	
JISBD'23	
ICWE'23	
SEAA'23	
ECMFA'23	
MODELS'22 Tools and Demonstrations	
MODELS'22	
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MODELS'21	http://conf.researchr.org/track/models-2021/models-2021-foundations-track-papers
ICSE'21 Artifact Evaluation	http://conf.researchr.org/track/icse-2021/icse-2021-Artifact-Evaluation
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ICMT'19	http://www.model-transformation.org/
JCIS'19	http://sistedes2019.spilab.es/jcis/#comite-de-programa-de-jcis
MODELS'19 Tutorials	http://modelsconf19.org/?page_id=820
MODELS'19 Tools and Demos	https://modelsconf19.org/?page_id=1059
SLE 2019	http://www.sleconf.org/2019/Committees.html
MPM4CPS'19	http://msdl.uantwerpen.be/conferences/MPM4CPS/2019/index.php/program-committee/
JISBD'18 (ISDM track)	http://congreso.us.es/sistedes2018/isdm/
MODELS'18 Posters	http://modelsconf2018.github.io/calls/posters/
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BigMDE'17	http://www.big-mde.eu/
MODELS'17 Tutorials	http://modelexecution.org/models2017tutorials/
MODELS'17 Posters	http://http://www.miso.es/models17_posters/call_for_posters.html
BigMDE'15	http://modelexecution.org/models2017tutorials/
MODELS'14 Doctoral Symposium	http://ceur-ws.org/Vol-1321/preface.pdf

TIPO DE PARTICIPACIÓN: Participación en la organización Lola Burgueño ha participado en la organización de los siguientes eventos:

- Estudiante voluntaria (ayuda a la organización) en MODELS'2013
- Estudiante voluntaria (ayuda a la organización) en MODELS'2014
- Organizadora Local de la reunión en Málaga del proyecto COST Action IC1404 en 2016
- Organizador local de ICSOC'2017
- PhD Symposium chair en ICSOC'2017
- Proceedings chair de MODELS'2017
- Educators Symposium Chair en MODELS'18
- Proceedings Chair en MODELS'19
- Junior Researcher Competition (JCR) Event chair en STAF'2019
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- Responsable de Comunicación y redes sociales del VI Congreso Español de Informática (CEDI 20/21)
- Student Volunteer chair en MODELS'21
- Coummunication co-chair de STAF'22
- Chair de la ACM Student Research Competition en MODELS'22
- PC chair de SLE'22 (adjunto impresión de la página web ya que, como PC chair, no tiene mucho sentido que me hiciera un certificado a mí misma).

A continuación se adjuntan los justificantes.

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MODELS 2013

September 29, 2013 through October 4, 2013

CERTIFICATE

This is to certify that

Loli Burgueño

has helped the organization of the **ACM/IEEE 16th International Conference on Model Driven-Engineering Languages and Systems (MODELS 2013)**, held in Miami, Florida – USA, as student volunteer from 29 September 2013 through 4 October 2013.

Jeff Gray	Antonio Vallecillo
General Chair	General Chair

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VALENCIA

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Lolí Burgueño

for the collaboration with the
ACM/IEEE 17th International Conference on Model Driven Engineering Languages and Systems (MODELS 2014) and its Satellite Events,
held in Valencia, Spain from Sunday September 28 through Friday October 3, 2014.

Valencia, September 28, 2014

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COST Action IC1404: Multi-Paradigm Modelling for Cyber-Physical Systems

http://www.mpm4cps.eu/

Proceedings of the 5th Workshop of the MPM4CPS COST Action

November 24-25, 2016 • Malaga, Spain

Hans Vangheluwe, Vasco Amaral, Holger Giese, Jan Broenink, Bernhard Schätz, Alexander Norta, Paulo Carreira, Miguel Goulão, Antonio Vallecillo, Tanja Mayerhofer (Eds.)

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Preface

In virtually any area of human activity, Cyber-Physical Systems (CPS) are emerging. CPS are truly complex, designed systems that integrate physical, software and network aspects. To date, no unifying theory and no systematic design methods, techniques and tools exist for such systems. Individual mechanical, electrical, network or software engineering disciplines only offer partial solutions. Multi-paradigm Modelling (MPM) proposes to model every part and aspect of a system explicitly, at the most appropriate level(s) of abstraction, using the most appropriate modelling formalism(s). Modelling language engineering, including model transformations, and the study of their semantics, are used to realize MPM. MPM is seen as an effective answer to the challenges of designing CPS.

The COST Action IC1404: Multi-Paradigm Modelling for Cyber-Physical Systems (MPM4CPS) aims to promote foundations, techniques and tools for multi-paradigm modelling for cyber-physical systems, and to provide educational resources to both academia and industry. This will be achieved by bringing together and disseminating knowledge and experiments on CPS problems and MPM solutions.

The fifth MPM4CPS workshop took place on November 24-25, 2016 in Malaga, Spain. The program comprised presentations of MPM4CPS COST Action members discussing their work on foundations, techniques, application domains, and education in MPM4CPS, as well as joint work meetings. These proceedings collect the presentations given at the workshop. They cover many different aspects of multi-paradigm modelling for cyber-physical systems including, but not limited to

- foundations of MPM4CPS including
  - language engineering,
  - model transformations,
  - verification paradigms,
  - traceability;
- techniques in MPM4CPS including
  - co-simulation,
  - uncertainty modelling,
  - model-driven testing,
  - predictive analysis;
- application domains of MPM4CPS in the
  - automotive industry,
  - aviation industry,
  - smart grids,
  - robotics;
- education in MPM4CPS.

We would like to thank the presenters contributing their work to the MPM4CPS COST Action. Furthermore, we would like to thank Antonio Vallecillo, Loli Burgueño and Tanja Mayerhofer for organizing the workshop.

December 2016

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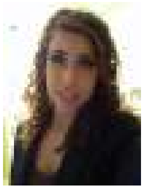

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The reports of the 2015 and 2016 STSMs can now be consulted here.

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2. Service-Oriented Computing – ICSOC 2017 Workshops
ASOCA, ISyCC, WESOACS, and Satellite Events, Málaga, Spain, November 13–16, 2017, Revised Selected Papers

About these proceedings

Introduction

This book constitutes the revised selected papers of the scientific satellite events that were held in conjunction with the 15th International Conference on Service-Oriented Computing, ICSOC 2017, held in Málaga, Spain, in November 2017.

The ICSOC 2017 workshop track consisted of three workshops on a wide range of topics that fall into the general area of service computing:

ASOCA 2017: The Second Workshop on Adaptive Service-Oriented and Cloud Applications

ISyCC 2016: The Second Workshop on IoT Systems Provisioning and Management in Cloud Computing

Service management Service science Service specification Service-oriented architecture Software engineering Ubiquitous computing User interfaces Web service

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Málaga, Spain, November 13–16, 2017
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Preface

This volume presents the proceedings of the scientific satellite events that were held in conjunction with the 2017 International Conference on Service-Oriented Computing, which took place in Málaga, Spain, November 13–16, 2017. Since the first edition in Trento in 2003, ICSOC has become a leading conference in the rapidly evolving areas of service research.

The satellite events provide venues for specialist groups to meet, to generate focused discussions on specific sub-areas within service-oriented computing, and to engage in community-building activities. These events helped significantly enrich the main conference by both expanding the scope of research topics and attracting participants from a wider community. The selected scientific satellite events were organized around three main tracks, including a workshop track, a PhD symposium track, and a demonstration track.

The interest in the ICSOCs 2017 workshop track was high and from eight workshop proposals three were finally selected. The workshop track included a wide range of topics that fall into the general area of service computing. A special focus this year was on cloud computing and the Internet of Things, also reflected in the titles of workshops. These technology trends in combination with novel application domains led to inspiring research results.

- ASOCA 2017: the Second Workshop on Adaptive Service-Oriented and Cloud Applications
- ISyCC 2017: the Second Workshop on IoT Systems Provisioning and Management for Context-Aware Smart Cities
- WESOACS 2017: the 13th International Workshop on Engineering Service-Oriented Applications and Cloud Services.

The workshops were held on November 13, 2017. Each workshop had its own chairs and Program Committee who were responsible for the selection of papers. The overall organization for the workshop program, including the selection of the workshop proposals, was carried out by Lars Braubach and Juan M. Murillo. The ICSOC PhD Symposium is an international forum for PhD students to present, share, and discuss their research in a constructive and critical atmosphere. It also provides students with fruitful feedback and advice on their research approach and thesis. The PhD Symposium Track was chaired by Loli Burgeño and Naouel Moha.

The ICSOC Demonstration Track offers an exciting and highly interactive way to show research prototypes/work in service-oriented computing (SOC) and related areas. The Demonstration Track was chaired by Nima Kaviani and Manuel Lama.

We would like to thank the workshop, PhD symposium, and demonstration authors, as well as keynote speakers and workshop Organizing Committees, who together contributed to this important aspect of the conference.

We hope that these proceedings will serve as a valuable reference for researchers and practitioners working in the SOC domain and its emerging applications.

January 2018

Lars Braubach
Juan M. Murillo
Nima Kaviani
Manuel Lama
Loli Burgueño
Naouel Moha
Marc Oriol

ICSOC 2017

International Conference on
Service-Oriented Computing

Attestation

This is to certify that

Loli Burgueño

has been Local Organizer of

ICSOC 2017

Malaga, Spain
November, 13-16

Carlos Canal, General Chair

Vol-2019
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MODELS-SE 2017
MODELS 2017 Satellite Events

- Workshops
- Posters
- Doctoral Symposium
- 13th Educator Symposium at MODELS
- ACM Student Research Competition
- Tools and Demonstrations

Proceedings of MODELS 2017 Satellite Event: Workshops (ModComp, ME, EXE, COMMitMDE, MRT, MULTI, GEMOC, MoDeVVa, MDETools, FlexMDE, MDEbug), Posters, Doctoral Symposium, Educator Symposium, ACM Student Research Competition, and Tools and Demonstrations
co-located with ACM/IEEE 20th International Conference on Model Driven Engineering Languages and Systems (MODELS 2017)

Austin, TX, USA, September, 17, 2017.

Edited by

Loli Burgueño, University of Málaga and Marbella International University Centre
Jonathan Corley, University of West Georgia
Nelly Bencomo, Aston University (Doctoral Symposium Chair)
Peter J. Clarke, Florida International University (Educators Symposium Chair)
Philippe Collet, University of Nice Sophia Antipolis (Tool & Demonstration Chair)

Michalis Famelis, Université de Montréal (Workshop Chair)
Sudipto Ghosh, Colorado State University (Tool & Demonstration Chair)
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Alfonso Pierantonio, University of L'Aquila (Educators Symposium Chair)
Julia Rubin, University of British Columbia (Doctoral Symposium Chair)
Davide Di Ruscio, University of L'Aquila (ACM Student Research Competition Chair)

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MRT - 12th International Workshop on Models@run.time

MULTI - 4th International Workshop on Multi-Level Modelling

GEMOC - 5th Workshop on the Globalization of Modeling Languages

MoDeVVa - 14th Model Driven Engineering, Verification and Validation. Integrating Verification and Validation in MDE

MDETools - Model-Driven Engineering Tools

FlexMDE - 3rd Flexible MDE Workshop

MDEbug - 1st International Workshop on Debugging in Model-Driven Engineering

Posters

Doctoral Symposium

13th Educator Symposium at MODELS

ACM Student Research Competition

Tools and Demonstrations

MODELS 2017 Satellite Events

Loli Burgueño[1] and Jonathan Corley[3]

[1]University of Málaga, Spain
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[3] University of West Georgia, USA

Preface

This joint volume of proceedings gathers together papers from the satellite events from MODELS 2017 including the workshops (listed below), Educators and Doctoral Symposia, Posters and Tools & Demonstrations sessions, and the ACM Student Research Competition. These events were all held during the 2017 MODELS conference September 17th through September 22nd. MODELS is the premier conference series for model-based software and systems engineering covering all aspects of modeling from languages and methods to tools and applications. The many workshops at MODELS provide devoted meetings for discussion and sharing of ideas relevant to a specific topic. The Educators Symposium provides a venue for educators interested in MDE to gather to share ideas and discuss relevant topics and trends. The Posters session provides a venue for researchers to present and receive feedback on early and ongoing projects, innovative applications of existing tools, and ideas for novel applications in the area of MDE. The Tools & Demonstrations session recognizes the importance of tools to MDE, and includes submissions of both industry and research tools. The Doctoral Symposium and ACM Student Research Competition support student research. The Doctoral Symposium enables young researchers to present receive feedback on their existing and planned research projects from their fellow students and experienced faculty mentors in the area of MDE. The ACM Student Research Competition supports student researchers through a competition where the students present novel research in the area of MDE, gaining the opportunity to meet and exchange ideas with fellow students and experienced researchers in the field as well as getting feedback on their research projects and presentation skills from a panel of distinguished judges from industry and academia. The papers for each event were reviewed and selected by the organizers of the appropriate event along with the associated program committee. Below, we briefly list the many organizers that made the MODELS 2017 Satellite Events a success. Furthermore, we would like to recognize the MODELS 2017 Workshop Chairs who reviewed and selected the workshops.

Workshop Chairs

- Michalis Famelis - Université de Montréal, Canada
- Sahar Kokaly - McMaster University, Canada

ModComp - 4th International Workshop on Interplay of Model-Driven and Component-Based Software Engineering - Organizers

- Federico Ciccozzi - Mälardalen University, Sweden
- Ivano Malavolta - Vrije University, The Netherlands

ME - 11th International Workshop on Models and Evolution - Organizers

- Tanja Mayerhofer - TU Wien, Austria
- Alfonso Pierantonio - University of L'Aquila, Italy
- Bernhard Schätz - fortiss GmbH, Germany
- Dalila Tamzalit - University of Nantes, France

EXE - 3rd International Workshop on Executable Modeling - Organizers

- Tanja Mayerhofer - TU Wien, Austria
- Philip Langer - EclipseSource, Austria
- Ed Seidewitz - nMeta, USA
- Jeff Gray - University of Alabama, USA
- Erwan Bousse - TU Wien, Austria

COMMitMDE - 2nd International Workshop Collaborative Modelling in MDE - Organizers

- Henry Muccini - University of L'Aquila, Italy
- Sebastien Gerard - CEA, LIST, France
- Dimitrios S. Kolovos - University of York, UK
- Ivano Malavolta - Vrije Universiteit Amsterdam, The Netherlands
- Jan Bosch - Chalmers University of Technology, Gothenburg, Sweden

MRT - 12th International Workshop on Models@run.time - Organizers

- Sebastian Götz - Technische Universität Dresden, Germany
- Nelly Bencomo - Aston Universiy, UK
- Kirstie L. Bellman - The Aerospace Organisation, US
- Gordon Blair - Lancaster University, UK

MULTI - 4th International Workshop on Multi-Level Modelling - Organizers

- Tony Clark - Sheffield Hallam University, UK
- Ulrich Frank - University of Duisburg-Essen, Germany
- Manuel Wimmer - Vienna University of Technology, Austria

GEMOC - 5th Workshop on the Globalization of Modeling Languages - Organizers

- Frédéric Boulanger - CentraleSupélec/LRI, Université Paris-Saclay, France

- Eugene Syriani - University of Montreal, Canada
- Andreas Wortmann - RWTH Aachen University, Germany

MoDeVVa - 14th Model Driven Engineering, Verification and Validation. Integrating Verification and Validation in MDE - Organizers

- Ernesto Posse - Zeligsoft, Canada
- Daniel Ratiu - Siemens, Germany
- Gehan Selim - McMasters University, Canada
- Faiez Zalila - INRIA, France

MDETools - Model-Driven Engineering Tools - Organizers

- Mojtaba Bagherzadeh - Queen's University, Canada
- Francis Bordeleau - Independent Consultant, Canada
- Jean-Michel Bruel - University of Toulouse, France
- Juergen Dingel - Queen’s University, Canada
- Sebastien Gerard - CEA list, France
- Nicolas Hili - Queen's University, Canada
- Sebastian Voss - Fortiss, Germany

FlexMDE - 3rd Flexible MDE Workshop - Organizers

- Davide Di Ruscio - University of L'Aquila, Italy
- Juan de Lara - Universidad Autonoma de Madrid, Spain
- Alfonso Pierantonio - University of L'Aquila, Italy

MDEbug - 1st International Workshop on Debugging in Model-Driven Engineering - Organizers

- Simon VAN MIERLO - University of Antwerp, Belgium
- Hans VANGHELUWE - University of Antwerp, Belgium and McGill University, Canada
- Manuel WIMMER - TU Wien, Austria
- Erwan BOUSSE - TU Wien, Austria
- Clark VERBRUGGE - McGill University, Canada

Educator Symposium Chairs

- Peter J Clarke - Florida International University, USA
- Alfonso Pierantonio - University of L’Aquila, Italy

Posters Chairs

- Martin Gogolla - University of Bremen, Germany
- Esther Guerra - Universidad Autónoma de Madrid, Spain

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- Philippe Collet -Université Côte d'Azur, France
- Sudipto Ghosh - Colorado State University, USA

ACM Student Research Competition Chairs

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Doctoral Symposium Chairs

- Julia Rubin - University of British Columbia, Canada
- Nelly Bencomo - Aston University, UK

Acknowledgements

We would like to thank all those who served as organizers (listed above), on program committees, or as volunteers in support of any of the events included in this volume. MODELS 2017 was made successful through the many contributions of each of you, and we are grateful for the privilege of being able to work with you over the past months.

We also acknowledge the team at CEUR that have made publishing this volume possible, and the team at EasyChair whose software was instrumental in reviewing the many contributions to the MODELS 2017 Satellite Events.

November 29th, 2017
Loli Burgueño and Jonathan Corley

Proceedings

21th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings

MODELS-Companion ’18

Proceedings Chairs: Önder Babur, Daniel Strüber

Tools and Demos Chairs: Sahar Kokaly, Dimitris Kolovos

Posters Chairs: Tanja Mayerhofer, Mansooreh Zahedi

Educators Symposium Chairs: Loli Burgueño, Martin Gogolla

Doctoral Symposium Chairs: Joel Greenyer, Silvia Abrahão

Copenhagen, Denmark, October 14-19, 2018

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Preface to the 19th International ACM/IEEE Conference on Model Driven Engineering Languages and Systems

Welcome to MODELS 2018, the 21st International ACM/IEEE Conference on Model Driven Engineering Languages and Systems, October 14-19, 2018 in Copenhagen, Denmark. Copenhagen is the capital of Denmark, and its most populous city. It features beautiful channels and architecture, wonderful music, and fine food. It's the perfect location to host MODELS, the premier conference series for model-based software and systems engineering. It covers all aspects of modeling, from languages and methods to tools and applications, and has done so since 1998.

Attendees of MODELS come from diverse backgrounds, including researchers, academics, engineers and industrial professionals; we have strived to put together a program, from the ground up, that reflects this. MODELS 2018 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems. This year's edition provides an opportunity for the modeling community to further advance the foundations of modeling, and come up with innovative applications of modeling in emerging areas of cyber-physical systems, embedded systems, socio-technical systems, cloud computing, big data, security, open source, and sustainability.

We put together a fascinating program for researchers, industrial practitioners, students, and educators in the field of model-driven engineering. MODELS 2018 comprises two main tracks: the Foundations track with two subcategories technical papers, new ideas/vision papers, and the Practice and Innovation track. Both tracks invited full, scholarly papers of the highest quality, and submissions were reviewed in accordance with the highest established standards of scientific rigor applied in peer review. Each paper was reviewed by at least three members of the program committee. The reviewers assessed the submissions in terms of their novelty, significance and potential impact, and were instructed to carefully consider weightings across these criteria (e.g., an extremely novel paper that may not have impact for a long time may be acceptable, as may a paper with less novelty, but substantial significance and short-term potential impact).

In 2018, the PC Chairs removed the rebuttal phase, which had been used in MODELS for a number of years. A longer discussion period was used instead. The evidence is that there was deeper discussion and more constructive reviews as a result. The review discussions were overseen by members of a program board, and decisions were finalized in a virtual meeting on 3--4 July 2018. Out of 101 papers submitted to the Foundations Track, the PC and PB accepted 29 (acceptance rate 29%). Out of 38 papers submitted to the PI Track, 13 were accepted (acceptance rate 34%).

The main conference also hosts 17 workshops, 12 tutorials, the educator and doctoral symposia, an Industry Day, the SAM2018 conference (Languages, Methods, and Tools for Systems Engineering), and a number of co-located industry events: xtUML Days, a Model-Based Systems Engineering meeting, an MPS Day organised by JetBrains, an event on Models, Agile and DevOps organized by HCL Technologies. The conference program includes demo sessions, and the presentation of four papers that had first been published in the predominant journal in the field, the Journal of Software Systems Modeling, or SOSYM.

We are honored to furthermore feature three distinguished keynote speakers: Noelle Eckley Selin will reflect on "Modeling air pollution: Informing policies to address a global environmental challenge"; Jim Cordy will consider the "Genetics of Computer Programs'"; and Martijn Wisse will take us into the world of modeling and robotics, in his talk "Models for motion prediction; robotic brains versus biological brains".

MODELS 2018 would not have been possible without the significant contributions of many individuals and organisations. The MODELS Steering Committee provided invaluable assistance and guidance, whilst the Program Committee and the Program Board undertook with dedication the critical tasks of reviewing and discussing the submissions. We are also grateful to members of the Organising Committee for making the necessary arrangements and helping to publicize the conference and prepare the proceedings. We thank the authors for their efforts in writing and revising their papers in accordance with feedback from the reviewers.

We would also like to thank our numerous sponsors: the Gold sponsors JetBrains, MPS, the Eclipse Foundation, and the Papyrus Industry Consortium; the Silver sponsor HCL. In addition there are our sustainable sponsors, the ACM, ACM Sigsoft, the IEEE, the IEEE Computer Society, our supporting publisher Springer, and our institutional patron, the IT University of Copenhagen.

Enjoy the conference!

Andrzej Wąsowski, General Chair
IT University of Copenhagen
Denmark

Richard Paige, Foundations Track Chair
University of York
United Kingdom

Øystein Haugen, Practice and Innovation Track Chair Østfold University College
Norway

Message from the Tools and Demonstrations Chairs

Since the inception of MODELS, the development of tools to support modeling activities has been an integral part of the research activities with many of these tools evolving into modeling platforms that support the development of new tools. The demonstration of tools at recent MODELS conferences has shown that researchers and practitioners are dedicating more time and effort to develop tools of a high quality to be used by the community.

This year, we solicited high-quality submissions for the tool demonstration track ranging across commercial, academic, and corporate research and industrial systems. We encouraged submissions on tools that are: research prototypes built to support novel research ideas, tools to support pedagogy, extensions of existing tools and tool chains, and mature tools not yet commercialized.

We received 17 submissions, each was reviewed by three members of our program committee and further assessed in the online discussion phase. Based on the purpose of the tool, submissions were evaluated on their technical merit, novelty, pedagogical impact, relevance to the modeling community and level of maturity. Eventually, the program committee accepted 10 submissions to be presented in the demonstrations sessions at the conference.

As the chairs of the demonstration track, we thank all authors for their submissions and the program committee members for their detailed reviews and lively discussion.

We hope you will enjoy the demonstrations at the conference!

Sahar Kokaly, Tools and Demonstrations Chair
McMaster University
Canada

Dimitris Kolovos, Tools and Demonstrations Chair
University of York
United Kingdom

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- **Andreas Wortmann**, RWTH Aachen University (Germany)
- **Thanos Zolotas**, University of York (UK)

Message from the Posters Chairs

The MODELS 2018 posters track provides an opportunity for researchers and practitioners to present, demonstrate, and discuss their most recent achievements, practical experiences, novel ideas, tools, and challenges related to model-based software and systems engineering. As premier conference in this area, MODELS provides an excellent environment for discussing recent results, receiving feedback and making new contacts within the model-based software and systems engineering community.

The goal of the poster track is to encourage and facilitate the exchange within the MODELS community, foster collaboration, and, therewith strengthen the community as a whole.

This year, the MODELS poster track accepted two types of poster submissions: (1) stand-alone poster submissions that present a novel contribution in the field of model-based software and systems engineering and are independent of any paper accepted at any MODELS 2018 event and (2) paper-accompanying poster submissions that are directly related to a paper accepted at the MODELS 2018 main track or any of the MODELS 2018 satellite events.

Stand-alone poster submissions comprised extended abstracts, which are published in this proceedings volume. Paper-accompanying poster submissions only consisted in the poster displayed at the poster session. They have the aim to further disseminate the contribution presented in the respective paper that is published in the proceedings of the respective event.

After a rigorous reviewing process by the MODELS 2018 poster selection committee, we could accept four stand-alone poster submissions. Furthermore, ten paper-accompanying poster submissions were admitted to the poster session. The poster session took place at the conference welcome reception on Wednesday, October 17th, 2018.

We very much thank the members of the MODELS 2018 poster selection committee for their effort in reviewing the stand-alone poster submissions. Furthermore, we would like to thank the MODELS 2018 organizing committee and organizers of MODELS 2018 satellite events, who have supported us in soliciting poster submissions and in organizing the poster track.

Tanja Mayerhofer, Poster Chair
TU Wien
Austria

Mansooreh Zahedi, Poster Chair
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Denmark

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- **Gerson Sunyé**, University of Nantes (France)
- **Matthias Tichy**, University of Ulm (Germany)

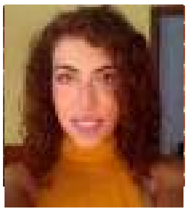
Message from the Educators Symposium Chairs

The 14th Educators Symposium at MODELS 2018 was held on October 16, 2018 in Copenhagen, Denmark. The symposium provided educators, researchers and practitioners a forum to discuss approaches to better address the issues facing the appropriate use of models and related technologies in the classroom.

All the submissions were reviewed by three members of the program committee and after a thorough process, eleven papers were accepted to constitute the program of the PhD symposium.

The program of the symposium started with a keynote, followed by two sessions in which the accepted papers were presented and ended with a discussion session. The keynote entitled “Teaching and Learning about Abstraction” was given by Prof. Perdita Stevens. The discussion session was guided by the chairs through a live survey.

We gratefully acknowledge the support of the contributors to the Educator Symposium and express our great esteem to the keynote speaker and program committee members for the time and effort they have put in reviewing papers.



Loli Burgueño, Educators Symposium Chair
University of Málaga
Spain

Martin Gogolla, Educators Symposium Chair
University of Bremen
Germany

Educators Symposium Program Committee

- **Perdita Stevens**, The University of Edinburgh (UK)
- **Dimitris Kolovos**, University of York (UK)
- **Gerti Kappel**, Vienna University of Technology (Austria)
- **Robert Clarisó**, Universitat Oberta de Catalunya (Spain)
- **Alfonso Pierantonio**, University of L'Aquila (Italy)
- **Peter Clarke**, Florida International University (USA)
- **Antonio Vallecillo**, Universidad de Málaga (Spain)
- **Martina Seidl**, Johannes Kepler University Linz (Austria)
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- **Mira Balaban**, Ben-Gurion University of the Negev (Israel)
- **Catherine Dubois**, ENSIIE-Samovar (France)
- **Juergen Dingel**, Queen's University (Canada)
- **Birgit Demuth**, TU Dresden (Germany)
- **Jeff Gray**, University of Alabama (USA)

Message from the Doctoral Symposium Chairs

The MODELS 2018 Doctoral Symposium was a one-day event held on September 16, 2018 in Copenhagen, Denmark. The Doctoral Symposium provided an opportunity for doctoral students to present their ongoing work and future research plans, and discuss them with experienced researchers and fellow doctoral students in the Model-Driven Engineering (MDE) community. Students participating in the Doctoral Symposium presented their work to a panel of experts who provided each student with valuable feedback on their work and highlighted opportunities to further improve their research work. In addition, the symposium facilitated the exchange of ideas among young researchers.

Twelve students made submissions to the Doctoral Symposium. Submissions underwent a thorough review with each submission receiving feedback from three expert reviewers. Following extensive discussion amongst the reviewers and chairs, nine submissions were accepted for presentation at the symposium. A four-page summary of each accepted paper appears in these proceedings.

Most of the participating students were in between the middle of their PhD and close to graduating; and two were in the initial stages. Every student of a paper accepted as full performed a formal presentation at the Doctoral Symposium.

The participants are working on various topics in the field of model-driven engineering, including consistency of models, verification in MDE processes, context-aware traceability, bidirectional model transformations for dependability analysis, automated design-space exploration, multi-model consistency preservation, usability of modeling tools, and several other exciting topics. The topics presented at the MODELS Doctoral Symposium give us a glimpse into the future of model-driven engineering research. Everyone attending the Doctoral Symposium will benefit from the presentations and discussions of this important contemporary work from our up-and-coming new MDE researchers.

To offer students practical guidance on completion of their research and initiation of future research career, the symposium also included a keynote talk by Prof. Jeff Gray, University of Alabama, USA, an informal panel on “Do's and Don'ts When Performing Doctoral Studies” and plenty of opportunities for social interactions.

We would like to express our gratitude to the keynote, panel members and selection committee who provided extensive and constructive feedback to the doctoral students, members of the Doctoral Panel for their participation during the day, and last but not least, all doctoral students who submitted a proposal to the Doctoral Symposium. We would also like to thank the MODELS 2018 organization committee for helping us deal with all the logistics involved in running the event.

Joel Greenyer, Doctoral Symposium Chair
Leibniz Universität Hannover
Germany

Silvia Abrahão, Doctoral Symposium Chair
Universitat Politècnica de València
Spain

Doctoral Symposium Selection Committee

- **Nelly Bencomo**, Aston University (UK)
- **Marsha Chechik**, University of Toronto (Canada)
- **Betty Cheng**, Michigan State University (USA)
- **Peter Clarke**, Florida International University (USA)
- **Davide Di Ruscio**, University of L'Aquila (Italy)
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- **Hans Vangheluwe**, University of Antwerp and McGill University (Belgium, Canada)
- **Andreas Vogelsang**, Technical University of Berlin (Germany)

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2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion

MODELS-C 2019

Proceedings

2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion

15–20 September 2019
Munich, Germany

Editors
Loli Burgueño, Alexander Pretschner, Sebastian Voss, Michel Chaudron, Jörg Kienzle, Markus Völter, Sébastien Gérard, Mansooreh Zahedi, Erwan Bousse, Arend Rensink, Fiona Polack, Gregor Engels, Gerti Kappel

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Preface to the ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)

Loli Burgueño[1,2], Alexander Pretschner[3], Sebastian Voss[4], Michel Chaudron[5], Jörg Kienzle[6], Markus Völter, Sébastien Gérard[2], Mansooreh Zahedi[7], Erwan Bousse[8], Arend Rensink[9], Fiona Polack[10],
Gregor Engels[11], Gerti Kappel[12]

[1] Open University of Catalonia, Spain
[2] Institut LIST, CEA, Université Paris-Saclay, France
[3] Technical University of Munich, Germany
[4] fortiss GmbH, Germany
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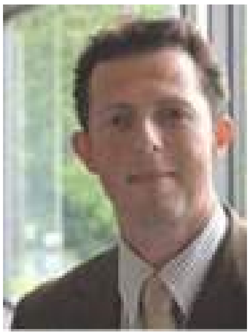

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Proceedings

2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems

MODELS 2019

Proceedings

2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems

15–20 September 2019
Munich, Germany

Editors

Marouane Kessentini, Tao Yue, Alexander Pretschner, Sebastian Voss, Loli Burgueño

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2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems (MODELS)

MODELS 2019

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Vol-2405
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STAF-CE 2019
STAF 2019 Co-Located Events: JRCE, MDE@DeRun and RPS

**STAF 2019 Co-Located Events Joint Proceedings: 1st Junior Researcher Community Event, 2nd International Workshop on Model-Driven Engineering for Design-Runtime Interaction in Complex Systems, and 1st Research Project Showcase Workshop
co-located with Software Technologies: Applications and Foundations (STAF 2019)**

Eindhoven, The Netherlands, July 15 - 19, 2019.

Edited by

**Alessandra Bagnato, Softeam Group, Research & Development Department, France
Hugo Bruneliere, IMT Atlantique & LS2N – CNRS, France
Loli Burgueño, Open University of Catalonia, Spain & CEA List, France
Romina Eramo, University of L'Aquila, Italy
Abel Gómez, Universitat Oberta de Catalunya, Spain**

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We offer a BibTeX file for citing papers of these events from LaTeX.

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STAF 2019 Co-Located Events Proceedings

JRCE, MDE@DeRun and RPS

July 15 - 19, 2019
Eindhoven, The Netherlands

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RPS Handle: `https://hdl.handle.net/20.500.12004/1/C/STAF-RPS/2019`

Welcome Words from the Editors

This volume contains the technical papers presented at three satellite events collocated with the 2019 edition of the STAF (Software Technologies: Applications and Foundations) federation of conferences on software technologies. The workshops took place at place at the TU/e Science park of the Eindhoven University of Technology in Eindhoven, The Netherlands, during July 1519, 2019. The STAF 2019 conferences and satellite events brought together leading researchers and practitioners from academia and industry to advance the state of the art in practical and foundational advances in software technology. They address all aspects of software technology, from object-oriented design, testing, mathematical approaches to modeling and verification, transformation, model-driven engineering, aspect-oriented techniques, and tools. The satellite events provided a highly interactive and collaborative environment to discuss emerging areas of software engineering, software technologies, model-driven engineering, and formal methods.

The three satellite events whose papers are included in this volume are (organizers are indicated too):

- Junior Research Community Event (JRCE 2019), July 16-18, 2019
  Loli Burgueño (Open University of Catalonia, Spain & CEA LIST, France)
- 2nd International Workshop on Model-Driven Engineering for Design-Runtime Interaction in Complex Systems (MDE@DeRun 2019), July 15, 2019
  Hugo Bruneliere (IMT Atlantique, LS2N-CNRS & ARMINES, France)
  Romina Eramo (University of LAquila, Italy)
  Abel Gómez (Universitat Oberta de Catalunya, Spain)
- Research Project Showcase (RPS 2019), July 15, 2019
  Alessandra Bagnato (Softeam R&D, France)

We would like to thank each organizer and all the people who have contributed to the STAF JRC, RPS and MDE@DeRun events for the interesting topics and resulting talks, as well as the respective Program Committee members and external reviewers who carried out thorough and careful reviews, created the program of each event, and made the compilation of this high-quality volume possible. We also thank the paper contributors and attendees of all workshops. We would like to extend our thanks to all keynote speakers for their excellent presentations. We also thank the developers and maintainers of the EasyChair conference management system, which was of great help in handling the paper submission, reviewing, and discussion for all satellite events, and in the preparation of this volume. Finally, we would like to thank the organizers of STAF 2019 for their help during the organization of all satellite events, as well as the Eindhoven University of Technology that hosted the workshops.

July 2019

Alessandra Bagnato
Hugo Bruneliere
Loli Burgueño
Romina Eramo
Abel Gómez

Junior Research Community Event (JRCE 2019)

The Junior Research Community Event provides a forum for junior researchers to interact with their fellows, showcase their research, exchange ideas and get feedback from senior researchers about how to continue their professional career: the different path they could follow, how to apply for research projects, how to supervise PhD students, the opportunities both academia and industry offer, or any other topic of interest.

All the submissions were reviewed by three members of the program committee and after a thorough process, three papers out of four were accepted to constitute the program. The three paper presentations took place together with the ECMFA/ICMT sessions and there was a keynote given by Prof. Alfonso Pierantonio from the University of LAquila, Italy.

We gratefully acknowledge the support of the contributors to the JRCE and express our great esteem to the keynote speaker and program committee members, whose names are listed below, for the time and effort they have put in reviewing papers.

The following members served in the international program committee:

Andreas Wortmann, RWTH Aachen University
Juan De Lara, Universidad Autónoma de Madrid
Gerson Sunyé, Université de Nantes
Adrian Rutle, Western Norway University of Applied Sciences
Davide Di Ruscio, University of LAquila
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Luis Ferreira Pires, University of Twente
Fiona Polack, Keele University

Loli Burgueño
JRCE 2019 Organization Committee

2nd International Workshop on Model-Driven Engineering for Design-Runtime Interaction in Complex Systems (MDE@DeRun 2019)

Complex systems are now predominant in several domains such as automotive, health-care, aerospace, industrial control, and automation. Such systems call for modern engineering practices such as Modeling/MDE to tackle advances in productivity and quality of these now Cyber-Physical Systems (CPSs). However, the proposed solutions need to be further developed to scale up for real-life industrial projects and to provide significant benefits at execution time. To this intent, one of the major challenges is to work on achieving a more efficient integration between the design and runtime aspects of the concerned systems: The system behavior at runtime has to be better matched with the original system design in order to be able to understand critical situations that may occur, as well as corresponding potential failures in design. Methods and tools already exist (many of them not model-based) for monitoring system execution and performing measurements of runtime properties. However, they do not usually allow a relevant integration with (and/or traceability back to) design models. Such a feedback loop from runtime is highly relevant at design time, the most suitable level for system engineers to analyze and take impactful decisions accordingly.

The MDE@DeRun workshop of STAF 2019 provides a venue where researchers and practitioners on model-driven/model-based techniques and architectures for complex systems can meet, disseminate and exchange ideas or challenges, identify current/future key issues and explore possible solutions related to the above-mentioned family of problems.

We would like to mention that this years edition of the MDE@DeRun workshop notably included a special keynote by Professor Manuel Wimmer (Johannes Kepler University Linz, Austria) untitled From Design-Time to Runtime and Back Again with Liquid Models. It also included an invited talk by Dr Hugo Bruneliere untitled A Model-based Framework for Continuous Development and Runtime Validation of Complex Systems: MegaM@Rt2 EU Project Results.

In addition, each one of the following 3 papers was reviewed by three different reviewers from the program committee and, according to the received reviews as well as following discussions, accepted to be presented at the workshop

The following members served in the international program committee:

Alessandra Bagnato, Softeam
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Alessio Bucaioni, Malardalen University
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Aitor Urbieta, IKERLAN

Hugo Bruneliere, Romina Eramo and Abel Gómez
MDE@DeRun 2019 Organization Committee

Research Project Showcase (RPS 2019)

Today's collaborative research projects act as a bridge between research (e.g., academia) and practitioners (e.g., industries). Within collaborative projects, the research community can share ideas in real industrial environments while, at the same time, can raise the need for new and different research inspired by the needs of the industry.

The Research Project Showcase of STAF 2019 provides an opportunity for researchers involved in ongoing and/or recently completed research projects (national, European and international) related to the topics of the conference to present their projects and disseminate the objectives, deliverables, or outcome.

The RPS Workshop will include the presentation of 8 different projects, each one of the corresponding eight accepted papers were reviewed by two different reviewers from the program committee and, according to the received reviews as well as following discussions, accepted to be presented at the workshop.

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Alessandra Bagnato
RPS 2019 Organization Committee

Proceedings

2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion

MODELS-C 2019

Proceedings

2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion

15–20 September 2019
Munich, Germany

Editors
Loli Burgueño, Alexander Pretschner, Sebastian Voss, Michel Chaudron, Jörg Kienzle, Markus Völter, Sébastien Gérard, Mansooreh Zahedi, Erwan Bousse, Arend Rensink, Fiona Polack, Gregor Engels, Gerti Kappel

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Preface to the ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)

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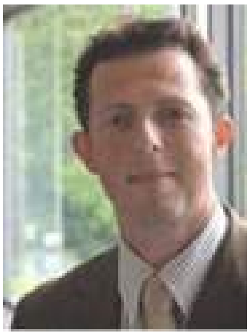

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Joanne Atlee (University of Waterloo, Canada)
Juergen Dingel (Queen's University, Canada)

MULTI – 6th International Workshop on Multi-Level Modelling

João Paulo A. Almeida (Federal University of Espírito Santo, Brazil)
Manuel Wimmer (Johannes Kepler University Linz, Austria)
Adrian Rutle (Western Norway University of Applied Sciences, Bergen, Norway)

MDE Intelligence – 1st Workshop on Artificial Intelligence and Model-driven Engineering

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Alexandru Burdusel (King's College London, UK)
Sébastien Gérard (CEA List, France)
Manuel Wimmer (Johannes Kepler Universität Linz, Austria)

MDETools – 3rd Workshop on Model-Driven Engineering Tools

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MLE – International Workshop on Modeling Language Engineering and Execution

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Romina Eramo (University of L'Aquila, Italy)
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Ralf Reussner (Karlsruhe Institute of Technology, Germany)
Andreas Winter (University of Oldenburg, Germany)

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Dominique Blouin (Télécom ParisTech, France)
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Julien DeAntoni (Université Nice – Sophia Antipolis, France)

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Dimitris Kolovos (University of York, UK)
Juan de Lara (Universidad Autonoma de Madrid, Spain)

MoDeVVa – 16th Workshop on Model-Driven Engineering, Verification and Validation

Raquel Araújo de Oliveira (University of Toulouse, France)
Iulian Ober (University of Toulouse, France)
Ernesto Posse (Zeligsoft, Canada)
Saad Bin Abid (Fortiss, Germany)

MRT – 14th International Workshop on Models@run.time

Sebastian Götz (Technische Universität Dresden, Germany)
Nelly Bencomo (Aston Universiy, UK)
Kirstie L. Bellman (The Aerospace Organisation, USA)
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Simos Gerasimou (University of York, UK)
Sebastian Wrede (Universität Bielefeld, Germany)
Andreas Wortmann (RWTH Aachen University, Germany)

DevOps – 1st international workshop on DevOps

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Jordi Cabot (ICREA, Spain)
Juergen Dingel (Queen's University, Canada)
Sébastien Mosser (Université du Québec à Montréal, Canada)

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STAF 2020 Workshops Proceedings*

Message from the Workshop Chairs

This volume contains the technical papers presented at three workshops collocated with the 2020 edition of the Software Technologies: Applications and Foundations (STAF) federation of conferences on software technologies.

The STAF conferences, satellite events and workshops bring together leading researchers and practitioners from academia and industry to advance the state of the art in practical and foundational advances in software technology. They address all aspects of software technology, from object-oriented design, testing, mathematical approaches to modeling and verification, transformation, model-driven engineering, aspect-oriented techniques, and tools.

Before the COVID-19 pandemic exploded, 11 workshops were accepted and planned to be celebrated with STAF 2020. Due to the pandemic, STAF 2020 had to cancel all its physical activities, which were intended to take place in the premises of the Western Norway University of Applied Sciences (Bergen, Norway) from June 22 to June 26, 2020, and new arrangements had to be made. Three workshops decided to go ahead and were celebrated virtually as part of STAF 2020. These workshops are:

1. 1st International Workshop on Modeling Smart Cities. Organizers: Ludovico Iovino, Manuel Wimmer and Juri Di Rocco
2. 4th International Workshop on Model-Driven Engineering for the Internet-of-Things. Organizers: Nicolas Ferry, Federico Ciccozzi, Manuel Wimmer, Arnor Solberg and Sebastien Mosser
3. 5th International Workshop on Open and Original Problems in Software Language Engineering. Organizers: Anya Helene Bagge and Vadim Zaytsev

We would like to thank the workshop organizers; whose hard work, despite the difficulties and challenges, made their events successful. Thanks to the local organizers of STAF 2020 for their trust and support. Finally, we would also like to thank all the participants and people who have contributed to the events as well as the respective Program Committee members and external reviewers who carried out thorough and careful reviews.

October 2020

Loli Burgueño
Lars Michael Kristensen

Proceedings

23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings

MODELS-C 2020

Tools and Demos Chairs: Benoit Combemale, Manuel Wimmer
Posters Chairs: Djamel Eddine Khelladi, Ferhat Khendek
Educators Symposium Chairs: Daria Bogdanova, Michalis Famelis
Doctoral Symposium Chairs: Manar Alalfi, Juergen Dingel
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Virtual Event, 16-23 October 2020

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Preface to the Tools & Demonstrations Track of the ACM / IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020)

MODELS is the premier conference series for model-based software and systems engineering. Since 1998, MODELS has been covering all aspects of modeling, from languages and methods to tools and applications. Since the inception of the conference, the development of tools to support modeling activities has been an integral part of the research activities with many of these tools evolving into modeling platforms that support the development of new tools. The demonstration of tools at recent MODELS conferences has shown that both researchers and practitioners dedicate more time and effort to developing high-quality tools to be used by the community and industry. It is also accepted that the availability of tools is a primary factor for the adoption of model-driven engineering approaches. With the Tools & Demonstrations track of MODELS 2020, we propose high-quality contributions, ranging across commercial, academic, and corporate research as well as industrial systems.

This year, we received 26 submissions. From these submissions, the following 15 were accepted for publication in the proceedings and presentation during the conference (acceptance rate of 58%):

- Gentleman: a light-weight web-based projectional editor generator, Louis-Edouard Lafontant and Eugene Syriani
- TyphonML: a Modeling Environment to Develop Hybrid Polystores, Francesco Basciani, Juri Di Rocco, Davide Di Ruscio, Ludovico Iovino and Alfonso Pierantonio
- A Profiler for the Matching Process of Henshin, Raffaela Groner, Sophie Gylstorff and Matthias Tichy
- Automated Video Game World Map Synthesis by Model-Based Techniques, Boqi Chen, Dylan Havelock, Connor Plante, Michael Sukkarieh, Oszkár Semeráth and Daniel Varro
- Papyrus for gamers, let's play modeling, Antonio Bucchiarone, Maxime Savary-Leblanc, Xavier Le Pallec, Jean-Michel Bruel, Antonio Cicchetti, Jordi Cabot, Sebastien Gerard, Hamna Aslam, Annapaola Marconi and Mirko Perillo
- A Trace Replayer of Distributed UML-RT Models, Majid Babaei, Mojtaba Bagherzadeh and Juergen Dingel
- Towards User-Centred tooling for Modelling of Big Data Applications, Hourieh Khalajzadeh, Tarun Verma, Andrew Simmons, John Grundy, Mohamed Abdelrazek and John Hosking
- CyprIoT Project - An Open Source Toolset to Model and Generate a Network of Things, Imad Berrouyne
- ModelMine: A Tool to Facilitate Mining Models from Open Source Repositories, Sayed Mohsin Reza, Omar Badreddin and Khandoker Rahad
- Insights Collaboration Space – A Team Collaboration App for the Design of Data-Driven Services, Susanne Braun, Marcus Trapp, Claudia Nass, Matthias Gerbershagen, Stefan Schweitzer, Rodrigo Falcão, Matthias Naab, Markus Schweitzer, Torsten Kreutzer and Nikolaus Wire
- Concrete Syntax-Based Find for Graphical DSLs, Elina Kalnina

- Using Benji to Systematically Evaluate Model Comparison Algorithms, Lorenzo Addazi and Antonio Cicchetti
- Strengthening Validation of Model Behavior through Filmstrip Templates in the tool USE, Nisha Desai and Martin Gogolla
- Enhancing Development and Consistency of UML Models and Model Executions with USE Studio, Marcel Schäfer and Martin Gogolla
- MMINT-A 2.0: Tool Support for Lifecycle of Model-Driven Safety Artifacts, Alessio Di Sandro, Gehan Selim, Sahar Kokaly, Torin Viger, Rick Salay and Marsha Chechik

We would like to thank the MODELS 2020 organization, in particular to Houari Sahraoui and Eugene Syriani, for giving us the opportunity to organize this track as well as to the proceedings chairs Esther Guerra and Ludovico Iovino, who were always very helpful and supportive. We also thanks the Program Committee chairs Juan de Lara and Silvia Abrahão for proposing a great interleave of the demonstrations into the general program, topic wise.
Furthermore, many thanks go to the reviewers and the members of the Program Committee for their timely and detailed reviews and for their help in choosing and suggestions for improving the selected papers:

- Erwan Bousse (Université de Nantes / LS2N),
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- Konstantinos Barmpis (University of York),
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- Sudipto Ghosh (Colorado State University),
- Antonio Vallecillo (Universidad de Málaga),
- Shaukat Ali (Simula Research Laboratory),
- Jesús Sánchez Cuadrado (Universidad de Murcia),
- Andreas Wortmann (RWTH Aachen University).

Finally, we thank everyone who helped in addition in this challenging time due to the COVID-19 pandemic to make the first virtual edition of this track possible.

Benoit Combemale and Manuel Wimmer
MODELS 2020 Tools & Demonstrations track chairs

Preface to the Posters Track of the ACM / IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020)

The MODELS 2020 posters track provides an opportunity for researchers and practitioners to present and discuss their most recent achievements, practical experiences, novel ideas, tools, and challenges related to model-based software and systems engineering. Posters are expected to stimulate discussions of recent advances, practical experiences, new ideas, visions for the future, tools, and challenges in the field of model-based software and systems engineering. The list of topics relevant for posters is the same as for the main track at MODELS.

For the last two years now, MODELS conference distinguishes two types of poster submissions, stand-alone poster submissions and paper-accompanying poster submissions. The content of this section of the proceedings is about the stand-alone poster submissions. These submissions present novel contributions in the field of model-based software and systems engineering, and are independent of any paper accepted at the MODELS 2020 main track or submitted to any of the MODELS 2020 satellite events. Each submission consists of a 2 pages extended abstract and a draft of the actual poster to be presented at the conference. After a thorough review where each submission received three reviews, the program committee selected four extended abstracts to be included in the proceedings and their respective posters to be presented at the conference. In addition, seven other paper-accompanying posters were accepted for presentation. We are very grateful for the work done by the program committee members and we would like also to thank the MODELS 2020 Organizing Committee for their help in organizing this track.

Djamel Eddine Khelladi and Ferhat Khendek
MODELS 2020 Posters track chairs

Preface to Educators Symposium at the ACM / IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020)

Model-driven engineering has been part of university curricula, as well as corporate training programs, for many years. Modelling notations are taught in a wide variety of courses and programs, from software engineering to enterprise architecture. Most educators would agree that teaching modeling is a challenging task, especially given the growing student population interested in modeling.

These proceedings 16th Educators Symposium at MODELS 2020 provide four papers dedicated to modeling education, which can serve as inspiration for modeling educators, researchers and practitioners.

Daria Bogdanova and Michalis Famelis
MODELS 2020 Educators Symposium chairs

Preface to Doctoral Symposium at the ACM / IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020)

The Doctoral Symposium of the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS’20) was held virtually on Monday, October 19, 2020.

The Doctoral Symposium is a well-established and valued part of the MODELS conference series. Its goal is to provide an international forum for doctoral students to interact with their fellow students and faculty mentors working in the area of model-driven engineering. The symposium supports students by providing independent and constructive feedback about their already completed and, more importantly, planned research work. The Symposium also aims to introduce and connect PhD students in the field to each other and the larger MODELS community. The Symposium was attended by prominent experts in the field of model-driven engineering, who actively participated in critical and constructive discussions.

Following pandemic-related health guidelines, MODELS’20 and the Symposium were held virtually. Authors of accepted submissions made recordings of their presentations available, and a synchronous teleconference session was used to provide individual, focused feedback to every participant.

Program

The symposium received a total of 18 submissions. Of these, nine submissions were accepted. Due to capacity constraints, many high-quality submissions unfortunately could not be included in the program. Accepted papers spanned an extraordinarily diverse set of topics and domains, providing evidence for enduring relevance of software and systems modeling. Concretely, presentations suggested to leverage modeling for safety assurance; validation; software design; the creation, integration, and evolution of domain-specific languages; and collaborative modeling. Areas of application included cyber-physical and automotive systems, artificial intelligence, robotics, micro-services, and computational biology.

Acknowledgements

We thank the MODELS’20 Proceedings Chairs Esther Guerra and Ludovico Iovino and the MODELS’20 Workshop Chairs Nelly Bencomo and Mathieu Acher for their efforts, as well as the General Chairs Houari Sahraoui and Eugene Syriani for their support. We also gratefully acknowledge the invaluable reviewing work by the MODELS’20 DocSymp Selection Committee.

Manar Alalfi (Ryerson University, Canada)
Juergen Dingel (Queen’s University, Canada)
MODELS 2020 Doctoral Symposium chairs

Preface to 3rd International Workshop on Modeling in Automotive System and Software Engineering (MASE 2020)

The 3rd International Workshop on Modeling in Automotive System and Software Engineering (MASE 2020) was held virtually on October 16, 2020 in collaboration with the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020).

It was the third MASE workshop, held four years after the first MASE workshop that took place in Ottawa, Canada as part of the program of MODELS'15.

For the first time, MASE 2020 extended its focus from automotive software to automotive software and system engineering.

Automotive industry is increasingly relying on and becoming a driver of advances in system and software development, engineering methods, techniques and tools to deal with the many unique technical and organizational challenges it is facing. Significant advances have been made dealing with many of these challenges involving, for instance, variability modelling and software product lines, standardization, model-based development, and systems engineering. However, the remaining challenges are compounded by future trends. System and software complexities continue to grow and the industry is being forced to incorporate disruptive technology such as electrification, machine learning, autonomous vehicles and, in the near future, support for vehicle-to-vehicle and vehicle-to-infrastructure communications and collaborations.

A central objective of MASE 2020 was to provide a forum for practitioners and researchers from industry and academia in which novel, innovative, model-based solutions to current and future challenges in automotive system and software development could be presented and discussed. It also aimed at identifying new research problems arising from current trends.

Program

The selection process was highly competitive. MASE 2020 received a total of 7 submissions of high quality. All submissions went through a thorough review process and each submission received three independent peer reviews. Out of the 7 submissions, only 3 papers were accepted for publication. Accepted papers spanned a diverse set of topics: from formal methods to artificial intelligence through testing and requirements.

Industrial participation was high with co-authors from several companies including Zenuity AB, Leopold Kostal GmbH and Fraunhofer IEM. The program kicked off with a keynote by Olaf Kath senior director at Ansys.

Acknowledgements

First and foremost, we would like to thank the MASE 2020 authors, key note speaker and program committee who made this workshop possible with their submissions, lively participation and invaluable reviewing work. We are particularly grateful to MODELS 2020 proceedings chairs Esther Guerra and Ludovico Iovino, workshop chairs Nelly Bencomo and Mathieu Acher as well as the general chairs Houari Sahraoui and Eugene Syriani for their support and effort.

Alessio Bucaioni (Mälardalen University,Sweden)
Joanne Atlee (University of Waterloo, Canada)
Juergen Dingel (Queen’s University, Canada)
Sahar Kokaly (General Motors, Canada)
MASE 2020 workshop organizers

Preface to 1st International Workshop on Open Model Based Engineering Environment (OpenMBEE 2020)

The first International Workshop on Open Model Based Engineering Environment (OpenMBEE) is held on October 19, 2020 in collaboration with the IEEE/ACM 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS 2020).

The OpenMBEE group is a community of engineering practitioners, software developers, and researchers that share a common vision for a world where engineering modeling relies on a rich open source set of models and software that support engineering modeling and analysis in the form of an integrated environment. This environment shall enable collaborative modeling at scale and be an open platform for engineering tools. It is also expected to support conventions and practices that will cultivate a culture of collaborative engineering model development to transform existing siloed engineering practices.

The goal is to contribute techniques and tools supporting all aspects of development, use, maintenance and evolution of OpenMBEE-relevant artifacts, and make these available to the OpenMBEE community to allow them to collaboratively construct and analyze the high-quality products needed to develop missions and systems.

Program

The workshop program includes two keynotes and presentations of four submitted research papers. The first keynote entitled “SysML v2 as Enabling Technology for MBx Ecosystems” is given by Ed Seidewitz, Chief Technology Officer at Model Driven Solutions from Maryland, USA. The second keynote entitled “SysML v2 on JetBrains MPS” is given by Markus Voelter, an independent researcher and consultant from Stuttgart, Germany.

Acknowledgements

We thank Markus Voelter, Ed Seidewitz, and the research paper submitters for their contributions and for sharing their expertise. We also gratefully acknowledge the OpenMBEE International Workshop Program Committee for their timely and valuable reviewing work. Finally, we thank the MODELS’20 Organizing Committee for their support and patience in establishing this workshop.

Robert Karban - Jet Propulsion Laboratory, California Institute of Technology
Ivan Gomes - Jet Propulsion Laboratory, California Institute of Technology
Ahsan Qamar - Ford Motor Company
Juergen Dingel - Queen’s University
Sebastian Herzig - Microsoft Corporation
Ed Seidewitz - Model Driven Solutions
Markus Voelter - Independent
Brittany Friedland - Boeing Commercial Airplanes
Bjorn Cole - Lockheed Martin Corporation
OpenMBEE 2020 workshop organizers

Preface to 2nd International Workshop on Modeling Language Engineering and Execution (MLE 2020)

The 2nd International Workshop on Modeling Language Engineering and Execution (MLE 2020) was held on October 19, 2020 virtually in collaboration with the ACM/IEEE 23rd International Conference on Model Driven-Engineering Languages and Systems (MODELS'20). MLE 2020 is the second edition of a brand-new MODELS workshop resulting from the merger of two recurring MODELS workshops, namely GEMOC and EXE. Accordingly, it will be a full-day workshop that brings together researchers and practitioners in the modeling languages community to discuss the challenges associated with the engineering of modeling languages, with executability, and with integrating multiple, heterogeneous modeling languages. The languages of interest include both general-purpose and domain-specific languages with topics ranging from the requirements, design, and implementation of languages that may or may not be executable. Following the previous editions of the MLE, GEMOC, and EXE workshops, the objective is to continue collaborations and to expand on the two overlapping communities that are focused on solving problems arising both from the globalization of modeling languages − i.e., the use of multiple DSLs to support coordinated development of diverse aspects of a system − and the problems related to the executability of modeling languages − i.e., defining, composing, verifying and tooling the execution semantics of DSLs.

For this edition of the workshop, we received seven submissions, out of which five were accepted. The accepted papers cover a variety of topics on modeling language engineering and execution, ranging from foundational work on semantics of executable models to model reuse through composition to literature studies on specific languages. We thank MODELS'20 workshop chairs and the MLE 2020 program committee for their service and making MLE 2020 possible.

Taylor Riche (National Instruments, Austin, USA)
Andreas Wortmann (RWTH Aachen University, Aachen, Germany)
Steffen Zschaler (King's College London, London, UK)
MLE 2020 workshop organizers

Preface to 2nd Workshop on Artificial Intelligence and Model-Driven Engineering (MDE Intelligence 2020)

Abstract

Model-driven engineering (MDE) and artificial intelligence (AI) are two separate fields in computer science, which can clearly benefit from cross-pollination and collaboration. There are at least two ways in which such integration—which we call MDE Intelligence—can manifest: (1) MDE can benefit from integrating AI concepts and ideas to increase its power: flexibility, user experience, quality, etc. (Artificial Intelligence for MDE). For example, using model transformations through search-based approaches, or by increasing the ability to abstract from partially formed, manual sketches into fully-shaped and formally specified meta-models and editors. (2) AI is software, and as such, it can benefit from integrating concepts and ideas from MDE that have been proven to improve software development (MDE for Artificial Intelligence). For example, using domain-specific languages allows domain experts to directly express and manipulate their problems while providing an auditable conversion pipeline. Together this can improve trust in and safety of AI technologies. Similarly, MDE technologies can contribute to the goal of explainable AI.

To discuss and further stimulate such integrations, the 2nd edition of the Workshop on Artificial Intelligence and Model-driven Engineering (MDE Intelligence) was held virtually on October 16, 2020 as part of the satellite events of the IEEE/ACM 23th International Conference on Model-Driven Engineering Languages and Systems (MODELS 2020).

Introduction

Artificial Intelligence (AI) has become part of everyone's life. It is used by companies to exploit the information they collect to improve the products or services they offer and, wanted or unwanted, it is present in almost every device around us. Lately, AI is also starting to impact all aspects of the system and software development lifecycle, from their upfront specification to their design, testing, deployment and maintenance, with the main goal of helping engineers produce systems and software faster and with better quality while being able to handle ever more complex systems. The hope is that AI will help deal with the increasing complexity of systems and software.

There is no doubt that MDE has already become a means to tame part of this complexity. However, its adoption by industry still relies on their capacity to manage the underlying methodological changes including among other things the adoption of new tools. To go one step further, we believe there is a clear need for AI-empowered MDE, which will push the limits of "classic" MDE and provide the right techniques to develop the next generation of highly complex model-based system and software systems engineers will have to design tomorrow.

This workshop provides a forum to discuss, study and explore the opportunities and challenges raised by the integration of AI and MDE.

One important topic is how to choose, evaluate and adapt AI techniques to Model-Driven Engineering as a way to improve current system and software modeling and generation processes in order to increase the benefits and reduce the costs of adopting MDE. We believe that AI artifacts will empower the MDE tools and boost hence the advantages, and then adoption, of MDE at industry level.

At the same time, AI is software itself (and, in fact, complex software). We believe that an AI-powered MDE approach will also benefit the design of AI artifacts themselves and especially help address the challenge of designing "trustable" AI.

Last but not least, although AI is the most popular branch of computer science to create and simulate intelligence, any kind of technique that provides human cognitive capabilities and helps creating "intelligent" software are also in the scope of this workshop. An example would be knowledge representation techniques and ontologies that can be useful on their own or support other kinds of AI techniques.

Goal of the workshop

The success of AI applied to numerous and diverse fields and the success of the 1st edition of the MDE Intelligence workshop make it clear that there is a need for a continuing forum to discuss the synergies between MDE and AI as part of the MODELS community.
MDEIntelligence aimed to bring together researchers and practitioners working in both the MDE and AI communities, asking them to contribute use cases, data, experiences and requirements for our community. The workshop included a keynote, presentations of the accepted papers and a dedicated session to showcase other (possibly unpublished) work, including industrial work. This session aimed to encourage wider discussion and a more synergistic view by workshop participants.

Summary of the workshop

The workshop received 11 abstracts, 4 of which were withdrawn before submission. From the 7 submissions received, the following 4 were accepted for publication in the proceedings and presentation during the workshop:

- Kevin Lano, Shichao Fang and Sobhan Yassipour Tehrani. Enhancing model transformation synthesis using natural language processing.
- Angela Barriga, Lawrence Mandow, José Luis Pérez de la Cruz, Adrian Rutle, Rogardt Heldal and Ludovico Iovino. A comparative study of reinforcement learning techniques to repair models.
- Rijul Saini, Gunter Mussbacher, Jin L.C. Guo and Jörg Kienzle. DoMoBOT: A Bot for Automated and Interactive Domain Modelling.
- Gunter Mussbacher, Benoit Combemale, Silvia Abrahão, Nelly Bencomo, Loli Burgueño, Gregor Engels, Jörg Kienzle, Thomas Kühn, Sebastien Mosser, Houari Sahraoui and Martin Weyssow. Towards an Assessment Grid for Intelligent Modeling Assistance.

The accepted papers cover different forms of connecting MDE and AI such as domain modeling bots, modeling assistants, reinforcement learning and search-based software engineering in combination with natural language processing applied to the field of model transformations.

Acknowledgement

We would like to thank the MODELS 2020 organization, in particular to Houari Sahraoui and Eugene Syriani, for giving us the opportunity to organize this workshop as well as to the

workshops chairs Nelly Bencomo and Mathieu Acher, who were always very helpful and supportive. MDEIntelligence 2020 was particularly challenging to organise (in line with many other workshops and conferences) due to the COVID-19 pandemic and we thank the conference organisers for their support in transferring the workshop to an online format.

Many thanks to the reviewers and the members of the Program Committee for their timely and detailed reviews and for their help in choosing and suggestions for improving the selected papers:

- Shaukat Ali (Simula Research Laboratory)
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- Shekoufeh Kolahdouz Rahimi (University of Isfahan)
- Shuai Li (CEA LIST)
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- Daniel Varro (McGill University & Budapest University of Technology and Economics)

Last but not least, thanks our thanks go to all those who submitted papers, particularly to the presenters of the accepted papers, and to Alexander Egyed for giving the keynote.

Loli Burgueño, Manuel Wimmer and Steffen Zschaler.
MDE Intelligence 2020 workshop organizers

Preface to 2nd International Workshop on Analytics and Mining of Model Repositories (AMMoRe 2020)

Abstract

Model-based approaches promote the use of models and related artifacts (such as metamodels and model transformations) as central elements to tackle the complexity of building systems. Both in academia and in industry there is a growing need to efficiently i) store; ii) analyze; and ii) search & navigate, and iii) curate large collections of models. Such collections include for example large sets of software models such as the Lindholmen UML dataset, or of heterogeneous models in large MDE ecosystems and systems-of-systems, including e.g. software, hardware, and business models. The workshop Analytics and Mining of Model Repositories (AM-MoRe) aims to gather modelling researchers and practitioners to discuss the emerging problems and propose solutions. The scope ranges from industrial reports and empirical analyses in the problem domain to novel cross-disciplinary approaches for large-scale analytics and management, e.g. exploiting techniques from data analytics, repository mining and machine learning.

Objectives and scope

Big data approaches are causing large changes in the way we can perform science and business. Big Data is also entering the arena of software engineering and software modelling. We want to bring together the communities of Big Data/Machine Learning and Software Modelling. Various datasets of models have now become available and now our community must learn methods, techniques and tools for analyzing these large datasets. Many such methods, techniques and tools are known from the Big Data/Machine Learning and Information Retrieval/Natural Language Processing communities. How they can be adapted and applied to models and model repositories is an open question. Conversely, the insights that come out of this may lead to insights for these communities that are usable beyond software modelling.

Undoubtedly, MODELS is the premier conference series for model-driven software and systems engineering. It tries to cover all aspects of modeling, yet analytics and mining of model repositories (and other large collections of models) has not been a prime focus or the topic of a MODELS workshop besides the first edition of AMMoRe in 2018, nor of any other event in the community so far (to the best of our knowledge). Yet it is an increasingly timely and important topic. This is more evident given the special theme of MODELS'20 is "modeling in the era of data", which makes AMMoRe an even better fit for MODELS this year. AMMoRe aims to bring together researchers in software modelling, model repositories and model analytics, big-data and machine learning, information retrieval and natural language processing. Orthogonal to these domains, it welcomes contributions from a wide range of technical spaces to promote cross-fertilization: Model-Driven Engineering, Systems Engineering, Business Process Modelling, Software Architecture and so on. The topics of interest of AMMoRe 2020 include:

- Industrial reports, empirical studies on model corpora, ap-plications of model corpora
- Repository mining and management for modelling artefacts
- Clone-, pattern-, aspect-mining for modelling artefacts

- Applications of exploratory or descriptive data analytics, predictive analytics, machine learning or deep learning
- Large-scale model management and consistency checking
- Natural language processing for modelling
- Model searching, indexing, retrieval, storage
- Linking, enriching and labelling model-repositories
- Visualization of (possibly heterogeneous) large sets of modelling artifacts
- Techniques to analyze and automate (co-)evolution in modelling
- Variability mining and management, model-driven software product lines
- Distributed computing for modelling, with an eye towards Big Data
- Intelligent techniques for automating modelling tasks
- Building and composing model-analytics workflows (based on online services/repositories)

Workshop organization

Önder Babur, Michel Chaudron, Loek Cleophas, Ludovico Iovino and Dimitris Kolovos organized and chaired the program committee (PC) for the second edition of AMMoRe. Each of the submissions was reviewed by three PC members and the papers were selected based on their relevance to the workshop's topics and the reviews provided by PC members. The AMMoRe 2020 PC consisted of:

- Benny Akesson (TNO and University of Amsterdam, NL)
- Alessandra Bagnato (Softeam, FR)
- Mark van den Brand (Eindhoven University of Technology, NL)
- Carlos Cetina (Universidad San Jorge, ES)
- Juri Di Rocco (University of L'Aquila, IT)
- Davide Di Ruscio (University of L'Aquila, IT)
- Antonio Garcia-Dominguez (Aston University, UK)
- Yannis Korkontzelos (Edge Hill University, UK)
- Henrik Leopold (Kuehne Logistics University, DE)
- Nicholas Matragkas (University of York, UK)
- Jan Mendling (Vienna University of Economics and Business, AT)
- Richard Paige (McMaster University, CA)
- Alfonso Pierantonio (University of L'Aquila, IT)
- Ivan Polasek (Slovak University of Technology, SK)
- Matthew Stephan (University of Miami, US)
- Daniel Strüber (Radboud University Nijmegen, NL)
- Bedir Tekinerdogan (Wageningen University & Research, NL)
- Barbara Weber (University of St.Gallen, CH)
- Manuel Wimmer (Johannes Kepler University Linz, AT)
- Andreas Wortmann (RWTH Aachen, DE)

Program

AMMoRe 2020 is co-hosted with another MODELS workshop, Models and Evolution (ME'20). The final program of AMMoRe 2020 includes 2 paper presentations:

- An Extensible Tool-Chain for Analyzing Datasets of Metamodels (by Angela Barriga, Davide Di Ruscio, Ludovico Iovino, Phuong Nguyen and Alfonso Pierantonio) presents a dataset of metamodels for using for experimenting with new tools and techniques in

Model-Driven Engineering. The proposed approach employs a toolchain which automatically curates the dataset, hence facilitates flexible reuse.

- Metamodel Deprecation to Manage Technical Debt in Model Co-evolution (by Ludovico Iovino, Davide Di Ruscio, Amleto Di Salle and Alfonso Pierantonio) addresses the problem of evolution of metamodels invalidating existing artifacts (hence leading to technical debt) and proposes an approach using deprecation to mitigate the manual effort for reducing/eliminating technical debt. Tool support and a demonstration of the feasibility of the approach are presented.

Outlook

With this second edition of AMMoRe, we aim to build and strengthen an audience from various domains and communities working on analytics and mining of model repositories. We hope to increase our effort and organize further iterations of this workshop and other follow-up events, with the goal of attracting more attention to these timely and important topics.

Acknowledgements

The organizers are very thankful to all PC members for their reviewing, an important service to the workshop; and for the quality of their reviews.

Önder Babur (Eindhoven University of Technology, The Netherlands, o.babur@tue.nl)
Michel R. V. Chaudron (Chalmers | University of Gothenburg, Sweden, chaudron@chalmers.se)
Loek Cleophas (Eindhoven University of Technology, The Netherlands - Stellenbosch University, Republic of South Africa, l.g.w.a.cleophas@tue.nl)
Ludovico Iovino (Gran Sasso Science Institute, Italy, ludovico.iovino@gssi.it)
Dimitris Kolovos (University of York, United Kingdom, dimitris.kolovos@york.ac.uk)
AMMoRe 2020 workshop organizers

Preface to 14th Workshop on Models and Evolution (ME 2020)

Inspired by analogous evolution required by any software artefacts, the Models and Evolution (ME) 2020 Workshop represents the forum where to discuss the evolution of artefacts of the modelling process with input from academic as well as industrial practice. Modeling artefacts are increasingly recognised as significant to many areas of software development and integration. Their pervasiveness has escalated the importance of capturing the various aspects of the evolutionary pressure they are subject to. With the increasing use of Model-Based Development in multiple domains (e.g., Automotive Software Engineering, Business Process Engineering), models are becoming core artefacts of modern software engineering processes. By raising the level of abstraction and using concepts closer to the problem and application domain rather than the solution and technical domain, models become core assets and reusable intellectual property, being worth the effort of maintaining and evolving them. As traditional software artifacts, models can be subject to many kinds of changes, which range from rapidly evolving platforms to the evolution of the functionality provided by the applications developed. These modifications include changes at all levels, from requirements through architecture and design, to executable models, documentation and test suites. Dealing with and managing the changes that accompany the evolution of software assets is therefore an essential aspect of Software Engineering as a discipline.

The workshop on Models and Evolution has been co-located with IEEE / ACM 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS) and represented a forum for practitioners and researchers. We received five papers out of which three have been selected for inclusion in the technical program and in the proceedings.

The workshop has existed in different forms since 2007 (before it was known as MoDSE and MCCM). Each edition received high attention and enough submissions for concluding that this is and remains a current and relevant topic in the practice and theory of model-driven development. Thus, we would like to thank the authors - without them the workshop simply would not exist - and the program committee for their hard work.

The Models and Evolution workshop has been merged with the Second International Workshop on Analytics and Mining of Model Repositories (AMMoRe) for this year, due to the relevant overlap of the topics of the accepted papers.

Ludovino Iovino, Alfonso Pierantonio, and Dalila Tamzalit
ME 2020 workshop organizers

Preface to 2nd International Workshop on Security for and by Model-Driven Engineering (SecureMDE@Models2020)

Security concerns still are a hot topic as shown by the increasing number of cyber-attacks occurring in the world. The average cost of cyber-incidents is increasing year by year. It ranges from $ 200,000 to $ 1.3 million for small and medium-sized businesses and can reach up to $ 27 million for large US companies. Despite large efforts to better consider security during software and system development, things are not better. One of the limitations for an improved integration of security concerns is that security and software and system engineering are often considered separately. Investigating ways in which model-driven engineering and security are and will be combined is highly relevant for the researchers and practitioners who will attend MODELS 2020. There are at least two ways in which MDE and Security might be beneficially combined: using MDE to support the development of secure systems and, integrating security techniques in MDE to give support to new development scenarios such as collaborative and distributed modeling. In this sense, SecureMDE 2020 provides a forum for presenting and discussing a wide range of topics related to the interplay between MDE and Security. Indeed, MDE has succeeded to play a key role in many critical tasks related to ICT security. However, new domains such as Internet of Things, Cyber-physical systems, Systems of Systems, and Blockchain-based technologies stress the limitations of previous work and pose new challenges to current model-driven security techniques. Moreover, the increased adoption of MDE in collaborative scenarios highlights the need for security for MDE itself in order to deal with requirements such as confidentiality and integrity.

The first edition of this workshop occurred in Toulouse, France in 2018, and was collocated with the STAF'2018 federation of conferences. The second one is collocated as part of the satellite events of the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS'2020).

We received eight papers out of which six have been selected for inclusion in the technical program and in the proceedings. The accepted papers cover many different approaches considering security for and by MDE including, but not limited to: how to ease the development of decentralized secure storage applications; how to deal with advanced persistent threats in the context of cyberspace mission planning; how to integrate UML-based data models, role-based access control (RBAC), and BPMN business processes for information systems; how to conduct a security analysis guided by safety criteria; how to use security analysis tools at the model and at the code level (case study paper); how to detect human vulnerabilities in socio-technical systems (case study paper). Accepted papers are listed below:

- Alfa Yohannis, Alfonso de la Vega, Delaram Kahrobaei and Dimitris Kolovos. *Towards Model-Based Development of Decentralised Peer-to-Peer Data Vaults*.
- Tithnara Nicolas Sun, Ciprian Teodorov and Luka Le Roux. *Operational Design for Advanced Persistent Threats*.
- Paul Perrotin, Salah Sadou, Antoine Beugnard and David Hairion. *Detecting Human Vulnerably in Socio-Technical Systems: A Naval Case Study*.
- Akram Idani and Mario Cortes-Cornax. *Towards a Model Driven Formal Approach for Merging Data, Access Control and Business Processes*.
- Gabriel Pedroza and Guillaume Mockly. *Method and Framework for Security Risks Analysis Guided by Safety Criteria*.
- Matthias Pasquier, Frédéric Jouault, Matthias Brun and JulienPérochon. *Evaluating Tool Support for Embedded Operating System Security: an Experience Feedback*.

Acknowledgements

We would like to thank the MODELS 2020 Organizing Committee for giving us the opportunity to organize SecureMDE 2020, especially the workshops chairs Nelly Bencomo (Aston University, UK) and Mathieu Archer (University of Rennes 1, France), who were always very helpful and supportive. Many thanks to all those who submitted papers, and particularly to the presenters of the accepted papers. Last but not least, our thanks go to the reviewers and the members of the Program Committee for their timely responses and high-quality reviews that helped the workshop committee select the best contributions and gave authors valuable suggestions for improving their papers.

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Preface to 1st International Workshop on Modeling in Low-Code Development Platforms (LowCode 2020)

The growing need for secure, trustworthy, and cost-efficient software as well as recent developments in cloud computing technologies, and the shortage of highly skilled professional software developers, have given rise to a new generation of so-called low-code software development platforms, such as Google AppSheet and Microsoft PowerApps. Low-code platforms enable the development and deployment of fully functional applications using mainly visual abstractions and interfaces and requiring little or no procedural code. This makes them accessible to an increasingly digital-native and tech-savvy workforce who can directly and effectively contribute to the software development process, even if they lack a programming background.

At the heart of low-code applications are typically models of the structure, the behavior, and the presentation of the application. Such application models need to be edited (using graphical and textual interfaces), validated, version-controlled, and eventually transformed or interpreted to deliver applications for end-users. As all of these activities have been of core interest to the MoDELS community over the last two decades, the LowCode workshop has been established at MoDELS as an opportunity to connect low-code platform vendors with model-driven engineering technology providers as well as to stimulate research on low-code platforms using model-driven engineering concepts and techniques.

The workshop received 21 submissions. From these submissions, the following 17 were accepted for publication in the proceedings and presentation during the workshop:

- Léa Brunschwig, Esther Guerra and Juan de Lara: Towards access control for collaborative modelling apps.
- Sorour Jahanbin, Dimitris Kolovos and Simos Gerasimou: Intelligent Run-Time Partitioning of Low-Code System Models.
- Jordi Cabot: Positioning of the low-code movement within the field of model-driven engineering.
- Lissette Almonte, Iván Cantador, Esther Guerra and Juan de Lara: Towards automating the construction of recommender systems for low-code development platforms.
- Bruno Piedade, João Pedro Dias and Filipe Correia: An Empirical Study on Visual Programming Docker Compose Configurations.
- Faezeh Khorram, Jean-Marie Mottu and Gerson Sunyé: Challenges & Opportunities in Low-Code Testing.
- Alexandre Jacinto, Miguel Lourenço and Carla Ferreira: Test Mocks for Low-Code Applications built with OutSystems.
- Panagiotis Kourouklidis, Dimitris Kolovos, Nicholas Matragkas and Joost Noppen: Towards a low-code solution for monitoring machine learning model performance.
- Apurvanand Sahay, Davide Di Ruscio and Alfonso Pierantonio: Understanding the role of Model Transformation Compositions in Low-Code Development Platforms.
- Fatima Rani, Pablo Diez, Enrique Chavarriaga, Esther Guerra and Juan de Lara: Automated Migration of EuGENia Graphical Editors to the Web.

- Jean Felicien Ihirwe, Davide Di Ruscio, Silvia Mazzini, Pierluigi Pierlini and Alfonso Pierantonio: Lowcode Engineering for Internet of things: A state of research.
- Mariana Bexiga, Stoyan Garbatov and João Costa Seco: Closing the Gap Between Designers and Developers in a Low Code Ecosystem.
- Qurat Ul Ain Ali, Dimitris Kolovos and Konstantinos Barmpis: Efficiently Querying Large-Scale Heterogeneous Models.
- Claudio Di Sipio, Davide Di Ruscio and Phuong T. Nguyen: Democratizing the development of modeling assistants by means of low-code platforms.
- Jolan Philippe, Massimo Tisi, Héléne Coullon and Gerson Sunyé: Towards Multi-Paradigm Model Management Operations.
- Benedek Horváth, Ákos Horváth and Manuel Wimmer: Towards the Next Generation of Reactive Model Transformations on Low-Code Platforms: Three Research Lines.
- Alessandro Colantoni, Luca Berardinelli and Manuel Wimmer: DevOpsML: Towards Modeling DevOps Processes and Platforms.

We would like to thank the MODELS 2020 organization, in particular to Houari Sahraoui and Eugene Syriani, for giving us the opportunity to organize this workshop as well as to the workshops chairs Nelly Bencomo and Mathieu Acher, who were always very helpful and supportive.

Many thanks go to the reviewers and the members of the Program Committee for their timely and detailed reviews and for their help in choosing and suggestions for improving the selected papers:

- Francesco Basciani (University of L'Aquila, Italy)
- Antonio Cicchetti (Maalardalen University, Sweden)
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- Alfonso Pierantonio (University of L'Aquila, Italy)
- Adrian Rutle (Western Norway University of Applied Sciences, Norway)
- Matthias Tichy (University of Ulm, Germany)
- Andreas Wortmann (RWTH Aachen University, Germany)
- Yannis Zorgios (CLMS, UK)

LowCode 2020 was particularly challenging to organize (in line with many other workshops and conferences) due to the COVID-19 pandemic and we thank everyone who helped in addition to make the first virtual edition of LowCode possible.

Juan de Lara, Davide Di Ruscio, Dimitris Kolovos, Massimo Tisi, and Manuel Wimmer
LowCode 2020 workshop organizers

Preface to 7th International Workshop on Multi-Level Modeling (MULTI 2020)

Multi-level modeling (MLM) represents a significant extension to the traditional two-level object-oriented paradigm with the potential to dramatically improve upon the utility, reliability, and complexity of models. Different from conventional approaches, MLM allows for an arbitrary number of classification levels and introduces further concepts that foster expressiveness, reuse, and adaptability.

A key aspect of the MLM paradigm is the use of entities that are simultaneously types and instances, a feature which has consequences for conceptual modeling, language engineering, and for the development of model-based software systems.

The objectives of the MULTI series are to provide a forum for the MLM community to address the foundations of MLM approaches and to support future modelers through better modeling languages, tools, methods, and guidelines. The workshop encouraged the presentation of case studies and tool demonstrations in addition to submissions on new concepts, implementation approaches, formalisms, controversial positions, and requirements for evaluation criteria.

The workshop received five submissions which were all accepted for publication in the proceedings and for presentation during the workshop:

- Manfred A. Jeusfeld, João Paulo A. Almeida, Victorio A. Carvalho, Claudenir M. Fonseca and Bernd Neumayr: Deductive reconstruction of MLT* for multi-level modeling
- Zoltán Theisz, Sándor Bácsi, Gergely Mezei, Ferenc A. Somogyi and Dániel Palatinszky: Join potency – a way of combining separate multi-level models
- Thomas Kühne and Arne Lange: Meaningful Metrics for Multi-Level Modeling
- Ulrich Frank and Daniel Töpel: Contingent Level Classes: Motivation, Conceptualization and Implications for Model Management
- Chris Partridge, Andrew Mitchell, Sergio de Cesare, Matthew West, Oscar Xiberta Soto, Marco da Silva and Mesbah Khan: Implicit requirements for ontological multi-level types in the UNICLASS classification

We would like to say thank you to the MODELS 2020 organization, in particular to Houari Sahraoui and Eugene Syriani, for giving us the opportunity to organize this workshop as well as to the workshops chairs Nelly Bencomo and Mathieu Acher, who were always very helpful and supportive.

Many thanks go to the reviewers and the members of the Program Committee for their timely and detailed reviews and for their suggestions for improving the accepted papers:

- João Paulo A. Almeida (Fed. Univ. of Espírito Santo, Brazil)
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- Tony Clark (Aston University, UK)
- Marian Daun (University of Duisburg-Essen, Germany)
- Juan de Lara (Universidád Autónoma de Madrid, Spain)
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- Chris Partridge (BORO Solutions Ltd and University of Westminster, UK)
- Adrian Rutle (Western Norway University of Applied Sciences, Norway)
- Markus Stumptner (University of South Australia)
- Manuel Wimmer (Johannes Kepler University Linz, Austria)

Last but not least, our thanks go to our Steering Committee members:

- Colin Atkinson (University of Mannheim, Germany)
- Thomas Kühne (Victoria University of Wellington, NZ)
- Juan de Lara (Universidad Autónoma de Madrid, Spain)

The organisation of MULTI, like that of many other conferences and workshops, was particularly challenging this year due to the COVID-19 pandemic and we thank everyone who helped to make the first virtual edition of MULTI possible.

Adrian Rutle, Bernd Neumayr and Manuel Wimmer
MULTI 2020 workshop organizers

Preface to 2nd International Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS 2020)

Tackling the complexity involved in developing truly complex, designed systems is a topic of intense research and development. Systems complexity has drastically increased once software components were introduced in the form of embedded systems, controlling physical parts of the system, and has grown into Cyber-Physical Systems (CPS), where the networking aspect of the systems and their environment are of specific interest. The complexity faced when engineering CPSs is mostly due to the plethora of cross-disciplinary design alternatives and inter-domain interactions. To date, no unifying theory nor system design methods, techniques, or tools to design, analyze, and ultimately deploy CPSs exist. Individual (physical systems, software, and network) engineering disciplines offer only partial solutions and do not match for the complexity observed in CPS.

Multi-Paradigm Modeling (MPM) offers a foundational framework for gluing the various required disciplines together in a consistent way. The inherent complexity of CPSs is broken down by specifying each aspect of the system at the most appropriate level of abstraction, which allows for the modelling of different views on the system, each expressed in appropriate modeling formalisms. MPM offers processes and tools that can combine, couple, and integrate each of the views that compose a system. MPM encompasses many research topics - from language engineering (for DSLs, including their (visual) syntax and semantics), to processes to support multi-view and multi-abstraction modeling, simulation for system analysis, and deployment. The added complexity that CPSs bring compared to embedded and software-intensive systems requires looking at these new applications and how MPM techniques can be applied or adapted for them, tying together multiple domains. Many remaining research questions require answers from researchers from different domains, as well as a unified effort from researchers that work on supporting MPM techniques and technologies.

The MPM4CPS workshop series aims at further advancing the state-of-the-art as well as defining the future directions of this emerging research area by bringing together world experts from academia and industry. The second edition of the Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS) was held virtually as part of the satellite events of the IEEE/ACM 23th International Conference on Model-Driven Engineering Languages and Systems (MODELS 2020).

The workshop received 11 submissions. From these 11 submissions received, the following 4 were accepted as full papers in the proceedings and as presentations during the workshop:

- René Schöne, Johannes Mey, Sebastian Ebert and Uwe Assmann: Connecting conceptual models using Relational Reference Attribute Grammars.
- Asmaa Niati, Cyrine Selma, Dalila Tamzalit, Hugo Bruneliere, Nasser Mebarki and Olivier Cardin: Towards a Digital Twin for Cyber-Physical Production Systems: A Multi-Paradigm Modeling Approach in the Postal Industry.
- Moharram Challenger and Hans Vangheluwe: Towards employing ABM and MAS integrated with MBSE for the lifecycle of sCPSoS.

- Jerome Hugues, Anton Hristosov, John J. Hudak and Joe Yankel: TwinOps – DevOps meets Model-Based Engineering and Digital Twins for the engineering of CPS.

In addition, we accepted 3 lightning talks with extended abstracts:

- Romain Franceschini, Bentley Oakes, Simon Van Mierlo, Moharram Challenger and Hans Vangheluwe: Towards Adaptive Abstraction for Continuous Time Models with Dynamic Structure.
- Liam Walsh, Juergen Dingel and Karim Jahed: Toward a Web-Based Client-Agnostic Hybrid Model Editor.
- Sándor Bácsi, Zoltán Theisz, Gergely Mezei, Ferenc A. Somogyi and Dániel Palatinszky: Step-wise refinement in multi-paradigm modeling.

We would like to thank the MODELS 2020 organization, in particular the general chairs Houari Sahraoui and Eugene Syriani, for giving us the opportunity to organize this workshop as well as the workshops chairs Nelly Bencomo and Mathieu Acher for their great support and organization.

Many thanks go to the reviewers and the members of the Program Committee for their timely and detailed reviews and for their help in choosing and suggesting improvements of the selected papers:

- Rima Al-Ali, Charles University
- Shaukat Ali, Simula Research Laboratory
- Ankica Barisic, Nova-LINCS Research Center
- Luca Berardinelli, Johannes Kepler Universität Linz
- Frédéric Boulanger, Centrale Supélec & Laboratoire de Recherche en Informatique (LRI)
- Moharram Challenger, University of Antwerp
- Antonio Cicchetti, Mälardalen Research and Technology Centre (MRTC)
- Andrea D’Ambrogio, University of Rome Tor Vergata
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- Martin Törngren, KTH Royal Institute of Technology

- Clark Verbrugge, McGill University
- Manuel Wimmer, JKU Linz, Austria
- Andreas Wortmann, RWTH Aachen University

We would also like to take this opportunity to specifically thank Simon Van Mierlo, formerly from University of Antwerp, who greatly contributed to the first edition of MPM4CPS last year (MoDELS'19 at Munich, Germany). He was also involved in the organization of this edition from the start. He now left academia to pursue a career in industry: good luck to you and a big THANK YOU!

Last but not least, our thanks go to our Steering Committee members:

- Hans Vangheluwe (University of Antwerp – Flanders Make, Belgium)
- Pieter J. Mosterman (MathWorks, USA)
- Jeff Gray (University of Alabama, USA)
- Vasco Amaral (Universidade NOVA de Lisboa, Portugal)

MPM4CPS 2020 was particularly challenging to organize this year due to the COVID-19 situation and we thank everyone who helped in addition to make the first virtual edition of MPM4CPS possible.

Moussa Amrani, Dominique Blouin, Julien DeAntoni, Simon Van Mierlo and Manuel Wimmer
MPM4CPS 2020 workshop organizers

November 16-17, 2020
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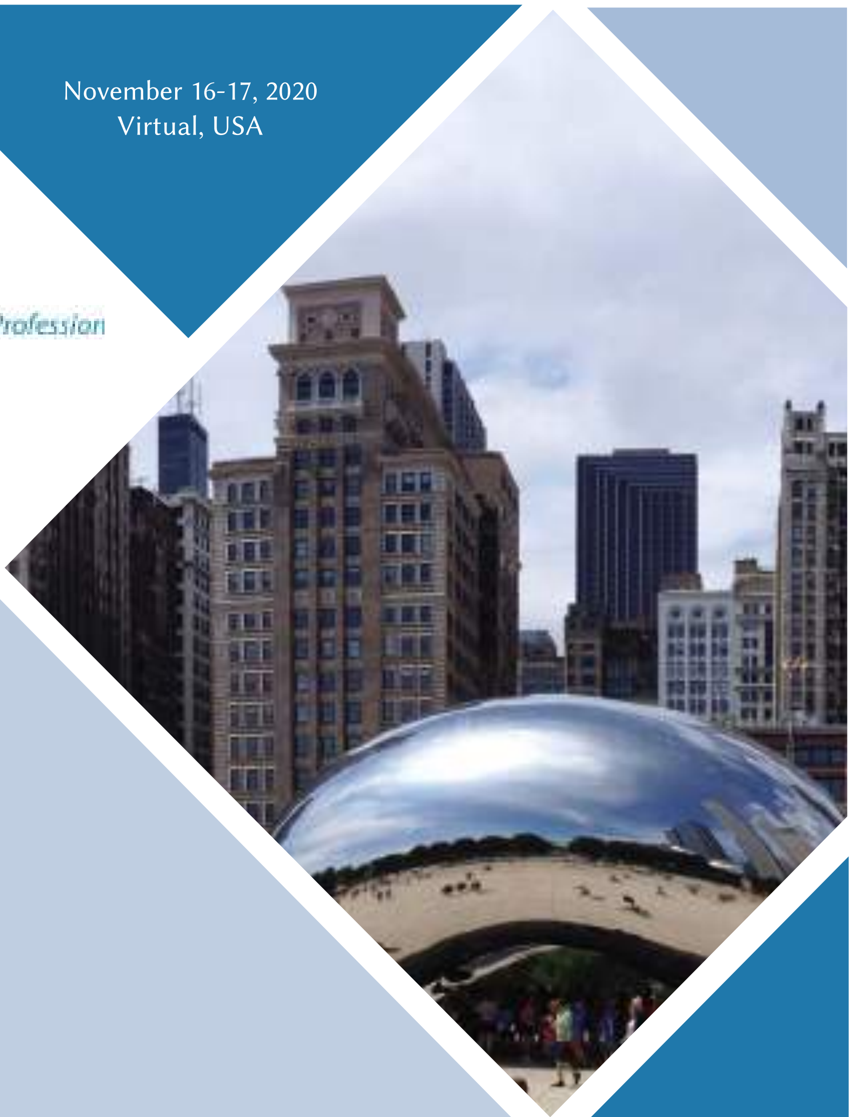

SLE '20

Proceedings of the 13th ACM SIGPLAN International Conference on

Software Language Engineering

Edited by:
Ralf Lämmel, Laurence Tratt, and Juan de Lara

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Message from the Chairs

Welcome to the 13th ACM SIGPLAN International Conference on Software Language Engineering (SLE) held in November 2020 as part of SPLASH 2020. This is the first fully online edition of SLE due to the effects of COVID-19. Despite the many challenges this has caused, the SLE programme is once again worthy of your consideration!

Software Language Engineering (SLE) is a thriving research discipline targeted at establishing an engineering approach to the development, use, and maintenance of software languages, that is, of languages for the specification, modeling and programming of software. Key topics of interest for SLE include approaches, methodologies and tools for language design and implementation with a focus on techniques for static and behavioral semantics, generative or interpretative approaches (including transformation languages and code generation) as well as meta-languages and tools (including language workbenches). Techniques enabling the testing, simulation or formal verification for language validation purposes are also of particular interest. Last but not least, SLE accommodates empirical evaluation and experience reports of language engineering tools, such as user studies evaluating usability, performance benchmarks or industrial applications.

SLE 2020 received a total of 44 submissions (34 regular and 10 short). Each submission was reviewed by at least three members of the Program Committee, which selected 21 for presentation: 16 regular research papers and 5 short papers.

For the fifth year, SLE used an evaluation process to assess the quality of artifacts on which papers are based. The aim is to foster a culture of experimental reproducibility as well as a higher quality in the research area as a whole. Authors of accepted papers could voluntarily submit their research artifacts for evaluation carried out by an independent committee. 14 papers submitted artifacts, of which 12 received the ACM badge “Functional” and 2 the “Reusable” one.

As the Organization Committee, we are deeply indebted to the hard work of the many people who contributed to the success of this year’s SLE. Specifically, we would like to acknowledge the work of all Program Committee, the Artifact Evaluation Committee, and the External Reviewers for the timely delivery of reviews and open-minded discussions which resulted in a rich and diverse program. We are also grateful to SLE’s Steering Committee and the SPLASH organization for their help. Finally, we would like to thank the authors of all submitted papers — you represent the core of the SLE conference, and it is your work that advances the state of the art in software language engineering.

We hope that you will enjoy reading these proceedings and we wish you the best in these difficult times!

Ralf Lämmel (General Chair)
Juan de Lara and Laurence Tratt (Programme Chairs)
Antonio García-Domínguez and Lukas Diekmann (Artifact Evaluation Chairs)
Loli Burgueño (Publicity Chair)

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Preface to the JOT issue on 17th European Conference on Modelling Foundations and Applications (ECMFA 2021)

Loli Burgueño* **and Martin Gogolla****
*Open University of Catalonia, Spain
**University of Bremen, Germany

ABSTRACT In this preface, the editors present an overview of the topics and scope of the European Conference on Modelling Foundations and Applications (ECMFA), and describe the editorial and reviewing process for its 17th edition (ECMFA 2021). The papers selected for publication and presentation are presented and briefly described, as well as the details about the keynote talk by Prof. Jean-Marc Jézéquel. Finally, the ECMFA committees are acknowledged.

KEYWORDS Model-based engineering, modelling foundations, modelling applications

1. Introduction: About ECMFA

The European Conference on Modelling Foundations and Applications (ECMFA) is the premier European forum dedicated to advancing the state of knowledge and fostering the application of all aspects of Model-based Engineering (MBE) and related approaches.

Model-based Engineering addresses the design, analysis, and development of software and systems relying on exploiting high-level models and computer-based automation to achieve significant boosts in both productivity and quality.

In its 16th edition, ECMFA introduced two major successful innovations that have been maintained in the current 17th ECMFA edition to strengthen the scope of the community and to foster the quality of its contributions.

- First, the International Conference on Model Transformations (ICMT) joined forces with ECMFA, merging both into one single event that unites all aspects related to Model-Based Engineering (MBE).
- Second, a two-phase submission and review process was introduced, with two possible submission periods (October and February). Authors of papers not accepted in the first phase were invited to re-submit improved versions of their work in the second submission phase that also welcomed fresh submissions.

Due to the COVID-19 pandemic and its associated restrictions, the steering and organizing committee decided to celebrate the conference virtually in June 2021.

2. Submission and review process

2.1. Types of submissions

ECMFA solicits two types of papers presenting original research on all aspects of model-based engineering:

- Foundation Papers, dealing with modeling foundations, such as metamodeling, model transformations, model validation, verification and testing, model engineering methods and tools, and related aspects.
- Application Papers, dealing with the application of modeling techniques, including experience reports on the use of MBE methods and tools, industrial case studies, or successful applications of MBE practices in industry or in public administration, with significant modeling lessons learned. All applications must have been done in real contexts and at least one of the authors of the paper must be from the company or administration where the application took place.

JOT reference format:
Loli Burgueño and Martin Gogolla. *Preface to the JOT issue on 17th European Conference on Modelling Foundations and Applications:(ECMFA 2021).* Journal of Object Technology. Vol. 20, No. 3, 2021.
http://dx.doi.org/10.5381/jot.2021.20.3.e1

No simultaneous submission to other publication outlets (either a conference or a journal) was allowed.

2.2. Topics of interest

Topics of interest included, but were not limited to:

– Foundations of MBE;
– Application of MBE methods, tools, and techniques to specific domains, e.g., automotive, cyber-physical systems, robotics, Artificial Intelligence or IoT;
– Successful use of MBE in connection with other disciplines and approaches, such as Artificial Intelligence, Blockchain, or Open Source;
– Educational aspects of MBE;
– Tools and initiatives for the successful adoption of MBE in industry.

2.3. Review criteria and process

All submissions have been peer-reviewed by three members of the Program Committee, who assessed them in terms of their novelty, significance, technical quality, rigor, and suitability for the conference.

Contributions could be submitted to any of the two submission deadlines: October 11, 2020, or February 21, 2021.

Papers submitted to the first round of review could be accepted-as-is, accepted with minor revisions, undergo major revisions (and be re-submitted in the second round), or rejected. Recommendations for papers submitted in the second round are for accept, minor revisions, or reject.

Papers accepted at any of the two rounds with minor revisions were given around one month to complete the revisions. The same reviewers assessed how well the revision requests have been addressed by the authors, and whether the final paper maintained or improved the level of contribution of the original submission. Papers not accepted in the first round could be resubmitted in the second one, indicating how the authors had improved the paper to address the reviewers' criticisms.

3. Accepted papers

In the first round, ECMFA received 16 submissions. Five were given a minor revision, seven a major revision, and four were rejected. All 5 minor revisions were successfully addressed by the authors and the program committee agreed to accept the papers. With respect to the 7 major revisions, only 4 of them were re-submitted to the second round and reviewed again.

In the second round, ECMFA received 16 abstracts, of which 4 were withdrawn, making it 12 new papers. These new papers, plus the 4 re-submitted ones constituted a total of 16 papers submitted to the second round. Two of the re-submitted papers were accepted and two rejected, and 9 of the new papers were rejected and 3 accepted after a minor revision.

In summary, from received 32 papers, 10 were accepted, resulting in an acceptance rate of 31%.

The list of accepted papers is as follows:

– Addressing the trade off between smells and quality in model refactoring. Angela Barriga, Lorenzo Bettini, Ludovico Iovino, Adrian Rutle, Rogardt Heldal.
– Uncertainty management with extra-functional qualities in multi-artefact co-evolution. Francesco Basciani, Davide Di Ruscio, Ludovico Iovino, Alfonso Pierantonio.
– Towards a Generic Method for Articulating Design Uncertainty. Mouna Dhaouadi, Kate M. B. Spencer, Megan H. Varnum, Alicia M. Grubb, Michalis Famelis.
– Automatic Generation of Configuration Files: an Experience Report from the Railway Domain. Enxhi Ferko, Alessio Bucaioni, Jan Carlson, Zulqarnain Haider.
– Clustering Natural Language Test Case Instructions as Input for Deriving Automotive Testing DSLs. Katharina Juhnke, Alexander Nikic, Matthias Tichy.
– Adapting TDL to Provide Testing Support for Executable DSLs. Faezeh Khorram, Erwan Bousse, Jean-Marie Mottu, Gerson Sunyé.
– Co-evolution of Metamodel and Generators: Higher-order Templating to the Rescue. Tiziano Lombardi, Vittorio Cortellessa, Alfonso Pierantonio.
– Modeling Objects with Uncertain Behaviors. Paula Muñoz, Priyanka Karkhanis, Mark van den Brand, Antonio Vallecillo.
– Fixing Multiple Type Errors in Model Transformations with Alternative Oracles to Test Cases. Zahra Varaminybahnemiry, Jessie Galasso, Houari Sahraoui.
– Automating Model Transformations for Railway Systems Engineering. Nils Weidmann, Shubhangi Salunkhe, Anthony Anjorin, Enes Yigitbas, Gregor Engels.

Two of these papers (Ferko et al. 2021; Weidmann et al. 2021) belong to the Applications category. First, Ferko et al. (Ferko et al. 2021) present an experience report of a Software Product Line (SPL) engineering experiment at Bomdardier Railway Transportation. Then, Weidmann et al. (Weidmann et al. 2021) introduce a bidirectional transformation approach between SysML and Event-B models for the purposes of supporting verification of railway models at DB Netz AG, a railway infrastructure manager that operates large parts of the German railway system.

As for the eight foundations papers, Barriga et al. (Barriga et al. 2021) build on top of PARMOREL, a reinforcement learning-based framework for automatically refactoring models. They extend PARMOREL to support smells detection and selective refactoring based on quality characteristics. Muñoz et al. (noz et al. 2021) present an approach to model the behavior of complex systems and their associated uncertainties in UML and OCL. They also present how these specifications can be used to analyze and simulate systems. Basciani et al. (Basciani et al. 2021) propose an approach to migrate both models and model-to-model transformations in response to a metamodel evolution based on the notion of information loss. Dhaouadi et al. (Dhaouadi et al. 2021) discuss DRUIDE, a language and workflow for articulating design time uncertainty. Khorram et al. (Khorram et al. 2021) introduce a fully generic testing approach for any given executable domain specific language (xDSL) by extending the existing Test Description Language (TDL). Lombardi et al. (Lombardi et al. 2021) put forward a novel technique to make template-based code generators resilient to changes due to metamodel evolution. A tool named Hotello is introduced for the specification of meta-templates. Varaminybahnemiry et al. (Varaminybahnemiry et al. 2021) present an approach to automatically fix type errors in model transformations. The approach aims at correcting the errors when neither predefined patches nor behavior-safe guards such as test suites are available by exploring the space of possible patches using an evolutionary algorithm. Juhnke et al. (Juhnke et al. 2021) introduce a clustering approach to automatically cluster highly similar domain-specific instructions, which can be useful for the derivation of test cases in the automotive domain.

4. Keynote by Jean-Marc Jézéquel

Jean-Marc Jézéquel delivered on Tuesday, June 22, 2021, the keynote talk entitled “A Tale of Taming Variability with MDE”.

4.1. Abstract

Finding better ways to handle software complexity (both inherent and accidental) is the holy grail for a significant part of the software engineering community, and especially for the Model driven Engineering (MDE) one. To that purpose, plenty of techniques have been proposed, leading to a succession of trends in model based software development paradigms in the last decades. While these trends seem to pop out from nowhere, we claim that most of them actually stem from trying to get a better grasp on the variability of software. We revisit the history of MDE trying to identify the main aspect of variability they wanted to address when they were introduced. We conclude on what are the variability challenges of our time, including variability of data leading to machine learning of models.

4.2. Biography

Jean-Marc Jézéquel is a Professor at the University of Rennes and a member of the DiverSE team at IRISA/Inria. From 2012 to 2020 he was Director of IRISA, one of the largest public research lab in Informatics in France. In 2016 he received the Silver Medal from CNRS and in 2020 the IEEE/ACM MODELS career award.

His interests include model driven software engineering for software product lines, and specifically component based, dynamically adaptable systems with quality of service constraints, including security, reliability, performance, timeliness etc. He is the author of 4 books and of more than 300 publications in international journals and conferences. He was a member of the steering committees of the AOSD and MODELS conference series. He is currently Associate Editor in Chief of IEEE Computer and of the Journal on Software and System Modeling, as well as member of the editorial boards of the Journal on Software and Systems, and the Journal of Object Technology. He received an engineering degree from Telecom Bretagne in 1986, and a Ph.D. degree in Computer Science from the University of Rennes, France, in 1989.

5. Committees

Following the ECMFA tradition, ECMFA 2021 had two Program co-chairs. They were:

- Loli Burgueño, Open University of Catalonia, Spain
- Martin Gogolla, University of Bremen, Germany

Despite the European nature of the conference, the Program Committee of ECMFA 2021 was composed of 51 MBE experts from both academia and industry, from all over the world (see Fig. 1 for their geographical location):

- Silvia Abrahão, Universitat Politecnica de Valencia
- Shaukat Ali, Simula Research Lab
- Vasco Amaral, Universidade Nova de Lisboa
- Alessandra Bagnato, Softeam
- Nelly Bencomo, Aston University
- Marco Brambilla, Politecnico di Milano
- Jean-Michel Bruel, IRIT
- Eric Cariou, LIUPPA and Universite de Pau
- Carlos Cetina, Universidad San Jorge
- Antonio Cicchetti, Mälardalen University
- Federico Ciccozzi, Mälardalen University
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- Toni Clark, Aston University
- Benoît Combemale, University of Toulouse
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- Zinovy Diskin, McMaster Univ. and Univ. of Waterloo
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- Richard Paige, McMaster University
- Alfonso Pierantonio, University of L’Aquila
- Fiona Polack, Keele University
- Arend Rensink, University of Twente
- Bernhard Rumpe, RWTH Aachen University
- Adrian Rutle, Western Norway Univ. of Applied Sciences
- Jesús Sanchez Cuadrado, Universidad de Murcia
- Andy Schürr, Darmstadt University of Technology
- Bran Selic, Malina Software Corp.
- Gabriele Taentzer, Philipps-Universität Marburg
- Matthias Tichy, University of Ulm
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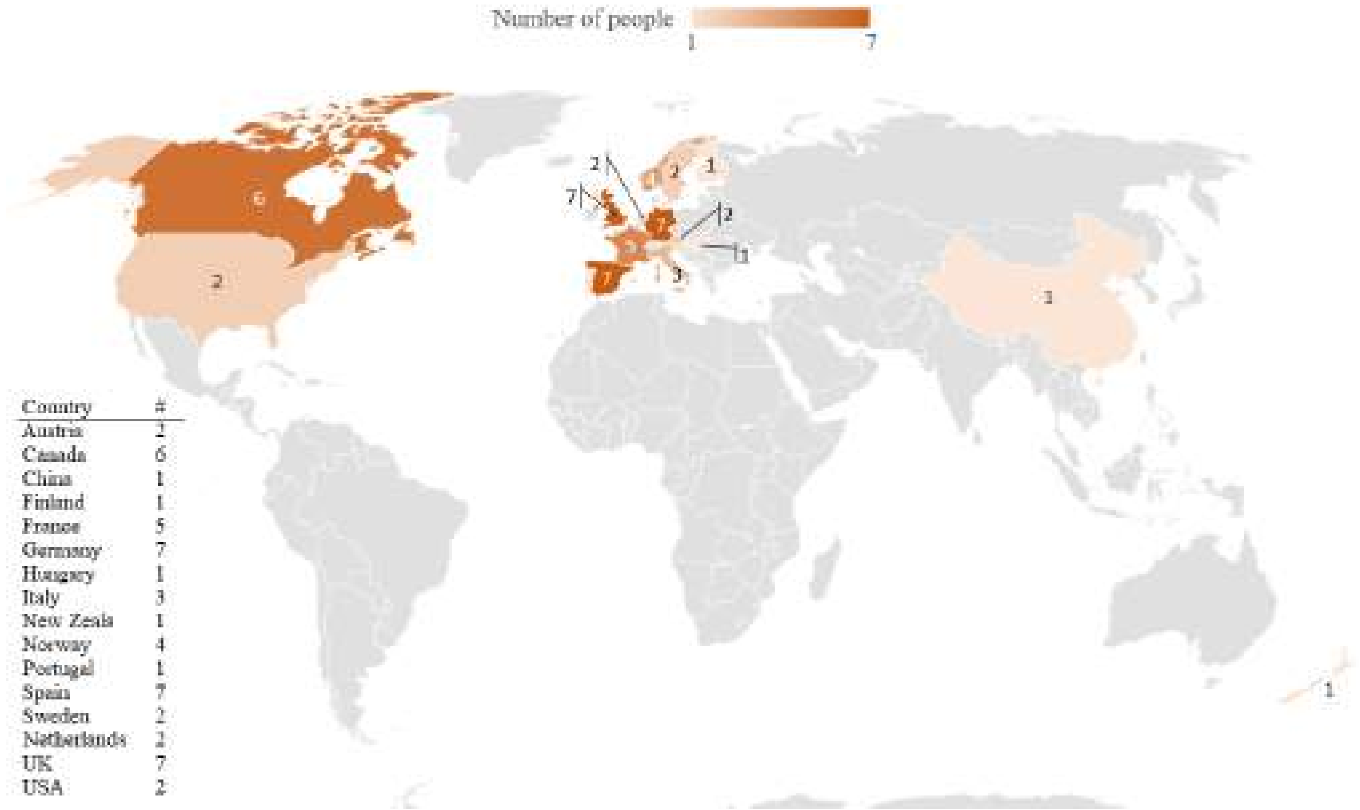

Figure 1 Country of origin of the PC members

– Athanasios Zolotas, University of York
– Steffen Zschaler, King's College London

Three additional sub-reviewers helped with the papers during the reviewing process:

– Mehrnoosh Askarpour, McMaster University
– Malte Heithoff, RWTH Aachen University
– Louis Wachtmeister, RWTH Aachen University

6. Acknowledgments

We would like to thank the organizing committee, especially to the General Chair Adrian Rutle (Western Norway University of Applied Sciences, Norway), for providing us with all the necessary resources and support to organize ECMFA 2021. Thanks to the JOT EiC Alfonso Pierantonio (University of L'Aquila) for all his help with the publication process. Thanks to all those who trusted ECMFA and submitted papers, regardless of whether they were accepted or not, and particularly to the presenters of the accepted papers. Many thanks to the reviewers and the members of the Program Committee, for their timely and accurate reviews and for their helpful suggestions for improving the selected papers. We also thank our keynote speaker Jean-Marc Jézéquel for accepting our invitation to give such an interesting talk. Last but not least, thanks to the Steering Committee, in particular to Antonio Vallecillo and Richard Paige, for their help and support to our decisions in this very particular edition of the conference due to COVID-19. We miss social and intellectual interaction during the coffee breaks and the social events like the conference dinner.

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About the authors

Loli Burgueño is a researcher and lecturer at the Open University of Catalonia, in Barcelona, Spain. She graduated in Computer Science and Engineering from the University of Málaga in 2011, earned her master's degree in Software Engineering and Artificial Intelligence in 2012 and graduated from her PhD in 2016. Her research interests in Model-Driven Engineering include the performance, scalability and testing of model transformations, the modeling of uncertainty in software models for its use in the Industry 4.0 and the integration of Artificial Intelligence techniques into modeling tools and processes. She is an active member of the modeling community and has co-chaired and organized numerous events at conferences such as MODELS, STAF and ICSOC. She is a member of the SoSyM editorial board. Contact her at lburguenoc@uoc.edu.

Martin Gogolla is professor for Computer Science at University of Bremen, Germany and is the head of the Research Group Database Systems. His research interests include software development with object-oriented approaches, formal methods in system design, semantics of languages, and formal specification. Martin Gogolla is actively participating in the MODELS community and is involved in the organisation of the OCL workshops. Martin Gogolla is Associate Editor of the Springer journal on Software and Systems Modeling. In his group, foundational work on the semantics of and the tooling for UML, OCL and general modeling languages has been carried out. The group develops the OCL and UML tool USE (UML-based Specification Environment) since about 15 years. The tool is internationally and nationally widely accepted and employed for research and teaching and in software production. Contact him at gogolla@informatik.uni-bremen.de.

JISBD

SOLICITUD DE CONTRIBUCIONES

Las Jornadas de Ingeniería del Software y Bases de Datos (JISBD) son un foro de referencia para los investigadores de España, Portugal y Latinoamérica en las áreas de Ingeniería del Software y Bases de Datos. La comunidad iberoamericana alrededor de estas dos disciplinas encuentra en esta conferencia un punto de encuentro ineludible en el que presentar sus trabajos más recientes y significativos, así como experiencias en el área a través de proyectos o colaboraciones con la industria. Las JISBD son un marco perfecto para debatir e intercambiar ideas entre investigadores, docentes y profesionales de la industria, y así establecer o consolidar colaboraciones.

A lo largo de sus más de veinte ediciones las JISBD han contribuido significativamente a la consolidación de las comunidades de Ingeniería del Software y Bases de Datos en el ámbito iberoamericano. Un año más las JISBD ofrece este punto de encuentro en la capital de la Costa del Sol, la ciudad de Málaga, en septiembre de 2021, en el marco del Congreso Español De Informática (CEDI 2020).

En su XXV edición JISBD se organiza en seis áreas de interés o "**tracks**" (en la web del evento se detallan el alcance y temas incluidos en cada una):

- Arquitecturas Software y Variabilidad (ASV)
- Ingeniería y Ciencia de Datos (ICD)
- Ingeniería del Software Dirigida por Modelos (ISDM)
- Ingeniería del Software Basada en Búsqueda y Aprendizaje Automático (ISBBAA)

TIPOS DE CONTRIBUCIONES

Cada track aceptará trabajos de los siguientes tipos:

- **Artículo completo**: contribuciones consolidadas donde se describan resultados de investigación o experiencias de aplicación práctica. Estos trabajos tendrán una extensión máxima de 14 páginas en formato LNCS (http://bit.ly/1tSDAN1). Este año cabe la posibilidad de acompañar opcionalmente el artículo con un artefacto. Según ACM, un artefacto es un "objeto digital que es o bien creado por los autores para ser usado como parte del estudio o bien generado por el experimento en sí mismo […] sistemas software, scripts usados para ejecutar experimentos, datasets de entrada, datos recogidos del experimento, scripts usados para analizar resultados". La localización del artefacto se indicará con una url situada al final del artículo completo. La url contendrá las instrucciones para ser ejecutado. Instrucciones básicas de ejecución para un artefacto pueden verse en http://www.artifact-eval.org/guidelines.html (sección *Code Artifacts Packaging* y *Non-Code Artifacts Format*)
- **Artículo corto**: presentación de trabajo emergente o en curso que discuta propuestas novedosas o problemas abiertos en el ámbito de la ingeniería del software y bases de datos, con una extensión entre 2 y 4 páginas en formato LNCS. Estos artículos deberían ser trabajos en curso preferiblemente de alumnos de doctorado. Los artículos sobre problemas abiertos no necesitarán discutir soluciones determinadas, pero sí plantear situaciones reales en los que se hayan identificado problemas que las propuestas y herramientas existentes no sean capaces de solucionar de forma apropiada. Deben ser artículos que fomenten la discusión entre los participantes y que sirvan de punto de partida para futuros trabajos y colaboraciones en el área.
- **Demostración de herramienta**: a presentar en el transcurso de la conferencia, y acompañada de un artículo de entre 2 y 4 páginas en formato LNCS y un vídeo de demostración.
- **Descripción de proyectos de I+D aplicados o contratos con empresas**. Con un máximo de 4 páginas en formato LNCS tendrán 4 secciones: resumen, problema a resolver y a quién lo resuelve, tecnologías usadas y

2 páginas en formato LNCS en el que una empresa explique soluciones implantadas en las que se apliquen enfoques o técnicas de Ingeniería del Software y/o Bases de Datos. Estos trabajos no aparecerán impresos en las actas, salvo una reseña breve, pero sí serán presentados en las sesiones.

- **Artículo relevante**: trabajo relevante ya publicado (es suficiente con disponer de la versión electrónica inicial) durante el año 2020 en revistas con índice de impacto (cuartiles Q1 y Q2 de revistas indexadas en JCR) o presentados en 2020 en congresos relevantes (clases 1 y 2 del ranking SCIE de congresos relevantes). Estos trabajos no aparecerán impresos en las actas, salvo una reseña breve, pero sí serán presentados en las sesiones. El ranking SCIE-2018 de congresos para los trabajos ya publicados está disponible en http://gii-grin-scie-rating.scie.es/ . Se ha de presentar un resumen en formato LNCS, dónde se indique el título, los autores, una breve reseña de la contribución y de la calidad de la publicación, las palabras clave, el nombre de la revista o congreso, el año y el enlace DOI.

Todas las contribuciones podrán estar escritas en castellano, portugués o inglés.

FECHAS IMPORTANTES

- Envío de contribuciones: 2 de mayo de 2021
- Notificación a los autores: 6 de junio de 2021
- Envío de versiones definitivas: 20 de junio de 2021
- Registro temprano: 30 de junio de 2021
- Jornadas: 22-24 de septiembre de 2021

ENVÍO DE CONTRIBUCIONES

Los autores podrán enviar sus contribuciones a través del sistema EasyChair (https://easychair.org/conferences/?conf=jisbd2021), eligiendo el track principal al cual se envían y, opcionalmente, uno alternativo adicional dentro del

SELECCIÓN Y PUBLICACIÓN DE CONTRIBUCIONES

Cada track tiene su propio comité de revisores para la selección de artículos. Los coordinadores de un track pueden estimar que una contribución no encaja en dicho track. En ese caso, la presidenta del comité de programa podrá decidir su reenvío a un track alternativo.

Las actas de JISBD 2021 se publicarán en formato digital y estarán alojadas en la Biblioteca Digital de SISTEDES (http://biblioteca.sistedes.es/).

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El firmante, D. Antonio Vallecillo Moreno con NIF 25.047.092 T, catedrático del área de Lenguajes y Sistemas Informáticos de la Universidad de Málaga, en calidad de Vicepresidente de la Sociedad Científica Informática de España (SCIE, http://scie.es) y como Presidente del Comité Organizador del VI Congreso Español de Informática (CEDI 20/21, https://congresocedi.es) que se celebrará del 22 al 24 de Septiembre de 2021 en las instalaciones de la ETSI Informática de la Universidad de Málaga,

HACE CONSTAR QUE

D.ª Lola Burgueño Caballero, con NIF 25.346.121 Y, forma parte del equipo de organización del **VI Congreso Español de Informática (CEDI 20/21)**, encargándose de forma activa de todos los temas comunicación. El congreso CEDI es un evento que se celebra cada cuatro años y que reúne a 18 congresos de 11 sociedades científicas españolas relacionadas con la informática, y a donde se estima que asistan unas 1000 personas.

Y para que así conste y surta los efectos oportunos, firma la presente en Málaga a 20 de marzo de 2021.

A. Vallecillo

Antonio Vallecillo Moreno.
Dept. Lenguajes y Ciencias de la Computación
Universidad de Málaga

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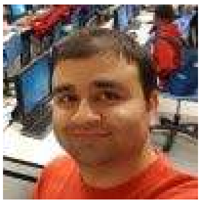

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(https://conf.researchr.org/profile/models-2021/haiyanzhao)

Eugene Syriani Panel Chairs
Université de Montréal
Canada

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Houari Sahraoui Panel Chairs
Université de Montréal
Canada

(https://conf.researchr.org/profile/models-2021/houarisahraoui)

Catherine Dubois Educators Symposium Chairs
ENSIIE Paris-Evry

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Steffen Zschaler Educators Symposium Chairs
King's College London
United Kingdom

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Tao Yue Doctorial Symposium Chairs
Nanjing University of Aeronautics and Astronautics
China

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Paolo Arcaini Doctorial Symposium Chairs
National Institute of Informatics
Japan

(https://conf.researchr.org/profile/models-2021/paoloarcaini)

Masimo Tsi Artifact Evaluation Chairs
Institut Mines-Telecom Atlantique

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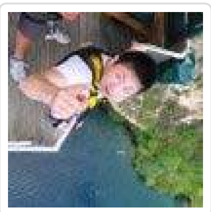
Waseda University
Japan

(https://conf.researchr.org/profile/models-2021/hironoriwashizaki)

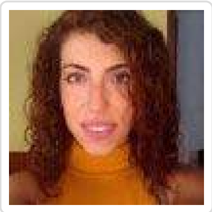
Shintaro Hosoai Industry/Exhibition Chairs
Change Vision, Inc.

(https://conf.researchr.org/profile/models-2021/shintarohosoai)



Lei Ma Student Volunteers Chairs
Kyushu University

(https://conf.researchr.org/profile/models-2021/leima)



Loli Burgueño Student Volunteers Chairs
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Spain

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Christos Tsigkanos ACM Student Research Competition Chairs
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(https://conf.researchr.org/profile/models-2021/christostsigkanos)

Seung Yeob Shin Proceedings Chairs
University of Luxembourg

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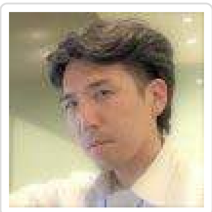

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- Reiko Heckel, *University of Leicester, UK*
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- Antonio Vallecillo, *University of Malaga, Spain*
- Pieter Van Gorp, *Eindhoven University of Technology, The Netherlands*
- Jan Vitek, *Northeastern University, USA*

Contact us

Contact us at staf2022<at>univ-nantes<dot>fr.

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(https://conf.researchr.org/profile/models-2022/eugenesyriani)

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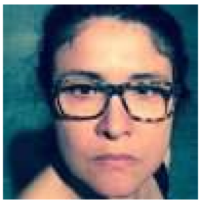
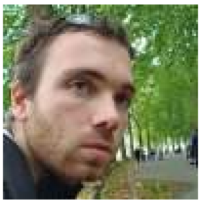
Manuel Wimmer PC Chair Foundations Track
JKU Linz
Austria

(https://conf.researchr.org/profile/models-2022/manuelwimmer)



Nelly Bencomo PC Chair Practice and Innovation Track
Durham University
United Kingdom

(https://conf.researchr.org/profile/models-2022/nellybencomo)



Sébastien Mosser Conference Chair
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(https://conf.researchr.org/profile/models-2022/sebastianmosser)

Istvan David Workshops Co-Chair
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Jesús Sánchez Cuadrado Workshops Co-Chair

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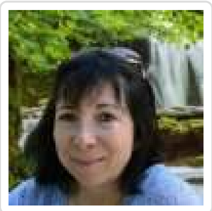

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France

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University of L'Aquila

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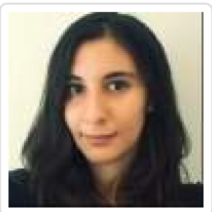
(https://conf.researchr.org/profile/models-2022/davidediruscio)



Jessie Galasso-Carbonnel Tools and Demo Co-Chair

Université de Montréal

Canada

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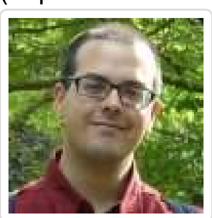

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United Kingdom

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Edouard Batot Artifact Evaluation Co-Chair

Universitat Oberta de Catalunya

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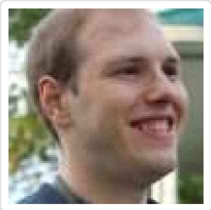

Bentley James Oakes Posters Chair
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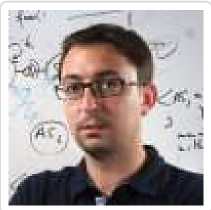

Benoit Combemale Journal-first Papers Chair
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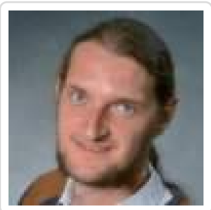

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Canada

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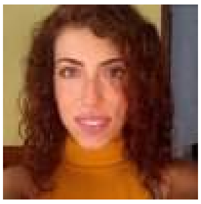

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Spain

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Fondazione Bruno Kessler, Trento, Italy
Italy

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Sudipto Ghosh Regional publicity chair (North America)

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Toacy Oliveira Regional Publicity Chair (Latin America)
Federal University of Rio de Janeiro
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Xiao He Regional publicity chair (Asia)
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Eric Umuhoza Regional publicity chair (Africa)
Carnegie Mellon University-Africa
Rwanda

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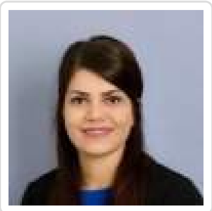
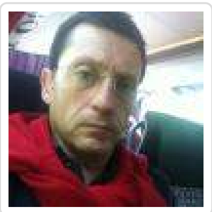


Hourieh Khalajzadeh Regional publicity chair (Oceania)
Monash University, Australia

(https://conf.researchr.org/profile/models-2022/houriehkhalajzadeh)



Alfonso Pierantonio Panel Co-Chair

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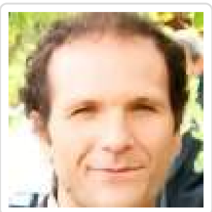

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Richard Paige Social Media Chair
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Manouchehr Zadahmad Web Co-Chair
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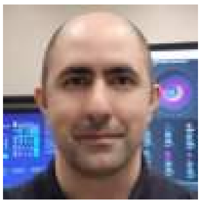

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MohammadAmin Zaheri Web Co-Chair

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SLE (Software Language Engineering) 2022

The ACM SIGPLAN International Conference on Software Language Engineering (SLE) is devoted to the principles of software languages: their design, their implementation, and their evolution.

With the ubiquity of computers, software has become the dominating intellectual asset of our time. In turn, this software depends on software languages, namely the languages it is written in, the languages used to describe its environment, and the languages driving its development process. Given that everything depends on software and that software depends on software languages, it seems fair to say that for many years to come, everything will depend on software languages.

Software language engineering (SLE) is the discipline of engineering languages and their tools required for the creation of software. It abstracts from the differences between programming languages, modelling languages, and other software languages, and emphasizes the engineering facet of the creation of such languages, that is, the establishment of the scientific methods and practices that enable the best results. While SLE is certainly driven by its metacircular character (software languages are engineered using software languages), SLE is not self-satisfying: its scope extends to the engineering of languages for all and everything.

Like its predecessors, the 15th edition of the SLE conference, SLE 2022, will bring together researchers from different areas united by their common interest in the creation, capture, and tooling of software languages. It overlaps with traditional conferences on the design and implementation of programming languages, model-driven engineering, and compiler construction, and emphasizes the fusion of their communities. To foster the latter, SLE traditionally fills a two-day program with a single track, with the only temporal overlap occurring between co-located events.

SLE 2022 will be co-located with SPLASH (https://2022.splashcon.org), GPCE (https://conf.researchr.org/home/gpce-2022) will be hosted in Auckland, New Zealand.

- Community website: http://www.sleconf.org/2022 (http://www.sleconf.org/2022)
- Conference website: https://conf.researchr.org/home/sle-2022 (https://conf.researchr.org/home/sle-2022)

Important Dates	AoE (UTC-12h)
Wed 6 Apr 2022 1st round: Abstract submissions	
Wed 13 Apr 2022 1st round: Paper submissions	
Fri 13 May 2022 1st round: Notification	

Fri 8 Jul 2022
2nd round: Abstract submissions (tentative)

Fri 15 Jul 2022
2nd round: Paper submissions (tentative)

Wed 7 Sep 2022
2nd round: Review notification (tentative)

Mon 12 Sep 2022
2nd round: Author response period (tentative)

Mon 19 Sep 2022
2nd round: Notification (tentative)

Mon 26 Sep 2022
Artifact submissions (tentative)

Mon 10 Oct 2022
Artifact kick-the-tires Author response (tentative)

Mon 24 Oct 2022
Artifact notification (tentative)

Fri 4 Nov 2022
Camera-ready (for both rounds) (tentative)

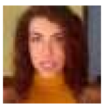
Mon 5 - Sat 10 Dec 2022
Conference (TENTATIVE)

Submission Link

https://sle22.hotcrp.com (https://sle22.hotcrp.com)

Organising Committee (https://2022.splashcon.org/committee/sle-2022-organising-committee)

Bernd Fischer
Stellenbosch University, South Africa
South Africa
(https://2022.splashcon.org/profile/berndfischer)
General Chair



Lola Burgueño
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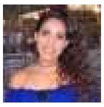
Spain
(https://2022.splashcon.org/profile/loliburgueno)
PC Chair


Walter Cazzola
Università degli Studi di Milano
Italy
(https://2022.splashcon.org/profile/waltercazzola)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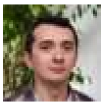
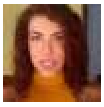
Thomas Kühn
Karlsruhe Institute of Technology
Germany
Artifact Evaluation Co-Chair
(https://2022.splashcon.org/profile/thomaskuhn)

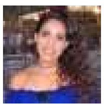

Andrei Chiş
feenk, Switzerland
Publicity Chair
(https://2022.splashcon.org/profile/andreichis)

Program Committee (https://2022.splashcon.org/committee/sle-2022-program-committee)


Lola Burgueño
Open University of Catalonia
Spain
Program Co-Chair
(https://2022.splashcon.org/profile/loliburgueno)

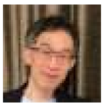

Walter Cazzola
Università degli Studi di Milano
Italy
Program Co-Chair
(https://2022.splashcon.org/profile/waltercazzola)


Shaukat Ali
Simula Research Laboratory, Norway
Norway
(https://2022.splashcon.org/profile/shaukatali)


Juliana Alves Pereira
PUC-Rio
Brazil
(https://2022.splashcon.org/profile/julianaalvespereira)


Arvid Butting
Software Engineering, RWTH Aachen University
Germany
(https://2022.splashcon.org/profile/arvidbutting)

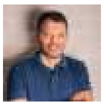

Marsha Chechik
University of Toronto
(https://2022.splashcon.org/profile/marshachechik)


Shigeru Chiba
The University of Tokyo
Japan
(https://2022.splashcon.org/profile/shigeruchiba)


Benoit Combemale
University of Rennes; Inria; IRISA
France
(https://2022.splashcon.org/profile/benoitcombemale)


Zhenjiang Hu
Peking University
China
(https://2022.splashcon.org/profile/zhenjianghu)


Jörg Kienzle
McGill University, Canada
Canada
(https://2022.splashcon.org/profile/jorgkienzle)


Dimitris Kolovos
University of York
United Kingdom
(https://2022.splashcon.org/profile/dimitriskolovos)


Thomas Kühn
Karlsruhe Institute of Technology
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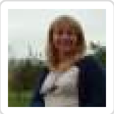
Stefan Marr
University of Kent
United Kingdom
(https://2022.splashcon.org/profile/stefanmarr)


Marjan Mernik
University of Maribor
Slovenia
(https://2022.splashcon.org/profile/marjanmernik)

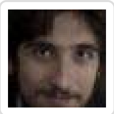

Natsuko Noda
Shibaura Institute of Technology

(https://2022.splashcon.org/profile/natsukonoda)



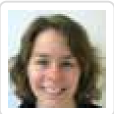
Elizabeth Scott
Royal Holloway University of London

(https://2022.splashcon.org/profile/elizabethscott)



Marco Servetto
Victoria University Wellington, New Zealand

(https://2022.splashcon.org/profile/marcoservetto)



Emma Söderberg
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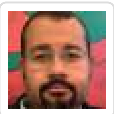
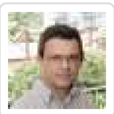


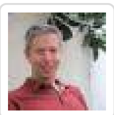
Walid Taha

(https://2022.splashcon.org/profile/walidtaha)



Marco Tulio Valente
Federal University of Minas Gerais, Brazil

(https://2022.splashcon.org/profile/marcotuliovalente)

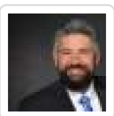


Eric Van Wyk
University of Minnesota, USA
United States

(https://2022.splashcon.org/profile/ericvanwyk)

Ran Wei
Dalian University of Technology
China

(https://2022.splashcon.org/profile/ranwei1)



Andreas Wortmann
RWTH Aachen University

(https://2022.splashcon.org/profile/andreaswortmann)

Vadim Zaytsev
University of Twente, Netherlands
Netherlands

(https://2022.splashcon.org/profile/vadimzaytsev)

Steffen Zschaler

King's College London

United Kingdom

(https://2022.splashcon.org/profile/steffenzschaler)

Juan de Lara

Autonomous University of Madrid

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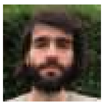

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TIPO DE PARTICIPACIÓN: Ponencia Lola Burgueño ha publicado los siguientes artículos de congreso. La candidata presentó a la audiencia los artículos marcados con (*).

- Congresos relevantes
  - MODELS'13 (*)
  - MODELS'15 (recibió el premio al mejor artículo)
  - RE'15
  - ICSOC'2017
  - MODELS'18 (1)
  - MODELS'18 (2) (recibió el premio al mejor artículo) (*)
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Ana Moreira Bernhard Schätz Jeff Gray
Antonio Vallecillo Peter Clarke (Eds.)

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Preface

Welcome to the proceedings of the ACM/IEEE 16th International Conference on Model Driven Engineering Languages and Systems (MODELS 2013). This year's MODELS edition took place in the "Magic City" of Miami, a renowned region for education and research. As the MODELS community celebrated its 16^{th} birthday, this major hub for culture, entertainment, arts, and fashion offered a unique stage for hosting the international diversity of participants who attended MODELS.

Since its beginnings, the use of models has always been a core principle in computer science. Recently, model-based engineering has gained rapid popularity across various engineering disciplines. The pervasive use of models as the core artifacts of the development process, and model-driven development of complex systems, has been strengthened by a focus on executable models and automatic transformations supporting the generation of more refined models and implementations. Software models have become industrially accepted best practices in many application areas. Domains like automotive systems and avionics, interactive systems, business engineering, games, and Web-based applications commonly apply a tool-supported, model-based, or model-driven approach toward software development. The potential for early validation and verification, coupled with the generation of production code, has been shown to cover a large percentage of implemented functionality with improved productivity and reliability.

This increased success of using models in software and systems engineering also opens up new challenges, requiring collaborative research across multiple disciplines, ranging from offering suitable domain-specific modeling concepts to supporting legacy needs through models. The MODELS conference is devoted to model-based development for software and systems engineering, covering all types of modeling languages, methods, tools, and their applications. MODELS 2013 offered an opportunity for researchers, practitioners, educators, and students to come together, to reflect on and discuss our progress as a community, and to identify the important challenges still to be overcome.

The MODELS community was challenged to demonstrate the maturity and effectiveness of model-based and model-driven engineering, and to explore their limits by investigating new application areas and combinations with other emerging technologies. This challenge resulted in papers submitted to the MODELS 2013 Foundations and Applications Tracks.

The program of MODELS 2013 had a strong mix of research and application papers that demonstrate the advances in this thriving field, anchored by three keynote sessions. Our first keynote speaker was Charles Simonyi from Intentional Software, who talked about "The Magic of Software." Charles is a well-known high-tech pioneer, philanthropist, and space traveler. He was the chief architect of Microsoft Word, Excel and other widely-used application programs. He left Microsoft to found Intentional Software, which aims to develop and market computer software for knowledge processing. His passion for science and for space has led him to travel into space twice aboard the Soyuz spacecraft, becoming the fifth space tourist and the first ever to fly twice. Despite this, we found that his opinions are practical and down to earth!

Our second keynote speaker was Constance Heitmeyer, who leads the Software Engineering Section of the Naval Research Laboratory's (NRL.s) Center for High Assurance Computer Systems. She talked about "Model-Based Development of Software Systems: A Panacea or Academic Poppycock?" Her talk was an interesting view of software modeling from the perspective of transitioning research results to software practice. Among other things, she is the chief designer of NRL's SCR (Software Cost Reduction) toolset, a set of tools for modeling, validating, and verifying complex software systems, which has been transferred to over 200 industry, government, and university groups.

We were also honored with a keynote presentation by Professor Bernd Brügge, a renowned expert and well-known speaker from the Technische Universität München and Carnegie Mellon University. He discussed a challenging topic in his talk "Creativity vs. Rigor: Informal Modeling Is OK," showing how it is possible to include informal modeling techniques in project courses with real customers involving a large number of students at the sophomore and even freshmen level, without compromising the ideas of model-driven software development.

The Foundations Track papers provide significant contributions to the core software modeling body of knowledge in the form of new ideas and results that advance the state of the art. Two categories of Foundations Track papers are included in these proceedings: *Technical Papers*, describing original scientifically rigorous solutions to challenging model-driven development problems, and *Exploratory Papers*, describing new, non-conventional modeling research positions or approaches that challenge the status quo and describe solutions that are based on new ways of looking at software modeling problems.

The Applications Track papers demonstrate the relevance and effectiveness of the model-based paradigm of engineering. They include two categories of papers: *Application Papers*, providing a realistic and verifiable picture of the current state of the practice in model-based engineering and explore the problems encountered by the industrial adoption of model-based techniques, and *Empirical Evaluation Papers*, evaluating existing problem cases or scientifically validated proposed solutions through empirical studies, experiments, case studies, or simulations.

Following the successful format initiated in 2012, we used a Foundations Program Committee and an Applications Program Committee to evaluate all the papers. A separate Program Board (PB) also convened to help ensure that all reviews received by the authors provided constructive feedback, and to check that the selection process was as rigorous and fair as possible. In the 2013 review process each paper was reviewed by at least three members of the Program Committees; the reviews were monitored by a PB member assigned to the paper.

Each paper was extensively discussed at the online Program Committee (PC) meeting, giving due consideration to author responses. A physical PB meeting was held as a satellite event of ICSE 2013, in San Francisco, during May 24–25, 2013, to finalize the selection of papers by making acceptance decisions on those papers for which online PC discussions did not converge on a clear decision.

For MODELS 2013, we received a total of 180 full papers from the 236 abstracts submitted. From these, 130 papers were submitted to the Foundations Track and 50 to the Applications Track. Out of the 130 papers, the PC and PB accepted 30 papers and invited four for resubmission. Of the 50 Applications Track papers, 12 were accepted and one was invited to be improved and resubmitted. All five papers invited for resubmission were accepted after a second round of evaluations. This results in a total number of 47 papers accepted, with a 26% acceptance rate.

The PC chairs also conducted an author survey to obtain feedback on the quality of reviews. We received 112 responses from authors of Foundations Track papers and 44 responses from Applications Track authors. Authors were asked to evaluate the usefulness of the reviews. Over 76% of the respondents indicated that their reviews were either useful or very useful. Feedback like this helps us determine the effectiveness of the MODELS review process and we greatly appreciate the effort of the authors who submitted completed survey forms.

In addition to the invited talks and technical sessions, MODELS 2013 featured the traditional set of satellite events which this year included 18 workshops, ten tutorials, two sessions dedicated to tool demonstrations, one panel on "Abstraction Challenges," and one evening session devoted to posters of emergent ideas. The Educators and Doctoral Symposia also occurred again at MODELS 2013, providing the premier venue for both educators and doctoral students working on topics related to model-driven engineering. For the first time in its history, MODELS hosted the ACM Student Research Competition (SRC), sponsored by Microsoft Research. The ACM SRC is a forum for undergraduate and graduate students to showcase their research, exchange ideas, and improve their communication skills while competing for prizes at MODELS 2013.

Organizing MODELS 2013 involved the considerable effort of over 100 hard-working members of the Organizing Committee and the various selection committees. A list of the Organizing Committee and selection committees for the satellite events can be found on the MODELS 2013 website (http://www.modelsconference.org/). We thank them all for their expertise, time, and commitment across several years of planning and coordination.

We are particularly grateful to the Foundations PC, the Applications PC and the PB for their continued observance in maintaining the quality of the MODELS program. We also thank the additional reviewers who contributed to the MODELS 2013 review process. We extend special thanks to Gregor Engels (MODELS Steering Committee Chair) and all the other members of the Steering Committee for their support during the planning and execution of MODELS 2013. We appreciate the helpful assistance from Geri Georg, who served as the

MODELS Steering Committee Chair during the early phases of the MODELS 2013 formation.

Our special gratitude goes to the local Miami team at Florida International University, including the excellent group of student volunteers, for their hard work behind the scenes to make this conference happen. Organizing a conference represents almost two years of hard work and complete dedication.

We thank all the authors who submitted papers to MODELS, and we congratulate those authors whose papers appear in these proceedings. These papers reflect the quality of the current state of the art in software modeling research and practice.

A special word of gratitude is due to Richard van de Stadt for his CyberChair support. He went far beyond the call of duty in providing innovative responses to the many challenges presented him and was a tireless collaborator and companion on this exciting journey.

No conference would be viable without sponsors. We sincerely thank all of our generous supporters, especially our gold sponsors CEA-List and Microsoft Research, silver sponsors Intentional Software, Tata Consulting Services and Siemens, and the rest of the contributing and supporting companies and organizations including the OMG, Springer, CEUR, Greater Miami Convention and Visitors Bureau, and society sponsors IEEE, IEEE Computer Society, ACM and ACM SIGSOFT.

We are convinced that everyone had both an exciting and stimulating time in Miami, and left with new ideas and enthusiasm to broaden the MODELS community and strengthen the application of models in the engineering of software systems.

August 2013

Ana Moreira
Bernhard Schätz
Jeff Gray
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Testing M2T/T2M Transformations

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Abstract. Testing model-to-model (M2M) transformations is becoming a prominent topic in the current Model-driven Engineering landscape. Current approaches for transformation testing, however, assume having explicit model representations for the input domain and for the output domain of the transformation. This excludes other important transformation kinds, such as model-to-text (M2T) and text-to-model (T2M) transformations, from being properly tested since adequate model representations are missing either for the input domain or for the output domain. The contribution of this paper to overcome this gap is extending Tracts, a M2M transformation testing approach, for M2T/T2M transformation testing. The main mechanism we employ for reusing Tracts is to represent text within a generic metamodel. By this, we transform the M2T/T2M transformation specification problems into equivalent M2M transformation specification problems. We demonstrate the applicability of the approach by two examples and present how the approach is implemented for the Eclipse Modeling Framework (EMF). Finally, we apply the approach to evaluate code generation capabilities of several existing UML tools.

1 Introduction

Much effort has been put into the establishment of model-to-model (M2M) transformation testing techniques in the past years [1,28]. Several approaches have been developed for defining contracts for M2M transformations that act as specifications for model transformation implementations [6,13], as oracle functions to validate the output of transformations [13,15], and as drivers for generating test cases [14]. In particular, constraints for input models, output models and for the relationship between both may be specified.

Besides M2M transformations, model-to-text (M2T) and text-to-model (T2M) transformations are of major importance in Model-driven Engineering [4,8]. M2T transformations are typically used to bridge the gap between modeling languages and programming languages by defining code generations but may be employed in a generic manner to produce text from models such as documentation or textual representations of a model's content. T2M transformations are typically used for reverse engineering [5], e.g., transforming legacy applications to models in the case of model-driven software modernization. However, these kinds of transformations have not gained much attention when it comes to testing.

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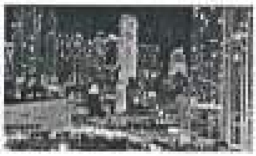

CERTIFICATE OF PARTICIPATION

This is to certify that

LOLI BURGUEÑO CABALLERO

has attended the **ACM/IEEE 16th International Conference on Model Driven Engineering Languages and Systems (MODELS 2013)**, held in Miami, Florida – USA, from 29 September 2013 through 4 October 2013.

Jeff Gray
General Chair

Antonio Vallecillo
General Chair

2015 ACM/IEEE 18th International Conference on Model Driven Engineering Languages and Systems (MODELS)

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Timothy Lethbridge, Jordi Cabot, and Alexander Egyed

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Employing Classifying Terms for Testing Model Transformations

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***Abstract*—This contribution proposes a new technique for developing test cases for UML and OCL models. The technique is based on an approach that automatically constructs object models for class models enriched by OCL constraints. By guiding the construction process through so-called classifying terms, the built test cases in form of object models are classified into equivalence classes. A classifying term can be an arbitrary OCL term on the class model that calculates for an object model a characteristic value. From each equivalence class of object models with identical characteristic values one representative is chosen. The constructed test cases behave significantly different with regard to the selected classifying term. By building few diverse object models, properties of the UML and OCL model can be explored effectively. The technique is applied for automatically constructing relevant source model test cases for model transformations between a source and target metamodel.**

I. Introduction

As the complexity of model transformations grows, there is an increasing need to count on more powerful and precise testing techniques. One essential aspect of model transformation testing (and, in general, of software testing) is the selection of effective test cases [1].

One way to achieve this is by using *Equivalence Partitioning*, a software testing technique that divides the input data of a software unit into partitions of equivalent data from which test cases can be derived [2]. The fundamental concept of this technique is based on the use of equivalence classes, and the selection of one representative element from each class. An advantage of this approach is the reduction of the total number of test cases to a finite set of testable test cases, still covering a maximum of requirements. Testing time is also significantly reduced, due to lesser number of test cases.

The key idea of this approach is that we need to test only one input model from each partition as we assume that all the models in a certain partition will be treated in the same way by the transformation. If one model belonging to a partition has certain characteristics of interest, we assume all of the models in that partition will have them too and thus will behave the same. Therefore, there is no point in testing any of these others. Similarly, if one of the models in a partition does not work, then we assume that none of the models in that partition will work. Again, there is little point in testing any more in that partition. In sum, this is because all models in a partition are *equivalent*.

The main issues are how to define the equivalence classes that define the partitions in an expressive and flexible way, and how to automatically select one representative element of each class.

To achieve this, our contribution proposes a new technique for developing test cases for UML and OCL models, based on an approach that automatically constructs object models for class models enriched by OCL constraints. By guiding the construction process through so-called classifying terms, the built test cases in form of object models are classified into equivalence classes. Classifying terms are arbitrary OCL terms on a class model that calculate a characteristic value for each object model. Each equivalence class is then defined by the set of object models with identical characteristic values and with one canonical representative object model. By inspecting these object models, a developer can explore properties of the class model and its constraints.

In this contribution we also show how classifying terms can be effectively used in combination with Tracts [3], a specification and black-box testing approach for model transformations, providing a sound and practical mechanism for the automated generation of suitable test models for Tracts.

This paper is organized in 5 sections. After this Introduction, Section II introduces classifying terms, describes how they are specified, and presents the mechanism available for automatically constructing the representative object models. Then, Section III describes how classifying terms can be used in the context of Tracts to implement model transformation testing. Section IV relates our work to other similar approaches. Finally, Section V concludes and outlines some future lines of work.

II. Classifying Terms

Classifying terms are an instrument to explore model properties. We discuss their underlying concepts and their implementation in the context of a tool, the UML-based Specification Environment (USE). The underlying ideas can be employed however in similar modeling tools. USE allows the modeler to describe a system with a UML class model (class diagram) and OCL constraints, among other description means like, for example, UML protocol state machines. USE is intended for validation and verification of UML models. One central validation task is the automatic construction of object

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Foundations

behavior of the program on those inputs and, in some cases, on the outputs. In this regard, the work in [1] proposed to pick a set of relevant properties for the input models, define ranges of values for each property and check that there is at least one instance of each property that has one value in each range. Nevertheless, this proposal is less expressive than classifying terms as they do not consider the use of OCL, less flexible and lacks full automation. In [31], a mechanism for generating test cases by analysing the OCL expressions in the source metamodel in order to partition the input model space was presented. This is a systematic approach similar to ours, but focusing on the original source model constraints. Our proposal allows the developer partitioning the source (and target) model space independently from these constraints, in a more flexible manner.

V. Conclusions

This contribution has introduced classifying terms, an instrument for exploring object models in the context of a UML class model and accompanying OCL constraints. Classifying terms allow the developer to construct relevant test cases in form of object models in a goal-oriented way. Classifying terms determine equivalence classes of test cases, selection of representatives and exploration of model properties. Their usefulness has been demonstrated by generating input test models for model transformations.

Our work can be continued in various directions. The translation to relational logic can be improved and extended, for example, by considering further collection kinds. The current user interface for classifying terms is minimal, names could be given to the terms, and these names together with the values could be indicated in the resulting object models. The restriction, that only integer and boolean terms are used, can be weakened, at least enumerations do not present any problem. It would be interesting to consider more than one equivalence class representative by distinguishing between first and second level classifying terms, where second level terms are only applied for non-empty first level equivalence classes. Larger case studies should give more feedback on the features and scalability of the approach. Last but not least, particular tool support for model transformations with different options for source and target is needed.

Acknowledgment

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Handling Non-functional Requirements in Model-Driven Development: An Ongoing Industrial Survey

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***Abstract*—Model-Driven Development (MDD) is no longer a novel development paradigm. It has become mature from a research perspective and recent studies show its adoption in industry. Still, some issues remain a challenge. Among them, we are interested in the treatment of non-functional requirements (NFRs) in MDD processes. Very few MDD approaches have been reported to deal with NFRs (and they do it in a limited way). However, it is clear that NFRs need to be considered somehow in the final product of the MDD process. To better understand how NFRs are integrated into the existing MDD approaches, we have initiated the *NFR4MDD* project, a multi-national empirical study, based on interviews with companies working on MDD projects. Our project aims at surveying the state of the practice for this topic. In this paper, we summarize our research protocol and present the current status of our study. The discussion will focus on the peculiarities of our study's context and organization involving about 20 researchers from 8 European countries.**

***Index Terms*—Non-Functional Requirements, Model-Driven Development, Quality Requirements, NFR, MDD, Empirical Study, Survey, Semi-Structured Interviews.**

I. Introduction

Model-Driven Development (MDD) is a development paradigm, where models play a central role [1], [2]. *"Model-driven development is simply the notion that we can construct a model of a system that we can then transform into the real thing"* [2]. One of the benefits of using MDD is the higher abstraction level by providing platform independence. Other related concepts are Model-Driven Architecture (MDA) [3], the OMG perspective of MDD; and Model-Driven Engineering (MDE) [4], which includes other software engineering activities in addition to development. In this paper, we will focus on MDD approaches for software production.

Non-Functional Requirements (NFRs) are one of the main research targets in the Requirements Engineering community [5] and their industrial impact has been documented in many empirical studies (e.g., [6], [7], [8], [9]). There are many definitions for the concept of NFR [5]. For example, they have been defined as: *"(...) global requirements on [the system] development or operational cost, performance, reliability, maintainability, portability, robustness, and the like."* [10]. However there is no common agreement on the concrete meaning of the term NFR [11].

Dealing with NFRs is a major challenge in software development. The lack of integration of NFRs with functional requirements can result in increased time-to-market and project cost [5], [12]. This holds also for MDD. Being supported or not by MDD approaches, practitioners have to deal with NFRs in one way or another.

Ameller et al. [13] presented at RE'10 a vision paper on the impact of NFRs in MDD processes and foresaw different ways to handle them. The authors pointed out the lack of support of NFRs in MDD (based on a literature review) and hypothesized that this situation is probably even more dramatic in the industrial practice. This topic was also subject of a keynote[1], given at the MoDRE@RE'14 workshop, where some industrial attendees and academics with industrial experience reinforced this hypothesis through their questions and opinions. Moreover, recent empirical studies that report the adoption of MDD in industry [14], [15], [16], [17] do not provide insights on how practitioners deal with NFRs.

[1]www.slideshare.net/gessiupc/mo-dre-2014-keynote

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V. Conclusion

In this paper, we have reported the planning and current status of an empirical study about the management of NFRs in MDD processes in industry. We have explained the objective and the research questions, the context, the methodology used, and the planning of the tasks remaining. We have explained the difficulties that we have encountered during the organization of this project together with our solutions. We also have discussed the threats to the validity of the survey and selected mitigation actions for these threats.

The RE Next call for papers has provided us with a great opportunity for the study. First, given the current preliminary stage, we expect to get relevant feedback from the reviewers for improving our protocol in a timely manner. Should the paper be accepted, the presentation at the conference itself would provide an excellent opportunity to share our first impressions on the ongoing analysis and raise awareness of the study. The writing of the paper itself has also represented a kind of proof of concept for the full study in terms of collaborative work. In this respect, this paper has served as a motivating instrument to activate the participation of all researchers involved. We also consider that this paper provides a valuable experience in organizing such an Europe-wide kind of study which could help other researchers organizing similar collaborative projects.

Once this study is completed, our intention is to extend it to worldwide scale. We are open for future iterations with participants from all the continents. We think that the RE conference will be a great venue to foster such participation.

Acknowledgment

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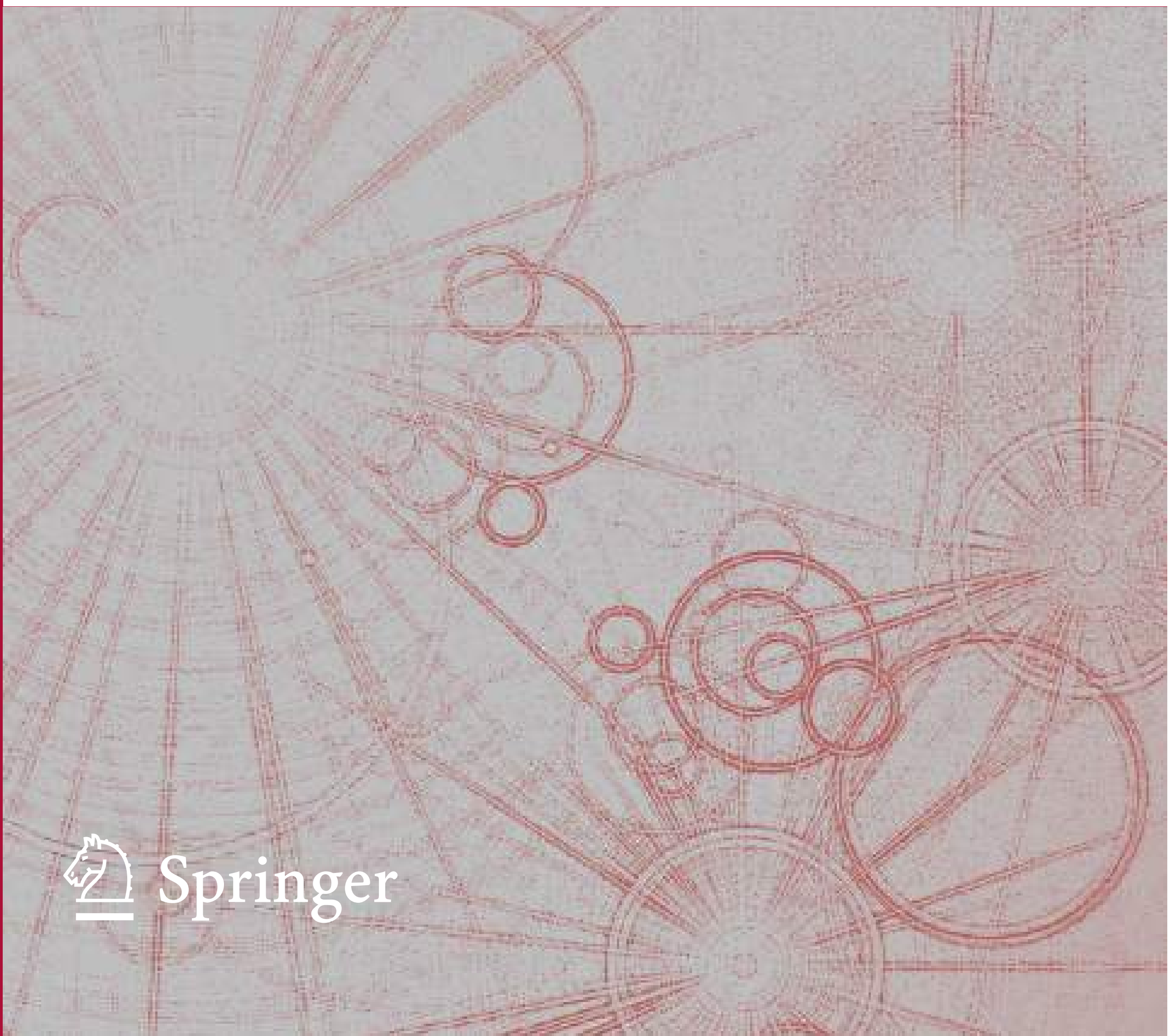

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Preface

Welcome to the Proceedings of ICSOC 2017, the 15th International Conference on Service-Oriented Computing. ICSOC is the premier international forum for academics, industry researchers, developers, and practitioners to report and share ground-breaking work on all topics related to services and service-oriented computing. ICSOC fosters cross-community scientific innovation and excellence by gathering experts from various disciplines, such as business process management, distributed systems, computer networks, wireless and mobile computing, cloud computing, cyber-physical systems, networking, scientific workflows, services science, data science, management science, and software engineering.

ICSOC 2017, the 15th event in this series, took place in Málaga, Spain, during November 13–16, 2017. Following on the ICSOC tradition, it featured three keynote presentations, a research and industry presentations track, as well as workshops, tool demonstrations, tutorials, and a PhD track.

Since its beginnings, services have become a core principle in software development. They provide perfect mechanisms for modularization, encapsulation, and for designing, analyzing, and deploying the architecture of large software systems, at the right level of abstraction, and in terms of loosely coupled, independent, and reusable parts with well-defined interfaces. Recently, services have gained rapid popularity across most software disciplines, showing all their benefits for building complex and critical applications in domains such as cloud computing, the Internet of Things (IoT), cyber-physical systems, mobile computing, and so on. This pervasive use of services has become industrially accepted best practice in all these application areas.

The increased success of using services in software and systems engineering has also raised new challenges, requiring collaborative research across multiple disciplines, groups, companies, and centers. As with previous editions, this year's call for papers generated substantial interest from the community. A total of 179 full research and industry submissions were received from 23 countries across six continents. Each paper submission was carefully reviewed by at least three members of the Program Committee (PC), followed by discussions moderated by a senior PC member who made a recommendation in the form of a meta-review. The PC consisted of 172 world-class experts in service-oriented computing and related areas (153 PC members and 19 senior PC members) from 28 different countries. The ICSOC 2017 program featured 33 full papers (acceptance rate of 18%) and 20 short papers. The selected papers cover a wide variety of important topics in the area of service-oriented computing, including foundational issues on service discovery and service-systems design, business process modelling and management, economics of service-systems engineering, as well as services on the cloud, social networks, IoT, and data analytics.

We would like to express our gratitude to all individuals, institutions, and sponsors that supported ICSOC 2017. This high-quality program would not have been possible without the expertise and dedication of our PC members and in particular our senior PC members. We are also grateful for the guidance of the General Chair, Carlos Canal, the untiring efforts of external reviewers, and the complete ICSOC Steering Committee. All of them helped make ICSOC 2017 a great success. Finally, we would like to thank all the authors who submitted papers to the conference, and we congratulate those authors whose papers appear in these proceedings. These papers reflect the quality of the current state of the art in service oriented computing research and practice. We hope that you find these papers interesting and stimulating.

August 2017

Michael Maximilien
Antonio Vallecillo
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Mining and Analytics

Quality of Service

Formally Modeling, Executing, and Testing Service-Oriented Systems with UML and OCL

Loli Burgueño[1,2(✉)] and Martin Gogolla[3]

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Abstract. One of the issues that developers of service-oriented systems currently discuss is the lack of practical, but formal modeling notations and tools that can address the many different, important aspects. This paper presents an approach to model structural and behavioral properties of service-oriented systems with UML and OCL models. Essential service-oriented concepts as service request, service provision or orchestration are formally represented by UML concepts. The models can be executed, tested and analyzed. Feedback is given to the developer in terms of the UML and OCL model.

1 Introduction

In recent years, service-oriented systems have become increasingly complex. There has been an explosion on the number of services available—either produced within the companies internal development process or provided by third parties—that are integrated into service-oriented applications. Although following the principles of the Service-Oriented Architecture (SOA), this fact of encompassing such a high number of software components makes the task of reasoning about the systems as a whole difficult. Another reality that has a strong impact on the complexity of these applications is that SOA systems are generally distributed and weakly-coupled among themselves.

As for any software to be developed, it has been proved over the years [1,3,4] that the modeling of SOA applications is an essential task. This is the reason why there exists a wide range of tools and frameworks. In our view, there is a lack of practical tools for reasoning about the compositions of the services that service developers, integrators and choreographers build. To the best of our knowledge, current "formal" models for service composition or choreography rely on formalisms such as process algebras, temporal logic or petri nets. These models are useful to analyze some properties, but not so easy to be practically applied from a development perspective. In this sense, a lightweight approach with strong formal foundations could provide easy and cheap formalization of

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21th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems

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Preface to the 19th International ACM/IEEE Conference on Model Driven Engineering Languages and Systems

Welcome to MODELS 2018, the 21st International ACM/IEEE Conference on Model Driven Engineering Languages and Systems, October 14-19, 2018 in Copenhagen, Denmark. Copenhagen is the capital of Denmark, and its most populous city. It features beautiful channels and architecture, wonderful music, and fine food. It's the perfect location to host MODELS, the premier conference series for model-based software and systems engineering. It covers all aspects of modeling, from languages and methods to tools and applications, and has done so since 1998.

Attendees of MODELS come from diverse backgrounds, including researchers, academics, engineers and industrial professionals; we have strived to put together a program, from the ground up, that reflects this. MODELS 2018 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems. This year's edition provides an opportunity for the modeling community to further advance the foundations of modeling, and come up with innovative applications of modeling in emerging areas of cyber-physical systems, embedded systems, socio-technical systems, cloud computing, big data, security, open source, and sustainability.

We put together a fascinating program for researchers, industrial practitioners, students, and educators in the field of model-driven engineering. MODELS 2018 comprises two main tracks: the Foundations track with two subcategories technical papers, new ideas/vision papers, and the Practice and Innovation track. Both tracks invited full, scholarly papers of the highest quality, and submissions were reviewed in accordance with the highest established standards of scientific rigor applied in peer review. Each paper was reviewed by at least three members of the program committee. The reviewers assessed the submissions in terms of their novelty, significance and potential impact, and were instructed to carefully consider weightings across these criteria (e.g., an extremely novel paper that may not have impact for a long time may be acceptable, as may a paper with less novelty, but substantial significance and short-term potential impact).

In 2018, the PC Chairs removed the rebuttal phase, which had been used in MODELS for a number of years. A longer discussion period was used instead. The evidence is that there was deeper discussion and more constructive reviews as a result. The review discussions were overseen by members of a program board, and decisions were finalized in a virtual meeting on 3--4 July 2018. Out of 101 papers submitted to the Foundations Track, the PC and PB accepted 29 (acceptance rate 29%). Out of 38 papers submitted to the PI Track, 13 were accepted (acceptance rate 34%).

The main conference also hosts 17 workshops, 12 tutorials, the educator and doctoral symposia, an Industry Day, the SAM2018 conference (Languages, Methods, and Tools for Systems Engineering), and a number of co-located industry events: xtUML Days, a Model-Based Systems Engineering meeting, an MPS Day organised by JetBrains, an event on Models, Agile and DevOps organized by HCL Technologies. The conference program includes demo sessions, and the presentation of four papers that had first been published in the predominant journal in the field, the Journal of Software Systems Modeling, or SOSYM.

We are honored to furthermore feature three distinguished keynote speakers: Noelle Eckley Selin will reflect on “Modeling air pollution: Informing policies to address a global environmental challenge”; Jim Cordy will consider the “Genetics of Computer Programs'”; and Martijn Wisse will take us into the world of modeling and robotics, in his talk “Models for motion prediction; robotic brains versus biological brains”.

MODELS 2018 would not have been possible without the significant contributions of many individuals and organisations. The MODELS Steering Committee provided invaluable assistance and guidance, whilst the Program Committee and the Program Board undertook with dedication the critical tasks of reviewing and discussing the submissions. We are also grateful to members of the Organising Committee for making the necessary arrangements and helping to publicize the conference and prepare the proceedings. We thank the authors for their efforts in writing and revising their papers in accordance with feedback from the reviewers. We would also like to thank our numerous sponsors: the Gold sponsors JetBrains, MPS, the Eclipse Foundation, and the Papyrus Industry Consortium; the Silver sponsor HCL. In addition there are our sustainable sponsors, the ACM, ACM Sigsoft, the IEEE, the IEEE Computer Society, our supporting publisher Springer, and our institutional patron, the IT University of Copenhagen.

Enjoy the conference!

Richard Paige, Øystein Haugen and Andrzej Wasowski

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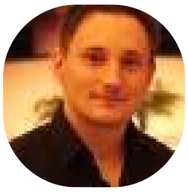

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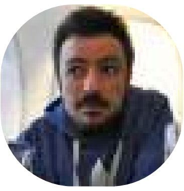

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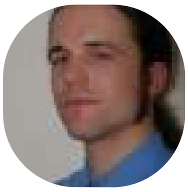

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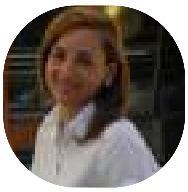

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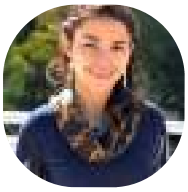

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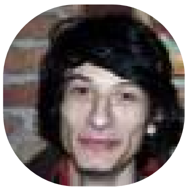

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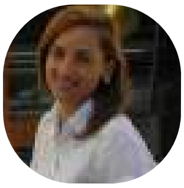

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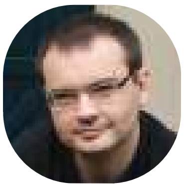

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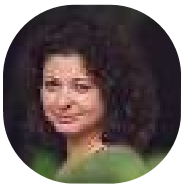

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MODELS'18

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Extending Complex Event Processing to Graph-structured Information

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ABSTRACT

Complex Event Processing (CEP) is a powerful technology in real-time distributed environments for analyzing fast and distributed streams of data, and deriving conclusions from them. CEP permits defining complex events based on the events produced by the incoming sources in order to identify complex meaningful circumstances and to respond to them as quickly as possible. However, in many situations the information that needs to be analyzed is not structured as a mere sequence of events, but as graphs of interconnected data that evolve over time. This paper proposes an extension of CEP systems that permits dealing with graph-structured information. Two case studies are used to validate the proposal and to compare its performance with traditional CEP systems. We discuss the benefits and limitations of the CEP extensions presented.

CCS CONCEPTS

• **Software and its engineering** → *Model-driven software engineering*; *Software performance*; • **Computer systems organization** → *Real-time systems*; • **Information systems** → *Query languages*; *Graph-based database models*;

KEYWORDS

Complex Event Processing, Data Streams, Graph-structured Information, Vicinity Graphs

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1 INTRODUCTION

Stream processing systems are becoming widespread due to the steadily growing number of information sources that continuously produce and offer data. Among them, Complex Event Processing (CEP) is currently a mature technology for analyzing and correlating streams of information about real-time events that happen in a system, and deriving conclusions from them [7, 15, 24, 25]. A distinguishing feature of CEP, not present in many stream processing systems, is that it permits defining complex events or patterns on top of the primitive events in order to identify elaborate meaningful circumstances and to respond to them as quickly as possible. Such event types and event patterns are defined using Event Processing Languages (EPLs).

In many applications, however, the information that needs to be analyzed is not structured as a mere sequence of partially ordered timed events, but as graphs of highly interconnected datasets that evolve over time—e.g., contagious disease spreading data or social media networks. In these systems, not only the type of event and the moment in time at which it occurs are relevant, but also its connections with other surrounding objects, the state of these objects, and the current network topology.

This paper proposes an extension of CEP systems that permits dealing with graph-structured information, in addition to their timed-events stream processing capabilities, and its implementation using graph technologies based on cluster computing platforms. Two case studies are used to illustrate the proposal, and to discuss the benefits and limitations of this kind of extension of CEP systems.

Our solution makes use of the fact that the structure of a CEP event stream can be generalized from a sequence of time-ordered elements to a model (i.e., a graph of interrelated elements). Besides, the behavior of a CEP system can be naturally considered as a special case of in-place model transformation (MT) [12, 13], and therefore most of the MT machinery can be reused. To tackle the stringent requirements of CEP systems regarding their scalability and performance, we propose the use of the recent graph-parallel computation technologies (such as the GraphX component of Spark [19]), which provide the required supporting storage and access infrastructure.

One of our major contributions is the generalization of the concept of CEP *windows* to the more general concept of graph *vicinity*. CEP makes use of windows in order to restrict the matching space transformations on large models stored in graph databases. As mentioned above, we tried with Neo4j and also with Gremlim, but the results were not good enough when compared to CEP systems.

7 CONCLUSIONS AND FUTURE WORK

This work has explored the extension of CEP concepts and mechanisms applied to real models that contain graph-structured information, beyond sequential streams of events. The concept of *vicinity* has been introduced, and a prototypical solution has been developed to validate the proposal and to analyze its advantages and limitations.

The proposal has just set the basis and initial ideas for this line of work, and opens the path for different research alternatives. In particular, we are interested in investigating what kinds of changes in the graph structure, patterns and in the architecture of our prototypical implementation would serve to optimize the response time of our current solution. Furthermore, a possible next step for improving the response time could be implementing Spark Streaming in our system, and combining it with Graphx and Spark SQL to optimize the patterns.

We are also planning to develop a mapping from Cypher to GraphX, so that patterns could be expressed in Cypher, which is much more compact, easy to use, and specific to this type of queries, and then translated into the more efficient GraphX queries. Another possibility worth taking into consideration is the development of our own domain-specific language (DSL) close to the domain expert knowledge, with the appropriate mechanisms to express queries in a more natural and lightweight way. This DSL would also have the corresponding mapping to GraphX, so that the queries expressed can be executed.

Regarding the concept of vicinity, we are planning to extend model transformation languages, and in particular ATL, with the concept of local context of a query (i.e., vicinity), and then generate the queries, in a similar way to what [9] do. Moreover, we would like to study how different strategies (in the style of [14, 22]) could be defined to improve the accuracy of the results, and how to measure the error (or lack of accuracy) we are incurring in by selecting a given spatial window when specifying rules that contain NACs, or when restricting the queries to small windows.

Finally, many more experiments and case studies are needed to better assess the expressiveness and performance of our proposal, and to improve its current results. Although our initial results are currently encouraging, there is room for improvement in several aspects, as we have discussed in this paper.

Acknowledgments. This work was partially funded by the European Commission (FEDER), Spanish Research Projects TIN2014-52034-R and TIN2015-70560-R, and the Andalusian Government Project COPAS (P12-TIC-1867).

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Preface to the 19th International ACM/IEEE Conference on Model Driven Engineering Languages and Systems

Welcome to MODELS 2018, the 21st International ACM/IEEE Conference on Model Driven Engineering Languages and Systems, October 14-19, 2018 in Copenhagen, Denmark. Copenhagen is the capital of Denmark, and its most populous city. It features beautiful channels and architecture, wonderful music, and fine food. It's the perfect location to host MODELS, the premier conference series for model-based software and systems engineering. It covers all aspects of modeling, from languages and methods to tools and applications, and has done so since 1998.

Attendees of MODELS come from diverse backgrounds, including researchers, academics, engineers and industrial professionals; we have strived to put together a program, from the ground up, that reflects this. MODELS 2018 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems. This year's edition provides an opportunity for the modeling community to further advance the foundations of modeling, and come up with innovative applications of modeling in emerging areas of cyber-physical systems, embedded systems, socio-technical systems, cloud computing, big data, security, open source, and sustainability.

We put together a fascinating program for researchers, industrial practitioners, students, and educators in the field of model-driven engineering. MODELS 2018 comprises two main tracks: the Foundations track with two subcategories technical papers, new ideas/vision papers, and the Practice and Innovation track. Both tracks invited full, scholarly papers of the highest quality, and submissions were reviewed in accordance with the highest established standards of scientific rigor applied in peer review. Each paper was reviewed by at least three members of the program committee. The reviewers assessed the submissions in terms of their novelty, significance and potential impact, and were instructed to carefully consider weightings across these criteria (e.g., an extremely novel paper that may not have impact for a long time may be acceptable, as may a paper with less novelty, but substantial significance and short-term potential impact).

In 2018, the PC Chairs removed the rebuttal phase, which had been used in MODELS for a number of years. A longer discussion period was used instead. The evidence is that there was deeper discussion and more constructive reviews as a result. The review discussions were overseen by members of a program board, and decisions were finalized in a virtual meeting on 3--4 July 2018. Out of 101 papers submitted to the Foundations Track, the PC and PB accepted 29 (acceptance rate 29%). Out of 38 papers submitted to the PI Track, 13 were accepted (acceptance rate 34%).

The main conference also hosts 17 workshops, 12 tutorials, the educator and doctoral symposia, an Industry Day, the SAM2018 conference (Languages, Methods, and Tools for Systems Engineering), and a number of co-located industry events: xtUML Days, a Model-Based Systems Engineering meeting, an MPS Day organised by JetBrains, an event on Models, Agile and DevOps organized by HCL Technologies. The conference program includes demo sessions, and the presentation of four papers that had first been published in the predominant journal in the field, the Journal of Software Systems Modeling, or SOSYM.

We are honored to furthermore feature three distinguished keynote speakers: Noelle Eckley Selin will reflect on “Modeling air pollution: Informing policies to address a global environmental challenge”; Jim Cordy will consider the “Genetics of Computer Programs'”; and Martijn Wisse will take us into the world of modeling and robotics, in his talk “Models for motion prediction; robotic brains versus biological brains”.

MODELS 2018 would not have been possible without the significant contributions of many individuals and organisations. The MODELS Steering Committee provided invaluable assistance and guidance, whilst the Program Committee and the Program Board undertook with dedication the critical tasks of reviewing and discussing the submissions. We are also grateful to members of the Organising Committee for making the necessary arrangements and helping to publicize the conference and prepare the proceedings. We thank the authors for their efforts in writing and revising their papers in accordance with feedback from the reviewers. We would also like to thank our numerous sponsors: the Gold sponsors JetBrains, MPS, the Eclipse Foundation, and the Papyrus Industry Consortium; the Silver sponsor HCL. In addition there are our sustainable sponsors, the ACM, ACM Sigsoft, the IEEE, the IEEE Computer Society, our supporting publisher Springer, and our institutional patron, the IT University of Copenhagen.

Enjoy the conference!

Richard Paige, Øystein Haugen and Andrzej Wasowski

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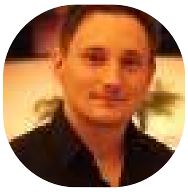
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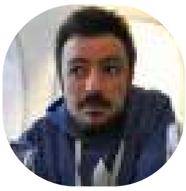
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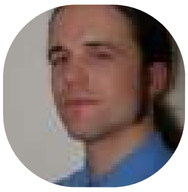

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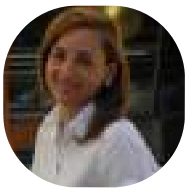

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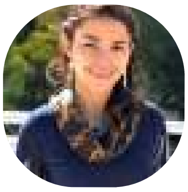

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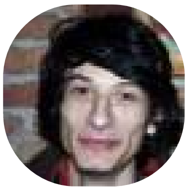

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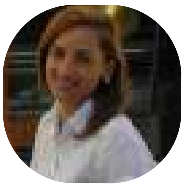

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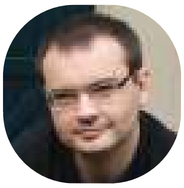

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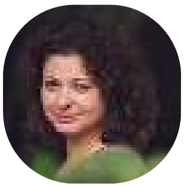

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MODELS'18

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Expressing Confidence in Models and in Model Transformation Elements

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ABSTRACT

The expression and management of uncertainty, both in the information and in the operations that manipulate it, is a critical issue in those systems that work with physical environments. Measurement uncertainty can be due to several factors, such as unreliable data sources, tolerance in the measurements, or the inability to determine if a certain event has actually happened or not. In particular, this contribution focuses on the expression of one kind of uncertainty, namely the *confidence* on the model elements, i.e., the degree of belief that we have on their occurrence, and on how such an uncertainty can be managed and propagated through model transformations, whose rules can also be subject to uncertainty.

CCS CONCEPTS

• Information systems → Uncertainty; **• Software and its engineering → Model-driven software engineering**; **Domain specific languages**; *Software design engineering*;

KEYWORDS

Uncertainty; confidence; models; model transformations.

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1 INTRODUCTION

Measurement uncertainty is an intrinsic property of any physical system. This uncertainty can be due to different causes, such as unreliable data sources and communication networks, tolerance in the measurement of the physical elements values, estimates due to the lack of accurate knowledge about certain parameters, or the inability to determine whether a particular event has actually happened or not. The explicit representation and proper management of measurement uncertainty is a crucial issue in any faithful model of a given physical system. This includes not only the (static) representation of the uncertainty, but also how it evolves and is propagated through the system operations.

In this paper, we focus on the treatment of a special kind of uncertainty, *confidence*, which refers to the quality of being certain about something, e.g., up to what extent something is true or will happen. In our context, we will assign confidence to model elements and to model transformation rules.

The former kind of confidence refers to the degree of belief that we have on the actual existence of an entity, i.e., the real entity that the model element represents. A very typical example occurs in systems whose objects represent events from the physical environment, such as those produced by (unreliable) sensors that take measures, which can sometimes be false negatives—i.e., the event has occurred but it was lost, or the system did not record it properly. Similarly, if we consider robots or drones that move from one point to another and whose exact position always yields a margin of error of millimeters or even centimeters, the precise location of a moving artifact is also subject to uncertainty, and therefore we need to assign a level of confidence to it. Likewise, in a social network environment, the establishment of certain derived relationships between two objects (friendship, closeness, preference) may be subject to uncertainty because the person or program estimating such a derived relationship may not be fully reliable, or completely sure about his judgment—and therefore it may have some associated margin of error.

To assign confidence to model elements—both to objects and to relationships—we propose the use of attributes that permit estimating the confidence (i.e, the degree of belief) that we have on their existence, by means of probabilities associated to them.

Furthermore, model transformations (hereinafter, MT) may be subject to uncertainty, too, due to several factors. First, some transformation rules may have some associated uncertainty, when we do not have a 100% confidence on them—for example, a rule of a recommender system that generates a `wouldLike` relationship between a user and a product based on a set of preferences and a history of user actions may not be 100% accurate, and therefore we need to 'qualify' the results with this kind of information. Second, during

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to uncertainty. Moreover, the propagation of design uncertainty, due to its particular nature, is completely different from that of measurement uncertainty or of confidence in the model elements.

Other authors have also identified the need of counting on mechanisms to represent and manipulate physical values in software models [34], in particular units or real-time properties [6, 29]. Again this kind of uncertainty is different from the one treated here, although we have needed it in order to define the confidence of the model objects.

Finally, there is an active research area on probabilistic programming languages[1]. These programs are targeted to describe probabilistic models and then perform inference in those models. Our proposal here uses a simpler approach, assigning just probabilities to objects representing the belief that we have on their occurrence, which is the main focus of our work.

6 CONCLUSIONS

This contribution proposes the representation and management of the information about the *confidence* we have in the elements of the models, and how such confidence is propagated through model transformations. We have identified different types of uncertainty that can affect such confidence, and proposed a way to calculate the confidence of the elements generated by a transformation.

Our work can be continued in various directions. First, more and larger case studies should give us more feedback on the features and scalability of our approach. One particular aspect of interest is the application of our proposal to existing models and model transformations in the least intrusive way possible. In this respect, the use of high-order transformations could provide the required mechanisms to adapt existing MTs, adding confidence to their elements and rules. Finally, we are also working on the integrated support of all these mechanisms and tools within widely used model transformation languages, such as ATL.

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Preface to the 22nd International ACM/IEEE Conference on Model Driven Engineering Languages and Systems

Welcome to MODELS 2019, the 22nd International ACM/IEEE Conference on Model Driven Engineering Languages and Systems, September 15-20, 2019 in Munich, Germany.

Munich is the capital city of Bavaria. Munich strikes a strong balance between a city that’s fun to live in yet runs like a well-oiled machine. The city’s public transportation is comfortable and clean, and its airport, which offers connections to over two hundred international destinations. As a result, Munich is highly international; with eighteen universities (including LMU and TUM) attracting international students and a high percentage of foreign residents. It´s the perfect location to host MODELS, the premier conference series for model-based software and systems engineering. It covers all aspects of modeling, from languages and methods to tools and applications, and has done so since 1998.

Attendees of MODELS come from diverse backgrounds, including researchers, academics, engineers and industrial professionals; we have strived to put together a program reflecting foundational research excellence with a special emphasis on industrial relevance. MODELS is organized with support of IEEE and ACM. Since 1998, MODELS has covered all aspects of modeling, from languages and methods, to tools and applications. MODELS 2019 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems.

We put together a fascinating program for researchers, industrial practitioners, students, and educators in the field of model-driven engineering. MODELS 2019 comprises two main tracks: the Foundations track with two subcategories technical papers, new ideas/vision papers, and the Practice and Innovation track. Both tracks invited full, scholarly papers of the highest quality, and submissions were reviewed in accordance with the highest established standards of scientific rigor applied in peer review. Each paper was reviewed by at least three members of the program committee, following the double-blind review guidelines. The reviewers assessed the submissions in terms of their novelty, significance and potential impact, and were instructed to carefully consider weightings across these criteria. All review discussions were overseen by members of a program board.

Out of 89 papers submitted (incl. also 8 desk-rejected) to the Foundations Track, the PC and PB accepted 18 (acceptance rate 20%). Out of 33 papers submitted to the PI Track, 12 were accepted (acceptance rate 36%). The main conference also hosts 18 workshops, 10 tutorials, the educator and doctoral symposia, an Automotive Industry Day, an Industry Day and a number of co-located industry events: a MPS Day organized by JetBrains and an event on MAD@MODELS organized by HCL Technologies. The conference program includes demo sessions, and the presentation of seven papers that had first been published in the predominant journal in the field, the Journal of Software Systems Modeling, or SOSYM. We are honored to furthermore feature three distinguished keynote speakers: Manfred Broy will reflect on “On the Interplay between Formal Foundations, Peer Driven Research, Applied Research and Transfer in Software and Systems Engineering”; Renzo Vitale talks about “Designing Sounds and Music for Modernity” and Kristina Shea will take us into the world of “Designing with 3D and 4D Printing: Impacts on computational modeling and optimization”.

MODELS 2019 would not have been possible without the significant contributions of many individuals and organizations. The MODELS Steering Committee provided invaluable assistance and guidance, whilst the Program Committee and the Program Board undertook with dedication the critical tasks of reviewing and discussing the submissions. We are also grateful to members of the Organizing Committee for making the necessary arrangements and helping to publicize the conference and prepare the proceedings.

We thank the authors for their efforts in writing and revising their papers in accordance with feedback from the reviewers. We would also like to thank our numerous sponsors, especially our Platinum Sponsor: Vector and our Gold Sponsors Airbus, Jetbrains MPS and Continental. Furthermore, big thanks to our Silver Sponsors Sponsors: BICCnet, ZD.B, OBEO, Huawei, HCL Software and Eclipse Foundation. Supported by our Bronze Sponsors: Verified and ITPower Solutions. Furthermore, the ACM, the IEEE, the IEEE Computer Society are long time supporters. Finally, a huge thank for local arrangements and organization to our industrial patron, the fortiss research and transfer institute.

Enjoy the conference!

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2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems (MODELS)

An LSTM-Based Neural Network Architecture for Model Transformations

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***Abstract*—Model transformations are a key element in any model-driven engineering approach. But writing them is a time-consuming and error-prone activity that requires specific knowledge of the transformation language semantics.**

We propose to take advantage of the advances in Artificial Intelligence and, in particular Long Short-Term Memory Neural Networks (LSTM), to automatically infer model transformations from sets of input-output model pairs. Once the transformation mappings have been learned, the LSTM system is able to autonomously transform new input models into their corresponding output models without the need of writing any transformation-specific code. We evaluate the correctness and performance of our approach and discuss its advantages and limitations.

***Index Terms*—MDE, model transformations, LSTM ANN**

I. Introduction

AI is evolving fast thanks to the advances in hardware and the arrival of the big data era. A recent survey [1] predicts that “AI will outperform humans in many activities in the next ten years, such as translating languages, writing high-school essays, or working as a surgeon”.

AI is also starting to impact the software development processes itself.In fact, as of today, there are initiatives claiming the (prospective) applications of AI in the different phases of the software development lifecycle [2], from the requirement analysis and design to the development, testing, deployment, maintenance, etc. The main goal is always the same: help software engineers develop software easier, faster and less error-prone while being able to manage more complex problems. In this sense, the concepts of intelligent software and cognified software engineering [3], [4] have been introduced.

However, few approaches target model-driven engineering (MDE). Some exceptions are [5], to generate UML class diagrams from natural language specifications, [6] to collaboratively build domain models using chatbots, and [7] to provide a tool for classifying web images as UML static diagrams. Still, we are not aware of the existence of any solution addressing a key element of any MDE approach: model transformations.

Indeed, writing model transformations is an important but also time-consuming and error-prone process. And while there is a myriad of proposals to facilitate the definition of model transformations, we lack a solution that empowers non-expert users to autonomously transform new input models into their corresponding output models without the need of writing any transformation-specific code.

This paper proposes such a solution based on Machine Learning (ML). ML, and in particular, its supervised learning methods, enables machines to learn patterns from existing data source and make predictions about new data. Given a set of input-output data, an ML algorithms would be able to learn the mappings between the sample inputs and the outputs and, then, predict for new input data, what the output would be. The simplest example in this context is language translation. The first attempt to translate text from one language to another was to translate word by word. Afterwards, companies hired linguists to create language-specific rules and started using Statistical Machine Translation (SMT). Currently, big companies such as Google generate translations by means of Artificial Neural Networks (ANNs) [8]. We adopt a similar approach for the model transformation challenge.

In this sense, we suggest a change of paradigm in the way we approach model transformation problems and propose to rely on a ML-based framework using a particular type of ANNs, Long Short-Term Memory (LSTM) ANNs to derive transformations from sets of input/output models given as input data for the training phase.

The rest of the paper is organized as follows. Section II introduces some basic concepts. Section III describes the main components of our approach, which we evaluate in Section IV. In Section VI, we discuss the limitations of our approach. Section VII presents the related work and, finally, Section VIII concludes our paper.

II. Background in Artificial Neural Networks

An ANN can be seen as an structure composed by neurons with directed connections between them. Each neuron is a mathematical function that receives a set of values through its input connections and computes an output value that is taken by another connection and transferred to another neuron. Two specific types of neurons are the *input* and *output* neurons which do not have input predecessors or successors respectively and serve only as input and output interfaces to the ANN. Connections have associated weights (i.e., real numbers) that the neurons use and that are adjusted during the learning

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the couples of input/output models. This enables non-expert users to employ our approach.

Model transformation is just an instantiation of the more general problem of data transformation, which shows up across many fields of computer science (e.g., databases, XML, modeling, and big data). This topic has been largely addressed by the (relational) database community, especially dealing with the heterogeneity of the data sources and the impedance mismatch problems [29]–[31]. Nevertheless, ML-based approaches have not been attempted either in that community. We hope our results can be replicated in that context as well.

The programming research community has been much more active in the area of mixing ML and (code) transformation. In [13], Chen et al. use neural networks to translate code from one programming language to another. We have learn a lot from this work. Nevertheless, given that we transform models and not code, our work has adapted some of the ideas from [13] in several points such as the encoding for inputs and outputs, the need of a pre- and postprocessing steps and the parametrization of the neural networks to better fit the model transformation problem.

VIII. Conclusions and Future Work

In this paper, we have presented a ML architecture based on LSTM neural networks for automatically inferring MTs.

We plan to continue this work along a number of different directions, mainly addressing some of the challenges discussed above. In particular, we plan to focus on the performance and usability of our approach (e.g. developing heuristics to help users configure and optimize the training phase, including recommendations on the size of the datasets) and study its applicability to similar domains (like model-to-text transformations). In parallel, we hope to collaborate with the model transformation community at large to better understand the role approaches like ours can play in the transformation domain. ML will not completely replace transformation languages but could make them redundant in a variety of scenarios. Better understanding the trade-offs of each transformation strategy (ML-based, by example, pure MTLs,..) would benefit us all.

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An NLP-Based Architecture for the Autocompletion of Partial Domain Models

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Abstract. Domain models capture the key concepts and relationships of a business domain. Typically, domain models are manually defined by software designers in the initial phases of a software development cycle, based on their interactions with the client and their own domain expertise. Given the key role of domain models in the quality of the final system, it is important that they properly reflect the reality of the business.

To facilitate the definition of domain models and improve their quality, we propose to move towards a more assisted domain modeling building process where an NLP-based assistant will provide autocomplete suggestions for the partial model under construction based on the automatic analysis of the textual information available for the project (contextual knowledge) and/or its related business domain (general knowledge). The process will also take into account the feedback collected from the designer's interaction with the assistant. We have developed a proof-of-concept tool and have performed a preliminary evaluation that shows promising results.

Keywords: Domain model · Autocomplete · Modeling recommendations · Assistant · Natural language processing

1 Introduction

Domain modeling is the activity in which informal descriptions of a (business) domain are translated into a structured and unambiguous representation using a concrete (formal) notation. Domain models, also known as conceptual schemas [29], are built as part of a software development project to abstract the key concepts of the domain relevant for the project, leaving out superfluous details.

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Theory and Practice of Model Transformation

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Foreword

Software Technologies: Applications and Foundations (STAF) is a federation of leading conferences on software technologies. It provides a loose umbrella organization with a Steering Committee that ensures continuity. The STAF federated event takes place annually. The participating conferences may vary from year to year, but they all focus on foundational and practical advances in software technology. The conferences address all aspects of software technology, from object-oriented design, testing, mathematical approaches to modeling and verification, transformation, model-driven engineering, aspect-oriented techniques, and tools.

STAF 2017 took place in Marburg, Germany, during July 17–21, 2017, and hosted the four conferences ECMFA 2017, ICGT 2017, ICMT 2017, and TAP 2017, the transformation tool contest TTC 2017, six workshops, a doctoral symposium, and a projects showcase event. STAF 2017 featured four internationally renowned keynote speakers, and welcomed participants from around the world.

The STAF 2017 Organizing Committee would like to thank (a) all participants for submitting to and attending the event, (b) the Program Committees and Steering Committees of all the individual conferences and satellite events for their hard work, (c) the keynote speakers for their thoughtful, insightful, and inspiring talks, and (d) the Philipps-Universität, the city of Marburg, and all sponsors for their support. A special thanks goes to Christoph Bockisch (local chair), Barbara Dinklage, and the rest of the members of the Department of Mathematics and Computer Science of the Philipps-Universität, coping with all the foreseen and unforeseen work to prepare a memorable event.

July 2017 Gabriele Taentzer

Preface

This volume contains the papers presented at ICMT 2017: the 10th International Conference on Model Transformation held during July 17–18, 2017, in Marburg, Germany, as part of the STAF 2017 (Software Technologies: Applications and Foundations) conference series. ICMT is the premier forum for researchers and practitioners from all areas of model transformation.

Modeling is key in reducing the complexity of software systems during their development and maintenance. Model transformations elevate models from passive documentation to first-class artifacts of the development process, and play a key role in analyzing models to reveal flaws and in integrating heterogeneous data and tools.

Model transformation includes approaches such as: model-to-text transformation, e.g., to generate code or other textual artifacts from models; text-to-model transformations, e.g., to derive models from structured text such as legacy code; and model-to-model transformations, e.g., to normalize, weave, analyze, optimize, simulate, and refactor models, as well as to translate between modeling languages.

Model transformation encompasses a variety of technical spaces including modelware, grammarware, dataware, and ontoware; a variety of model representations, e.g., based on different types of graphs; and a variety of transformation paradigms including rule-based transformations, term rewriting, and model manipulation using general-purpose programming languages.

The study of model transformation includes foundations, structuring mechanisms and properties (e.g., modularity, composability, reusability, and parameterization of transformations), transformation languages, techniques, and tools. An important goal of the field is the development of high-level model transformation languages, providing transformations that are amenable to higher-order model transformations and analysis mechanisms, or tailored to specific transformation problems. The efficient execution of model queries and transformations by scalable transformation engines on top of large graph data structures is also a key challenge in different application scenarios. Novel algorithms as well as innovative (e.g., distributed) execution strategies and domain-specific optimizations are sought in this respect. Model transformations have become artifacts that need to be managed in a structured way, resulting in developing methodology and tools to deal with versioning, (co-)evolution, etc. Correctness of model transformations has to be guaranteed as well.

This year ICMT 2017 received 31 submissions. Each submission was reviewed by three Program Committee members. After an online discussion period, the Program Committee accepted ten full papers and two short papers as part of the conference program. These papers included regular research, application, and tool demonstration papers presented in the context of four sessions on model transformation languages, model transformation tools, developing model transformations, applications of model transformations, and the future of the field.

A lot of people contributed to the success of ICMT 2017. We are grateful to the Program Committee members and reviewers for the timely delivery of thorough reviews and constructive discussions under a very tight review schedule. We also thank our keynote speaker, Ramon Schiffelers, for his excellent talk on the use of model transformations in an industrial context. Last but not least, we would like to thank the authors, who constitute the heart of the model transformation community, for their enthusiasm and hard work.

The organization of STAF made for a successful conference. We thank the local organizers, and in particular the general chair, Gabriele Taentzer, and the local chair, Christoph Bockish, for their hard work; and we thank Philipps-Universität Marburg for hosting us.

July 2017

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Empowering High Tech Systems Engineering Using MDSE Ecosystems (Invited Talk)

Ramon Schiffelers

ASML, Eindhoven University of Technology

Abstract. ASML is the world's leading provider of complex lithography systems for the semiconductor industry. To keep up with the increasing performance, evolvability and predictability requirements, ASML increasingly adopts model driven engineering methods and techniques within its development processes.

Models are developed and used for different purposes in several phases of the development process. There is not a single modeling language and analysis tool to address all these use cases. Instead, so-called Multi-Disciplinary Systems Engineering (MDSE) ecosystems are developed that seamlessly integrate dedicated (modeling) languages and tools for a given domain of interest. More specific, a MDSE ecosystem is an intuitive integrated development environment that consists of domain specific languages (DSLs) formalizing the domain in which engineers can model their system at hand. It contains transformations to transform these models automatically to one or more aspect models that form the inputs for (COTS) tools for rigorous analysis of (non)-functional properties, and synthesis tools to generate (code) artifacts to be used at run-time. Here, model transformations formalize and automate the relations between the various domain and aspect models.

Several of such MDSE ecosystems have been developed and introduced in the development processes and products of ASML, each for a specific domain. This presentation discusses both the technical and organizational challenges that have been overcome to develop these MDSE ecosystems, and have them adopted in a demanding industrial environment. Furthermore, it discusses challenges that need to be addressed to enable efficient development, analysis and synthesis of next generation industrial scale MDSE ecosystems.

Contents

Testing Transformation Models Using Classifying Terms

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Abstract. Testing the correctness of the specification of a model transformation can be as hard as testing the model transformation itself. Besides, this test has to wait until at least one implementation is available. In this paper we explore the use of tracts and classifying terms to test the correctness of a model transformation specification (a transformation model) on its own, independently from any implementation. We have validated the approach using two experiments and report on the problems and achievements found concerning conceptual and tooling aspects.

1 Introduction

In general, the specification of a model transformation (as of any program) can become as complex as the program itself and thus can contain errors. Normally specifications and implementations work hand-by-hand, since they both can be considered as two complementary descriptions of the intended behavior of the system, at different levels of abstraction. Checking that the implementation conforms to the specification is one possible test for correctness of both artefacts, since they are normally developed by different people, at different times, and using different languages and approaches (e.g., declarative vs imperative). However, this process needs to wait until both the specification and the implementation are available.

Unlike other approaches, such as [2], where specifications and implementations of model transformations (MT) are tested for correctness against each other, in this paper we explore the possibility of testing the correctness of the specification of a MT on its own, independently from any possible implementation. For this we use a particular contract-based approach for MT specification [9], whereby a transformation specification is modularly given by a set of tracts, each one focusing on a particular use case of the transformation. Every tract is defined in terms of particular input and output models (those relevant to the use case) and how they should be related by the transformation. Developers are then expected to identify the transformation scenarios of interest (each one defined by one tract) and check whether the transformation behaves as expected in these scenarios.

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Foreword

Software Technologies: Applications and Foundations (STAF) is a federation of leading conferences on software technologies. It provides a loose umbrella organization with a Steering Committee that ensures continuity. The STAF federated event takes place annually. The participating conferences and workshops may vary from year to year, but they all focus on foundational and practical advances in software technology. The conferences address all aspects of software technology, from object-oriented design, testing, mathematical approaches to modeling and verification, transformation, model-driven engineering, aspect-oriented techniques, and tools. STAF was created in 2013 as a follow-up to the TOOLS conference series that played a key role in the deployment of object-oriented technologies. TOOLS was created in 1988 by Jean Bézivin and Bertrand Meyer and STAF 2018 can be considered its 30th birthday. STAF 2018 took place in Toulouse, France, during June 25–29, 2018, and hosted: five conferences, ECMFA 2018, ICGT 2018, ICMT 2018, SEFM 2018, TAP 2018, and the Transformation Tool Contest TTC 2018; eight workshops and associated events. STAF 2018 featured seven internationally renowned keynote speakers, welcomed participants from all around the world and had the pleasure to host a talk by the founders of the TOOLS conference, Jean Bézivin and Bertrand Meyer. The STAF 2018 Organizing Committee would like to thank (a) all participants for submitting to and attending the event, (b) the Program Committees and Steering Committees of all the individual conferences and satellite events for their hard work, (c) the keynote speakers for their thoughtful, insightful, and inspiring talks, and (d) the Ecole Nationale Supérieure d'Electrotechnique, Electronique, Hydraulique et Télécommunications (ENSEEIHT), the Institut National Polytechnique de Toulouse (Toulouse INP), the Institut de Recherche en Informatique de Toulouse (IRIT), the region Occitanie, and all sponsors for their support. A special thanks goes to all the members of the Software and System Reliability department of the IRIT laboratory and the members of the INP-Act SAIC, coping with all the foreseen and unforeseen work to prepare a memorable event.

June 2018

Marc Pantel
Jean-Michel Bruel

Preface

The 14th European Conference on Modelling Foundations and Applications (ECMFA 2018) was organized by the ENSEEIHT – Ecole Nationale Supérieure d'Ingénieurs en Electrotechnique, Electronique, Informatique, Hydraulique et Télécommunications — and held in Toulouse during June 26–28, 2018, as part of the Software Technologies: Applications and Foundations (STAF) federation of conferences.

ECMFA is the key European conference aiming at advancing the state of knowledge and fostering the industrial application of model-based engineering (MBE) and related methods. MBE is an approach to software engineering that sets a primary focus on leveraging high-level and suitable abstractions (models) to enable computer-based automation and advanced analyses. Its focus is on engaging the key figures of research and industry in a dialog that will result in stronger and more effective practical application of MBE, hence producing more reliable software based on state-of-the-art research results.

In this edition, the Program Committee received 45 submissions. Each submission was reviewed by at least three Program Committee members. The committee decided to accept 18 papers, 12 papers for the Foundations Track and 6 papers for the Applications Track. Papers on a wide range of MBE aspects were accepted, including topics such as (bidirectional and unidirectional) model transformations, model management, re-engineering, modelling environments, verification and validation, and domain-specific modelling with respect to business processes, automotive software, and safety-critical software.

We thank Perdita Stevens and Mélanie Bats for their inspiring keynote talks at ECMFA 2018. Furthermore, we are grateful to all the Program Committee members for providing their expertise while reviewing the submitted papers. Their helpful and constructive feedback to all authors is most appreciated. We thank the ECMFA Steering Committee in the person of Richard Paige for his priceless advice and the organization chairs, Marc Pantel and Jean-Michel Bruel, for their prompt and continuous support. Last but not least, we are grateful to all authors who submitted papers to ECMFA 2018.

June 2018

Alfonso Pierantonio
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Contents

Expressing Measurement Uncertainty in OCL/UML Datatypes

Manuel F. Bertoa[1], Nathalie Moreno[1], Gala Barquero[1], Loli Burgueño[1], Javier Troya[2], and Antonio Vallecillo[1](✉)

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Abstract. Uncertainty is an inherent property of any measure or estimation performed in any physical setting, and therefore it needs to be considered when modeling systems that manage real data. Although several modeling languages permit the representation of measurement uncertainty for describing certain system attributes, these aspects are not normally incorporated into their type systems. Thus, operating with uncertain values and propagating uncertainty are normally cumbersome processes, difficult to achieve at the model level. This paper proposes an extension of OCL and UML datatypes to incorporate data uncertainty coming from physical measurements or user estimations into the models, along with the set of operations defined for the values of these types.

1 Introduction

It has been claimed that the expressiveness of a model is at least as important as the formality of its expression [19]. This expressiveness is determined by the suitability of the language for describing the concepts of the problem domain or for implementing the design. While in software engineering there exists a variety of modeling languages tailored at addressing different problems, they may not be well suited for capturing some key aspects of the real world [3,17,27], and in particular for managing data uncertainty in a natural manner. In this respect, the emergence of Cyber-Physical Systems (CPS) [3] and the Internet of Things (IoT), as examples of systems that have to interact with the physical world, has made evident the need to faithfully represent some extra-functional properties of the modeled systems and their elements, as well as to overcome current limitations of existing modeling languages and tools.

One aspect of particular relevance is related to the *uncertainty* of the attribute values of the modeled elements, specially when dealing with certain *quality characteristics* such as precision, performance or accuracy. Data uncertainty can come from different reasons, including variability of input variables, numerical errors or approximations of some parameters, observation errors, measurement errors, or simply lack of knowledge of the true behavior of the system or its underlying physics [12]. On other occasions estimations are needed

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Toulouse, 29 June, 2018

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Preface

The International Conference on Web Engineering (ICWE) is the prime yearly international conference that focuses on different aspects of designing, building, maintaining, and using Web applications. Supported by the International Society of Web Engineering (ISWE), ICWE brings together researchers and practitioners representing various fields and disciplines of the challenges in the engineering of the Web as well as the problems in the associated technologies.

This year ICWE returned to Cáceres (Spain), where the conference started in 2001. This volume collects the full research papers, vision and short research papers, demonstrations, industry papers, tutorials, and extended abstracts for the keynotes presented at the 18th International Conference on Web Engineering (ICWE 2018). The previous editions took place in Rome, Italy (2017), Lugano, Swizerland (2016), Rotterdam, The Netherlands (2015), Toulouse, France (2014), Aalborg, Denmark (2013), Berlin, Germany (2012), Paphos, Cyprus (2011), Vienna, Austria (2010), San Sebástian, Spain (2009), Yorktown Heights, NY, USA (2008), Como, Italy (2007), Palo Alto, CA, USA (2006), Sydney, Australia (2005), Munich, Germany (2004), Oviedo, Spain (2003), Santa Fe, Argentina (2002), and Cáceres, Spain (2001).

The 18th edition of ICWE accepted contributions related to to different dimensions of Web Engineering: Web application modeling and engineering; Web infrastructures and architectures; execution models; human computation and crowdsourcing applications; Web application composition and mashups; social and Semantic Web applications; Web of Things applications; big data and data analytics; security, privacy, and identity on the Web; Web standards.

The main research track continued with the Program Committee (PC) organization firstly introduced at ICWE 2016, with a senior PC composed of well-known experts from the field in charge of monitoring the work and animating the discussions of the broader regular PC. This made it easier to run the virtual PC meeting of the full research papers track and the discussion about each paper.

The program for ICWE 2018 was versatile and multifaceted. For the full technical papers track, we selected 18 out of 57 submissions, resulting in an acceptance rate of 31%. In addition to the full technical papers, there were also several other tracks, including highly competitive short, vision, and industrial papers tracks, as well as demo tracks to stimulate discussions among the participants.

ICWE 2018 also accepted five tutorials on cutting-edge topics in the field of Web engineering, entitled: How to Cook an Agile Web-Based Model-Driven Environment in a Night; Interactive Web Lectures with ASQ; HTML5; Practical Design Science; and Engineering of Web Stream Processing Applications. Moreover, five workshops were also selected to be co-located at ICWE 2018, complementing the scientific program.

This excellent and comprehensive program would not have been possible without the help of those who contributed to the success of the event. We would like to thank all the different chairs for their hard work: Carlos Canal, Florian Daniel, Oscar Diaz, Piero Fraternali, Martin Gaedke, In-Young Ko, Qing Li, Cesare Pautasso, Juan Carlos Preciado, Gustavo Rossi, Fernando Sánchez, Kari Systä, Antero Taivalsaari, Maja Vukovic, and Marco Winckler. Our thanks also go to Antti Peuhkurinen (Varjo Technologies) and Michael Papazoglou (Tilburg University), who accepted to be our keynote speakers.

Special thanks are extended to Oscar Diaz and Martin Gaedke for their advice, support, and encouragement in their role of SC liaisons for the conference. We are grateful to our local organizers Juan Manuel Murillo and the Quercus Software Engineering Group of Extremadura University for their logistical support, and to Springer for publishing this volume. In addition, we want to thank the PC members, the additional reviewers, and the student volunteers for their effort to make ICWE 2018 a very special event, both in terms of academic ambition as well as practical arrangements.

Finally, we want to thank you, authors and the ICWE community, for taking the time and effort to participate in ICWE 2018.

April 2018

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Abstracts of the Invited Talks

Demystifying Smart Data and Smart Industrial-Strength Applications: Solving Problems and Creating Opportunities

Michael P. Papazoglou

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Abstract. Smart Data emphasize the latent value inherent in widely dispersed and unconnected data sources. The decisive criterion here is not necessarily the amount of data available, but smart content techniques that promote not only the collection and accumulation of related data, but also its context, and understanding. This requires discovering associations between the data, prioritizing results, finding useful insights, discovering patterns and trends within the data to reveal a wider picture that is more relevant to the problem in hand and react to them. Smart Industrial-Strength Applications are a new generation of software applications that combine the benefits of smart data and advanced analytics to help organisations manage their resources (including humans), data, processes and systems more efficiently.

Smart Data and Application innovations promise to bring greater speed and efficiency to industries as diverse as smart agriculture, smart cities, smart tourism, and smart health care delivery where they provide meaningful insights to decision makers and help them solve complex problems. They hold the promise of stronger economic growth, better and more job creation and rising living standards.

This talk will focus on the role, characteristics, potential of smart data and applications for diverse domains, and their enabling technologies. To illustrate the potential of smart data and applications, the talk will draw on examples that highlight the interplay of medical and technical aspects of smart healthcare applications. Smart healthcare involves deploying computing, information, service, sensor and visualisation technologies to aid in preventing disease, improving the quality of care and lowering overall cost. The talk will also examine the design and deployment requirements, particularly for point-of-care medical applications, which emerge from the interplay of the actual clinical situation and the novelty of the smart healthcare application.

Keywords: Smart data · Smart applications · Smart healthcare applications

Mixed Reality and Programmable World

Antti Peuhkurinen

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Abstract. Third computing revolution, the one after desktop computers and mobile touch screen devices, is emerging in a form of mixed reality. Mixed reality with its infinite screen and programmable world is how we might soon experience a new application paradigm. This new paradigm again reangles the development of the current technologies and will also introduce new technologies.

In this presentation we will look how current technologies can be used and what new enablers are needed for this new application paradigm.

Keywords: Internet of things · Programmable world · Mixed reality

Contents

Tutorials

Managing Uncertain Complex Events in Web of Things Applications

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Abstract. A critical issue in the Web of Things (WoT) is the need to process and analyze the interactions of Web-interconnected real-world objects. Complex Event Processing (CEP) is a powerful technology for analyzing streams of information about real-time distributed events, coming from different sources, and for extracting conclusions from them. However, in many situations these events are not free from uncertainty, due to either unreliable data sources and networks, measurement uncertainty, or to the inability to determine whether an event has actually happened or not. This short research paper discusses how CEP systems can incorporate different kinds of uncertainty, both in the events and in the rules. A case study is used to validate the proposal, and we discuss the benefits and limitations of this CEP extension.

1 Introduction

The Internet of Things (IoT) is a system of interrelated mechanical and digital devices, computing objects, and people, provided with unique identifiers and the ability to autonomously communicate and transfer data over a network. The Web of Things (WoT) aims at providing approaches, software architectural styles and programming patterns to build the IoT in an open, flexible, and scalable way.

Processing and analysing the steadily growing number of information sources that continuously produce and offer data in any complex system is one of the current challenges the WoT faces. To address this issue, *stream processing systems* are becoming widespread, specially in the IoT domain [8,9], where applications should process and react to events arriving from various kinds of sources including wireless sensor networks, RFID devices, GPS, etc.

Complex Event Processing (CEP) is a kind of stream-processing system for analyzing and correlating streams of information about real-time events that happen in a system, and deriving conclusions from them [3,7,12,13]. A distinguishing feature of CEP, not present in most stream-processing systems, is that it permits defining complex events or patterns on top of the primitive events, to identify elaborate meaningful circumstances and to respond to them as quickly

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Alberto H. F. Laender · Barbara Pernici ·
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Preface

We are proud to present the proceedings of the 38th International Conference on Conceptual Modeling (ER 2019), held in Salvador, Brazil, during November 4–7, 2019. The ER conference series is an annual premier forum featuring the latest research breakthroughs in theories, models, methods, and tools for developing, communicating, and applying conceptual models.

This year, we are very delighted to celebrate 40 years of ER and to bring the conference back to Brazil after 10 years. We have put together a strong scientific program consisting of keynote talks by four distinguished speakers, oral presentations of accepted main conference papers, a doctoral consortium, seven workshops, and four tutorials. For the keynote talks, we were extremely honored to have Veda C. Storey, the winner of Peter Chen Award 2018 and Full Professor of Computer Information Systems and Professor of Computer Science at the Georgia State University (USA), Marco A. Casanova, Professor of Computer Science at the Pontifical Catholic University of Rio de Janeiro (Brazil), Barbara Weber, Professor for Software Systems Programming and Development at the University of St. Gallen (Switzerland), and Paul D. Nielsen, Director and CEO of the Software Engineering Institute (USA), sharing their research and practice insights. The industrial keynote talk was delivered by C. Mohan, an outstanding researcher from IBM Research, an IBM fellow, and a database community leader bestowed with many awards and honors.

For the main conference, we received 142 paper submissions of which 22 were accepted as full papers and another 22 were accepted as short papers. The overall acceptance rate was about 31%. In our review process, each paper was reviewed by three PC members and one senior PC member to ensure that all accepted papers were carefully selected. All the accepted papers were given presentation timeslots distributed into 12 paper sessions. In addition, ER 2019 hosted a Doctoral Consortium for PhD students and academics to share their research ideas, to seek advice, and to explore collaboration in conceptual modeling research. The conference also included an ER Forum to cover emerging and early stage research, as well as poster and demo sessions to increase opportunities for interaction.

Finally, we would like to thank all participants, authors, reviewers, and organizers of the conference for their contribution to making ER 2019 a successful event. We thank Springer for their proceedings support and EasyChair for its wonderful conference management system. Special thanks to our many sponsors and to the ER Steering Committee for their support and advice.

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A Systematic Approach to Generate Diverse Instantiations for Conceptual Schemas

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Abstract. Generating valid instantiations for a conceptual schema is instrumental in ensuring its quality by means of verification, validation or testing. This problem becomes even more challenging when we also require that the computed instantiations exhibit significant differences among them, i.e., they are diverse. In this work, we propose an *automatic* method that guarantees synthesizing a diverse set of instantiations from a conceptual schema by combining model finders, classifying terms and constraint strengthening techniques. This technique has been implemented in the USE tool for UML/OCL.

Keywords: Methodologies and tools for conceptual design · Quality of conceptual models · Integrity constraints

1 Introduction

Verification, validation and testing are different mechanisms to ensure the quality of a conceptual schema. These approaches typically require the same resource: creating one or more instantiations of the conceptual schema. With "instantiation" we refer to an example for an information base of a conceptual schema [16]. These instantiations can be used as *illustrations* to better understand the model, to explain its behavior or to simulate it; as *counterexamples* that describe invalid configurations; and as *test cases* to capture scenarios that should be checked.

A key property of any set of instantiations to be used in a quality assurance process is its *diversity*. That is, the instantiations in the set should cover a broad spectrum of different configurations and scenarios. Otherwise, relevant corner cases might be missed, causing faults and/or wrong conclusions.

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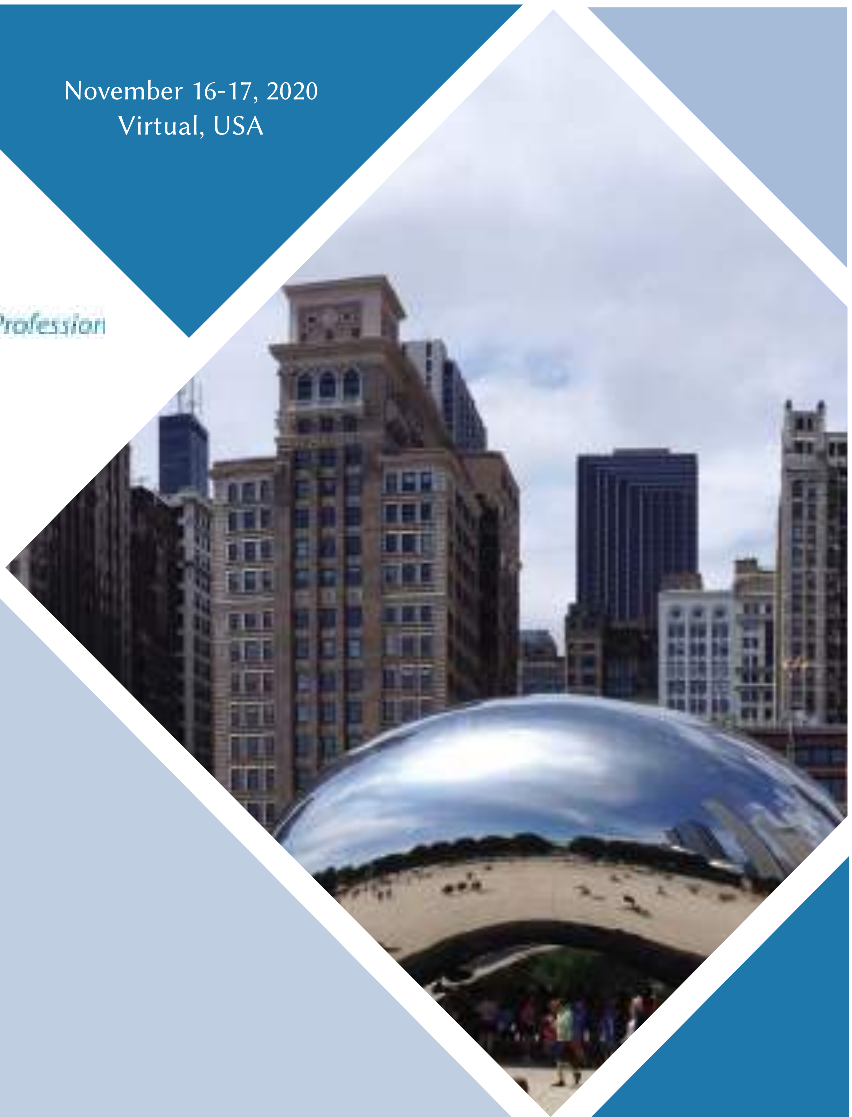

SLE '20

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Message from the Chairs

Welcome to the 13th ACM SIGPLAN International Conference on Software Language Engineering (SLE) held in November 2020 as part of SPLASH 2020. This is the first fully online edition of SLE due to the effects of COVID-19. Despite the many challenges this has caused, the SLE programme is once again worthy of your consideration!

Software Language Engineering (SLE) is a thriving research discipline targeted at establishing an engineering approach to the development, use, and maintenance of software languages, that is, of languages for the specification, modeling and programming of software. Key topics of interest for SLE include approaches, methodologies and tools for language design and implementation with a focus on techniques for static and behavioral semantics, generative or interpretative approaches (including transformation languages and code generation) as well as meta-languages and tools (including language workbenches). Techniques enabling the testing, simulation or formal verification for language validation purposes are also of particular interest. Last but not least, SLE accommodates empirical evaluation and experience reports of language engineering tools, such as user studies evaluating usability, performance benchmarks or industrial applications.

SLE 2020 received a total of 44 submissions (34 regular and 10 short). Each submission was reviewed by at least three members of the Program Committee, which selected 21 for presentation: 16 regular research papers and 5 short papers.

For the fifth year, SLE used an evaluation process to assess the quality of artifacts on which papers are based. The aim is to foster a culture of experimental reproducibility as well as a higher quality in the research area as a whole. Authors of accepted papers could voluntarily submit their research artifacts for evaluation carried out by an independent committee. 14 papers submitted artifacts, of which 12 received the ACM badge "Functional" and 2 the "Reusable" one.

As the Organization Committee, we are deeply indebted to the hard work of the many people who contributed to the success of this year's SLE. Specifically, we would like to acknowledge the work of all Program Committee, the Artifact Evaluation Committee, and the External Reviewers for the timely delivery of reviews and open-minded discussions which resulted in a rich and diverse program. We are also grateful to SLE's Steering Committee and the SPLASH organization for their help. Finally, we would like to thank the authors of all submitted papers — you represent the core of the SLE conference, and it is your work that advances the state of the art in software language engineering.

We hope that you will enjoy reading these proceedings and we wish you the best in these difficult times!

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Towards the Optical Character Recognition of DSLs

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Abstract

OCR engines aim to identify and extract text strings from documents or images. While current efforts focus mostly in mainstream languages, there is little support for programming or domain-specific languages (DSLs). In this paper, we present our vision about the current state of OCR recognition for DSLs and its challenges. We discuss some strategies to improve the OCR quality applied to DSL textual expressions by leveraging DSL specifications and domain data. To better support our ideas we present the preliminary results of an empirical study and outline a research roadmap.

CCS Concepts: • **Software and its engineering** → **Domain specific languages**; • **Applied computing** → **Optical character recognition**.

Keywords: optical character recognition, domain-specific languages, text recognition

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1 Introduction

Optical Character Recognition (OCR) aims to identify and extract text strings from images (scanned documents, pictures of handwritten text, video frames, etc.). OCR is still a very active research area [18] that benefits from advances in computer vision, neural networks, machine translation, etc.

Current efforts focus mostly on mainstream natural languages for which there is ample available data to be used for training, predefined language models and public dictionaries that help achieve high levels of accuracy in the OCR process. Instead, specific OCR support decreases considerably when targeting programming languages—although some works to extract source code from programming video tutorials have appeared lately [14, 24, 26]—and even more when addressing Domain-Specific Languages (DSLs) where, due to their own nature and unlike general-purpose languages (GPL), we do not count on predefined dictionaries or pretrained recognition algorithms. For instance, unlike GPLs, we cannot assume that code repositories like GitHub have enough good examples of any DSL we can think of to train a OCR model for the language from scratch.

Nevertheless, good OCR support for DSLs could bring significant benefits and open the door to interesting applications in the field of DSLs. For instance, one could parse old manuals of legacy DSLs (or even conference proceedings from past or related SLE conferences) to automatically extract examples, which could be later used as test data for new parsers or to train any machine learning-based algorithms. In these cases, numerous examples are needed, and common solutions such as the generation of synthetic [21] data may not be optimal. When possible, our approach would be an additional source of data. From a teaching perspective, such OCR for DSLs could help in processing student assignments for automatic assessment[1]. Additionally, DSLs are currently also documented by means of video tutorials, as in the case of general programming languages. Furthermore, there is the specific case of graphical DSLs, whose graphical notation is complemented with textual languages. In those cases, the textual DSL expressions often appear as annotations next to the referenced graphical elements. Those annotated diagrams are usually stored, published, or shared as images. OCL [6] is an example of a textual language that complements UML [23] models. While complex OCL expressions are better defined

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Preface

This volume contains the proceedings of the first workshop on the Analysis of Model Transformations (AMT'12), collocated with the ACM/IEEE 15th International Conference on Model Driven Engineering Languages & Systems (MODELS 2012) in Innsbruck, Austria. The workshop was held on October 2, 2012.

The AMT'12 program consisted of eight papers. Each submission was reviewed by three members of the Program Committee. The selected papers constituted a strong program of stimulating, timely, and diverse research. A more detailed summary of the workshop can be found in these proceedings.

We thank the PC members for their work preparing the reviews and the MODELS'12 Workshop Chairs, Joanna Chimiak-Opoka and Jeff Gray, for their support.

October, 2012

Juergen Dingel
Levi Lúcio
Hans Vangheluwe
Dániel Varró

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Towards Tracking "Guilty" Transformation Rules

A Requirements Perspective

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ABSTRACT

Several approaches for specifying the requirements for model transformations have been proposed. Most of them define constraints on source and target models as well as on the relationships between them. A major advantage of these approaches is their independence from transformation implementation languages and transformation implementations. However, when these constraints are used for testing, identifying the model transformation rules that violate the constraints is not possible. In this paper we present an approach for automatically aligning specifications of model transformations and their implementations. Matching functions establish these alignments based on the used metamodel elements in the constraints and rules. We present our first results and outline further use cases where an alignment between constraints and rules is beneficial.

1. INTRODUCTION

Model transformations are critical points in the Model-driven Engineering (MDE) development process. The quality of the resulting system is highly influenced by the quality of the employed model transformations to produce the systems. However, users of transformations have to deal with the problem that transformations are difficult to debug and test for correctness. Such tests require a specification which expresses what is correct and what is not, something that is currently not supported by most transformation languages.

A possible solution is to define with specification languages the requirements that a transformation has to fulfil. There are several approaches available for defining constraints on the input and output models as well as on the relationships between them (for an overview see [12]). These constraints are used as a blueprint for developing the model transformations employing implementation languages such as ATL, QVT, or graph transformations. Thus, the specification and the implementations are normally not coupled at all, which has several advantages but may also lead to disadvantages. In particular, when it comes to tracking errors, the missing traceability between specifications and implementations hampers the debugging process. Often the specifications are employed as oracles to check the transformation result. In case constraints are not fulfilled, the elements involved in the constraint evaluation may give a valuable information for the transformation engineer, but the link to the transformation rules is not available.

To tackle this limitation, we present in this paper a first solution for measuring the alignment between a constraint and a model transformation rule by applying an automated matching function. In particular, three different measures are introduced which provide different viewpoints on the alignment problem. We employ the approach for a case study and finally discuss how this general approach may be applied for specific use cases in model transformation engineering.

AMT '12, October 01 - 05 2012, Innsbruck, Austria

2. BACKGROUND

In this section, we shortly introduce the formalisms used in this paper for specifying and implementing model transformations. As we shall see, these formalisms are not integrated, and thus, the developed artifacts are completely independent of each other.

2.1 Specifying Transformations with Tracts

Tracts were introduced in [3] as a specification and black-box testing mechanism for model transformations. They provide modular pieces of specification, each one focusing on a particular transformation scenario. Thus every model transformation can be specified by means of a set of tracts, each one covering a particular use case—which is defined in terms of particular input and output models and how they should be related by the transformation. In this way, tracts allow partitioning the full input space of the transformation into smaller, more focused behavioural units, and to define specific tests for them. Basically, what we do with the tracts is to identify the scenarios of interest to the user of the transformation (each one defined by a tract) and check whether the transformation behaves as expected in these scenarios. Another characteristic of Tracts is that we do not require complete proofs, just to check that the transformation works for the tract test suites, hence providing a *light-weight* form of verification.

In a nutshell, a tract defines a set of constraints on the *source* and *target* metamodels, a set of *source-target* constraints, and a tract *test suite*, i.e., a collection of source models satisfying the source constraints. The constraints serve as "contracts" (in the sense of contract-based design [7]) and their implementations. In [5], model footprints of operations are statically computed by the use of metamodel footprints. We pursue the idea of computing metamodel footprints from transformation specifications and implementations for establishing traceability links instead of reasoning on model footprints.

6. NEXT STEPS

The main motivation for this work was the need to track transformation rules that can be considered "guilty" for violating parts of the transformation specifications. Due to the generic nature of the matching tables, a multitude of further use cases emerge.

Properties of Alignments. Based on the matching tables, we are able to reason on the degree of tangling and scattering between constraints and rules. Scattering occurs when a single constraint is scattered across multiple rules, while tangling occurs when a single transformation rule is implementing multiple constraints at once. The work of Berg et al. [13] may be valid input to reason about design guidelines of transformation specifications and implementations based on matching tables.

Refinement of Alignments. More information may be extracted from constraints and transformation rules. For example, from the ATL transformations, inheritance between transformation rules, lazy rule calls, and types used in filters and bindings may be extracted. From the constraints, the accessed metamodel features may be extracted, too. Based on this additional information, more refined alignments may be explored. Furthermore, as we have mentioned in the evaluation, some constraints are using a multitude of types. To distinguish between types, e.g., types only required to navigate to the most relevant information in a model, types occurring more often in constraints may have less impact on the alignments as types that do not as frequently occur.

Alignment-based Slicing. Another direction for future work is to slice model transformations, metamodels, and models based on constraints. This is of course useful for debugging model transformations, however, using slicing techniques may be also beneficial for maintenance tasks. Imagine the requirements are changed by modifying a specific constraint. Adapting the transformation implementation to this change may be easier by reasoning only on a particular slice of the transformation problem referring to a subset of the transformation, metamodel, and models.

7. ACKNOWLEDGMENTS

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On the Concurrent Execution of Model Transformations with Linda

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ABSTRACT

Nowadays there exists a wide variety of model transformation languages. However, all of them present limitations, mainly performance issues, when the complexity and size of model transformations and models grow. The problems arise due to the in-memory allocation of large models as well as the time taken by the execution engines for producing the output models. This restricts the benefits of using model transformations in different application fields of model engineering where the complexity of the transformation tasks exceeds the capabilities of sequential execution engines. In this paper we tackle these limitations by introducing concurrency for model transformations to effectively improve the execution performance. Instead of reinventing the wheel, we base our approach on Linda, a mature coordination language for parallel processes. We explore how model transformations fit into Linda and show a set of basic mechanisms to enable concurrent model transformations. Initial results of applying our approach show a great potential of using Linda to improve the execution performance with respect to existing approaches.

Categories and Subject Descriptors

D.2 [**Software**]: Software Engineering; D.1.3 [**Programming Techniques**]: Concurrent Programming; C.4 [**Computer Systems Organization**]: Performance of systems

Keywords

Model transformation, concurrency, Linda, tuple spaces

1. INTRODUCTION

In model engineering [2], models are used as the main artifacts for capturing knowledge about different domains. One prominent example for model engineering is model-driven software engineering [3, 24], where models are used in a generative manner to produce software systems in a semi-automatic way. Model transformations (MTs) are so to speak at the heart of MDE, by providing the mechanisms for manipulating and transforming models. MTs can be classified according to different characteristics [7, 19]: abstraction level of input and output models (i.e., horizontal vs. vertical transformations), directionality (i.e., uni-directional vs. bi-directional transformations), manipulation of input and output models (i.e., in-place vs. out-place transformations), etc. In model-driven software engineering, out-place transformations are very popular for implementing model compilers that produce concrete code from more abstract models. However, transformations are not limited to be applied for producing code. For instance, model transformations are becoming also a promising approach to deal with data integration, especially when complex data structure are involved such as in Social Web data management [31].

Because of this increasing variety of model transformation scenarios, there exists a wide range of different languages with which model transformations can be developed, each of them comprises different characteristics [6]. Some examples of transformation languages from different language categories are GrGen (graph transformation) [14], Kermeta (imperative) [20], QVT-R (declarative) [12], ATL (hybrid) [15] and UML-RSDS (general purpose MDE tool) [18]. However, all of them present limitations, mainly performance issues, when the complexity and size of model transformations and models grow [5, 16]. The problems arise due to the in-memory allocation of large models as well as the time taken by the execution engines for producing the output models. This restricts the benefits of using models and model transformations in different application fields of model engineering, e.g., biology, medicine, and sociology, where the complexity of the models and model transformation tasks is such

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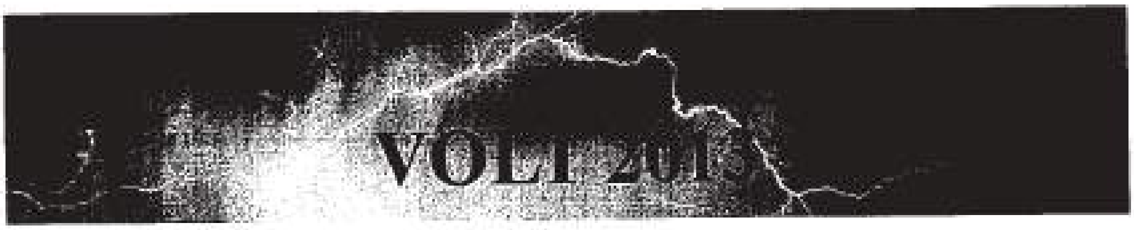

Confirmation of Participation

I confirm that

Loli Burgueño

attended the STAF Workshop on Verification of Model Transformations, held the 17th of June in Budapest.

Manuel Wimmer, Vienna University of Technology, Austria
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Concurrent and Distributed Model Transformations based on Linda

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Abstract. Recently Model-Driven Engineering (MDE) is becoming more and more popular as it is able to solve complex problems by exploiting the abstraction power of models. As models, metamodels and model transformations are the heart of MDE, they play a vital role. Nevertheless, existing transformation languages and accompanying tools cannot deal with large models such those used in the fields of astronomy, genetics, etc. The main problems are related to the storage of very large models, the unreasonable time needed to execute the transformation and the impossibility of transforming distributed or streaming models. We tackle this problem by means of incorporating the concurrent and distributed mechanisms that Linda (a mature coordination language for parallel processes) provides into model transformation approaches.

Keywords: MDE, model transformation, concurrency, distribution, Linda

1 Introduction and Problem

MDE is a relatively new paradigm which has grown in popularity in the last decade. So to speak, model transformations (MTs) are, together with models and metamodels, the key of MDE, allowing to systematically manipulate models. MTs can be classified according to different characteristics [6, 19]: abstraction level of input and output models (i.e., horizontal vs. vertical transformations), kind (i.e., model-to-model, text-to-model or model-to-text), directionality (i.e., uni-directional vs. bi-directional transformations), manipulation of input and output models (i.e., in-place vs. out-place transformations), etc. And there are several different intents for which transformations are applied [1]: abstraction, refinement, synthesis, model composition, etc.

Because of this increasing variety of MTs scenarios, there exists a wide range of different languages for developing MTs, each of them comprises different characteristics [5]. Some examples of MTs from different language categories are GrGen (graph transformation) [14], Kermeta (imperative) [20], QVT-R (declarative) [12], ATL (hybrid) [16] and UML-RSDS (general purpose MDE tool) [18].

Lately, the MDE paradigm is being embraced by companies, thus, MTs are extensively used and the problems being addressed are increasingly complex.

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MODELS 2013
29 September 2013 through 4 October 2013

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ACM/IEEE 17th International Conference on
Model Driven Engineering Languages and Systems

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AMT 2014 – Analysis of Model Transformations Workshop Proceedings

Juergen Dingel, Juan de Lara, Levi Lúcio, Hans Vangheluwe (Eds.)

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Preface

To facilitate the processing and manipulation of models, a lot of research has gone into developing languages, standards, and tools to support model transformations. A quick search on the internet produces more than 30 different transformation languages that have been proposed in the literature or implemented in open-source or commercial tools. The increasing adoption of these languages and the growing size and complexity of the model transformations developed require a better understanding of how all activities in the model transformation life cycle can be optimally supported.

Properties of an artifact created by a model transformation are intimately linked to the model transformation that produced it. In other words, to be able to guarantee certain properties of the produced artifact, it may be very helpful, or even indispensable, to also have knowledge of the producing transformation. As the use and significance of modeling increase, the importance that the model transformations produce models of sufficient quality and with desirable properties increases as well; similarly, as the number and complexity of model transformations grows, the importance that transformations satisfy certain non-functional requirements and that life cycle activities for model transformations such as development, quality assurance, maintenance, and evolution are well supported grows as well.

The central objective of the AMT workshop is to provide a forum for the discussion and exchange of innovative ideas for the analysis of model transformations, broadly construed. Analyses might support a variety of model transformation activities including the development, quality assurance, maintenance and evolution by facilitating, for instance,

- the detection of typing errors, anti-patterns, dead code, transformation slices, likely invariants, or performance bottlenecks;
- the informal, semi-formal, or formal establishment of properties related to correctness or performance;
- test suite evaluation through code coverage determination;
- code completion and generation;
- the evolution of metamodels;
- impact analysis;
- refactoring.

Another objective of the workshop is to help clarify which transformation analysis problems can be solved with the help of existing analysis techniques and tools developed in the context of general-purpose programming languages and source code transformation languages, and which analysis problems require new approaches specific to model transformations. The exchange of ideas between the modeling community on the one hand and the programming languages community and source code transformation community on the other hand thus is another objective of the workshop.

In this third edition, AMT received 16 submissions, out of which 9 were accepted. The workshop also held a keynote speech by Ronan Barrett from Ericsson on exploring the non-functional properties of model transformation techniques used in industry. We are grateful to all authors, attendees, program committee members, external reviewers and local organizers for helping make AMT 2014 a success.

October 2014 Juergen Dingel, Levi Lúcio, Hans Vanghewluwe and Juan de Lara

Towards Approximate Model Transformations

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Abstract. As the size and complexity of models grow, there is a need to count on novel mechanisms and tools for transforming them. This is required, e.g., when model transformations need to provide target models without having access to the complete source models or in really short time—as it happens, e.g., with streaming models—or with very large models for which the transformation algorithms become too slow to be of practical use if the complete population of a model is investigated.

In this paper we introduce *Approximate Model Transformations*, which aim at producing target models that are accurate enough to provide meaningful and useful results in an efficient way, but without having to be fully correct. So to speak, this kind of transformations treats accuracy for execution performance. In particular, we redefine the traditional OCL operators used to query models (e.g., allInstances, select, collect, etc.) by adopting sampling techniques and analyse the accuracy of approximate model transformations results.

Keywords: Model Transformation, Approximation, Performance, Sampling

1 Introduction

Model transformations (MTs) are gaining acceptance as model-driven techniques are becoming commonplace. While models capture the views on systems for particular purposes and at given levels of abstraction, MTs are in charge of the manipulation, analysis, synthesis, and refinement of the models [3]. They do not only allow the generation of implementations from high-level models, but also to generate other views that can be properly analyzed or that provide users with the information they need, at the right level of abstraction, e.g., a synopsis of a larger data set.

So far the community has mainly focused on the *correct* implementation of a MT, according to its specification [4, 14–16, 30, 32], although there is an emergent need to consider other (non-functional) aspects such as performance, scalability, usability, maintainability and so forth [5]. In particular, the study of the performance of MTs is gaining interest as very large models living in the cloud have to be transformed as well [8, 28, 29]. The usual approach to improve performance has focused on the use of incremental execution [7, 22] and parallelization techniques [8, 28].

In this paper we explore a different path. Our aim is to weaken the need to produce *exact* target models but *approximate* ones. Such approximate target models should be accurate enough to provide meaningful and useful results to users, but alleviate the

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BigMDE 2014
Scalability in Model Driven Engineering

Proceedings of the 2nd Workshop on Scalability in Model Driven Engineering
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York, UK, July 24, 2014.

Edited by

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Complete workshop proceedings as one file.

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LinTraP: Primitive Operators for the Execution of Model Transformations with LinTra

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ABSTRACT
The problems addressed by Model-Driven Engineering (MDE) approaches are increasingly complex, hence performance and scalability of model transformations are gaining importance. In previous work, we introduced LinTra, which is a platform for executing out-place model transformations in parallel. The parallel execution of LinTra is based on the Linda coordination language, where high-level model transformation languages (MTLs) are compiled to LinTra and eventually executed through Linda. In order to define the compilation modularly, this paper presents a minimal, yet sufficient, collection of primitive operators that can be composed to (re-)construct any out-place, unidirectional MTL.

Categories and Subject Descriptors
D.2 [**Software**]: Software Engineering; D.1.3 [**Programming Techniques**]: Concurrent Programming; C.4 [**Computer Systems Organization**]: Performance of systems

Keywords
Model Transformation, Linda, LinTra

1. INTRODUCTION
Model-Driven Engineering [2] is a relatively new paradigm that has grown in popularity in the last decade. Although there is a wide variety of approaches and languages with different characteristics and oriented to different types of model transformations (MT), most model transformation engines are based on sequential and local execution strategies. Thus, they have limited capabilities to transform very large models (with thousands or millions of elements), and provide even less capabilities to perform the transformation in a reasonable amount of time.

In previous works [3, 4], we investigated concurrency and distribution for out-place transformations to increase their performance and scalability. Our approach, LinTra, is based on Linda [8], a mature coordination language for parallel processes that supports reading and writing data in parallel into distributed tuple spaces. A tuple space follows the Blackboard architecture [5], which makes the data distributed among different machines transparent to the user.

To execute transformations on the LinTra architecture, LinTra specifies how to represent models and metamodels, how the trace links between the elements in the input model and the elements created from them are encoded for efficient retrieval, which agents are involved in the execution of the MTs and their role, how the MTs are executed in parallel, and how the models are distributed over the set of machines composing the cluster where each MT is executed.

The implementation of several case studies using the Java implementation of LinTra (jLinTra) is available on our website[1], together with the performance comparison with several well-known model transformation languages (MTLs) such as ATL [11], QVT-O [14] and RubyTL [7].

In order to hide the underlying LinTra architecture and in order to ease the compilation from any existing out-place MTL to the LinTra engine, in this paper we propose a collection of minimal, yet sufficient, primitive operators that can be composed to (re-)construct any out-place and unidirectional MTL. These primitive operators encapsulate the LinTra implementation code that makes the parallel and distributed execution possible, serving as an abstraction of the implementation details of the general-purpose language in which LinTra is implemented.

The rest of the paper is structured as follows. Section 2 introduces the collection of primitives. Section 3 illustrates examples of primitive combinations in order to write MTs. Section 4 discusses the related work to our approach. Finally, Section 5 presents our conclusions and an outlook on future work.

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To Whom It May Concern:

This letter is to certify that Loli Burgueno attended the Software Technology: Applications and Foundations Federated Conference 2014 (including ICMT 2014, ECMFA 2014, ICGT 2014, TAP 2014 and TTC 2014), 21-25 July 2014, in York, United Kingdom

Best regards,

Bob French (Local Chair)

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Iterative Development of Transformation Models by Using Classifying Terms

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Abstract

In this paper we propose an iterative process for the correct specification of model transformations, i.e., for developing correct *transformation models*. This permits checking the correctness of a model transformation specification before any implementation is available. The proposal is based on the use of classifying terms for partitioning the input space and for simplifying the testing process.

1 Introduction

As model-driven engineering (MDE) is progressively being adopted by industry, model transformations (MT) are becoming commonplace. Their complexity is also growing, since the problems they need to deal with are increasingly harder. From simple structural migration, model queries or pattern-based code-generation, they now have to cope with complex model synthesis, behavioural analysis and stream data processing. This has led, among other things, to the need of *engineering* model transformations [7].

In this context, the specification of a model transformation becomes a critical task, in particular for checking the correctness of its implementations. Please note that correctness is not an absolute property, but needs to be checked against a contract, or specification, which determines the expected behaviour, the context whether such a behaviour needs to be guaranteed, as well as some other properties of interest. The specification states what should be done, but without determining how. The problem, again, is that the specification of a model transformation can be as complex as the transformation itself.

Here we will make use of the fact that, in essence, a model transformation is an algorithmic specification (either declarative or operational) of the relationship between two or more models, and more specifically, of the mapping from one model to another [12]. Thus, one way to specify a model transformation is by means of a *transformation model* that defines such a relation [3].

In this paper we propose an iterative process for the correct specification of model transformations, i.e., for developing correct transformation models. This is done by testing the relationship specified by the transformation. We use classifying terms [5] to implement a divide-and-conquer strategy that permits simplifying the analysis of the mappings established by the model transformation, by focusing on particular input models. This approach is based on the ideas proposed by *equivalence partitioning*, a software testing technique that divides the input data of a software unit into partitions of equivalent data from which test cases can be derived. Once a problem is detected, the specification is revised to solve it. This process is iterated until the specification is found free of errors.

One additional benefit of our approach, and a difference with regard to previous proposals, is that it permits testing the specification without needing an implementation of the model transformation, which is the common way in which model transformation specifications and implementations are tested (by checking one against the other, i.e., using a particular kind of *redundancy testing*). In our approach, model transformation specifications can be tested on their own, before any implementation is available.

not consider the use of OCL, less flexible and lacks full automation. Reference [6] presents a mechanism for generating test cases by analysing the OCL expressions in the source metamodel in order to partition the input model space. This is a systematic approach similar to ours, but focusing on the original source model constraints. Our proposal allows the developer partitioning the source (and target) model space independently from these constraints, in a more flexible manner.

Finally, the work in [10] proved the correctness of specifications by making use of algebras. Our approach can be seen as a first step and as an easier and cheaper way that does not require for the developer to have any extra knowledge or create any other software artifact.

5 Conclusion and Future Work

In this paper we have presented an iterative approach for the correct development of *transformation models*. These models provide the specifications of model transformations, and with our proposal they can be checked before any implementation is available, and independently from any of them.

There are several lines of work that we plan to address next. In the first place, we would like to validate our proposal with more transformations, in order to gain a better understanding of its advantages and limitations; identify different contexts of use in which our approach works well and other in which the results are not satisfactory (and why), and build a repository of thoroughly tested and validated transformation models that can be reused by the community. Second, we plan to improve the tool support to further automate all tests, so human intervention is kept to the minimum. Finally, we need to define a systematic approach of defining classifying term and transformation model testing using the preliminary ideas outlined in this paper.

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October 2, 2015

Re: **Certificate of Attendance**

To who it may concern,

This is to certify that Loli Burgueño attended the ACM/IEEE 18th International Conference on Model Driven Engineering Languages and Systems (Models 2015), which was held between September 27 and October 2, 2015, at the Delta Hotel Ottawa Centre in Ottawa, Canada. The attendee presented the paper "Employing Classifying Terms for Testing Model Transformations".

Sincerely,

Timothy C. Lethbridge, PhD, P.Eng
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BigMDE 2015

Dimitris Kolovos
Davide Di Ruscio
Nicholas Matragkas
Jesús Sánchez Cuadrado
Istvan Rath
Massimo Tisi

Preface

As Model Driven Engineering (MDE) is increasingly applied to larger and more complex systems, the current generation of modelling and model management technologies are being pushed to their limits in terms of capacity and efficiency. As such, additional research and development is imperative in order to enable MDE to remain relevant with industrial practice and to continue delivering its widely-recognised productivity, quality, and maintainability benefits.

The third edition of the BigMDE workshop (http://www.big-mde.eu/) has been co-located with the Software Technologies: Applications and Foundations (STAF 2015) conference. BigMDE 2015 provided a forum for developers and users of modelling and model management languages and tools where to discuss different problems and solutions related to scalability aspects of MDE, including

- Working with large models
- Collaborative modelling (version control, collaborative editing)
- Transformation and validation of large models
- Model fragmentation and modularity mechanisms
- Efficient model persistence and retrieval
- Models and model transformations on the cloud
- Visualization techniques for large models

Many people contributed to the success of BigMDE 2015. We would like to truly acknowledge the work of all Program Committee members, and reviewers for the timely delivery of reviews and constructive discussions given the very tight review schedule. Finally, we would like to thank the authors, without whom this workshop would not exist.

July 23, 2015
L'Aquila, Italy

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Parallel In-place Model Transformations with LinTra

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Abstract. As software systems have grown large and complex in the last few years, the problems with which Model-Driven Development has to cope have increased at the same pace. In particular, the need to improve the performance and scalability of model transformations has become a critical issue. In previous work we introduced LinTra, a model transformation platform for the parallel execution of out-place model transformations. Nevertheless, in-place model transformations are required in several contexts and domains as well. In this paper we discuss the fundamentals of in-place model transformations in the light of their parallel execution and provide LinTra with an in-place execution mode.

Keywords: In-place Model Transformations, Performance, Scalability, Linda

1 Introduction

Model transformations (MT) are gaining acceptance as model-driven techniques are becoming commonplace [1]. While models capture the views on systems for particular purposes and at given levels of abstraction, model transformations are in charge of the manipulation, analysis, synthesis, and refinement of the models [2].

So far the community has mainly focused on the correct implementation of a model transformation, according to its specification [3–8], although there is an emergent need to consider other (non-functional) aspects such as performance, scalability, usability, maintainability and so forth [9]. In particular, the study of the performance of model transformations is gaining interest as very large models living on the cloud have to be transformed as well. Consequently, new approaches to parallelize model transformations are starting to appear [10–13]. Following this path, in a previous work we introduced LinTra [11, 14], a model transformation engine, together with its implementation in Java called jLinTra. LinTra encapsulates all the concurrent mechanisms needed for the parallel execution of model transformations, and in particular users do not need to worry about threads and their synchronization. The engine is based on Linda [15], a mature coordination language for parallel processes.

So far, LinTra only permitted out-place model transformations. In this kind of transformations, input and output models often conform to different metamodels and output models are created from scratch. However, there are many situations in which we need to evolve models, instead of creating them anew. For instance, when migrating and modernizing software using model-driven engineering (MDE) approaches [16, 17], (i)

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STAF

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TO WHOM IT MAY CONCERN:

This letter is to certify that Loli Burgueno attended the

Software Technology: Application and Foundations Federated Conference 2015

(including ECMFA 2015, ICGT 2015, ICMT 2015, TAP 2015, and TTC 2015), 20-14 July 2015, in L'Aquila, Italy.

Best Regards

Alfonso Pierantonio (General Chair)

http://www.disim.univaq.it/staf2015

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Edited by

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Testing M2M/M2T/T2M Transformations

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***Abstract*—As Model-Driven Engineering is becoming adopted by industry, models and model transformations (MTs) are extensively used. Hence, there is the urgent need for systematic testing mechanisms and tools to check their correctness. In this work, we make use of a particular case of contracts for model transformations called Tracts. First, Tracts allow the transformation developer to specify and test a model-to-model transformation in a modular way, and to identify bugs. However, they do not allow to track where the faults in the implementation are. For doing that, we present an approach based on matching functions that automatically establish the alignments between the specification and the implementation of a transformation using the metamodel footprints. Second, we extend Tracts to deal with text-to-model and model-to-text transformations in order to broaden and complete the scope of our testing proposal. Finally, we provide the corresponding tools that realize our proposal.**

I. Problem and Motivation

Model transformations (MT) are gaining more and more interest as industry is progressively adopting model-driven techniques [1]. The main advantage of using of model transformations is to save effort and reduce errors by automating the creation and alteration of models as long as it is possible. Thus, they are becoming a promising approach in many different scenarios to solve a wide variety of problems, e.g. to deal with the migration of systems, their modernization, for code generation, etc., especially when complex data structures are involved. This complexity may lead to the existence of bugs in the model transformation implementation that make it faulty. Then, the need of testing, validation and verification procedures for model transformations is emerging in recent years [2], [3].

So far, most of the efforts by the research community have focused on testing model-to-model (M2M) transformations for which having explicit model representations for the input and output domain is assumed. There are different approaches that can be classified attending to their characteristics as black-box vs. white-box and static vs. dynamic. Depending on the concrete situation, the transformation developer needs to make the decision of what mechanism to use. When black-box dynamic approaches such as Tracts [4] are the best option, the developer finds that they do allow the testing of model transformations but they do not track where the problem is in the implementation, i.e., they reveal that there is a problem but they do not point to where it is or what is producing it.

Furthermore, text-to-model (T2M) and model-to-text (M2T) transformations are extensively used [5] for code generation and reverse engineering for the modernization of legacy applications [6]. However, they have received little attention so far by the research community.

The contribution presented in this paper is twofold. First, we have extended the Tract approach for M2T and T2M transformations. We have created a generic metamodel that represents text repositories and inject the text into a model that conforms to that metamodel. Once both source and target domains count on a concrete and well-defined representation, M2T and T2M transformations are reduced to M2M transformations. Therefore, Tracts can be used for checking their correctness.

Second, we define a mechanism based on *matching tables* that permit relating the rules of a model transformation with its Tracts, i.e., aligning the model transformation implementation with its specification. By analysing the matching tables, the rules that cause a fault can be identified, hence realizing a useful tracking mechanism for locating faults in model transformations.

The structure of the paper is as follows. Section II introduces the concepts in which this work stands and the related work. Section III presents the core of our contribution: the extension of Tracts for M2T and T2M transformations and how the matching tables are computed and interpreted. Finally, Section IV shows the results we have obtained and the contributions we have made.

II. Background and Related Work

The need for systematic verification of model transformations has been studied in previous works and the challenges it has to deal with have been outlined [7], [8]. Many approaches ranging from lightweight certification to full verification have been proposed to reason about different kinds of properties of M2M transformations [2], [3]. One of them is the use of contracts [4], [9], [10].

Tracts, which are a particular case of contracts, are a black-box testing mechanism for M2M transformations. They consist of a set of constraints on the source and target metamodels, a set of source-target constraints, and a test suite, i.e., a collection of source models. They provide modular pieces of specification, each one focusing on a particular transformation scenario. This permits each model transformation to be specified by means of a set of Tracts, each one covering a specific use case. Usually, they are seen as unit tests, which means that developers identify the scenarios of interest and define a Tract

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MODELS 2015
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October 2, 2015

Re: **Certificate of Attendance**

To who it may concern,

This is to certify that Loli Burgueño attended the ACM/IEEE 18th International Conference on Model Driven Engineering Languages and Systems (Models 2015), which was held between September 27 and October 2, 2015, at the Delta Hotel Ottawa Centre in Ottawa, Canada. The attendee presented the paper "Employing Classifying Terms for Testing Model Transformations".

Sincerely,

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Message from the Chairs – MUTATION 2015

It is our pleasure to welcome you to the 10th edition of the International Workshop on Mutation Analysis (Mutation 2015), collocated with the 8th IEEE International Conference on Software Testing, Verification and Validation (ICST'15) in Graz, Austria. During its ten editions, the Mutation workshop has provided a forum to bring together researchers and practitioners, enabling them to exchange ideas, address fundamental challenges in mutation testing, and discuss new applications of mutation.

Mutation 2015 received 18 submissions and each paper was reviewed by at least three members of the program committee. After the reviewing and discussion process, the program committee accepted 10 papers (8 full papers, 1 short paper, and 1 industrial paper).

Mutation 2015 features a keynote given by Paul Ammann on how to transform mutation testing from the technology of the future into the technology of the present. Moreover, the three panelists Mark Harman, Jeff Offutt, and Yue Jia accepted our invitation to discuss what makes an effective mutation tool and how to bridge the gap between research and industry tools.

Finally, we would like to thank the program committee and the external reviewers for their contributions, and the authors and participants for assuring the quality and success of this workshop.

Enjoy the workshop!

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Towards Systematic Mutations for and with ATL Model Transformations

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***Abstract*—Model transformation is a key technique to automate software engineering tasks, such as generating implementations of software systems from higher-level models. To enable this automation, transformation engines are used to synthesize various types of software artifacts from models, where the rules according to which these artifacts are generated are implemented by means of dedicated model transformation languages. Hence, the quality of the generated software artifacts depends on the quality of the transformation rules applied to generate them. Thus, there is the need for approaches to certify their behavior for a selected set of test models. As mutation analysis has proven useful as a practical testing approach, we propose a set of mutation operators for the ATLAS Transformation Language (ATL) derived by a comprehensive language-centric synthesis approach. We describe the rationale behind each of the mutation operators and propose an automated process to generate mutants for ATL transformations based on a combination of generic mutation operators and higher-order transformations. Finally, we describe a cost-effective solution for executing the obtained mutants.**

Keywords*—Mutation, Model Transformations, ATL, Higher-Order Transformations

I. Introduction

Model transformation is a key technique to automate software engineering tasks in Model-Driven Engineering (MDE) [1], [2]. To enable this automation, transformation engines are available which are able to synthesize various types of software artifacts from models, where the rules according to which these artifacts are generated are implemented by means of dedicated model transformation languages. Hence, the quality of the generated software artifacts is highly affected by the quality of the developed model transformations. As a result, model transformations are subject to thorough tests for correctness [3]–[6]. For this reason, several approaches have been proposed that either verify the correct behavior of the transformations using formal methods [7] or certify their behavior for a selected set of test models mainly to identity bugs in a cost-effective way [8], [9].

As mutation analysis has proven to be useful as a practical testing approach [10], it is also applied to test model transformations mainly for the generation of (i) test data in terms of input models [11], [12] and (ii) mutants of model transformations [13]–[15]. Considering the latter approaches, they propose generic mutation operators, i.e., independent of a particular transformation language, and mutation operators that are dedicated to a specific language, such as the ATLAS Transformation Language (ATL) [16], [17]. As a result, the focus of these approaches is mainly set on partially identifying effective mutation operators while neglecting means to automate the generation of mutated model transformations and to efficiently execute them.

Problem. Due to the fact that mutation analysis requires a complete set of mutation operators, and consequently, a large number of mutated model transformations to be effective, manually generating them appears infeasible [18]. Moreover, their execution against the input models leads typically to high computational costs [10], particularly if a mutant is considered as a complete re-execution of the original transformation to which a fault is injected. Hence, automation is required to cope with the challenges of generating an effective set of mutation operators as well as mutated model transformations. Furthermore, to deal with the execution of mutants, techniques are required to reduce the computational costs of executing the model transformation mutants.

Contribution. Our contribution is threefold: (i) we have derived a systematic set of mutation operators dedicated to ATL by proposing a general language-centric synthesis approach for mutation operators, (ii) we have automated the generation of model transformation mutants by realizing a framework that exploits the concept of Higher-Order Transformations (HOTs) [19], and (iii) we have studied the possibility to integrate into our framework means to reduce the computational costs of executing model transformation mutants by relying on techniques for incremental model transformation execution, which we have proposed in previous work [20].

Structure. In Section II, we give the background for our work by introducing ATL by-example. We provide details regarding our mutation operator synthesis approach and the ATL mutation operators in particular in Section III. Then, in Section IV, we present our framework for automating the generation of mutated ATL model transformations and give insights into how they can be executed in a cost-effective way. In Section V, we introduce the prototypical implementation of our proposed framework and apply it to the example introduced in Section II. Finally, we discuss related work in Section VI before we conclude with an outlook on future work in Section VII.

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mutation operators and to generate mutants for these models through model transformations.

VII. Conclusion and Future Work

In this paper we have presented a novel approach to produce mutants for ATL transformations. To this end, we have identified an extensive set of mutation operators dedicated to ATL by a systematic analysis of its metamodel and described the effect they produce in the output model. We have automated the generation of mutants by realizing a framework that exploits the concept of HOTs, and we have explained the possibility to integrate into our framework means to reduce the computational costs of executing model transformation mutants.

We have demonstrated the feasibility of our approach with a proof-of-concept prototype, with which we are able to mutate any ATL model transformation following the approach described in Figure 8(b). We have several ideas to realize next. We want to investigate the tendency for individual operators to produce either redundant or equivalent mutants. Other than the mutation operators identified, we plan to study more mutations in ATL by considering the imperative part of the language and mutations within OCL expressions. In particular, we want to study the effectiveness of the mutation operators, and specially to identify different mutation operators for *Filters*, which are defined with OCL expressions, as well as their consequences. Furthermore, we want to study the realization of the approach described in Figure 8(a), so that the selection of mutations to perform can be driven by the user, who could specify several options in the form of parameters not only for model transformations but also for languages and models defined with metamodels in general.

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Generating Effective Test Suites for Model Transformations Using Classifying Terms

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Abstract. Generating sample models for testing a model transformation is no easy task. This paper explores the use of classifying terms and stratified sampling for developing richer test cases for model transformations. Classifying terms are used to define the equivalence classes that characterize the relevant subgroups for the test cases. From each equivalence class of object models, several representative models are chosen depending on the required sample size. We compare our results with test suites developed using random sampling, and conclude that by using an ordered and stratified approach the coverage and effectiveness of the test suite can be significantly improved.

1 Introduction

One of the main problems of existing model transformation testing techniques lies in the difficulty of selecting effective test cases [1]. This is specially important when dealing with large models because they normally include many different aspects of the system under study, which usually deserve individual treatment and particular coverage. This is why homogeneous sampling techniques for selecting object models that constitute the test cases tend to fall short.

In this paper we explore a new technique for developing test cases for models in an orderly and comprehensive manner. The approach uses classifying terms [2] for partitioning the model space into a set of representative model classes and for selecting a set of object models from each class in order to implement *stratified sampling* [3,4]. Stratified sampling is a mature probability sampling technique wherein the designer divides the entire test case population into different subgroups (or *strata*), each one focusing on particular characteristics of the test models, and then selects proportionally the final samples from the different subgroups.

We compare the effectiveness of our proposal with regard to random sampling, using a case study of a model transformation under test for which we have identified some kinds of models of particular interest for the tester. We generate a set of test models using random sampling and analyse their coverage. Then we show how it is possible to generate specific test models for the reference classes hence significantly improving the effectiveness and coverage of the samples.

This paper is organized in six sections. After this introduction, Section 2 introduces the preliminary concepts used in the paper: tracts, classifying terms and stratified sampling, as well as the running example used to illustrate our proposal. Then, Section 3

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Static Analysis of Complex Event Processing Programs

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ABSTRACT

Complex Event Processing (CEP) provides a mechanism to efficiently correlate and infer conclusions about systems by means of analyzing the events they process. In areas such as the Internet of Things (IoT), Cyber Physical Systems (CPS), system monitoring or data streaming analytics, CEP is able to read events from a data stream and to generate complex events that represent situations of interest to the system owner by means of event patterns. Every time a sequence of events matches a pattern, a complex event is created and added to the data stream. The dependencies among the rules and the possibility of non-confluent behavior of CEP rule-based systems may lead to unexpected outputs when executing CEP programs. In this work, we show how to statically check and correct two particular properties of CEP systems: rule acyclicity and rule race conditions. We use Esper EPL as a CEP language, and present a tool we have developed to perform these analyses.

KEYWORDS

Complex Event Processing; Esper EPL; Static Analysis; Rule Acyclicity; Rule Race Conditions

1 INTRODUCTION

Domains such as Internet of Things (IoT), Cyber-Physical Systems (CPS), social networks, or system monitoring, generate gigabytes of data every second. In order to take advantage of that situation, approaches for data analytics have arisen and are used to extract useful information and knowledge from it.

Complex Event Processing (CEP) [9, 15] addresses the issue of analyzing a specific kind of data: events about facts or situations occurring in real-time. CEP systems deal with the tasks of processing streams of events and the identification of significant patterns by means of techniques such as detection of relationships among events, event correlation, and aspects such as causality and timing.

CEP systems are developed using Event Pattern Languages (EPL), which are normally rule-based languages that define rules for each pattern. Patterns are triggered when their matching conditions are met (e.g., the relevant source event occurs) and are in charge of generating the resulting complex events.

As with any other rule-based language, CEP programs are easy to develop and very efficient when they are composed of a small set of rules. However, as the number of patterns (rules) grow, the complexity of CEP programs becomes unmanageable, their behavior can be unpredictable, and checking their correctness becomes a very difficult task.

In this work, we present a tool for the static analysis of CEP programs, which addresses the issues of detecting and fixing acyclicity and rule race conditions. This static analyses help improve and maintain the code quality and give developers immediate feedback in the early development phases of the CEP software system.

The rest of the paper is structured as follows. First, Section 2 presents the background of our work. Then, we present our main contribution in Section 3, and our tool in Section 4. Section 5 discusses a validation exercise we have used to evaluate our approach, using a real CEP application. Finally, Section 6 compares our approach with other related works, and Section 7 concludes and outlines our future lines of work.

2 BACKGROUND

Complex Event Processing offers a form of data processing [6] that aims at defining and detecting situations of interest, from the analysis of low-level event notifications [7].

There are two types of events in a CEP system: *simple* events, which contain the information received by the sensors; and *complex* events, which are generated by the CEP system and inserted into the data stream [10]. Each event has a type and a set of attributes associated. CEP programs are composed of sets of patterns that analyze and match sequences of events (both *simple* and *complex*) taking into account their content and temporal relations. Each time a match occurs, a complex event is created.

Although several CEP systems and languages exist, they all share the same basic concepts, mechanisms and structure. In this paper we write the rules in one particular EPL, called Esper EPL [8].

2.1 CEP by example

In order to explain CEP and to illustrate our proposal, we will use the Smart House case study we introduced in [18]. In this system, a house contains a set of devices and services that cooperate to simplify the lives of its residents.

For the particular case of ensuring security in situations of fire, we know that when a fire starts, the temperature increases at a rate higher than a given value; and carbon monoxide (CO), which weights less than air, increases and accumulates in the ceiling. For this reason, temperature and carbon monoxide (CO) sensors have been installed in the ceiling. They record the absolute value of the temperature and CO in their respective position every second and send signals to the central system.

In case of fire, another key aspect is to determine whether or not someone is at home. For this purpose, our system uses the mobile phones of its occupants as motion detectors that inform of their geographical coordinates at all times.

Using the measurements produced by these sensors, and using Esper EPL, we have defined the set of CEP rules that we show in Listing 1. Lines 1–3 show the types of the simple events, in the form of templates that specify their name and attributes. In this example,

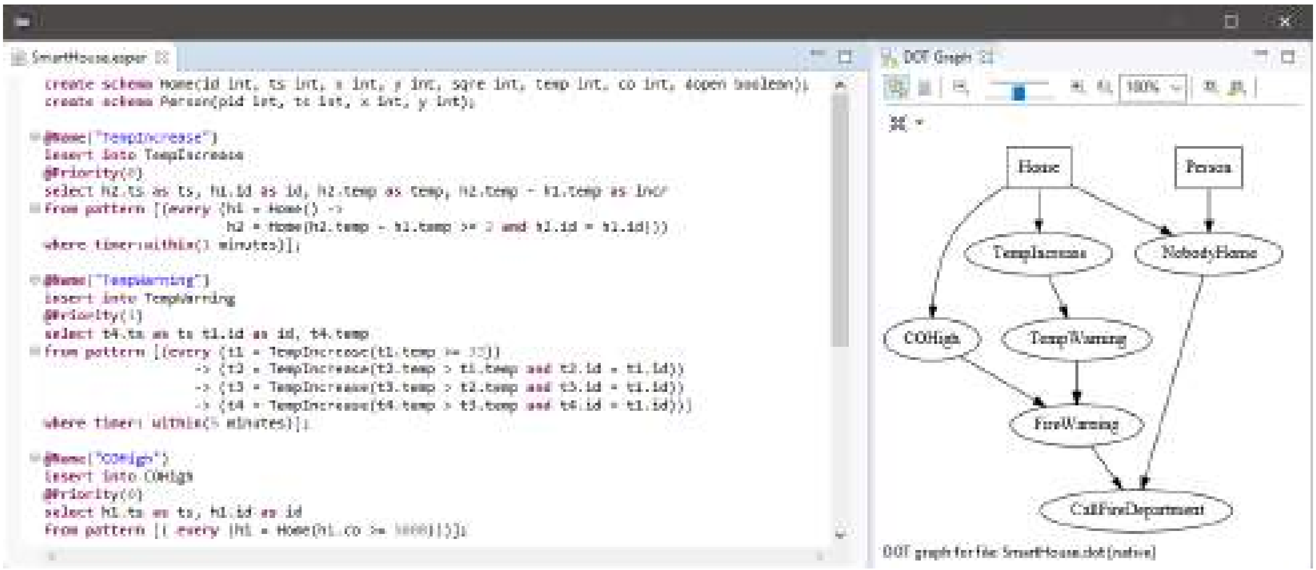

Figure 4: Screenshot of the CEPA tool showing its graphical interface to the user.

Finally, some of the issues discussed here were identified in our previous work [4]. This paper reports on the tool we have developed to implement the analyses hinted in that work, and how we have realized it.

7 CONCLUSIONS

In this contribution, we present our approach to statically analyze Esper EPL programs, and to automatically check two properties: rule acyclicity and rule race conditions. Furthermore, when rule race conditions are detected, we suggest how to repair the Esper code to avoid non-confluence problems. We have built an Eclipse tool, called CEPA, that offers support for conducting such tests.

In the future we plan to increase the list of analyses supported by our tool, such as for example dead-end detection. Furthermore, we would like to extend our current scope, by integrating into our tool the dynamic analyses we explored in [4]. Finally, although the performance of the algorithm currently used for detecting cycles in the graph is acceptable, we would also like to evaluate other algorithms [16], in particular the one by Johnson [13].

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Model Finding and Model Completion with USE

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Abstract. This short contribution demonstrates central options in the tool USE (Uml-based Specification Environment) for exploring UML models within software development. It particularly uses so-called classifying OCL terms for building validation and verification scenarios and for completing partial models. The contribution demonstrates the tool's options with an example: statecharts together with a simple syntax model and a model for capturing finite fractions of the statechart semantics.

1 Introduction

In this paper, we demonstrate the options available in the tool USE [10,11] (Uml-based Specification Environment) for UML and OCL models and the concept of classifying terms (CTs) [12], which permit generating relevant and distinguished sample object models for a given specification, together with the completion capabilities of the USE model validator for specifying particular validation ("Are we building the right product; aim: build test cases) and verification ("Are we building the product right; aim: verify a property) scenarios. With them we are able to quickly develop distinguishable and structurally non-equivalent object models that satisfy certain system properties. More precisely, classifying OCL terms permit defining equivalence classes with those models that, from the modeller's perspective, are equivalent. Then, the USE model validator is able to generate one representative object model for each equivalence class, hence significantly simplifying the number of test cases, and improving the effectiveness of the model checking process. In this contribution we illustrate these ideas for exploring models within software development. We demonstrate the tool options with a simple example: statecharts together with a simple syntax model and a model for capturing finite fractions of the statechart semantics. One central advantage we see in our approach is that we offer mainstream languages like UML and OCL to formulate models and use these languages also to give feedback.

The structure of the rest of this paper is as follows. Section 2 presents the background work: CTs and the USE model validator completion capabilities. Section 3 shows how a system can be tested with cts and object model completion. Section 4 compares our work to similar related proposals. Finally, Sect. 5 concludes the paper.

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Message from the ICSE 2018 General Chair

ICSE 40TH INTERNATIONAL CONFERENCE ON SOFTWARE ENGINEERING
MAY 27 – JUNE 3 2018
GOTHENBURG, SWEDEN

It is my great pleasure to welcome you to the 40th International Conference on Software Engineering in Gothenburg, Sweden. Science and research, as well as the openness to new ideas and new people, are an important part of the Scandinavian culture. Sweden hosts many high technology companies in which software plays an essential role. The Town of Gothenburg, with its two internationally renowned universities, variety of ICT and related companies, with many cultural attractions, and beautiful natural surroundings, welcomes you!

This year's ICSE is unique in at least two respects. **ICSE 2018 celebrates its 40th anniversary.** During its journey, ICSE has developed to the premier conference in Software Engineering, known for its quality, excellence, attractiveness, and inspirational atmosphere. We pay tribute to the 40th anniversary with a collection of memories of previous conferences printed in a booklet, and with a celebration session gathering all previous chairs to thank them for their devoted and highly successful work. The second unique event of this conference is **the celebration of the 50 years of Software Engineering**, that is considered to be born at the NATO Software Engineering Conference 1968, held in Garmisch, where the term Software Engineering was established. We honor this event with keynotes which have direct impact of the Software Engineering development and a panel with some of the participants of the 1968 conference.

ICSE 2018 is, however, not only about the past. It is much about the present and the future - and in particular, about the essence of Software Engineering - collaboration between industry and academia, practitioners and researchers. ICSE 2018 hosts a one-day **Industry Forum** event gathering researchers and practitioners and offering talks of prominent researchers and experts from leading software and software-intensive systems companies.

As a part of the program and the celebration, we are happy to have outstanding conference keynote speakers from industry and academia. **Magnus Frodigh**, acting Head of Research at Ericsson, will talk about new challenges in building *Communication systems and networks as enablers or digitizing industry and society*. **Frederick P. Brooks, Jr**., the Kenan Professor of Computer Science, known for his legendary book "The Mythical Man-Month: Essays on Software Engineering", will talk about the beginnings of Software Engineering *Learning the Hard Way: A History of Software Engineering 1948-1980.* **Margaret Hamilton,** CEO of Hamilton Technologies, famous for building Apollo's on-board flight software and inventing the term "Software Engineering" to establish it as a form of engineering in its own right, will reflect on being a software engineer with a talk *The Language as a Software Engineer*. **Brian Randell** from Newcastle University, also a participant of the famous NATO conference 1968, and one of the most prominent researchers in Software Engineering, will introduce the panel discussion *50 years of Software Engineering*, with several participants of the 1968 conference. **Ivar Jacobson,** the inventor of "use case" and one of the co-authors of UML, will conclude the celebration with a talk *50 years of software engineering, so now what?* on Friday. The same day, the plenary keynotes, **Andrew J. Ko** and **Brad A. Myers**, the authors of the most influential paper, will present their paper *Debugging reinvented: asking and answering why and why not questions about program behavior.* **Andreas Zeller**, the holder of Outstanding Research Award for 2018, will conclude the award session with his inspiring talk *Relevance, Simplicity, and Innovation: Stories and Takeaways from Software Engineering Research.*

The ICSE 2018 week starts on Sunday May 27, with three days of workshops, co-located events, special events and symposia. It then continues on Wednesday May 30 with three days of the main conference, and concludes with more workshops and co-located events for the last two days, Saturday June 2, and Sunday, June 3. We have **29 workshops** with the total 280 papers accepted for the presentation and publication, **seven co-located events**, and the conference pre-events: **Technical Briefings** with 12 short tutorials, and

New Faculty Symposium with inspirational talks from leading researchers in Software Engineering giving advice to young researchers. A side track, but exceptionally attractive one, is the **2001: A Space Odyssey Symposium** - 50 years celebration of the movie that includes a talk about the HAL computer given by **David Stork**, followed by the panel and finishing by showing the movie. In addition, ICSE 2018 is emphasizing the industrial relevance by exchanging a live video stream with the local event **Lindholmen Software Development Day**, that each year attracts 500-600 software developers from the region.

The heart of ICSE 2018 is the main conference. The special event this year is the celebration of 40th anniversary of ICSE, with more than 40 program and general chairs from the previous conferences showing on the stage, and with a book *40 editions of ICSE: the ruby anniversary celebration*, specially printed for this occasion.

The main conference will include several tracks. The **Technical Papers** track, with 105 accepted papers (of 502 submitted), and 49 Journal First Papers (JFP), is the largest technical papers track in the history of ICSE. To make it possible to present all papers for three days, four parallel tracks during the first two days, and six tracks on the third day are organized. In parallel with the Technical Track, we will have four other special tracks. As a part of the main conference, the **Industry Forum** (IF) track offers two keynotes, **Jan Bosch** from Chalmers University of Technology, and **Danica Kragic** from Royal University of Technology, Stockholm, with several invited speakers and a panel from industry and academia. The **Software Engineering in Practice** (SEIP) track, with 36 accepted papers out of 131 submitted (the record number of submissions), and three keynote speakers (**Linda Northrop** from SEI, **Frank Buschmann** from Siemens, and **Ödgärd Andersson** from Volvo Cars), will talk about current challenges and opportunities in software industry. The **Software Engineering and Training** (SEET) track accepted 21 papers for presentation, out of 74 submitted. The track offers a keynote (**Gregor Kiczales** from UBC) and a panel composed of distinguished researchers and lecturers. The **Software Engineering in Society** (SEIS) track received 31 submissions of which 11 were selected for the presentation, combined with a keynote presentation (**Roberto di Cosmo**, Paris Diderot University) and a panel discussion. ICSE 2018 is continuing a tradition established earlier with **New Ideas and Emerging Results** (NIER) track, which received 101 submissions and accepted 28 papers for the presentation. In addition, 30 tools will be demonstrated, selected out of 72 submissions. All in all, 280 papers have been accepted for presentations on the main conference tracks, which is the same as the number of papers accepted for the workshops. During the lunches and coffee breaks, the participants can enjoy the poster exhibition; during the three days, 175 posters, about 60 each day, will be presented in the exhibition area. Of these, 160 posters were accepted for publication as extended abstracts in a separate volume.

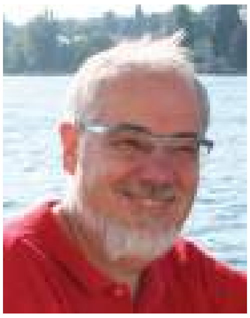
ICSE 2018 includes three events dedicated to PhD and Master students. In the **Doctoral Symposium** (DS), 17 PhD students were accepted to present and discuss their research. The **Student Contest on Software Engineering** (SCORE) invited three student teams to compete in the final, and **ACM Student Research Competition (**SRC**)** selected 10 students for the final competition.

Finally, ICSE 2018 has 8 co-located events: **ICGSE 2018** - 13th IEEE International Conference on Global Software Engineering, **ICPC 2018** - 26th IEEE International Conference on Program Comprehension, **MSR 2018** - 15th International Conference on Mining Software Repositories, **MobileSoft 2018** - 5th IEEE/ACM International Conference on Mobile Software Engineering and Systems, **SEAMS 2018** - 13th International Symposium on Software Engineering for Adaptive and Self-Managing Systems, **TechDebt 2018** - International Conference on Technical Debt, **SEiA 2018** - Symposium on Software Engineering in Africa, and **FormaliSE 2018** - 6th Conference on Formal Methods in Software Engineering. The last two started as new conferences, and SEiA was the first co-located event at ICSE organized from Africa. ICSE is also hosting more than 20 community meetings run during lunches or after the sessions.

ICSE 2018 will most probably be the largest conference in ICSE history. By the early registration due date, ICSE 2018 has more than1600 registrations, and 1250 registrations for the main conferences which is already the record, two months before the conference start.

All of these events required significant organizational and logistical effort, communication, flexibility and dedication that was only possible as a result of a work of a great **Team.** The organizing committee, the dedicated 53 members, spent days and days in designing, organizing, managing, analyzing, improving, administrating, inventing, reminding, repeating, and putting their personal career ambitions on hold. How can I thank them all for this intensive, hard, but so inspirational time? First of all, I would like to thank the Technical Track chairs, **Marsha Chechik** and **Mark Harman.** We three started from the very beginning and worked hard for many hours. During this time, I learned a lot from them. I was deeply impressed and inspired by their analytical capabilities, sharpness, precision, creativity, enormous energy, and dedication to the work. But they were not alone. How many times did I ask the Web chairs, **Josip Maras** and **Hugo Andrade,** to *immediately* update the web pages, or how many times have the Publication chairs, **Bara Buhnova** and **Patrizio Pelliccione,** sent mails to the track chairs explaining the publication process, and process hundreds of papers and a few thousands of authors? But they were not alone. We had highly motivated and efficient track chairs: **Frances Paulisch** and **Jan Bosch** (SEIP), **Valerie Issarny** and **Schahram Dustdar** (SEIS), **Patricia Lago** and **Michal Young** (SEET), **Andrea Zisman** and **Sven Apel** (NIER), **Tien Nguyen** and **Anne Koziolek** (Demos), and **Gerardo Canfora** (JFP). We had chairs of special tracks full of new and innovative ideas: **Judith Bishop** and **Pekka Abrahamsson** (IF), **Jaana NyFjord** (Local Industry), **Olga Baysal** and **Jun Sun** (SRC), **Lars Grunske**, **Betty Cheng** and **Xaioying Bai** (NFS), **Jane Cleland-Huang** and **Per Runeson** (TB), **Tracy Hall** and **Julia Rubin** (DS), **Christine Julien** and **Rafael Prikladnicki** (SCORE). **David Rosenblum** and **Neno Medvidović** (50 years of SE) did real detective- and data mining work to find all sorts of details from the last 50 years in Software Engineering, and prepared the celebration including the anniversary booklet. But they were not alone. **Dimitra Dianakopoulu** and **Paul Grünbacher** (Workshop chairs) managed and inspired numerous workshops, and **Tom Zimmermann** (co-located events chair) handled all events co-located with ICSE, in every detail. How many messages, announcements, tweets and results have been sent, how many flyers, brochures have been designed and distributed by the publicity and communication chairs **Henry Muccini**, **Tao Xie**, **Federico Ciccozzi**, **Ivano Malavolta**, **Malin Ulfarson** and **David Issa Mattos**? And how many contributed posters from our many tracks did the Posters chairs, **Raffaela Mirandola** and **Yuriy Brun,** process, taking care of all possible details. And they were not alone. The Registration chair **Carlo Furia** spent many days designing, monitoring and analyzing the registration process, **Yue Jia** prepared Easychair. **Matt Dwyer** and **Volker Gruhn**, the most influential paper chairs organized the selection process of the most influential paper presented at ICSE 10 years ago. And when I asked **Sandeep Kuttal** for help in processing NSF scholarships on Dec. 30, she replied that she will try to manage whatever is possible before the New Year! When I asked **Will Tracz** about taking on the responsibility in processing awards, he knew exactly what needed to be done. And what an amazing job did **Birgit Penzenstadler** and **Christian Berger** (Student Volunteers chairs) do to prepare 52 students volunteers for a support? And finally, how many discussions did I have with **Michel Chaudron** (the Conference chair) about the banquet place, reception, lunch organization, music, child care? The magnificent 53! But we were not alone. We had numerous people helping us in the preparation and during the conference: 52 student volunteers from 22 countries, "local" PhD students and researchers, financial and administration officers at Chalmers University. We had also a fantastic help from conference organization company MEETX with **Jorge Gómez** leading the local organization on the venue side, from CPS IEEE working on the 46 proceedings volumes, and from ACM Sigsoft and IEEE TCSE, the conference sponsors. And we had numerous supporters, who helped in making all this happen. Finally, here we have 500+ researchers who served on different program committees, and 300+ members of the workshops committees, and 300+ members from co-located events. To all of them a big thanks, for the enormous work and enthusiasm to make this event memorable. And even all these people are not alone. Here are you, all participants. I wish you all to have a great time here in Gothenburg at ICSE 2018.

Enjoy this unique event and keep being inspired for the next 50 years!



Ivica Crnkovic
Chalmers University of Technology | University of Gothenburg
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Message from the RoSE 2018 Co-Organizers

Welcome to RoSE 2018, the 1st International Workshop on Robotics Software Engineering, on May 28, 2018, in Gothenburg, Sweden. RoSE 2018 is co-located with the 40th International Conference on Software Engineering (ICSE 2018).

Software engineering is a crucial enabler for successful deployment of robotic applications. The research communities advancing software engineering in robotics, however, are spread over various specialized conferences, such as ICRA, IROS, SIMPAR – each attended mostly by robotics researchers and practitioners – or ICSE and MODELS – mostly attended by software engineering researchers and practitioners. At robotics conferences, software engineering lacks visibility and vice versa.

The objective of RoSE is to bring together researchers and practitioners from both domains at a prominent conference to foster cross-fertilization between the two domains. Being the most prominent conference in software engineering, ICSE is the best venue to attract experts from both domains. Hosting this workshop at ICSE enables software engineering researchers to learn more about the challenges of robotics practitioners that (i) require further research from the software engineering community or (ii) are already solved but solutions are unnoticed by roboticists, yet.

The RoSE 2018 program includes a keynote, 9 paper presentations, and a working session. RoSE received 12 submissions. Each submission went through a thorough reviewing process, with each paper receiving at least three reviews. After an intense discussion, we have accepted 2 research papers, 3 challenge showcase papers, and 4 vision papers. We expect the workshop to foster the integration of software engineering research with robotics research and industrial robotics. To this end, especially the robotics challenges showcase is expected to generate novel research directions based on unsolved issues in both research and practice.

We look forward to seeing you at Rose and ICSE 2018 in Gothenburg!

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Using Physical Quantities in Robot Software Models

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ABSTRACT

One of the challenges of modeling any software application that deals with real-world physical systems resides in the correct representation of numerical values and their units. This paper shows how both measurement uncertainty and units can be effectively incorporated into software models, becoming part of their basic type systems, and illustrates this approach in the particular case of a robot language. We show how our approach allows robot modelers to safely represent and manipulate units and measurement uncertainties of the robots and their elements in a natural manner, statically ensuring unit-safe assignments and operations, as well as the propagation of uncertainty in the computations of derived attributes and operations.

KEYWORDS

Model-driven engineering, quantities, units, measurement uncertainty, cyber-physical systems, robotics

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1 INTRODUCTION

As any other cyber-physical systems, robots are typically designed and built as a network of interacting elements of different nature (software, hardware, communications, sensors, actuators, etc.) with physical input and output instead of as standalone devices, and with complex interactions among their internal elements, and also with their physical environment [15]. Model-Driven Engineering (MDE) [4] is a state-of-the-art approach for the design, development and maintenance of software applications, particularly well suited to deal with complex systems because it relies on two basic and key concepts: abstraction and automation [24]. MDE has been successfully used in many domains for modeling complex systems [11, 23], and software models have proved to be very useful for providing high-level formal descriptions of complex systems that permit their representation, specification, analysis and automated development.

When it comes to modeling robotic systems, and in order to faithfully represent and manipulate the key properties of physical world systems and their elements, software models need to be able to deal with correct numerical values and their units. This includes the representation of measurement uncertainty due to errors in physical measures or the tolerance of mechanical tools and devices, as well as the units in which these values are expressed. Ignoring uncertainty makes models too naïve, assuming that all measures are exact and that no deviation due to tolerance in the robot devices (gears, wheels, etc.) occur. Thus, we may be building a model of a system which does not provide a faithful representation for it.

Taking standard UML as a prominent example for a software modeling language, there is neither support for modeling units nor for modeling measurement uncertainty. Instead, mere `Real` numbers are used to specify attribute values that represent physical properties, explaining at most in the companion documentation the units in which each attribute value should be expressed (cf., for instance, [7]). Uncertainty is normally ignored, or considered somewhere else in the models.

Although some of the existing modeling languages, such as MARTE [20] and SysML [21], already provide mechanisms for describing these properties, such mechanisms are not integrated into their type systems and therefore they do not support operations for propagating uncertainty or for statically checking possible unit mismatches—which have already proved to be the cause of significant software disasters, such as the Mars Climate Orbiter [12] or the Gimli Glider Incident [16]. Furthermore, incorporating by hand units and measurement uncertainty into the models is far from trivial, and it can produce much more cumbersome models, significantly increasing the accidental complexity of the solution. In addition, both unit conversions and propagation of uncertainty need to be explicitly handled by users.

The authors of this paper have been recently working on an approach to deal with measurement uncertainty and units in software models [17, 18]. In particular, we have defined an extension of the UML and OCL type `Real` to represent physical properties, called `Quantity`, a set of operations for this new type, and type checks that impede the unit-mismatch problem.

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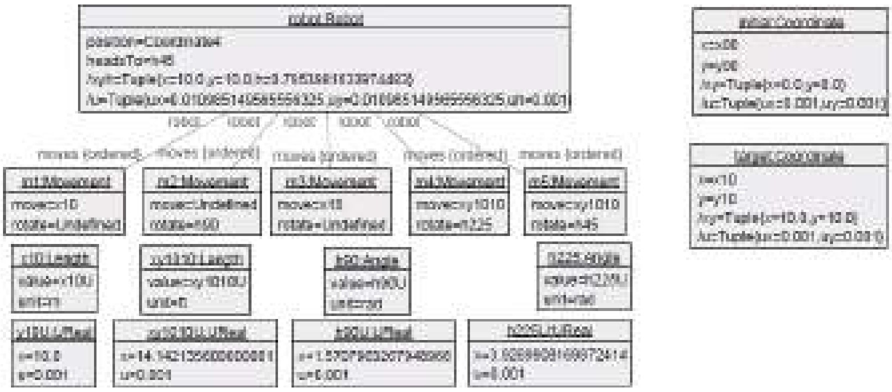

Figure 4: Object diagram for the Moving Robot example, after execution.

away. More importantly, none of these approaches permit dealing with units and measurement uncertainty in the models.

6 CONCLUSIONS AND FUTURE WORK

This paper presents, by means of the example of a robot language, how units of measurement and measurement uncertainty can be integrated into software models. Following our approach, dimensions (such as Length and Angle) can be considered primitive data types, whose values incorporate units and uncertainty. Dimensions also integrate the required mechanisms to deal with unit-safe assignments, unit conversions, and the propagation of uncertainty. We have also presented how our robot models are simulated and how to perform some analysis on them.

Our current plans for future work include extending other robot languages with Quantities, such as the ones defined in [7], and also conducting further experiments with real robots in order to validate the precision and accuracy of our estimations with respect to the robots actual behavior. We also plan to extend our approach to represent the precision of a value as a function.

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Belief Uncertainty in Software Models

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***Abstract*—This paper discusses the representation of *Belief Uncertainty* in software models. This kind of uncertainty refers to the situation in which the modeler, or any other belief agent, is uncertain about the behavior of the system, or the statements that the model expresses about it. In this work, we propose to assign a *degree of belief* to model statements (let they be constraints, or any other model expression), which is expressed by a probability (called *credence*, in statistical terms) that represents a quantification of such a subjective degree of belief. We discuss how it can be represented using current modeling notations, and how to operate with it in order to make informed decisions.**

***Index Terms*—Software models, uncertainty, degree of belief.**

I. Introduction

The explicit expression of Uncertainty in software models is gaining recognition as an effective means to faithfully represent and operate with the unknowns and imprecise information which are inherent to any system that works in a physical environment [1] or that integrates Artificial Intelligence (AI) components. Due to the "black-box" nature of AI, modeling and analyzing such systems typically requires accepting some uncertainties about their precise behavior.

In general, uncertainty applies to physical measurements, estimations, predictions of future events, or unknown properties of a system. It can be defined as "the quality or state that involves imperfect and/or unknown information" [2].

Despite this apparently clear definition, the term *uncertainty* still remains imprecise, since it embodies different kinds of uncertainties, each one requiring a different representation, and exhibiting different characteristics. For instance, *measurement uncertainty* (MU) refers to the inability to know with complete precision the value of a quantity [2], [3], and it is normally expressed by means of a number that represents the possible deviations of the values of the measured quantity; e.g., $x = 3.0 \pm 0.01$. Another example is *occurrence uncertainty* (OU), which refers to the likelihood that a physical entity represented in a model actually occurs in reality; it can be expressed by means of a real number in the range $[0..1]$ that represents the probability assigned to such an occurrence [4]. In order to describe and classify these types of uncertainty and others like content, occurrence, time, environment, geographical location, belief and indeterminacy uncertainty [5], a conceptual model called U-Model has been proposed [1], and there is an OMG effort to define a metamodel for Uncertainty Modeling [6].

In this paper we are interested in *Belief Uncertainty* (BU), which refers to the situation where a belief agent is uncertain about a statement made about the system. In this case, a belief statement is normally *subjective*, and refers to current or future states or properties of the system being modeled, or its environment. For example, we can not be fully sure whether the sensor providing the value of an attribute is operating correctly, or whether the precision of the sensor is correct.

Furthermore, belief statements can also refer to the way in which we have modeled the system. For example, a stakeholder cannot be fully sure whether the formula employed to compute a derived value in a system is correct, since we may not have a complete understanding on how the system works.

This paper aims at answering the following questions:

- How can we explicitly specify the belief uncertainty that a belief agent has about a system or about its model?
- How can we incorporate such information in the models, using existing modeling notations?
- Once specified and represented, how can we operate with belief uncertainty in order to be able to make informed decisions, and to reason about the system behavior?

To represent belief uncertainty, we will use the *degree of belief* that a belief agent assigns to a model statement [7]. In general, such a degree of belief can be measured using qualitative or quantitative methods, such as a grade or a probability. In this work, we will use Bayesian probabilities, which is the classical model for quantifying subjective beliefs [8], and more precisely the concept of *credence*. Credence is a statistical term that refers to a measure of belief strength, which expresses how much an agent believes that a proposition is true [9]. For example, a modeler can be 99% sure about the behavior of the rule that decides whether an alarm should be fired or not, or that the type used to represent a given entity is correct.

Representing and operating with Belief Uncertainty in software models is relevant in several situations, like for example:

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Finally, we also intend to use this work in the context of the Modelia[6] initiative. When the development of software relies on Machine Learning or Artificial Intelligence components, there is always some degree of confidence, precision or uncertainty on the results. We will need to be able to represent it and operate with it in our models.

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Towards Sketching Interfaces for Multi-Paradigm Modeling

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***Abstract*—Existing design processes typically begin with informal ideation by sketching out a basic approach that can be further developed into a more complete design. Although intuitively simple, and seemingly informal, the sketching process is actually a structured activity that strongly influences the design of the system; hence, it has an important role in the design success. In this work, we develop a well defined specification of the sketching activity. We consider *sketching* as a process of achieving agreement, based on stakeholders communicating ideas about a design and its properties, with the side-effect of incrementally developing a (set of) common language(s) specific to the idea domain. Our perspective on sketching further differs from more common notions of ideation by noting the roles of requirements and system properties, and offering a general perspective on sketching as a modular activity within design. We validate our approach by analyzing the sketches of a research group at the CAMPaM 2019 workshop. By recognizing sketching as a fundamental activity in design, we enhance the formalization of the design process, and suggest improvements to the tool support for sketching beyond the basic drawing features.**

***Index Terms*—sketching, multi-paradigm, ideation, interface**

I. Introduction

Imprecise drawings or *sketches* are commonly used during the design process in many domains. Core to the early *ideation phase* of the project—although also employed throughout the design process—sketches are produced on a transient medium, using informal imagery, text, and "back-of-the-envelope" calculations to explore solutions and to develop candidate designs. In collaborative settings, such drawings can be used to reach a common understanding of a problem and to express new ideas that are either discarded or refined in detailed designs.

Informal sketching is recognized as an important part of the design process [15], but also sits uneasily with more formal approaches to design and modeling. In Multi-Paradigm Modeling (MPM) [11], for example, the current assumption is that a (domain-specific) language is designed first, and then used by engineers to specify the system. When engineers are sketching, however, they do not necessarily use a well-defined modeling language: their vocabulary is incomplete and changes rapidly, with the freeform properties of sketching used to facilitate understanding and exploration.

Sketching has particular significance when applying MPM to design Cyber-Physical Systems (CPSs) [14]. In this context, sketching is an essential activity for cross-discipline brainstorming to reach a common understanding, and to quickly evaluate possible design candidates. Despite its importance, the sketching activity is currently performed in an ad-hoc way. While significant effort has been devoted to building sketching tools, little effort has been spent to identify the languages, elements, and processes used while sketching [2]. In this work we argue that, even if aimed at freeform expression, sketching has definable structure, and a more precise definition of sketching is possible that can expose the processes and artefacts involved. Better formalization of sketching enables tighter integration into formal design, allowing sketching artefacts to more seamlessly participate in traceability and other important parts of the complex CPS design process.

We validate our definitions by looking at the sketching activities performed by a research group of CAMPaM 2019[1], the workshop where we developed these ideas. We describe our envisioned approach, which revolves around model and language co-design: while a (team of) user(s) is sketching, a vocabulary and its semantics is gradually built up. Technical solutions to support these activities are proposed for dealing with imprecise syntax, uncertainty in the semantics, and supporting implementation platforms.

II. Background

This section provides background for the rest of the paper: we discuss ideation and sketching in different (engineering) disciplines, traditional system development workflows, and language engineering techniques, to provide an overview of the state-of-the-practice in sketching tools and to contrast this to typical system development workflows and tools.

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Model Workbench [12] is a sketching interface used (mainly) for textual languages: after every key stroke, the structure of the entered text is analyzed. Tokens and literals can be identified, but to make the distinction between the different types of tokens (keywords, identifiers, references), manual user input is required. Similarly to metaBup, the generated metamodel can be accessed and changed by the user.

The discussed tools only focus on syntax: no sketching of the semantics of the language is supported. Moreover, they do not allow for multiple concrete syntaxes to be sketched. Most tools make an explicit distinction between sketches (example models) and instance models. There is no integrated sketching/modeling environment where the language gradually evolves from an imprecise, sketched language with underspecified constraints and semantics to a fully specified language that can be used for detailed system design. We aim to bridge that gap by viewing the modeling activity not as distinct from the sketching activity, but a natural evolution of it. At any point in time, a modeling environment might allow for the user to start sketching parts of the system that are then later refined.

VII. Conclusion

This paper presents a vision to support the ideation phase, and specifically the sketching activity, for designing complex (cyber-physical) systems using a multi-paradigm modeling approach. We start from the observation that sketching is already performed in several domains, such as mechanical design. These sketches are always informal and are often not used in later design cycles. However, observing such sketches proved insightful and shows that the vocabulary used by the engineers in their sketches resembles a (partial) language for drawing examples to reach a common understanding and agreement; semantics of the language are sketched to convey its meaning. Conversely, traditional modeling and simulation tools require rigidly defined models before being able to simulate and analyze them. We propose to evolve current language engineering techniques to support sketching on three levels: model-language co-design, flexible workflows, and infrastructure. Our approach differs from current state-of-the-art sketching tools for model-driven engineering, as they typically take into account only syntax, and/or focus on the graphical aspect of the sketches to implement sketch recognition.

In future work, we plan to study the sketching process in more detail, to validate and potentially adapt or extend our formalization. We plan to additionally study the role of sketching in the requirements management, analysis, and design phases of project, especially in relation to existing, well-defined development processes. Once the languages, processes, and relation to other activities are validated, we plan an initial implementation of a sketching tool based on the recommendations presented in this paper. Its usefulness can then be evaluated with a number of user studies in different domains, with different user groups.

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Automatic Generation of Valid Behavioral Scripts from UML Sequence Diagrams ⋆

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Abstract. This paper presents the extension of a UML and OCL tool that enables the textual specification of UML sequence diagrams, and the automated generation of all valid behaviors according to these sequence diagrams. Message Sequence Charts (MSC) are used as the textual notation to specify the UML sequence diagrams, and the USE high-level action language SOIL is used to specify behavior.

Keywords: Model-Based Software Engineering · UML Sequence Diagrams · Message Sequence Charts · UML and OCL tool.

1 Introduction

In UML [11], sequence diagrams (SDs) describe one type of interaction, which focuses on the partial order of message interchanges between objects. These diagrams enable rich interaction descriptions, with modularity mechanisms and combination operators such as parallel, alternative, optional, or repeated action or event occurrences (`par`, `alt`, `opt`, `loop`). The semantics of UML interactions, and in particular of SDs, is defined in terms of their valid and invalid traces [9,11]. In this context, traces refer to sequences of action or event occurrences.

Most UML modeling tools support the specification of SDs. In addition to checking that the names and types of the messages are valid, a few tools also provide analysis capabilities, such as checking whether the trace of a program or model execution is valid (w.r.t. a SD) [3], generating test cases [18] and even code from them [8]. Nevertheless, often, the analysis potential is not fully exploited at the modeling level.

One interesting alternative provided by some modeling tools with simulation capabilities is the use of sequence diagrams to represent execution traces, i.e., as *views* of the behavior of the system being modeled. In particular, this is the approach followed by the tool USE (UML-based Specification Environment) [5,6]. In USE, modelers textually specify the structure of their systems using standard UML class diagrams and their associated invariants using OCL [10]. For the

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Native Support for UML and OCL Primitive Datatypes Enriched with Uncertainty in USE *

Tool Paper

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Abstract. Measurement uncertainty, an essential property of any physical system, is gaining attention in the modeling community due to the need to specify these kinds of system properties. Some notations already provide support for representing this information, but there is also the need to count on tools with native support for datatypes enriched with measurement uncertainty, able to manage it in a natural and transparent manner. This paper describes the extension that we have developed for the tool UML-based Specification Environment (USE) for supporting the primitive UML/OCL datatypes with uncertainty information.

Keywords: UML/OCL datatype · Measurement uncertainty · UML/OCL tool.

1 Introduction

Physical systems operating in the real world are always subject to uncertainty. In most of the cases, measurement uncertainty [10, 11] is a property which cannot be disregarded, i.e., we cannot assume that the measures taken by physical components as well as their state (position, temperature, etc.) are precise values. For instance, mechanical arms need to take into account the precision of their movements, the tolerance of their components and their decalibration over time. Hence, when modeling and simulating physical systems, we need to capture and operate with their intrinsic uncertainty. Due to this need to specify and represent these kinds of system properties, *uncertainty* is gaining attention in the modeling community.

In previous works [2, 3, 5], we defined an extension to the UML and OCL primitive datatypes to represent and operate with measurement uncertainty. In particular, we extended the types `Real`, `Integer`, `UnlimitedNatural`, `Boolean`

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Towards an Assessment Grid for Intelligent Modeling Assistance

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ABSTRACT

The ever-growing complexity of systems, the growing number of stakeholders, and the corresponding continuous emergence of new domain-specific modeling abstractions has led to significantly higher cognitive load on modelers. There is an urgent need to provide modelers with better, more Intelligent Modeling Assistants (IMAs). An important factor to consider is the ability to assess and compare, to learn from existing and inform future IMAs, while potentially combining them. Recently, a conceptual Reference Framework for Intelligent Modeling Assistance (RF-IMA) was proposed. RF-IMA defines the main required components and high-level properties of IMAs. In this paper, we present a detailed, level-wise definition for the properties of RF-IMA to enable a better understanding, comparison, and selection of existing and future IMAs. The proposed levels are a first step towards a comprehensive assessment grid for intelligent modeling assistance. For an initial validation of the proposed levels, we assess the existing landscape of intelligent modeling assistance and three future scenarios of intelligent modeling assistance against these levels.

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CCS CONCEPTS

• **General and reference** → **Evaluation**; • **Software and its engineering** → **Model-driven software engineering**; **Abstraction, modeling and modularity**; **Integrated and visual development environments**; **Application specific development environments**.

KEYWORDS

Model-Based Software Engineering, Intelligent Modeling Assistance, Integrated Development Environment, Artificial Intelligence, Feedback, Assessment Levels

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1 INTRODUCTION

Over the last decades, the use of abstractions provided by general-purpose and domain-specific modeling languages has supported a multitude of stakeholders involved in software development. However, modelers are facing high cognitive load for their modeling tasks due to *(i)* the continuous increase of the complexity of the problems where modeling techniques are used nowadays and *(ii)* the increasing number of stakeholders whose needs have to be addressed, and with it the domain-specific modeling abstractions used by these stakeholders. For example, the development of modern data-driven software systems potentially involves many addition, realizing the future scenarios, *e.g.,* by building prototypes of the described IMAs, would allow us to get further insights.

A future research avenue could be the potential use of the assessment grid as a blueprint for a feature model to configure IMAs as a product line. Along these lines, one could investigate trade-offs and dependencies among the different properties and their levels to get a better understanding of feature interactions in the feature model. Last but not least, IMAs themselves could be self-adaptive systems that can model themselves and learn from the interactions with the modeler to autonomously reach higher property levels.

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Testing challenges for NLP-intensive bots

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***Abstract*—The popularity of bots is on the rise, with many bots able to interact with users via a chat or voice interface thanks to the embedding of a Natural Language Processing (NLP) component. Still, companies often express concerns about the quality of such bots, as their malfunctioning could have a severe impact on the company revenue or image. Unfortunately, the field of testing NLP-intensive bots is still in its infancy. This paper aims to characterize the testing properties and techniques (and their adaptation) relevant to this type of bots. We believe this will be helpful as a reference framework to compare and evaluate future bot testing research initiatives.**

***Index Terms*—Bots,Testing,NLP,SWEBOK**

I. Introduction

The success of Artificial Intelligence (AI) has sparked a substantial interest in the software engineering (SE) field to improve its scalability and quality [1]. AI applications face common challenges in their SE processes [2]. Among those, they are hard to specify [3], test, verify and debug [4].

This is even more problematic for NLP-intensive bots. We define NLP-intensive bots (or NLP bots for short) as software bots where the processing of natural language text is crucial to the bot functionality. This category includes chatbots and voicebots[1] but also a large number of bots that need to react to events whose payload involves user utterances (e.g., a bot that reports toxic comments in a GitHub repository).

Testing NLP-intensive bots is especially difficult as testing needs to cover the NLP side of the bot, the software side—often implemented as a finite-state machine (FSM)—and the interaction between both. Thus, even if testing the core software aspects of a bot is a well established research topic [5], the other two are still open research challenges for which we do not even have a clear definition of the testing properties and techniques needed to address them.

In this paper, we review and adapt current testing concepts to NLP-intensive bots in order to advance towards a unified reference framework to promote, classify, compare and evaluate future bot testing research initiatives. Our characterization will rely on the SWEBOK [6] body of knowledge as the source of the testing challenges terminology and organization.

[1] A voicebot employs a speech-to-text component to translate the user input to text, which is what it is really processed by the bot.

II. Quick introduction to the elements of a NLP-intensive bot

NLP-intensive bots typically rely on *intent-based* NLP engines to understand user inputs. *Intents* are a class of events representing the user intention in an abstract way. They are defined through a data set composed of example sentences, which are used to train the underlying ML/NLP engine. For instance, a *Greetings* intent represents the different ways the user can greet the bot such as “Hi”, “Hello”, “Good morning”, etc. These alternative formulations for the intent will comprise the training set to teach the bot what types of user utterances should be matched with this intent.

An intent can carry *parameters*, which are contextual information automatically extracted from the user input. A parameter refers to an *entity*, which can be a preset type managed by the NLP engine (e.g., a city name, a date, etc.), or user-defined enumerations (e.g., a list of products available in an e-commerce website).

As Pereira and Díaz reported [7], bots cannot be reduced to raw NLP capabilities, and other dimensions such as complex system engineering, service integration, and testing have to be taken into account when developing such applications. Indeed, the intents produced by the NLP component are typically integrated in complex FSMs representing the bot’s execution logic. This FSM describes the bot *reaction* to a given intent, but also the sequences of intents/reactions that constitute a conversation path (or flow).

Finally, it is important to stress that bots are not standalone applications, and they have to be deeply integrated with the platform they target (e.g., messaging or voice platforms). This implies taking into account not only the limitations of the platform, but also its specific capabilities (e.g., advanced UI components such as buttons, datepickers, etc.).

An example of a NLP-intensive bot could be our bot to chat with GitHub[2] that can be used to both open issues in GitHub from Slack or, conversely, to subscribe and receive GitHub notifications and display them in Slack.

[2] https://github.com/xatkit-bot-platform/xatkit-examples/tree/master/GitHubBots/GithubBot

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its transitions. If a test identifies the difference between the original bot and a mutant, the mutant is "killed". A key challenge is to decide how different is the mutant from the original as NLP engines have a high-level of tolerance (e.g., typos in the input text may be recognized and corrected by the NLP engine, hence mutants that modify the utterances of an intent would not always affect the results of the tests).

4) Model-based Testing Techniques: **Finite State Machines**. As bots conversations themselves are typically described based on a FSM, all the arsenal of testing techniques for FSMs could be ported to NLP bot model-based testing.

Formal Specifications. Given the ambiguity of natural language, formal specifications are not amenable for the NLP component. On the other hand, the FSM, when present, can be analyzed (e.g., using model checking) in order to check desirable correctness properties such as reachability or to generate traces that can act as test cases.

C. Test-related measures

1) Evaluation of the Program Under Test: **Program Measurements That Aid in Planning and Designing Tests** should include the number of intents in the bot, the number of parameters and training sentences per intent, the length of conversation paths, the number of branches in a conversation, etc. Run-time measures should then include the frequency each of the above is matched/used.

Fault density for the NLP part could be defined as the ratio between the number of intents that failed to match a user input targeting that intent and the total number of intents of the bot.

2) Evaluation of the Tests Performed: **Coverage** in NLP bots must include *intent coverage*, defined as the ratio of intents matched at least once during the test and *intent parameter coverage* as the ratio of intent parameters matched at least once during the test. Besides, intents must be considered when creating tests that exercise the different paths in the FSM as matched intents are required to trigger most of them.

V. Conclusion

We have seen the many specificities of testing NLP-intensive bots, mixing "classical" software testing challenges with NLP/AI-based ones. Most of them are still open research challenges for the bot community. As such, we hope to see continuous efforts in this area in the near future and believe this paper can be helpful to characterize them.

Moreover, many of the open problems in software testing [22] such as test suite reduction [23], [24], prioritization [25], flaky tests [26] or diversity [27] are also of interest here. Similarly, well-known testing techniques in other domains, like A/B testing, could be applied to bots. Furthermore, beyond the SWEBOK properties, some testing concepts more specific to nlp-based interfaces may need to be considered.

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Refactoring Collections in OCL

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Abstract

The current OCL 2.4 specification organizes collections in one abstract class, `Collection(T)`, and four concrete subclasses, namely `Set(T)`, `Bag(T)`, `Sequence(T)`, and `OrderedSet(T)` depending on whether the collection elements are ordered or not, and whether duplicated elements are allowed or not. These four classes provide a clear and useful partition of the whole collections space, covering all relevant aspects. However, the specification of the operations associated with these classes is rather unwieldy and inefficient in the current standard: it contains duplicated descriptions, missing operations and unspecified details. In this paper, we analyze the problems with such specifications, and propose an alternative specification that avoids duplication and missing details based on the introduction of the appropriate intermediate abstract classes that capture the common features of interest of each kind of collection.

Keywords

UML, OCL, Collection, Set, Bag, Sequence, OrderedSet

1. Introduction

Collections are fundamental data structures in any modeling or programming language [1], they allow expressing how elements are grouped according to different policies, and the valid operations that can be applied to them. The current OCL standard [2] defines four basic kinds of collections, namely `Sequence`, `OrderedSet`, `Bag` and `Set`, depending on whether the order of their elements matters or not, and whether duplicated elements are allowed or not. They are expressive enough for representing the usual groups of elements appearing in the specification of any system model, and provide a rich set of operations on the collections for querying and updating them. Furthermore, OCL 2 collections can be nested, i.e., elements of collections can be other collections, and the `collectNested` iterator and the `flatten` operation were introduced in OCL 2 to deal with them.

However, a common problem that any OCL modeler has suffered has to do with the way in which OCL operations on collections are specified in the standard – probably because of the organization of the document, and how the collection classes are structured in a single

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An empirical study on the impact of introducing a modeling tool in a Requirement Engineering course

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***Abstract*—In numerous Programming and Software Engineering courses, students are asked to program on paper. This has supporters and detractors. Among its advantages, supporters claim that programming on paper allows students to focus on functionality, avoiding the distractions caused by syntax and without limiting their thinking to a specific programming language or paradigm. Detractors claim that this method lacks advanced capabilities provided by IDEs such as syntax check and auto-completion. More importantly, it does not give the opportunity to execute and test the code, which prevents students from discovering bugs.**

The state of the art has studied the benefits and disadvantages of programming on paper versus computer for general-purpose languages like Java and C with students of initial courses. Nevertheless, to the best of our knowledge, no study has been done targeting formal languages like OCL, which are taught in advanced courses.

In this paper, we present our experience after introducing a modeling tool for the specification of OCL constraints in a Requirements Engineering course. This course is optional and is offered in the third and fourth years of the Computer Engineering degree. Our study covers two academic years, 2019 and 2020, in which there were 136 and 161 students enrolled, respectively. We present the context and design of our experiment, the results obtained from the empirical study we have performed and our conclusions, which support the suitability of the use of tools.

***Index Terms*—Requirement engineering, modeling tools, OCL, teaching, empirical study**

I. Introduction

In recent years, the professors of the Requirements Engineering course of the Computer Engineering Bachelor Degree offered at the Open University of Catalonia (Universitat Oberta de Catalunya–UOC for short) have noticed that students showed some disappointment with the formative assessment. As part of this formative assessment, they were asked to define a series of restrictions using the declarative language OCL [12]. No digital support was recommended or provided and the students used to do this exercise on paper. The complaints of some of the students, added to the feeling that the lack of a software tool could be affecting the development and results of this exercise, made us consider the introduction of a modeling tool. The idea behind this change is that the tool could allow the students to execute and test such OCL constraints and therefore we could be preventing a potential learning obstacle.

The use of paper in Programming and Software Engineering courses has its supporters and its detractors. On the one hand, many educators endorse the benefits that programming on paper has for Computer Engineering students or for students of any other higher education program. They claim that programming on paper allows students to focus on the logic of the program they are writing, avoids distractions caused by syntax errors, and does not limit the students' thinking to a specific programming language, platform or paradigm[1]. These statements are also explicitly supported by many international companies. For example, during the hiring process, one of the several interviews that their interviewees must pass is the so-called *whiteboard interview*. During these sessions, the potential employees need to solve a problem on a whiteboard using the (pseudo-)language they prefer. This way interviewers assess the knowledge, competences and skills of a potential hire.

At universities, pencil-and-paper programming is frequently used not only as a means of learning but also when assessing the students' knowledge in both formative and summative assessments [1], [19], [20].

Despite its benefits and adoption in specific contexts, paper programming also has its detractors and some widely recognized drawbacks. For example, students often complain that they cannot execute, test, and debug the code they are writing. This method prevents students from verifying correctness of their code and hinders the detection of those errors that could be easily and early discovered with the simple execution of the program.

Apart from the studies that address programming using general-purpose languages (e.g., [1], [19], [20]), to the best of our knowledge, there is no study that focuses on the use of paper as opposed to a tool when learning formal languages and/or standard languages for the definition of rules (such as OCL). Since modeling languages such as UML/OCL [12], [13] are extensively used in the academic environment, not only in our university but in many others[2], we decided to document and publish our experience so that anyone in our situation can benefit from it.

Our study shows that the use of tools for learning rule-definition languages such as OCL is perceived positively by

[1] https://classcube.com/write-code-paper/
[2] https://mde-network.github.io/#miembros

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and its impact on student learning. A good part of these studies, which are mainly focused on learning programming languages, determine the advantages of electronic evaluation over traditional evaluation (on paper or oral). Bessedsen et al. [3] report an experiment with laboratory tests in an introductory programming course with more than 500 students. The result was satisfactory in all aspects: simplicity, efficiency, performance and satisfaction of the participants (both teachers and students). On the other hand, Rytkönen et al. [17] describe their experience teaching C programming. Their findings determine that students perceive programming exams in electronic format as more realistic and natural compared to exams on paper. Likewise, Bottcher et al. [6] report on their transition from paper to electronic exams for an introductory course in Java programming.

Finally, a study closer to our experience is the work published by Öqvist et al. [14], where the authors describe their experiment to evaluate the effects on student performance by comparing hand coding versus the use of programming tools. In this case, the subjects of the experiment were students of initial courses and the selected language was Java. Unfortunately, the results were inconclusive.

To the best of our knowledge, there are no similar studies focusing on the use of modeling tools versus manual drawings for graphical languages like UML or rule definition languages like OCL.

VIII. Conclusions

In this paper, we have presented a study that compares the impact of using of a modeling tool to specify OCL constraints versus the definition of the constraints on paper in a Requirements Engineering course. Our study uses different empirical methods (e.g., interviews and questionnaires) of different natures (quantitative and qualitative) and involves several subjects (students and teaching assistants) to cross-validate and confirm the validity of the results.

The study concludes that students have a positive perception towards the use of modeling tools to specify OCL constraints. Besides, teaching assistants also approve and advocate the use of such tools in subsequent editions of the course. Furthermore, the results seem to indicate that the use of MagicDraw has to some extent a positive impact on the students' final grades, which are slightly higher when they use the tool.

This study is a first attempt towards improving the learning of formal and standard languages, such as OCL, by undergraduate students as well as their satisfaction with the learning process. After this experiment, we have chosen to maintain the optional use of MagicDraw in our Requirements Engineering course and we plan to continue analyzing the evolution of our students' achievements and satisfaction.

In the future, we plan to study whether other instruments (such as the learning resources provided or other modeling tools) can help to improve the performance and satisfaction of the students. We also plan to measure how the usability of such tools can impact the perception of students and their learning experience. We will also explore solutions to be able to relate the student questionnaires with the grade obtained in the CATs at the same time that we ensure their anonymity. In the long term, the success in the use of these tools will allow us as professors to set more ambitious learning objectives both in this course and in other software engineering courses in our university.

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XVII

Jornadas de Ingeniería del Software y Bases de Datos

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Prólogo

Las XVII Jornadas de Ingeniería del Software y Bases de Datos (JISBD) (JISBD 2012) se celebraron del 17 al 19 de Septiembre de 2012 en Almería y fueron organizadas por Grupo de Investigación de Informática Aplicada de la Universidad de Almería. Al igual que en anteriores ediciones, JISBD se celebró en paralelo y compartiendo algunos actos de las XII Jornadas de Programación y Lenguajes (PROLE) y de las VIII Jornadas de Ciencia e Ingeniería de Servicios (JCIS). Lo tres eventos son organizados bajo el auspicio de SISTEDES, la Sociedad de Ingeniería del Software y Tecnologías de Desarrollo de Software.

JISBD se ha consolidado como un foro de referencia donde investigadores y profesionales de España, Portugal e Iberoamérica, en los campos de la Ingeniería del Software y de las Bases de Datos, pueden debatir e intercambiar ideas, crear sinergias y, sobre todo, conocer la investigación que se está llevando a cabo en dicha comunidad. A fin de conseguir de manera efectiva este espacio de intercambio, las jornadas se organizaron por sesiones temáticas en las que han tenido cabida hasta cinco tipos de contribuciones: (1) trabajos regulares, que presentan algún resultado de investigación, (2) trabajos emergentes, que están comenzando su andadura, (3) demostraciones de herramientas, (4) trabajos relevantes ya publicados y (5) tutoriales. Para iniciar el debate indicando los aspectos más destacables y los más discutibles de cada contribución, los coordinadores de sesión delegaron parcialmente dicha responsabilidad en la figura del contraponente de cada contribución.

Las sesiones temáticas de esta edición han sido:

- *Sesión 1:* Bases de Datos, Almacenes de Datos, Minería de Datos, Recuperación de la información
- *Sesión 2:* Ingeniería Web, Interfaces de Usuario, Sistemas Colaborativos, Computación Ubicua
- Sesión 3: Apoyo a la decisión en Ingeniería del Software, Metodologías, Experimentación
- *Sesión 4:* Calidad, Pruebas y Requisitos
- *Sesión 5:* Desarrollo de Software Dirigido por Modelos
- *Sesión 6:* Líneas de Producto, Componentes y Arquitecturas Software
- *Sesión 7:* Otros aspectos de Ingeniería del Software y Bases de Datos.

Este volumen presenta las 86 contribuciones que han formado parte de esta edición: 35 trabajos regulares (con un 71% de ratio de aceptación), 19 trabajos emergentes (con un 89% de ratio de aceptación), 18 trabajos ya publicados, 14 herramientas y 2 tutoriales. También ofrece una breve reseña de la charla invitada impartida por el profesor Armando Fox de la Universidad de California, Berkeley titulada: “Cruzando el abismo educativo” de la ingeniería de software utilizando Software como Servicio y computación en nube. Agradezco que aceptara formar parte de estas Jornadas y su más que colaborativa disposición.

Un signo que acompaña la madurez de la comunidad es la existencia de un abanico de herramientas software cada vez más poblado y de mayor calidad. En esta edición se dispuso un comité de apoyo para su revisión y se organizó una breve sesión plenaria el último día donde dar a conocer y discutir sobre el “mapa de herramientas” de la comunidad JISBD. Estamos convencidos de que esta iniciativa aumentará las sinergias entre los grupos de investigación y por ende aumentará el valor del conocimiento científico y tecnológico que va atesorando nuestra comunidad.

Me gustaría expresar mi más sincero agradecimiento a los miembros del Comité de Programa por su tiempo y dedicación a la hora de revisar y seleccionar los artículos que fueron finalmente aceptados para su presentación, y que han permitido confeccionar un año más un programa de gran calidad y nivel. También a los distintos Coordinadores que se han ocupado de organizar aspectos esenciales como las demostraciones de herramientas (Cristina Vicente y Fernando Sánchez), trabajos relevantes (Amador Durán), tutoriales (Ángeles Saavedra) y coordinadores de las diferentes sesiones temáticas. Por supuesto, mi agradecimiento a los autores que enviaron artículos a las Jornadas, hayan sido aceptados o no, por su esfuerzo y contribución al evento.

También me gustaría agradecer al equipo del comité de organización liderado por Luis Iribarne su gran esfuerzo y excelente trabajo, que han permitido hacer realidad esta conferencia; al Comité Permanente de las JISBD por depositar su confianza a la hora de presidir el Comité de Programa, y por su constante apoyo y soporte. Mención especial merece Coral Calero, cuyos consejos y ayuda como presidente saliente han sido siempre inestimables. Un especial agradecimiento a la Universidad de Almería, que ha hecho posible que la conferencia fuera todo un éxito. Asimismo, este evento no hubiera sido posible sin el aval de la Sociedad de Ingeniería del Software y Tecnologías de Desarrollo de Software (SISTEDES) y sin la colaboración de la Asociación de Técnicos de Informática (ATI), y la oficina española del W3C.

Muchas gracias a todos los asistentes y participantes a las JISBD 2012, y esperamos verles de nuevo en las próximas JISBD.

Almería, Septiembre 2012

Antonio Ruiz-Cortés
Presidente del Comité de Programa de JISBD 2012

Prologo de la Organización

Las jornadas SISTEDES 2012 son un evento científico-técnico nacional de ingeniería y tecnologías del software que se celebra este año en la Universidad de Almería durante los días 17, 18 y 19 de Septiembre de 2012, organizado por el Grupo de Investigación de Informática Aplicada (TIC-211). Las Jornadas SISTEDES 2012 están compuestas por las XVII Jornadas de Ingeniería del Software y de Bases de Datos (JISBD'2012), las XII Jornadas sobre Programación y Lenguajes (PROLE'2012), y la VIII Jornadas de Ciencia e Ingeniería de Servicios (JCIS'2012). Durante tres días, la Universidad de Almería alberga una de las reuniones científico-técnicas de informática más importantes de España, donde se exponen los trabajos de investigación más relevantes del panorama nacional en ingeniería y tecnología del software. Estos trabajos están auspiciados por importantes proyectos de investigación de Ciencia y Tecnología financiados por el Gobierno de España y Gobiernos Regionales, y por proyectos internacionales y proyectos I+D+i privados. Estos encuentros propician el intercambio de ideas entre investigadores procedentes de la universidad y de la empresa, permitiendo la difusión de las investigaciones más recientes en ingeniería y tecnología del software. Como en ediciones anteriores, estas jornadas están auspiciadas por la Asociación de Ingeniería del Software y Tecnologías de Desarrollo de Software (SISTEDES).

Agradecemos a nuestras entidades colaboradoras, Ministerio de Economía y Competitividad (MINECO), Junta de Andalucía, Diputación Provincial de Almería, Ayuntamiento de Almería, Vicerrectorado de Investigación, Vicerrectorado de Tecnologías de la Información (VTIC), Enseñanza Virtual (EVA), Escuela Superior de Ingeniería (ESI/EPS), Almerimatik, ICESA, Parque Científico-Tecnológico de Almería (PITA), IEEE España, Colegio de Ingenieros Informática de Andalucía, Fundación Mediterránea, y a la Universidad de Almería por el soporte facilitado. Asimismo a D. Félix Faura, Director de la Agencia Nacional de Evaluación y Prospectiva (ANEP) de la Secretaría de Estado de I+D+i, Ministerio de Economía y Competitividad, a D. Juan José Moreno, Catedrático de la Universidad Politécnica de Madrid, presidente de la Sociedad de Ingeniería y Tecnologías del Software (SISTEDES), a D. Francisco Ruiz, Catedrático de la Universidad de Castilla-La Mancha, y a D. Miguel Toro, Catedrático de la Universidad de Sevilla, por su participación en la mesa redonda "*La investigación científica informática en España y el año Turing*"; a Armando Fox de la Universidad de Berkley (EEUU) y a Maribel Fernández del King's College London (Reino Unido), como conferenciantes principales de las jornadas, y a los presidentes de las tres jornadas por facilitar la confección de un programa de *Actividades Turing*. Especial agradecimiento a los voluntarios de las jornadas SISTEDES 2012, estudiantes del Grado de Ingeniería Informática y del Postgrado de Doctorado de Informática de la Universidad de Almería, y a todo el equipo del Comité de Organización que han hecho posible con su trabajo la celebración de una nueva edición de las jornadas JISBD'2012, PROLE'2012 y JCIS'2012 (jornadas SISTEDES 2012) en la Universidad de Almería.

Luis Iribarne
Presidente del Comité de Organización
@sistedes2012{JISBD;PROLE;JCIS}

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Coordinadores: Dr. Pascual González y Dr. Juan Carlos Preciado

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Coordinadores: Dra. Mercedes Ruiz y Dr. Agustín Yagüe

Sesión Temática 4: Calidad, Pruebas y Requisitos
Coordinadores: Dr. Xavier Franch y Dr. Claudio de la Riva

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Sesión Temática 7: Miscelánea
Coordinadora: Dra. Coral Calero

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14. F.E. Hernandez and R.R. Ortega, “Eberos GML2D: A Graphical Domain-Specific Language for Modeling 2D Video Games,” Proc. 10th SPLASH Workshop on Domain-Specific Modeling, Aalto-Print, 2010;
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Prueba de Transformaciones de Modelos con TractsTool

Manuel Wimmer, Loli Burgueño, and Antonio Vallecillo

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Resumen Las tranformaciones de modelos son un elemento esencial en la Ingeniería Dirigida por Modelos (Model-driven Engineering, MDE) y por ello una tarea que está cobrando relevancia es probar su corrección. Los *Tracts* ofrecen un enfoque modular y extensible para la especificación y verificación de transformaciones de modelos. Este trabajo presenta TractsTool, una herramienta desarrollada en Eclipse que implementa los mecanismos que proporcionan los *Tracts*.

Palabras clave: MDE, Transformaciones de Modelos, Tracts

1. Introducción

La Ingeniería Dirigida por Modelos es una metodología que trabaja con modelos de dominio. Una tarea importante en este ámbito es la transformación de modelos, para la cual existen lenguajes que a partir de uno o varios modelos origen permiten obtener uno o varios modelos destino. Cada modelo implicado en una transformación es conforme a un metamodelo, que también debe ser conocido.

En sus inicios las transformaciones de modelos eran simples pero conforme la tecnología y el software ha ido evolucionando las tranformaciones cada vez son más complejas y por tanto aumenta la dificultad de probar su corrección.

Los *Tracts* [1] son un enfoque para la especificación y prueba de transformaciones de modelos. Concretamente, son un conjunto de restricciones impuestas sobre los modelos de entrada, de salida y sobre la relación que deben mantener los modelos de entrada con los de salida. El objetivo es que una vez ejecutada la transformación se comprueben las restricciones y en caso de que se satisfagan se podrá tener un mayor grado de certeza de que la transformación es correcta.

Como se puede intuir, puede ser costoso crear manualmente un número considerable de modelos de entrada para probar todos los casos que se puedan dar. Por ello, se hace uso de un lenguaje de creación de modelos, ASSL (A Snapshot Sequence Language) [2], que genera el conjunto de entrada. Concretamente, con ASSL se especifican las propiedades que los modelos generados (conforme a un metamodelo dado) deben satisfacer.

A. Ruíz, L. Iribarne (Eds.): JISBD'2012, pp. 561-564, ISBN:978-84-15487-28-9.
Jornadas SISTEDES'2012, Almería 17-19 sept. 2012, Universidad de Almería.

CERTIFICADO DE ASISTENCIA

Dª. Dolores Burgueño Caballero con DNI nº **25346121-Y** ha asistido a las Jornadas Sistedes 2012 **(JISBD)** que se celebraron en Almería los días 17, 18 y 19 de septiembre de 2012, organizado por el Grupo de Investigación Informática Aplicada (TIC) de la Universidad de Almería y la Fundación Mediterránea Empresa-Universidad de Almería.

Almería 19 de septiembre de 2012

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JISBD'13

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Sesión temática 3: Apoyo a la decisión en Ingeniería del Software, Proceso Software y Metodologías

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Trabajos regulares

Trabajos relevantes ya publicados

Herramientas

Sesión temática 6: Líneas de Producto, Componentes y Arquitecturas Software

Trabajos de investigación emergente

Trabajos regulares

Trabajos relevantes ya publicados

Herramientas

Concurrent Model Transformations with Linda

Loli Burgueño, Javier Troya, and Antonio Vallecillo

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Abstract. Nowadays, model transformations languages and engines use a sequential execution model. This is, only one execution thread deals with the whole transformation. However, model transformations dealing with very large models, such as those used in biology or aerospace applications, require concurrent solutions in order to speed up their performance. In this ongoing work we explore the use of Linda for implementing a set of basic mechanisms to enable concurrent model transformations, and present our initial results.

Key words: Model transformation, concurrency, Linda

1 Introduction

Model transformations (MTs) are at the heart of model-driven engineering (MDE), and provide mechanisms for manipulating and transforming models. MTs provide mechanisms to specify how output models are produced from input models. They can be classified according to different characteristics [1]: abstraction level of input and output models, type of language (declarative, imperative and hybrid), directionality, type of target model, etc.

As far as we are concerned, the engine of the transformation languages available in literature offer a sequential and non-distributed execution model. Only one execution thread deals with the whole transformation. Furthermore, the transformation can only be executed locally in a machine. This solution is inadequate for model transformations that deal with very large models, such as those used in biology or aerospace applications, because their performance is rather low. If transformation engines made use of concurrent execution models, different parts of a very big model, which are independent from each other, could be transformed at the same time by different execution threads. Besides, these independent parts could be distributed in different machines, all sharing a common space for building the output model. This would speed up the transformation process and would prevent from loading big models at once, which is normally very inefficient and a well-known scalability problem of current approaches [2].

Linda [3] is a model of coordination and communication among several parallel processes operating upon objects stored in and retrieved from shared, virtual and associative memory. By storing (input and output) models in an associative memory, we can apply a concurrent and distributed approach for transforming models. In this ongoing work we explore the use of a Linda-based language [4] for implementing a set of basic mechanisms to enable concurrent model transformations.

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On the Modular Specification of NFPs: A Case Study

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Abstract. The modular specification of non-functional properties of systems is a current challenge of Software Engineering, for which no clear solution exists. However, in the case of Domain-Specific Languages some successful proposals are starting to emerge, combining model-driven techniques with aspect-weaving mechanisms. In this paper we show one of these approaches in practice, and present the implementation we have developed to fully support it. We apply our approach for the specification and monitoring of non-functional properties using observers to a case study, illustrating how generic observers defining non-functional properties can be defined in an independent manner. Then, correspondences between these observers and the domain-specific model of the system can be established, and then weaved into a unified system specification using an ATL model transformation. Such a unified specification can also be analyzed in a natural way to obtain the required non-functional properties of the system.

Key words: non-functional properties, domain-specific languages, model transformations, weaving mechanisms

1 Introduction

Models and specifications of systems have been around the software industry from its very beginning, but Model-Driven Engineering (MDE) has come to articulate these models so that the development of information systems can be automated. MDE has raised the level of abstraction at which systems are developed in practice, yielding the focus in the development of software to models. Today, models are being used not only to specify systems, but also to simulate, analyze, modify and generate code of such systems. The popularity of MDE is indeed continuously growing, mainly because of the maturity of model transformation technologies.

MDE is at present being applied in many different scenarios, however it still needs appropriate mechanisms to handle the development of complex systems. Although some advances have happened in recent years, more powerful mechanisms for modularity and reusability of models, metamodels and model transformations are still to come if the technological solutions are to be applied on real developments.

Together with model transformations, the other key component making MDE so appealing is the use of Domain-Specific Modeling Languages (DSMLs). The use of languages based on concepts of the problem domain allow domain-experts, independently of their programming skills, to construct or participate in constructing substantial parts of new systems. Moreover, the implicit knowledge associated to specific domains may

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Por medio de la presente certificamos que

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celebrado en Madrid del 17 al 20 de
septiembre de 2013

Madrid, 20 de septiembre de 2013

Juan José Moreno Navarro
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Actas de las XIX Jornadas de Ingeniería del Software y Bases de Datos (JISBD)

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Prólogo

Las XIX Jornadas de Ingeniería del Software y Bases de Datos (JISBD), se celebran en Cádiz del 16 al 19 de septiembre de 2014. JISBD forma parte de las Jornadas SISTEDES, organizadas por la Sociedad de Ingeniería del Software y Tecnologías de Desarrollo de Software. Además de JISBD, las Jornadas SISTEDES agrupan a las Jornadas sobre Programación y Lenguajes (PROLE) y las Jornadas sobre Ciencia en Ingeniería de Servicios (JCIS), con las que la comunidad JISBD mantiene una estrecha relación.

JISBD se han consolidado, gracias al esfuerzo de nuestra comunidad, como un foro de intercambio y promoción de conocimiento en el área de Ingeniería del Software y Bases de Datos en el ámbito español, portugués y latinoamericano. En JISBD 2014, como en ocasiones anteriores, se han presentado cuatro tipos de contribuciones: artículos regulares, artículos de investigación emergente, artículos relevantes ya publicados y demostraciones de herramientas. Este año se cuenta con 50 contribuciones (14 regulares, 15 emergentes, 12 ya publicados y 9 demos), con un ratio de aceptación del 87% en regulares y 88% en emergentes.

Estas contribuciones se han repartido en las seis sesiones temáticas habituales de JISBD:

- Sesión 1: Bases de Datos, Almacenes de Datos, Minería de Datos, Recuperación de la Información.
- Sesión 2: Ingeniería Web, Interfaces de Usuario, Sistemas Colaborativos, Computación Ubicua.
- Sesión 3: Apoyo a la Decisión en Ingeniería del Software, Proceso Software y Metodologías.
- Sesión 4: Calidad, Pruebas y Requisitos.
- Sesión 5: Desarrollo de Software Dirigido por Modelos.
- Sesión 6: Líneas de Producto, Componentes y Arquitecturas Software.

Además, este año se han incorporado dos importantes novedades:

- Un taller de emprendimiento en las TIC que cuenta con la participación de varios casos de éxito de emprendedores así como la presentación de iniciativas de apoyo y financiación.

- Un Doctoral Consortium para que los doctorandos en el ámbito de SISTEDES presenten su proyecto de tesis doctoral y reciban realimentación por parte de expertos en un comité de evaluación

Se cuenta asimismo con dos conferencias invitadas: “Software Testing and/or Software Monitoring: Differences and Commonalities” ofrecida por Antonia Bertolino, Directora de Investigación del Italian National Research Council (CNR) en Pisa y “Automatic Identification of Service Candidates from Business Process Models” ofrecida por Jan Mendling, Director de Institute for Information Business en WU Vienna.

Me gustaría destacar y agradecer especialmente la importante contribución María José Escalona y Pepe Riquelme, responsables de las nuevas actividades que se han incorporado (el taller de emprendimiento y el Doctoral Consortium) que abordaron gustosamente esta nueva tarea con gran determinación. También destacar el papel de los miembros del Comité de Programa, cuyas revisiones dejan entrever el importante esfuerzo que han realizado para enriquecer los trabajos y promover la discusión científica. Finalmente, quiero subrayar el papel de los Coordinadores de Sesiones, en los que he delegado parte del trabajo, para hacer de éstas un foro interactivo de intercambio y generación de conocimiento, así como la labor realizada por los Comentaristas de los artículos en las distintas sesiones.

Pero JISBD 2014 no habrían dado su fruto sin el trabajo realizado por todos los miembros del Comité Organizador de la Universidad de Cádiz, presidido por Mercedes Ruiz y el apoyo de los miembros del Comité Permanente, a los que tengo que agradecer que hayan depositado en mí su confianza permitiéndome actuar como Presidente del Comité de Programa de JISBD 2014. Adicionalmente, tengo que mencionar la estrecha colaboración mantenida con los Presidentes de los Comités de Programa de los dos años anteriores, Ana Moreno y Antonio Ruiz, cuyos inestimables consejos han sido vitales.

No puedo terminar sin manifestar mi gratitud a los autores de los distintos trabajos, así como a todos los asistentes a las Jornadas, por contribuir al éxito y a la consolidación de las mismas.

Cádiz, Septiembre de 2014

Javier Tuya

Presidente del Comité de Programa de JISBD 2014

Prólogo de la organización

La décima novena edición de las Jornadas de Ingeniería del Software y Bases de Datos (JISBD) se celebra en 2014 en la ciudad de Cádiz, en el ámbito de las Jornadas Sistedes 2014. Como organizadores, agradecemos al Comité Permanente la confianza depositada en nosotros y confiamos en que nuestro trabajo les permita a todos disfrutar de unas Jornadas enriquecedoras tanto desde el punto científico como personal.

Queremos agradecer a los miembros del comité de programa de JISBD su disponibilidad y trabajo efectuado durante las revisiones y la confección del programa científico del evento, así como a los coordinadores de las diferentes sesiones su atención a los detalles particulares de cada una de ellas. Es imprescindible manifestar la excelente labor del presidente del comité de programa, Javier Tuya, que, con su implicación en todos los detalles relacionados con las Jornadas, nos ha facilitado en gran medida nuestra tarea.

También es necesario agradecer a las entidades colaboradoras su contribución en la celebración del evento. En tiempos como los actuales resulta, si cabe, aún más importante este agradecimiento. Agradecemos a la Universidad de Cádiz, a la Escuela Superior de Ingeniería y al Departamento de Ingeniería Informática las facilidades que nos han dado para el uso de las instalaciones y recursos. Queremos reconocer la importante contribución de los grupos de investigación de Mejora del Proceso Software y Métodos Formales y UCASE de Ingeniería del Software, porque han contribuido con lo más preciado que tienen que son sus miembros. De igual manera, queremos agradecer al Excmo. Ayuntamiento de Cádiz y a su Delegación de Turismo su atenta colaboración y atención en la organización de algunas de las actividades sociales del programa de las Jornadas. De igual manera, agradecemos a las empresas Renfe e Iberia su colaboración a la hora de poner a disposición de los asistentes los descuentos para el desplazamiento a Cádiz.

Nuestra gratitud a Luis Iribarne y a Juan Manuel Vara por su disponibilidad, sus valiosos consejos y experiencia compartida sobre la organización de las dos ediciones anteriores.

Finalmente, nuestro agradecimiento más particular y especial debe ir dedicado a todos aquellos que han colaborado en los trabajos de organización de las Jornadas. Agradecemos profundamente el tiempo, las energías, la implicación, el compromiso y el trabajo de todos los que han participado en la preparación y celebración de las Jornadas.

Os deseamos a todos una feliz estancia en Cádiz y confiamos en que las Jornadas constituyan un excelente foro de intercambio de conocimientos, experiencias y reflexión.

Cádiz, septiembre de 2014

Mercedes Ruiz

Presidenta del Comité Organizador
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Primitive Operators for the Concurrent Execution of Model Transformations Based on LinTra

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Abstract. Performance and scalability of model transformations are becoming prominent topics in Model-Driven Engineering. In previous work, we introduced LinTra, a platform for executing out-place model transformations in parallel. LinTra is based on the Linda coordination language for archiving concurrency and distribution and is intended to be used as a middleware where high-level model transformation languages (such as ATL and QVT) are compiled. To define modularly the compilation, this paper presents a minimal, yet sufficient, collection of primitive operators that can be composed to (re-)construct any out-place, unidirectional model transformation language (MTL). These primitives enable any MTL to be executed in parallel in a transparent way, without altering the original transformation.

Keywords: Model Transformation, Primitives, LinTra

1 Introduction

Model-Driven Engineering is a relatively new paradigm that has grown in popularity in the last decade. Although there are a wide variety of approaches and languages with different characteristics and oriented to different types of model transformations (MT), most of the model transformation engines are based on sequential and local execution strategies. Thus, they have limited capabilities to transform very large models and even less capability to do it in a reasonable amount of time.

In previous works [1,2], we investigated concurrency and distribution for out-place transformations to increase their performance and scalability. Our approach, LinTra, is based on Linda [5], a mature coordination language for parallel processes. Linda supports reading and writing data in parallel into distributed tuple spaces. A tuple space follows the Blackboard architecture [3], which makes the data distributed among different machines transparent to the user.

To execute transformations on the LinTra architecture, LinTra specifies how to represent models and metamodels, how the trace links are encoded for efficient retrieval,

5 Conclusion and Other Work

In this paper, we have presented a collection of primitives which will be combined for running concurrent and distributed out-place model transformations using LinTra. As this is our initial attempt to come up with the collection of primitives, in the next, we plan to study deeply existing MTLs and extend our set of primitive to encompass, some functionality that we are missing if any.

In terms of related work, several lines of work consider the transformation of large models and their performance and scalability problems [7]. With LinTra [1,2], and its current implementation written in Java, we provide a framework to execute parallel and distributed model transformations that requires all MTs to be executed in Java. With the goal of designing a Domain-Specific Language (DSL), we inspire our work on T-Core [9]. Specifically, on its collection of primitive operators that allows to write in-place MTs in an intermediate level of abstraction which is between the high-level MTLs and the low-level code used by the engines.

After we discover the complete set of primitive operators, there are some other lines of work we would like to explore. First, we will implement the primitives and encapsulate the LinTra code into them. To achieve that, we will explore how to formulate, in the most efficient way, the OCL constraints using the methods available in LinTra to query the Blackboard. Second, we plan to create compilers from the most common MTLs the primitives, so that distributed models can be transformed in parallel reusing MTs written in those languages by means of executing them in the LinTra engine. Third, we want to investigate some annotations for the high-level MTL, so that the user can provide the engine details such as how the parallelization must be done, how the input model should be partitioned, etc. to improve the performance of the transformation. Finally, we plan to investigate the possibility of creating a new and more specific high-level MTL.

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Jornadas Sistedes 2014

Cádiz, del 16 al 19 de septiembre

Certificado de asistencia

Dña. Dolores Burgueño Caballero (25346121Y) ha asistido a las Jornadas Sistedes 2014, celebradas en Cádiz del 16 al 19 de septiembre de 2014, organizadas por la Universidad de Cádiz.

Cádiz, 19 de septiembre de 2014

Presidenta del Comité de Organización:
Mercedes Ruiz Carreira

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Universidad de Cádiz

JISBD
XIX Jornadas de Ingeniería del Software y Bases de Datos

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Doctoral Consortium Jornadas Sistedes 2014

PREFACIO

Las Jornadas de Ingeniería del Software y Bases de Datos (JISBD) son un foro de referencia en la investigación en desarrollo de software en el ámbito iberoamericano. A lo largo de los años, el evento ha servido para que los investigadores de España, Portugal y Latinoamérica presenten sus trabajos y establecieran una comunidad muy sólida alrededor de ambas disciplinas, comunidad que, cada año, se reúne a compartir los avances realizados en cada uno de los campos de investigación.

Las XX Jornadas de Ingeniería del Software y Bases de Datos (JISBD 2015) se han celebrado en Santander del 15 al 17 de septiembre de 2015, como parte de las Jornadas SISTEDES. La vigésima edición es, sin duda, una ocasión para hacer balance del camino recorrido, por un lado, y de consolidar el papel dinamizador de la comunidad a la que aloja, por otro. Es un hecho incontestable que la comunidad de JISBD ha crecido considerablemente desde el inicio de las Jornadas. Con el paso del tiempo, los grupos han abierto nuevas líneas de investigación, por lo que, al amparo de JISBD han surgido un conjunto de comunidades cuyo interés abarca partes específicas de ambas disciplinas. Atendiendo a esa diversidad, y con el fin de que las Jornadas sean un punto de encuentro entre los miembros de cada comunidad, y de ellas entre sí, el programa de las JISBD 2015 se ha estructurado en Sesiones Temáticas o "*tracks*". Cada una de ellas se ha organizado alrededor de una comunidad científica que comparte interés por ciertos temas de investigación en Ingeniería del Software. Los *tracks* de JISBD 2015 han sido los siguientes:

- Gestión de Datos
- Ingeniería Web y Sistemas Colaborativos
- Proceso Software y Metodologías
- Calidad y Pruebas
- Desarrollo de Software Dirigido por Modelos
- Arquitecturas Software y Variabilidad
- Ingeniería del Software Guiada por Búsqueda

Con el fin de acoger a trabajos que no tengan acomodo temático en ninguno de los *tracks* seleccionados, se ha incluido igualmente un *Track* Abierto, con una lista de temas amplia.

En cada *track* se aceptaron distintos tipos de contribuciones: los artículos completos, presentando trabajos consolidados, junto a los artículos cortos, describiendo trabajo en curso o ideas incipientes, fueron los principales tipos de contribución. Además, y siguiendo la tradición de ediciones anteriores, se aceptaron, para su presentación, trabajos publicados en otros foros de calidad, con el fin de dar a conocer a la comunidad los resultados de los investigadores a nivel internacional; estos trabajos no aparecen en estas actas por razones obvias. Por último, se aceptaron demostraciones de herramientas. La revisión de las contribuciones se llevó a cabo por comités de revisión específicos por cada uno de los tracks. Se utilizó EasyChair como herramienta de gestión del proceso de revisión.

Como parte de la conmemoración del vigésimo aniversario, el programa de las JISBD 2015 incluye una conferencia invitada, impartida por uno de los investigadores europeos en Ingeniería del Software más relevantes a nivel internacional: el Prof. Dr. Carlo Ghezzi. El Profesor Ghezzi fue uno de los impulsores del proyecto Impact, patrocinado por ACM SigSoft, cuyo objetivo fundamental fue estudiar y poner de manifiesto la influencia en la industria del software de la investigación académica en Ingeniería del Software. Su charla versa sobre la evaluación de dicha investigación y de los investigadores. Es un tema crucial para la comunidad en los tiempos difíciles que estamos atravesando. Las charlas invitadas correspondientes a las conferencias JCIS y PROLE, celebradas conjuntamente con JISBD 2015, han sido igualmente interesantes y motivadoras.

Agradecimientos

Quisiera, en primer lugar, otorgar todo el crédito en la elaboración del programa a los coordinadores de los *tracks*, que aparecen listados en las páginas siguientes, al igual que los comités de revisión de cada uno de ellos. Sin su colaboración, la labor de selección hubiese resultado mucho más compleja.

Es indudable que unas jornadas como estas se sustentan en las contribuciones que los investigadores envían para su evaluación. Por ello, agradezco a todos ellos su esfuerzo y la confianza que han mostrado en JISBD como foro para la presentación de sus trabajos. Estoy convencido de que las revisiones recibidas habrán servido para mejorar un poco más los artículos.

Agradezco igualmente al Dr. Eduardo Mena el análisis bibliométrico realizado como herramienta de apoyo a la toma de decisión dentro del proceso de selección de los trabajos ya publicados. Espero que tal actividad siente un precedente para futuros eventos.

La labor del Comité Organizador merece igualmente ser destacada. Agradezco al Prof. Dr. Michael González Harbour y su equipo todo el apoyo recibido durante los meses precedentes, y su esfuerzo por que las Jornadas de 2015 sean un éxito como lo fueron las anteriores.

Por último, quiero agradecer al Comité Ejecutivo de SISTEDES, y especialmente al Prof. Dr. Óscar Díaz, su colaboración a lo largo del proceso.

Santander, Septiembre de 2015

José Hilario Canós Cerdá

Presidente del Comité de Programa

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Analysis of the Scientific Production of the Spanish Software Engineering Community

Loli Burgueño, Antonio Moreno-Delgado, and Antonio Vallecillo

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Abstract. Our group has been working on a report for the Spanish Society of Software Engineering and Software Development Technologies (SISTEDES) to provide a general overview of the Spanish scientific production and its contributions worldwide in the field of Software Engineering. Although a Database solution could have been used, we decided to employ Model-Driven Development (MDD) techniques in order to evaluate their applicability, suitability and fitness for these kinds of purposes, and to learn from the experience in this domain, which combines data integration, large scale models, and complex queries.

Keywords: SISTEDES, scientific contribution, Spain, software engineering, MDD

1 Introduction

The increase in research in the past years and the fact that in most of the cases it is funded by public institutions or private companies raised the need of indicators to measure its quality. Among the most popular are the Journal Citation Report (JCR), which measures the impact factor of a journal, and the *h-index*, which is a measure of the number of high impact papers a scientist has published. Given those metrics it is easy to know whether a publication or a researcher is remarkable. Nevertheless, in the case that the interest resides in knowing the influence of a whole community there is no other option than collecting the information of each member and apply descriptive statistical techniques. Descriptive statistics aims at analyzing a population in order to describe or summarize quantitatively its main features.

Our group has been working on a report for the Spanish Society of Software Engineering and Software Development Technologies (SISTEDES) to provide a general overview of the Spanish scientific production and its contributions worldwide in the field of Software Engineering, using the DBLP database as the source of publications.

Although a Database solution could have been used, we decided to employ MDD techniques to eat our own dog food. We wanted to check whether current MDD technologies and languages could easily deal with these kinds of applications, and to evaluate their applicability, suitability and fitness for these kinds of purposes. This was a good way to learn from the experience in this domain, tion about the authors using alternative mechanisms. A second improvement of our work would consist of using weaving models between the different sources instead of the very basic name-matching approach used here. Thirdly, we want to conduct a comparison analysis between our proposal and other approaches to bibliometric analysis that use traditional methods (e.g., databases). Similarly, the use of JLintra allowed us to handle very large models in an efficient way, but there are other approaches that use solutions such as EMFStore, CDO, Morsa or Neo4EMF and they provide querying mechanisms. A comparison analysis with these approaches could also help us better understand the advantages and limitations of our proposed solution. Fourth, we would like to automate the report generation and come up with a Domain Specific Language so that users could define the reports they want/need, and the whole process could take care of everything, specially the generation of the queries metamodels. Finally, we would also like to explore our points in common with MetaScience [5], a recent tool to analyze Scientific Conferences. Although the focus of the tool is on conferences and not on communities, many of the ideas of the two proposals could be shared.

Acknowledgments This work is funded by Research Project TIN2014-52034-R and by the Universidad de Málaga (Campus de Excelencia Internacional Andalucía Tech).

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A José María Troya

En una comida en Sevilla con José María Troya, Pere Botella e Isidro Ramos y en el marco de unas jornadas de trabajo organizadas por Miguel Toro decidimos iniciar formalmente la presentación de trabajos de investigación en Ingeniería del Software en forma de un congreso anual: las Jornadas de Ingeniería del Software, las que posteriormente, con la fusión de las Jornadas de Bases de Datos, darían origen a las JISBD y posteriormente a SISTEDES.

Algo se hizo bien y no fue fruto de la casualidad. Existían las bases suficientes para emprender nuestro particular viaje a Ithaca.

José María, desde su época de estudiante de la Especialidad de Cálculo Automático de la UCM, y más tarde durante la realización de su tesis doctoral, en la que resolvió un problema difícil definiendo una regla heurística para rebajar su complejidad computacional, se mostró como un trabajador infatigable, con una capacidad de iniciativa propia, una ética profesional a toda prueba y una sonriente amabilidad.

Los frutos de su posicionamiento personal y científico, excelentes y públicos, se acompañaron siempre con una amabilidad y seriedad que fraguaron el clima de amistad que caracteriza a nuestra comunidad. Gracias también por eso, José María.

Nosotros no hemos llegado todavía a Ithaca. Tú te anticipaste también en esto. Nos atrevemos a decir, recordando nuestras experiencias latinoamericanas juntos, que “te fuiste pronto como los elegidos en plena gloria y juventud”

Los versos de Kavafis en los que usa el Viaje como metáfora de la Vida no son capaces de llenar el vacío que nos has dejado, pero captan tu particular singladura:

“Cuando emprendas tu viaje a Ithaca /pide que el camino sea largo, /lleno de aventuras, lleno de experiencias/No temas a los lestrigones ni a los cíclopes / ni al colérico Poseidón, /seres tales jamás hallarás en tu camino, /si tu pensar es elevado, si selecta /es la emoción que toca tu espíritu y tu cuerpo/Ten siempre a Ithaca en tu mente. /Llegar allí es tu destino.”

Pero, con celeridad y silencio nos has dejado:

“Mas no apresures nunca el viaje/Mejor que dure muchos años /y atracar, viejo ya, en la isla, enriquecido de cuanto ganaste en el camino /sin esperar que Ithaca te enriquezca”

Tu ausencia estará siempre presente en JISBD, la cuales ayudaste a crear.

Descansa en Paz

Pere Botella, Isidro Ramos y Miguel Toro

Prólogo

Las "Jornadas de Ingeniería del Software y Bases de Datos" (JISBD) constituyen el foro que cada año reúne a la comunidad científica española en las áreas de Ingeniería del Software y Bases de Datos y siempre han atraído el interés de grupos de investigación de Portugal e Iberoamérica en estas dos áreas. JISBD es organizada por la Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software (SISTEDES) junto a otras dos conferencias: Jornadas de Programación Declarativa (PROLE) y Jornadas de Ciencia e Ingeniería de Servicios (JCIS). La vigésimo primera edición de JISBD es uno de los quince eventos científicos que integran la IV Conferencia Española de Informática (CEDI) que se celebra en Salamanca. CEDI tiene una periodicidad de tres años y su propósito es mostrar a la sociedad el estado actual de la informática en España.

En la edición actual, JISBD ha continuado con la organización basada en áreas temáticas o "tracks" puesta en marcha en la edición previa. Los tipos de contribución han sido los considerados en ediciones anteriores: artículos completos, artículos cortos, artículos relevantes y demos. Como novedad se realizó un llamamiento a nuevos tracks dentro de la primera solicitud de contribuciones lanzada a principios de noviembre de 2015. Dado que no se recibió ninguna solicitud no fue necesario aplicar el mecanismo previsto para dar cabida a nuevos tracks. Por tanto, JISBD'2016 incluye los mismos tracks que en la edición anterior: *Arquitecturas del Software y Variabilidad*, *Calidad y Pruebas*, *Desarrollo de Software Dirigido por Modelos*, *Gestión de Datos*, *Ingeniería del Software Guiada por Búsqueda*, *Ingeniería Web y Sistemas Pervasivos* y *Procesos Software y Metodologías*; y de nuevo se ha incluido el track *Abierto* para dar cabida a los trabajos que no encajan en ninguno de los tracks anteriores.

Otra novedad ha tenido que ver con la modalidad de "artículos relevantes" ya publicados en revistas con índices de impacto o conferencias internacionales prestigiosas en las áreas asociadas a un determinado track. Con el fin de facilitar el proceso de selección y asegurar la calidad de estas contribuciones, se ha establecido que un "trabajo relevante" debe haber sido publicado en una revista en el cuartil Q1 de JCR o en una de las dos conferencias que ha seleccionado cada track.

Cabe destacar un incremento significativo en el número de contribuciones recibidas con respecto a las tres ediciones anteriores. Mientras en 2015 se recibieron 70 contribuciones, 54 en 2014 y 64 en 2013, en esta edición se han recibido 94 contribuciones (34 completos, 29 cortos, 25 relevantes y 6 demos). El número de trabajos aceptados ha sido 79 (30 completos, 21 cortos, 24 relevantes y 5 demos). Estos números parecen avalar la nueva organización en torno a áreas temáticas y que las JISBD pueden jugar un importante papel para dinamizar las diferentes comunidades relacionadas con la ingeniería del software y las bases de datos en nuestro país.

La conferencia invitada será impartida por Andrei Voronkok, prestigioso investigador de la Universidad de Manchester que ha recibido el premio Herbrand por sus contribuciones al razonamiento automático y que es creador de EasyChair, una de las herramientas de gestión de conferencias más extendidas en el mundo. El Dr. Voronkok analizará los desafíos a los que se ha debido hacer frente en la construcción de EasyChair desde el punto de vista del diseño de software y la gestión de los datos, así como de los retos para el futuro. Además, las conferencias invitadas de JCIS (Tommi Mikkonnen, Institute of Pervasive Computing, Tampere, Finland) y de PROLE (Arnaud Gotlieb, Simula Research Laboratory, Norway), que se celebran en paralelo en esta ocasión, son también parte del programa de JISBD'2016.

Dada la estructura actual de JISBD basada en track, toda la labor de organización es realizada por un equipo formado por el Presidente del Comité de Programa y los coordinadores de cada track (el listado aparece a continuación de esta presentación). Expreso mi agradecimiento a cada uno de los coordinadores de tracks por el esfuerzo que han realizado y por su buena disposición, ha sido un placer coordinar este equipo. El trabajo que he debido realizar ha requerido un contacto permanente con SISTEDES y con el Comité Organizador de CEDI'2016. Por un lado, debo agradecer a Fernando de la Prieta toda la ayuda prestada, como persona de contacto con dicho comité, para resolver todas las cuestiones relacionadas con la web, el uso de EasyChair, la edición de actas y la gestión económica. Por otro lado, contar con Oscar Díaz como enlace con SISTEDES me ha dado una gran tranquilidad en la toma de decisiones. Agradezco también el apoyo recibido en todo momento por Diego Sevilla.

Los agradecimientos finales para aquellos que son los principales protagonistas: autores y revisores. A los primeros por apoyar a JISBD con el envío de publicaciones y la presentación de sus trabajos en Salamanca, y a los segundos por su dedicación a la tarea de mantener el nivel de calidad esperado de las contribuciones a JISBD y ayudar a los autores a mejorar sus trabajos.

Y por último, esta presentación de JISBD'2016 no puede acabar sin recordar a José María Troya, uno de los impulsores de estas Jornadas y de la Ingeniería del Software en nuestro país.

Salamanca, 13 de septiembre de 2016

Jesús J. García Molina
Presidente del Comité de Programa

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Tema Abierto:

Towards Distributed Model Transformations with LinTra

Loli Burgueño[1], Manuel Wimmer[2], and Antonio Vallecillo[1]

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Abstract. Performance and scalability of model transformations are becoming prominent topics in Model-Driven Engineering. In previous works we introduced LinTra, a platform for executing model transformations in parallel. LinTra is based on the Linda model of a coordination language and is intended to be used as a middleware where high-level model transformation languages are compiled. In this paper we present the initial results of our analyses on the scalability of out-place model-to-model transformation executions in LinTra when the models and the processing elements are distributed over a set of machines.

1 Introduction

The performance and scalability of model transformations is gaining interest as industry is progressively adopting model-driven techniques, multicore computers are becoming commonplace and the cloud is extensively used. However, existing model transformation engines are mostly based on sequential and in-memory execution strategies, and thus their capabilities to transform large models in parallel and distributed environments are limited.

In previous works we introduced LinTra [2,3], a platform for executing model transformations in parallel. LinTra is based on the Linda model of a coordination language and is intended to be used as a middleware where high-level model transformation languages are compiled. Currently LinTra outperforms existing sequential and parallel model transformation engines, but we also wanted to study how the distribution aspects affect the performance of LinTra. In this paper we present the initial results of our analyses on the scalability of out-place model-to-model transformation executions in LinTra when the models and the processing elements are distributed over a set of machines.

This paper is organized as follows. After this introduction, Sect. 2 briefly describes the background of our proposal and the running example we use in the paper to illustrate our approach. Then, Sect. 3 describes an implementation and evaluation based on the case study and, finally, Sect. 4 draws some conclusions and oulines future work.

2 Backgound

2.1 LinTra

LinTra [2, 3] is a framework for the parallel execution of model transformations. It uses data-parallelism and the Blackboard paradigm [4] to store the input and output

Execution times (seconds)					
# Elems	Config.0	Config.1	Config.2	Config.3	Config.4
200	0.05	6.65	0.03	11.85	0.01
2,000	0.04	26.85	0.09	43.24	0.02
20,000	0.11	292.84	0.39	422.51	0.03
100,000	0.84	1,602.08	3.02	3,343.25	0.09
200,000	1.53	3,087.76	6.20	3,781.01	0.74
300,000	2.14	5,364.64	12.24	3,460.81	1.01
400,000	3.00	7,230.36	13.29	7,246.77	1.44
1,000,000	16.50	24,855.58	40.02	27,726.10	3.98
2,000,000	18.38	49,711.19	90.97	47,134.36	11.53
5,000,000	52.97	104,393.49	314.42	113,122.47	26.38

Speed-up					
# Elems	Config.0	Config.1	Config.2	Config.3	Config.4
200	1.00	141.43	0.68	252.13	0.30
2,000	1.00	745.69	2.61	1,201.00	0.42
20,000	1.00	2,762.65	3.69	3,985.91	0.30
100,000	1.00	1,911.79	3.60	3,989.55	0.11
200,000	1.00	2,020.79	4.06	2,474.48	0.48
300,000	1.00	2,511.53	5.73	1,620.24	0.47
400,000	1.00	2,410.92	4.43	2,416.59	0.48
1,000,000	1.00	1,506.03	2.43	1,679.96	0.24
2,000,000	1.00	2,704.93	4.95	2,564.72	0.63
5,000,000	1.00	1,970.95	5.94	2,135.76	0.50
Average	***1.00***	***1,858.67***	***3.81***	***2,252.01***	***0.39***

Fig. 2. Execution times (left) and relative speedups (right) of distributed configurations.

Data and process distribution may have a significant impact on the performance of a model transformation. As expected, the results are very sensitive to the way in which data and processes are distributed among the nodes. We have run some experiments to show some initial results, but this issue deserves further investigations and more detailed analysis to provide more generalized results.

4 Conclusions and Future Work

This position paper has presented some initial experiments that try to estimate the effect of both data and process distribution on the performance of LinTra model transformations. The study conducted here is specific for that solution. We plan to compare these results with the emerging MT engines that also provide distribution (e.g. [1]). We also want to use different technological platforms that offer data distribution to evaluate their performance when connected with LinTra. More precisely, we want to check Infinispan with LevelBD as persistence layer whose results with LinTra are better than other data-grids when executed on a single machine [3], and the combination of Apache Spark and Cassandra. Finally, we also want to use UDP instead of TCP to see the speed-up obtained by simplifying the communication protocol used.

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El Comité Director del *V Congreso Español de Informática* (CEDI 2016)

HACE CONSTAR

Que Loli Burgueño Caballero ha presentado el artículo *Towards Distributed Model Transformations with LinTra* realizado por *Loli Burgueño, Manuel Wimmer and Antonio Vallecillo* en el congreso XXI JORNADAS DE INGENIERÍA DEL SOFTWARE Y BASES DE DATOS celebrado en Salamanca (España) del 13 al 16 de septiembre de 2016.

En Salamanca, a 13 de septiembre de 2016.

UNIVERSIDAD DE SALAMANCA DEPARTAMENTO INFORMÁTICA Y AUTOMÁTICA

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Confianza e Incertidumbre en Modelos y Transformaciones de Modelos

L. Burgueño[12], G. Barquero[1], N. Moreno[1], M. F. Bertoa[1], and A. Vallecillo[1]

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Resumen La incertidumbre, tanto en los datos como en los mecanismos que manipulan y operan sobre ellos, es un tema crucial en sistemas que trabajan con entornos físicos. Una incertidumbre que puede ser debida a diversos factores, como fuentes de datos poco fiables, tolerancia en las mediciones o la incapacidad para determinar si un determinado evento ha sucedido realmente o no. En este trabajo proponemos el uso de *modelos con confianza*, donde los objetos pueden llevar asociadas probabilidades. Al igual que en los modelos, la incertidumbre puede trasladarse a las transformaciones de modelos, donde las reglas también pueden estar sujetas a incertidumbre.

1. Introducción

Los sistemas físicos, por su naturaleza, llevan intrínseca incertidumbre tanto en los datos como en las aplicaciones y programas que los manejan y operan con ellos. Esta incertidumbre puede venir dada por diferentes causas, como por ejemplo las fuentes de datos y redes de comunicación poco fiables, la tolerancia en la medición de los valores de los elementos físicos, las estimaciones debidas a la imposibilidad de conocer con exactitud algunos parámetros, o la incapacidad de determinar si un determinado evento ha sucedido realmente o no. En la mayoría de los casos es imprescindible tener en cuenta esta incertidumbre y manejarla adecuadamente.

En este trabajo nos centramos en el tratamiento de la incertidumbre en el paradigma de la Ingeniería Dirigida por Modelos (MDE por sus siglas en inglés). Dicha incertidumbre, a la cual también llamamos confianza, se refleja en los elementos de los modelos, en particular en sus objetos. Para considerarla, proponemos el uso de atributos que permitan estimar la confianza sobre su existencia. Un ejemplo muy típico ocurre en los sistemas que contienen objetos que representan eventos del entorno físico, como robots o drones que se mueven de un punto a otro y cuya posición exacta siempre arroja un margen de error de milímetros o incluso centímetros, o en sensores que toman medidas y disparan eventos, los cuales en ocasiones pueden ser falsos positivos. De forma análoga, el establecimiento de ciertas relaciones derivadas entre dos objetos puede estar sujeta a incertidumbre debido a que la regla que estima dicha derivación puede tener cierto margen de error o imprecisión.

Por otro lado, cuando se establece una trasformación de modelos también se puede estar introduciendo incertidumbre debido a diferentes causas. En primer lugar, algunas reglas de la transformación pueden tener cierta incertidumbre asociada, cuando no tenemos una confianza del 100 % en ellas. En segundo lugar, en el proceso de *matching* de las reglas, puede que se incurra también en incertidumbre debida, por ejemplo, a la

Figura 2. Input and output models

particular de transformaciones de modelos [3]. Wang [6] aborda la incertidumbre en la selección de los antecedentes, mientras que Wasserkrug [7] y Cugola [2] tratan las otras dos fases usando Redes Bayesianas, aunque cada uno de forma diferente. En [5] hicimos una propuesta que cubre las tres fases en el caso de CEP, usando el sistema de tipos extendido para UML y OCL definido en [1]. Esto simplifica notablemente la representación de la incertidumbre y su propagación, como hemos visto en la sección 3. En este trabajo proponemos una extensión de dicha propuesta al dominio de los modelos y las transformaciones entre ellos, generalizando significativamente los resultados obtenidos, así como su aplicabilidad.

5. Conclusiones y trabajo futuro

En este trabajo emergente proponemos la inclusión de información sobre la *confianza* que tenemos en los elementos de los modelos y las transformaciones entre ellos. Hemos identificado distintos tipos de incertidumbre que pueden afectar a dicha confianza, y propuesto una forma de calcular la confianza de los elementos generados por una transformación. Por supuesto, la propuesta es inicial y está sujeta a un ejercicio de validación exhaustiva que permita comprobar su fiabilidad, aplicabilidad y uso.

Agradecimientos Este trabajo ha sido financiado por el proyecto TIN2014-52034-R.

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Preliminares

Las "Jornadas de Ingeniería del Software y Bases de Datos" (JISBD) son el principal foro anual que, desde hace 23 años, reúne a la comunidad científica española en las áreas de Ingeniería del Software y de Bases de Datos. Tradicionalmente este evento ha atraído también el interés de colegas extranjeros provenientes de Iberoamérica, tanto en lengua española como portuguesa. Las JISBD están promovidas por la Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software (SISTEDES) y se celebran junto con otras dos conferencias: Jornadas de Programación y Lenguajes (PROLE) y Jornadas de Ciencia e Ingeniería de Servicios (JCIS).

En esta XXIII edición, celebradas del 17 al 19 de septiembre en Sevilla, las JISBD han estado estructuradas en base a 7 áreas temáticas:

- Ingeniería Web y Sistemas Pervasivos (IWSP),
- Metodologías, Calidad y Pruebas Software (MCPS),
- Métodos Empíricos en Ingeniería del Software y Sistemas de Información (MEISSI)

Los tipos de contribuciones en cada área temática han sido: artículos completos, artículos cortos, artículos relevantes (ya publicados en otros foros de relevancia), demostraciones de herramientas y descripción de proyectos de I+D aplicados o contratos con empresas. Esta última modalidad ha supuesto una novedad con respecto a ediciones anteriores, acaparando el 12,5% de los trabajos enviados. Su finalidad es la de compartir con la comunidad la aplicabilidad de nuestros resultados de I+D en el ámbito empresarial. Esperamos que esta modalidad se consolide en los próximos años pues será un buen indicador de la deseable imbricación Universidad-Empresa.

Dando continuidad a ese sentido de aplicabilidad de resultados, este año JISBD ha contado con una conferencia invitada a cargo del profesor Marco Brambilla del Politécnico de Milán con el título "La explotación industrial del trabajo académico: lecciones aprendidas". Marco, como profesor, investigador en proyectos de grandes consorcios empresariales y emprendedor, trata de aportar una visión muy clara de la relación entre la industria y la universidad a través de las lecciones aprendidas durante su dilatada experiencia en la explotación industrial de su trabajo. Marco es inventor de IFML (Interaction Flow Modeling Language) adoptado como estándar por la OMG. Tiene dos patentes relacionadas con crowdsourcing y búsquedas multi dominio. Es socio y mentor científico de WebRatio, una compañía italiana que nació como spin-off y que comercializa fundamentalmente una herramienta de modelado de aplicaciones web que es un referente internacional. También es fundador y mentor científico de Fluxedo, una startup relacionada con la comunidad:

- Desarrollo de bibliotecas de procesamiento de sistemas con anotaciones tipo Spring, por parte de Macario Polo (UCLM)
- TESTAR – Testing automatizado a nivel de Interfaz Gráfica de Usuario por parte de Tanja Vos, Fernando Pastor y Ramón de Vries (UPV)
- Data Lakes: una aproximación práctica, por parte de Miguel Ángel Martínez y Aníbal Bregón (UVA)

Adicionalmente, y como eventos compartidos con las otras dos conferencias promovidas por SISTEDES, se contó con una charla invitada por parte de Victoria Ley Vega de Seoane, responsable de la división de Evaluación, Coordinación y Seguimiento Científico y Técnica de la Agencia Estatal de Investigación (AEI), titulada "Procesos de evaluación, selección y seguimiento en la Agencia Estatal de investigación" y una mesa redonda en torno al papel de "La Ingeniería en la Informática" en la que participaron Javier Aracil, Miguel Toro y Mario Piattini.

En esta edición de JISBD se presentaron 96 trabajos de 304 autores pertenecientes a 18 países diferentes, consolidando los números obtenidos en las dos ediciones anteriores. El desglose por tipo de trabajo fue el siguiente: 30 completos, 23 cortos, 4 demos, 27 relevantes y 12 descripciones de proyectos o contratos. Señalar que para que un trabajo fuera considerado relevante debía estar en Q1 ó Q2 del JCR o bien en congresos considerados como clases 1 y 2 en la clasificación de congresos relevantes en Informática (http://www.scie.es/clasificacion-congresos-relevantes-informatica/) promovido por SCIE (Sociedad Científica Informática de España) de la que SISTEDES forma parte. De los trabajos objeto de revisión (se excluyen los relevantes), finalmente fueron aceptados 60.

Dada la estructura actual de JISBD basada en áreas temáticas, toda la labor de organización en cuanto a Comité de Programa se refiere es realizada por un equipo formado por el duda, ha sido un placer coordinar este equipo. A veces he sentido que ellos me coordinaban a mi.

El trabajo realizado ha requerido un contacto permanente con el Comité Organizador de JISBD y con SISTEDES. Por un lado, debo agradecer a Amador Durán y Antonio Ruíz toda la ayuda prestada desde el primer momento y que ha facilitado enormemente la configuración del programa. Por otro lado, contar con Óscar Díaz como enlace con SISTEDES ha sido un lujo y una garantía de que todo iba en la dirección correcta. Especial mención merece el trabajo realizado por José Hilario Canós y su equipo en la confección de las actas que con el nivel de automatización alcanzado nos ha evitado realizar cualquier acción manual. Mi reconocimiento a Francisco Ruíz, presidente de la edición anterior, por sus acertados consejos.

Mi agradecimiento también al comité permanente de SISTEDES, y a Antonio Vallecillo como su presidente, por su “irresponsabilidad” al considerar que era digno de asumir esta responsabilidad. Espero no haberles defraudado. Ni a ellos ni a Juan Hernández que fue quien propuso mi nombre y al que debo agradecer no sólo esto sino otras muchas cosas. Para mi, que realicé parte de mis estudios en la Universidad de Sevilla y que presenté prácticamente mi primer trabajo de investigación en las I Jornadas de Ingeniería del Software (entonces JIS) celebradas en Sevilla, volver 23 años después a esta maravillosa ciudad como presidente del Comité de Programa es una extraordinaria satisfacción.

Los agradecimientos finales para aquellos que son los principales protagonistas: autores y revisores. A los primeros por apoyar a JISBD con el envío de publicaciones y la presentación de sus trabajos en Sevilla, y a los segundos por su dedicación a la tarea de mantener el nivel de calidad esperado de las contribuciones a JISBD, ayudar a los autores a mejorar sus trabajos y cumplir escrupulosamente con los plazos marcados. Gracias a ellos todo fue mucho más fácil.

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CERTIFICADO

Dª LOLA BURGUEÑO CABALLERO

ha asistido a las

JORNADAS DE LA SOCIEDAD DE INGENIERÍA DE SOFTWARE Y TECNOLOGIAS DE DESARROLLO DE SOFTWARE (SISTEDES),

celebradas del 17 al 19 de septiembre de 2018 en la Universidad de Sevilla.

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JISBD 2018

XXIII Jornadas de Ingeniería del Software y Bases de Datos

Sevilla, 17-19 de septiembre de 2018

Certificado de Presentación de Trabajo

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INFORMA QUE el trabajo:

Número: 43

Título: **Confianza e Incertidumbre en Modelos y Transformaciones de Modelos**

Autores: Loli Burgueño, Gala Barquero, Nathalie Moreno, Manuel F. Bertoa and Antonio Vallecillo

Área/track: ISDM

HA SIDO PRESENTADO EN JISBD 2018

Fernando Sánchez Figueroa
Presidente del comité de Programa de JISBD 2018

Preliminares

Las "Jornadas de Ingeniería del Software y Bases de Datos" (JISBD) son el principal foro anual que reúne a la comunidad científica española, portuguesa y latinoamericana en las áreas de Ingeniería del Software y Bases de Datos. A día de hoy se han convertido en un punto de encuentro ineludible para que la comunidad iberoamericana presente sus trabajos más recientes y significativos, comparta sus experiencias en el área a través de proyectos o colaboraciones con la industria, y establezca y consolide colaboraciones. Las JISBD están promovidas por la Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software (SISTEDES) y se celebran junto con otras dos conferencias: Jornadas de Programación y Lenguajes (PROLE) y Jornadas de Ciencia e Ingeniería de Servicios (JCIS). Esta XXIV edición, se ha celebrado en un enclave maravilloso, la ciudad de Cáceres, del 2 al 4 de septiembre, coincidiendo con su vigésimo aniversario, cuando las JISBD se celebraron en Cáceres en 1999. Esto hace especial a esta edición y se convierte en un motivo de celebración y recuerdo para la comunidad.

La XXIV edición de JISBD ha contado como conferenciante invitado con el profesor Dr. Paris Avgeriou de la *University of Groningen* de Holanda, donde dirige su grupo de investigación de ingeniería del software desde 2006, y en la actualidad es *Editor in Chief* de la revista *Journal of Systems and Software* y *Associate Editor* de la revista *IEEE Software*. El Dr. Paris Avgeriou es un investigador de referencia en el área de Ingeniería del Software, en general, y de las arquitecturas software, en particular; de ahí que su conferencia se haya centrado en un tema crítico en la actualidad en estas dos áreas, como es la deuda técnica, dando por título a su conferencia:

"Technical Debt: talking about the elephant in the room" Dr. Paris Avgeriou

Además, la XXIV edición de JISBD se ha estructurado en 7 áreas temáticas:

- Arquitecturas Software y Variabilidad (ASV),
- Gestión de Datos (GD),
- Ingeniería del Software Dirigida por Modelos (ISDM),
- Ingeniería del Software Guiada por Búsqueda (ISGB),
- Ingeniería Web y Sistemas Pervasivos (IWSP),
- Metodologías, Calidad y Pruebas Software (MCPS),
- Métodos Empíricos en Ingeniería del Software y Sistemas de Información (MEISSI)

Los tipos de contribuciones en cada área temática han sido: artículos completos, artículos cortos, artículos relevantes (ya publicados en otros foros de relevancia), demostraciones de herramientas, descripción de proyectos de I+D aplicados o contratos con empresas, y contribuciones industriales, dónde las empresas presenten enfoques o técnicas de ingeniería del software y/o bases de datos aplicados en la empresa. Esta última modalidad ha supuesto una novedad con respecto a ediciones anteriores, y constituye un primer paso para conseguir un acercamiento entre las necesidades de la industria y las soluciones en investigación. Esperamos que esta modalidad se consolide junto con la modalidad de proyectos I+D, introducida en la edición anterior, en los próximos años para incrementar las colaboraciones Universidad-Empresa. En esta edición se registraron en Easychair 100 artículos, siendo finalmente 97 los artículos presentados, consolidando los números obtenidos en las tres ediciones anteriores. Estos artículos se han realizado por un total de 272 autores y autoras procedentes de 20 países diferentes, siendo españoles el 86%. Así mismo, el 88% de los autores son procedentes de universidad, el 8% de institutos y laboratorios de investigación, y el 4% de empresa. Se espera mejorar estas tasas incrementado el número de autores que no provienen de la universidad, para que haya un balanceo más equitativo, igual que en el caso de género, ya que únicamente el 22% fueron

autoras. El desglose por tipo de trabajo fue el siguiente: 24 completos, 21 cortos, 3 demos, 41 relevantes, 5 descripciones de proyectos o contratos y 3 contribuciones con empresa. Señalar que para que un trabajo fuera considerado relevante debía estar en Q1 ó Q2 del JCR o bien en congresos considerados como clases 1 y 2 en la clasificación de congresos relevantes en Informática (http://www.scie.es/clasificacion-congresos-relevantes-informatica/) promovido por SCIE (Sociedad Científica Informática de España) de la que SISTEDES forma parte. Este año ha habido un gran volumen de trabajos relevantes, lo que demuestra la madurez y la calidad científica de la comunidad. Por otro lado, de los trabajos objeto de revisión (se excluyen los relevantes), finalmente fueron aceptados 53.
Adicionalmente, en esta edición, JISBD incluyó en su programa tres reuniones de redes de excelencia para que de esta forma toda la comunidad se sienta invitada a participar, y dos tutoriales dedicados a temáticas de gran actualidad e interés en nuestra comunidad:

- "DSR from the trenches" Marcela Fabiana Genero y Oscar Díaz
- "Combinando algoritmos exactos y heurísticos para problemas en ISGB" Francisco Chicano García

Finalmente quisiera concluir este prólogo dando las gracias. En primer lugar, a todos y cada uno de los coordinadores y coordinadoras de las áreas temáticas, ya que, gracias a su gran trabajo, esfuerzo, consejos, ideas y siempre disposición, han hecho que mi trabajo de presidenta de JISBD haya sido mucho más sencillo y que hayamos formado un gran equipo al que ha sido un placer coordinar, así muchas veces. Pero todo esto no hubiera sido posible sin la guía de Fernando Sánchez Figueroa, presidente de la edición anterior de JISBD, y la continua ayuda de Juan Hernández, como enlace con SISTEDES. Ha sido un lujo y un privilegio trabajar con vosotros. Por otro lado, quiero agradecer al comité organizador de estas jornadas, en especial a los presidentes del comité organizador a Juan M. Murillo Rodríguez y Fernando Sánchez Figueroa por toda la ayuda prestada desde el primer momento y que ha facilitado enormemente la configuración del programa, y al *webmaster*, Daniel Flores Martín, por su inmediatez y siempre disposición a todos y cada uno de los cambios sugeridos. Especial mención merece el trabajo realizado por José Hilario Canós y su equipo en la confección de las actas que con el nivel de automatización alcanzado nos ha evitado realizar cualquier acción manual.
Mi más sincero agradecimiento al comité permanente de SISTEDES, y a todas aquellas personas que habéis confiado en mí para asumir esta responsabilidad. Realmente ha sido un regalo y un sueño nunca soñado hecho realidad, jamás pensé cuando fui a mis primeras JISBD, en Almagro en el año 2001, de la mano de Isidro Ramos Salavert, que algún día sería presidenta de las jornadas; de hecho, ni me lo creía cuando Antonio Vallecillo me lo comunicó, nunca imaginé un regalo tan grande. Para mí ha sido una experiencia única e inolvidable, y sólo espero haber estado a la altura, gracias a todos, y en especial a Isidro Ramos por abrirme las puertas de esta comunidad tan especial. Gracias a todos de corazón.
Mis agradecimientos finales son para las principales protagonistas de estas jornadas, ya que sin ellas no serían posible, todas aquellas personas que han sido autores y revisores de JISBD 2019. A las primeras por apoyar a JISBD con el envío de publicaciones y la presentación de sus trabajos en Cáceres, y a las segundas por su dedicación a la tarea de mantener el nivel de calidad esperado de las contribuciones a JISBD, ayudar a los autores a mejorar sus trabajos y cumplir con los plazos marcados.
Por muchas JISBD como estas, sigamos construyendo comunidad.

Cáceres, septiembre de 2019

Jennifer Pérez Benedí
Presidenta del Comité de Programa de JISBD

Transformaciones de Datos con Machine Learning

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Resumen. Una de las tareas más comunes que los ingenieros tienen que llevar a cabo y que consumen más tiempo es la transformación de datos. Proponemos usar los avances en Inteligencia Artificial (IA), y en particular, en el área de Machine Learning (ML), para abordar este problema. Para ello, definimos una arquitectura que es capaz de inferir las transformaciones de datos a partir de un conjunto de pares de datos entrada-salida. Una vez que nuestro sistema haya aprendido cómo los datos de entrada se relacionan con los de salida, podrá realizar la traducción de nuevos datos de entrada automáticamente.

Palabras clave: MDE, Transformación de datos, Machine Learning

1 Introducción

La Inteligencia Artificial (IA) está evolucionando rápidamente gracias a las mejoras en el hardware y la llegada del Big Data. Algunos de los avances más notables son la capacidad de clasificar, reconocer y comprender imágenes y sonidos para mejorar la interacción entre humanos y máquinas. Actualmente hay máquinas que pueden realizar de forma autónoma tareas muy similares a las que llevan a cabo los humanos como, por ejemplo, detectar cambios en el entorno y reaccionar a ellos o aprender y aplicar dicho conocimiento para la toma de decisiones. Una encuesta [6] realizada recientemente afirma que 352 investigadores en IA predicen que esta superará a los humanos en los próximos diez años en actividades como como la traducción de idiomas, la redacción de documentos, o incluso operando en un quirófano.

La IA está comenzando a influenciar el desarrollo de software y hay iniciativas que prevén las (futuras) aplicaciones en cada una de sus fases [8], desde el análisis y diseño de requisitos hasta el desarrollo, las pruebas, el mantenimiento, etc. El objetivo es siempre el mismo: ayudar a los ingenieros a desarrollar software de una forma más sencilla, más rápida y de forma que sea menos propensa a errores. En este sentido, se han introducido los conceptos de software inteligente e ingeniería de software inteligente [14, 4]. A pesar de estas iniciativas, no conocemos de la existencia de ninguna solución cuyo objetivo sea resolver uno de los problemas más complejos y frecuentes en la ingeniería de software: la transformación de datos. Aunque hay una gran cantidad de propuestas que, sin usar IA, abordan el problema de la transformación de datos, todas requieren la intervención de usuarios con conocimientos de programación, incluso aquellas que elevan el nivel de abstracción usando la Ingeniería Dirigida por Modelos (MDE).

En el resto del documento presentamos nuestra propuesta, la cual usa ML en lugar de lenguajes específicos para realizar transformaciones de datos.

de técnicas de aumento de datos como p. ej., creación de nuevos datos mediante mutación o Redes Generativas Antagónicas o el uso de Transfer Learning [10].

4.3 Calidad de los resultados

Otro aspecto a tener en cuenta es la calidad de los datos generados por la red. Por ejemplo, si el conjunto de datos de entrada-salida que utilizamos para el entrenamiento no cubre todos los escenarios posibles, la red no predecirá correctamente esos casos. El sobreajuste o ajuste deficiente de la red a los datos de entrenamiento es otro riesgo para el cual habrá que desarrollar estrategias.

4.4 Rendimiento

Aunque ML resulte ser un enfoque adecuado para usuarios no expertos, habrá que estudiar si su rendimiento es aceptable para llevarlo a la práctica.

4.5 Aceptación social

Hay factores sociales que pueden frenar la adopción de un basado en ML. Los usuarios pueden ser reacios a confiar en una "caja negra" que no llegan a entender.

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Sistedes

Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software

JISBD 2019

XXIV Jornadas de Ingeniería del Software y Bases de Datos

Cáceres, 2-4 de septiembre de 2019

Certificado de Presentación de Trabajo

Doña Jennifer Pérez Benedí, en calidad de Presidenta del Comité de Programa de JISBD 2019,

INFORMA que el trabajo titulado **“Transformaciones de Datos con Machine Learning”** cuyos autores son Loli Burgueño, Jordi Cabot y Sébastien Gérard, ha sido presentado por **Lola Burgueño** en el área de *Ingeniería del Software Dirigida por Modelos* de JISBD 2019

Jennifer Pérez Benedí

Presidenta del comité de Programa de JISBD 2019

CERTIFICADO

Lola Burgueño

ha asistido a las JORNADAS DE LA SOCIEDAD DE INGENIERÍA DEL SOFTWARE Y TECNOLOGÍAS DE DESARROLLO DE SOFTWARE (SISTEDES), celebradas del 2 al 4 de septiembre de 2019 en la Universidad de Extremadura

En Cáceres, a 5 de septiembre de 2019

CO-PRESIDENTE DEL COMITÉ DIRECTOR

Fdo.: Juan Manuel Murillo Rodríguez

CO-PRESIDENTE DEL COMITÉ DIRECTOR

Fdo.: Fernando Sánchez Figueroa

TIPO DE PARTICIPACIÓN: Ponencia invitada Lola Burgueño ha presentado las siguientes ponencias invitadas:

- A LINDA-BASED PLATFORM FOR THE PARALLEL EXECUTION OF OUT-PLACE MODEL TRANSFORMATIONS
- Formally Modeling, Executing, and Testing Service-Oriented Systems with UML and OCL
- TESTING MODELS AND MODEL TRANSFORMATIONS USING CLASSIFYING TERMS

A continuación se adjuntan los justificantes.

A Linda-based Platform for the Parallel Execution of Out-place Model Transformations

Loli Burgueño[1], Manuel Wimmer[2], and Antonio Vallecillo[1]

[1] Universidad de Málaga, Spain. {loli,av}@lcc.uma.es
[2] Christian Doppler Laboratory for Model-Integrated Smart Production, TU Wien, Austria. wimmer@big.tuwien.ac.at

Abstract.
Context: The performance and scalability of model transformations is gaining interest as industry is progressively adopting model-driven techniques and multicore computers are becoming commonplace. However, existing model transformation engines are mostly based on sequential and in-memory execution strategies, and thus their capabilities to transform large models in parallel and distributed environments are limited.
Objective: This paper presents a solution that provides concurrency and distribution to model transformations.
Method: Inspired by the concepts and principles of the Linda coordination language, and the use of data parallelism to achieve parallelization, a novel Java-based execution platform is introduced. It offers a set of core features for the parallel execution of out-place transformations that can be used as a target for high-level transformation language compilers.
Results: Significant gains in performance and scalability of this platform are reported with regard to existing model transformation solutions. These results are demonstrated by running a model transformation test suite, and by its comparison against several state-of-the-art model transformation engines.
Conclusion: Our Linda-based approach to the concurrent execution of model transformations can serve as a platform for their scalable and efficient implementation in parallel and distributed environments.

Keywords: Model Transformation, Performance, Scalability, Parallelization

Reference

1. Burgueño, L., Wimmer, M., Vallecillo, A.: A Linda-based platform for the parallel execution of out-place model transformations. Information and Software Technology 79, 17 – 35 (2016), (DOI: 10.1016/j.infsof.2016.06.001)

Sistedes
Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software

Jornadas SISTEDES 2017

Tenerife, 19-21 Julio

CERTIFICADO DE ASISTENCIA

Loli Burgueño, con DNI 25346121-Y,

ha asistido a las sesiones de trabajo de las **Jornadas SISTEDES** que se han celebrado en la Universidad de La Laguna (Santa Cruz de Tenerife), del 19 al 21 de julio de 2017.

José Luis Roda García
Presidente del Comité Organizador

Sistedes

Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software

JISBD 2017

XXII Jornadas de Ingeniería del Software y Bases de Datos

San Cristóbal de La Laguna, Tenerife, 19-21 de julio de 2017

Certificado de Presentación de Trabajo

Don Francisco Ruiz González, Presidente del Comité de Programa de JISBD-2017,

CERTIFICA QUE el siguiente trabajo:

Número: 3

Título: **LinTra: A Framework for the Parallel and Distributed Execution of Model Transformations**

Autores: Loli Burgueño, Manuel Wimmer and Antonio Vallecillo

Área/track: ISDM - Ingeniería del Software Dirigida por Modelos

HA SIDO PRESENTADO en calidad de Artículo Relevante:

Francisco Ruiz González

Presidente del comité de Programa de JISBD 2017

Formally Modeling, Executing, and Testing Service-Oriented Systems with UML and OCL

Loli Burgueño[1] and Martin Gogolla[2]

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Abstract.
One of the issues that developers of service-oriented systems currently discuss is the lack of practical, but formal modeling notations and tools that can address the many different, important aspects. This paper presents an approach to model structural and behavioral properties of service-oriented systems with UML and OCL models. Essential service-oriented concepts as service request, service provision or orchestration are formally represented by UML concepts. The models can be executed, tested and analyzed. Feedback is given to the developer in terms of the UML and OCL model. Our approach supports the automatic generation of test scenarios in which, for example, the availability of services can be checked. Furthermore, the consistency of the service model can be proved by constructing test scenarios.

Keywords: Service-oriented systems, UML, OCL, Formal analysis

Reference

1. Burgueño, L., Gogolla, M.: Formally modeling, executing, and testing service-oriented systems with UML and OCL. In: Proc. of ICSOC 2017. LNCS, vol. 10601, pp. 113–122. Springer (2017), DOI: 0.1007/978-3-319-69035-3_8

SISTEDES
2018

CERTIFICADO

Dª LOLA BURGUEÑO CABALLERO

ha asistido a las

JORNADAS DE LA SOCIEDAD DE INGENIERÍA DE SOFTWARE Y TECNOLOGIAS DE DESARROLLO DE SOFTWARE (SISTEDES),

celebradas del 17 al 19 de septiembre de 2018 en la Universidad de Sevilla.

En Sevilla, a 19 de septiembre de 2018

LA VICERRECTORA DE RELACIONES INSTITUCIONALES

Fdo.: Elena Cano Bazaga

EL PRESIDENTE DEL COMITÉ DIRECTOR

Fdo.: Miguel Toro Bonilla

Preliminares

Las “Jornadas de Ingeniería del Software y Bases de Datos” (JISBD) son el principal foro anual que reúne a la comunidad científica española, portuguesa y latinoamericana en las áreas de Ingeniería del Software y Bases de Datos. A día de hoy se han convertido en un punto de encuentro ineludible para que la comunidad iberoamericana presente sus trabajos más recientes y significativos, comparta sus experiencias en el área a través de proyectos o colaboraciones con la industria, y establezca y consolide colaboraciones. Las JISBD están promovidas por la Sociedad de Ingeniería de Software y Tecnologías de Desarrollo de Software (SISTEDES) y se celebran junto con otras dos conferencias: Jornadas de Programación y Lenguajes (PROLE) y Jornadas de Ciencia e Ingeniería de Servicios (JCIS). Esta XXIV edición, se ha celebrado en un enclave maravilloso, la ciudad de Cáceres, del 2 al 4 de septiembre, coincidiendo con su vigésimo aniversario, cuando las JISBD se celebraron en Cáceres en 1999. Esto hace especial a esta edición y se convierte en un motivo de celebración y recuerdo para la comunidad.

La XXIV edición de JISBD ha contado como conferenciante invitado con el profesor Dr. Paris Avgeriou de la *University of Groningen* de Holanda, donde dirige su grupo de investigación de ingeniería del software desde 2006, y en la actualidad es *Editor in Chief* de la revista *Journal of Systems and Software* y *Associate Editor* de la revista *IEEE Software*. El Dr. Paris Avgeriou es un investigador de referencia en el área de Ingeniería del Software, en general, y de las arquitecturas software, en particular; de ahí que su conferencia se haya centrado en un tema crítico en la actualidad en estas dos áreas, como es la deuda técnica, dando por título a su conferencia:

“Technical Debt: talking about the elephant in the room” Dr. Paris Avgeriou

Además, la XXIV edición de JISBD se ha estructurado en 7 áreas temáticas:

- Arquitecturas Software y Variabilidad (ASV),
- Gestión de Datos (GD),
- Ingeniería del Software Dirigida por Modelos (ISDM),
- Ingeniería del Software Guiada por Búsqueda (ISGB),
- Ingeniería Web y Sistemas Pervasivos (IWSP),
- Metodologías, Calidad y Pruebas Software (MCPS),
- Métodos Empíricos en Ingeniería del Software y Sistemas de Información (MEISSI)

Los tipos de contribuciones en cada área temática han sido: artículos completos, artículos cortos, artículos relevantes (ya publicados en otros foros de relevancia), demostraciones de herramientas, descripción de proyectos de I+D aplicados o contratos con empresas, y contribuciones industriales, dónde las empresas presenten enfoques o técnicas de ingeniería del software y/o bases de datos aplicados en la empresa. Esta última modalidad ha supuesto una novedad con respecto a ediciones anteriores, y constituye un primer paso para conseguir un acercamiento entre las necesidades de la industria y las soluciones en investigación. Esperamos que esta modalidad se consolide junto con la modalidad de proyectos I+D, introducida en la edición anterior, en los próximos años para incrementar las colaboraciones Universidad-Empresa. En esta edición se registraron en Easychair 100 artículos, siendo finalmente 97 los artículos presentados, consolidando los números obtenidos en las tres ediciones anteriores. Estos artículos se han realizado por un total de 272 autores y autoras procedentes de 20 países diferentes, siendo españoles el 86%. Así mismo, el 88% de los autores son procedentes de universidad, el 8% de institutos y laboratorios de investigación, y el 4% de empresa. Se espera mejorar estas tasas incrementado el número de autores que no provienen de la universidad, para que haya un balanceo más equitativo, igual que en el caso de género, ya que únicamente el 22% fueron autoras. El desglose por tipo de trabajo fue el siguiente: 24 completos, 21 cortos, 3 demos, 41 relevantes, 5 descripciones de proyectos o contratos y 3 contribuciones con empresa. Señalar que para que un trabajo fuera considerado relevante debía estar en Q1 ó Q2 del JCR o bien en congresos considerados como clases 1 y 2 en la clasificación de congresos relevantes en Informática (http://www.scie.es/clasificacion-congresos-relevantes-informatica/) promovido por SCIE (Sociedad Científica Informática de España) de la que SISTEDES forma parte. Este año ha habido un gran volumen de trabajos relevantes, lo que demuestra la madurez y la calidad científica de la comunidad. Por otro lado, de los trabajos objeto de revisión (se excluyen los relevantes), finalmente fueron aceptados 53.

Adicionalmente, en esta edición, JISBD incluyó en su programa tres reuniones de redes de excelencia para que de esta forma toda la comunidad se sienta invitada a participar, y dos tutoriales dedicados a temáticas de gran actualidad e interés en nuestra comunidad:

- "DSR from the trenches" Marcela Fabiana Genero y Oscar Díaz
- "Combinando algoritmos exactos y heurísticos para problemas en ISGB" Francisco Chicano García

Finalmente quisiera concluir este prólogo dando las gracias. En primer lugar, a todos y cada uno de los coordinadores y coordinadoras de las áreas temáticas, ya que, gracias a su gran trabajo, esfuerzo, consejos, ideas y siempre disposición, han hecho que mi trabajo de presidenta de JISBD haya sido mucho más sencillo y que hayamos formado un gran equipo al que ha sido un placer coordinar, así muchas veces. Pero todo esto no hubiera sido posible sin la guía de Fernando Sánchez Figueroa, presidente de la edición anterior de JISBD, y la continua ayuda de Juan Hernández, como enlace con SISTEDES. Ha sido un lujo y un privilegio trabajar con vosotros. Por otro lado, quiero agradecer al comité organizador de estas jornadas, en especial a los presidentes del comité organizador a Juan M. Murillo Rodríguez y Fernando Sánchez Figueroa por toda la ayuda prestada desde el primer momento y que ha facilitado enormemente la configuración del programa, y al *webmaster*, Daniel Flores Martín, por su inmediatez y siempre disposición a todos y cada uno de los cambios sugeridos. Especial mención merece el trabajo realizado por José Hilario Canós y su equipo en la confección de las actas que con el nivel de automatización alcanzado nos ha evitado realizar cualquier acción manual.

Mi más sincero agradecimiento al comité permanente de SISTEDES, y a todas aquellas personas que habéis confiado en mí para asumir esta responsabilidad. Realmente ha sido un regalo y un sueño nunca soñado hecho realidad, jamás pensé cuando fui a mis primeras JISBD, en Almagro en el año 2001, de la mano de Isidro Ramos Salavert, que algún día sería presidenta de las jornadas; de hecho, ni me lo creía cuando Antonio Vallecillo me lo comunicó, nunca imaginé un regalo tan grande. Para mí ha sido una experiencia única e inolvidable, y sólo espero haber estado a la altura, gracias a todos, y en especial a Isidro Ramos por abrirme las puertas de esta comunidad tan especial. Gracias a todos de corazón.

Mis agradecimientos finales son para las principales protagonistas de estas jornadas, ya que sin ellas no serían posible, todas aquellas personas que han sido autores y revisores de JISBD 2019. A las primeras por apoyar a JISBD con el envío de publicaciones y la presentación de sus trabajos en Cáceres, y a las segundas por su dedicación a la tarea de mantener el nivel de calidad esperado de las contribuciones a JISBD, ayudar a los autores a mejorar sus trabajos y cumplir con los plazos marcados.

Por muchas JISBD como estas, sigamos construyendo comunidad.

Cáceres, septiembre de 2019

Jennifer Pérez Benedí
Presidenta del Comité de Programa de JISBD

TESTING MODELS AND MODEL TRANSFORMATIONS USING CLASSIFYING TERMS

FRANK HILKEN[1], MARTIN GOGOLLA[1], LOLI BURGUEÑO[2], ANTONIO VALLECILLO[2]

UNIVERSITY OF BREMEN, GERMANY, {fhilken,gogolla}@informatik.uni-bremen.de

UNIVERSITY OF MÁLAGA, SPAIN, {loli,av}@lcc.uma.es

Palabras Clave: model transformations, contract-based specifications equivalence partitioning
Lugar de publicación: Software & Systems Modeling 17(3): 885-912
Impact factor: 1.722 (Q2)
DOI: https://doi.org/10.1007/s10270-016-0568-3

Resumen(Abstract). This paper proposes the use of equivalence partitioning techniques for testing models and model transformations. In particular, we introduce the concept of classifying terms, which are general OCL terms on a class model enriched with OCL constraints. Classifying terms permit defining equivalence classes, in particular for partitioning the source and target model spaces of the transformation, defining for each class a set of equivalent models with regard to the transformation. Using these classes, a model validator tool is able to automatically construct object models for each class, which constitute relevant test cases for the transformation. We show how this approach of guiding the construction of test cases in an orderly, systematic and efficient manner can be effectively used in combination with Tracts for testing both directional and bidirectional model transformations and for analyzing their behavior.

Sistedes
Sociedad de Ingeniería de Software
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JISBD 2019

XXIV Jornadas de Ingeniería del Software y Bases de Datos

Cáceres, 2-4 de septiembre de 2019

Certificado de Presentación de Trabajo

Doña Jennifer Pérez Benedí, en calidad de Presidenta del Comité de Programa de JISBD 2019,

INFORMA que el trabajo titulado **"Testing Models and Model Transformations Using Classifying Terms"** cuyos autores son Frank Hilken, Martin Gogolla, Loli Burgueño y Antonio Vallecillo, ha sido presentado por **Lola Burgueño** en el área de *Ingeniería del Software Dirigida por Modelos* de JISBD 2019

Jennifer Pérez Benedí
Presidenta del comité de Programa de JISBD 2019

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CERTIFICADO

Lola Burgueño

ha asistido a las JORNADAS DE LA SOCIEDAD DE INGENIERÍA DEL SOFTWARE Y TECNOLOGÍAS DE DESARROLLO DE SOFTWARE (SISTEDES), celebradas del 2 al 4 de septiembre de 2019 en la Universidad de Extremadura

En Cáceres, a 5 de septiembre de 2019

CO-PRESIDENTE DEL COMITÉ DIRECTOR

Fdo.: Juan Manuel Murillo Rodríguez

CO-PRESIDENTE DEL COMITÉ DIRECTOR

Fdo.: Fernando Sánchez Figueroa

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TIPO DE PARTICIPACIÓN: Póster

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MODELS-JP 2013
Invited Talks, Demonstration Session, Poster Session, and ACM Student Research Competition @ MODELS'13

Joint Proceedings of MODELS'13 Invited Talks, Demonstration Session, Poster Session, and ACM Student Research Competition co-located with the 16th International Conference on Model Driven Engineering Languages and Systems (MODELS 2013)

Miami, USA, September 29 - October 4, 2013.

Edited by

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** Department of Informatics, King's College London, London, UK

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Publication Chair

Manuel Wimmer*

* Business Informatics Group, Institute of Software Technology and Interactive Systems, Vienna University of Technology, Austria

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Poster Session @ MODELS'13

ACM Student Research Competition @ MODELS'13

2014-01-10: submitted by Manuel Wimmer
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TractsTool: Testing Model Transformations based on Contracts

Loli Burgueño[1], Manuel Wimmer[2], Javier Troya[1], and Antonio Vallecillo[1]

[1] GISUM/Atenea Research Group. Universidad de Málaga, Spain
[2] Business Informatics Group, Vienna University of Technology, Austria

Abstract. Model transformations play an important role in Model-Driven Engineering (MDE), and as their size and complexity grow, there is an increasing need to count on tool support for testing their correctness. In this work, we present *TractsTool*, a tool for specifying and testing several different kinds of model transformations, e.g., model-to-model, model-to-text, and text-to-model transformations, based on contracts.

Keywords: Model transformation, contract-based design, testing, tool support

1 Introduction

The basis of the Model-Driven Engineering (MDE) paradigm is the usage of models. They have become key artifacts from which a system may be (semi-)automatically derived and implemented. Model transformations are the key mechanism of MDE for manipulating models. Model-to-model (M2M) transformations take as input models conforming to specific metamodels and transform them into other models conforming to other (or the same) metamodels. In addition to M2M transformations, model-to-text (M2T) and text-to-model (T2M) transformations are of major importance. The former are frequently used to produce code from models, while the latter are typically used for reverse engineering of legacy systems or injecting artifacts to the MDE technical space.

As the size and complexity of model transformations grow, there is an increasing need to count on mechanisms and tools for testing their correctness [1]. One option is to validate the behavior of the transformation and its associated properties (termination, determinism, etc.) using formal methods and their associated tools (cf. e.g., [2,3]). The main drawback is that the whole transformation needs to be dealt with, what makes this approach inefficient for large models and transformations. An alternative approach [4,5] consists of not validating the transformation for the full input space, but trying to certify that it works for a selected set of test input models. This may not fully prove correctness, but it can be very useful for identifying bugs in a cost-effective and light-weight manner.

The tool presented in this paper follows the latter approach. We generalize *model transformation contracts* [6] for the specification of the properties that need to be checked for a transformation, and subsequently, apply the ASSL language [7] to generate input test models. As presented in [8], our approach can be applied to M2M as well as to M2T and T2M transformations.

5 Conclusions and future work

We have presented the foundations of TractsTool, a tool for light-weight verification of any kind of model transformation by following the Tracts approach.

There are several lines of research that are still subject to ongoing work. Firstly, we plan to investigate how the Knowledge Discovery Metamodel (KDM) may be used for defining contracts that are programming language independent and reusable for a family of code generators. Secondly, the TractsTool's internal transformations presented in Section 4 are time-consuming when transforming very large models. Another objective is to provide a mechanism to generate automatically the ASSL program that in turn generates a set of default input models so that the user is not required to develop such programs by hand. Another improvement that may be made is to change the information that is displayed after the verification process. Specifically, diagnostic models are an interesting line of research in this respect. Finally, we plan to include error tracking [12] directly in TractsTool. Thus, in case a Tract fails, the transformation engineer should be supported in identifying the transformation rule(s) that have caused the failure.

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29 September 2013 through 4 October 2013

CERTIFICATE OF PARTICIPATION

This is to certify that

LOLI BURGUEÑO CABALLERO

has attended the **ACM/IEEE 16th International Conference on Model Driven Engineering Languages and Systems (MODELS 2013)**, held in Miami, Florida – USA, from 29 September 2013 through 4 October 2013.

Jeff Gray
General Chair

Antonio Vallecillo
General Chair

f. CONFERENCIAS Y SEMINARIOS

Lola Burgueño ha presentado las siguientes ponencias invitadas:

- "No need to model alone" en el workshop Lowcomote (EU Horizon 2020, Marie Skodowska-Curie)

A continuación se adjuntan los justificantes.

MSCA
Marie Skłodowska-Curie Actions
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement n° 813884

lowcomote

The organizing committee of the Workshop "Heterogeneous Low-Code Engineering in Industry", celebrated on Wednesday, 14th July 2021, as part of the training activities of the Lowcomote project (European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement n° 813884) issues this certificate in favor of

Lola Burgueño

to confirm that she has given an invited talk entitled "No need to model alone: A modeling assistant to bridge the gap between natural language and domain models" during the workshop.

Manuel Wimmer
Organizing Committee

IMT Atlantique — University of York — UAM — Università degli Studi dell'Aquila — JKU Johannes Kepler Universität Linz — BT — Intecs Solutions — UGROUND — CLMS — IncQueryLabs — Sparx Systems — METADEV — The Open Group — aws

g. OTROS MÉRITOS RELACIONADOS CON LA CALIDAD Y DIFUSIÓN DE RESULTADOS DE LA ACTIVIDAD INVESTIGADORA

Premio al mejor artículo (Best paper award) en MODELS'15 MODELS es una conferencia clase 2 (rating A)

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October 14-19, 2018 Copenhagen, Denmark

presented to

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for

Expressing Confidence in Models and in Model Transformations Elements

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Medalla de bronce en la ACM Student Research Competition en MODELS'15 MODELS es una conferencia clase 2 (rating A)

Preface

Proceedings ACM Student Research Competition at MoDELS 2015

Mira Balaban[1] and Martin Gogolla[2]

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1 Introduction

MoDELS 2015 hosted the ACM Student Research Competition, which is sponsored by Microsoft Research, for the 3rd time. The Student Research Competition (SRC) is a forum for undergraduate and graduate students to showcase their research, exchange ideas, and improve their communication skills while competing for prizes. The Student Research Competition has the following goals:

- to give undergraduate and graduate students the opportunity to share their research ideas and results in a special forum that provides visibility for their work;
- to give students the opportunity to meet with and interact with conference attendees to share ideas, gain new insights, and understand possible practical applications;
- to give students an opportunity to sharpen their communication skills, including visual, organizational, oral, and aural modalities;
- to provide detailed feedback to students about their research and presentation, from a panel of distinguished judges from industry and academia to recognize and reward outstanding student research.

The contest has two categories, one for undergraduate research and the other for graduate research[3]. For works accepted to the MoDELS 2013 Student Research Competition, a travel grant of up to US $500 were awarded to help cover travel expenses to the conference. The top three winners at MoDELS 2013 in each category (undergraduate and graduate) received prizes of US $500, US $300, and US $200, respectively. Moreover, all winners received an award plaque and two-year complimentary ACM membership with a subscription to ACM Digital Library. Winners were recognized during the closing plenary session of the MoDELS 2013 conference.

2 Selection procedure

The winners selection encompassed three steps as summarized in the following.

[3] For more information about the ACM SRC please refer to http://src.acm.org/

Abstract submission To participate in the competition, students submitted a research abstract related to the main themes of the conference and describing the research problem and motivation, background and related work, approach and uniqueness, results, and contributions. Thirteen contributions were submitted and a panel of experts (see Section 4) reviewed the submissions and selected eleven students to participate in the second round of the competition, which was held in Ottawa. The abstracts that were selected and are included in this document encompass a wide variety of subjects in the software modeling paradigm. They are listed below.

Graduate students category

– *Generating Examples for Knowledge Abstraction in MDE: a Multi-Objective Framework*, Edouard Batot, DIRO, Universite de Montreal, Canada
– *Testing M2M/M2T/T2M Transformations*, Loli Burgueno, University of Malaga, Spain
– *Automated Metamodel/Model Co-Evolution using a Multi-Objective Optimization Approach*, Wael Kessentini, University of Montreal, Canada
– *Change-driven Incremental Symbolic Execution of Evolving State Machines*, Amal Khalil, Queen's University, Canada
– *Explicitly Modelling Model Debugging Environments*, Simon Van Mierlo, University of Antwerp, Belgium
– *Generating model with uncertainty by means of JTL*, Gianni Rosa, University of L'Aquila, Italy
– *Architectural and Analytic Integration of Cyber-Physical System Models*, Ivan Ruchkin, Carnegie Mellon University, USA
– *Model-Based Reuse of APIs using Concern-Orientation*, Matthias Schoettle, McGill University, Canada
– *Automatic Generation of Transformations for Software Process Tailoring*, Luis Silvestre, University of Chile, Chile
– *Foundations of a Multi-Paradigm Modelling Tool*, Yentl Van Tendeloo, University of Antwerp, Belgium
– *A Behavioral Programming Approach to Search Based Software Engineering*, Moshe Weinstock, Ben-Gurion University of the Negev, Israel

Undergraduate students category: None

Poster session It took place in Ottawa and students had the opportunity to present their research to conference attendees and leading experts in the software engineering fields, including the SRC committee. Judges reviewed the posters and spoke to participants about their research. The judges evaluated the research (quality, novelty, and significance) and the presentation of the research (poster, discussion).

Presentation session All students gave short presentation of their research in a special session at the MoDELS 2015 conference. After each presentation, a short question and answer session occurred. Evaluations were based on the presenter's knowledge of his/her research area, contribution of the research, and the quality of the oral and visual presentation.

3 Winners

The following winners were selected by the selection procedure previously summarized:

Graduate students category

1. *Architectural and Analytic Integration of Cyber-Physical System Models*, Ivan Ruchkin, Carnegie Mellon University, USA
2. *Change-driven Incremental Symbolic Execution of Evolving State Machines*, Amal Khalil, Queen's University, Canada
3. *Testing M2M/M2T/T2M Transformations*, Loli Burgueno, University of Malaga, Spain

4 Acknowledgement

We would like to thank everyone who has made this special event possible. We are obliged to the students that contributed to have a successful event, and to Tim Lethbridge that as MoDELS2015 general chair strongly supported the event. The following judges made an excellent job in the different phases of the selection procedure:

- Silvia Abrahao (Universitat Politecnica de Valencia, Spain),
- Joao Araujo (Universidade Nova de Lisboa, Portugal),
- Zinovy Diskin (University of Waterloo, Canada),
- Geri Georg (Colorado State University, USA),
- Emilio Insfran (Universitat Politecnica de Valencia, Spain).
- Yvan Labiche (Carleton University, Canada),
- Lior Limonad (IBM, Israel),
- Alfonso Pierantonio (University of L'Aquila, Italy),
- Ivan Porres (Abo Akademi University, Finland),
- Gianna Reggio (DISI, Universita' di Genova, Italy),
- Houari Sahraoui (DIRO, Universite De Montreal, Canada),
- Martina Seidl (Johannes Kepler University Linz, Austria),
- Arnor Solberg (SINTEF, Norway),
- Harald Stoerrle (Danmarks Tekniske Universitet, Denmark),
- Arnon Sturm (Ben-Gurion University, Israel),
- Jon Whittle (Lancaster University, UK),
- Steffen Zschaler (King's College, London, UK),

Silvia Abrahao, Mira Balaban, Geri Georg, Martin Gogolla, Emilio Insfran, Martina Seidl, Arnor Solberg, and Arnon Sturm participated in a physical meeting during MoDELS 2015 and settled the final results.

Testing M2M/M2T/T2M Transformations

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***Abstract*—As Model-Driven Engineering is becoming adopted by industry, models and model transformations (MTs) are extensively used. Hence, there is the urgent need for systematic testing mechanisms and tools to check their correctness. In this work, we make use of a particular case of contracts for model transformations called Tracts. First, Tracts allow the transformation developer to specify and test a model-to-model transformation in a modular way, and to identify bugs. However, they do not allow to track where the faults in the implementation are. For doing that, we present an approach based on matching functions that automatically establish the alignments between the specification and the implementation of a transformation using the metamodel footprints. Second, we extend Tracts to deal with text-to-model and model-to-text transformations in order to broaden and complete the scope of our testing proposal. Finally, we provide the corresponding tools that realize our proposal.**

I. Problem and Motivation

Model transformations (MT) are gaining more and more interest as industry is progressively adopting model-driven techniques [1]. The main advantage of using of model transformations is to save effort and reduce errors by automating the creation and alteration of models as long as it is possible. Thus, they are becoming a promising approach in many different scenarios to solve a wide variety of problems, e.g. to deal with the migration of systems, their modernization, for code generation, etc., especially when complex data structures are involved. This complexity may lead to the existence of bugs in the model transformation implementation that make it faulty. Then, the need of testing, validation and verification procedures for model transformations is emerging in recent years [2], [3].

So far, most of the efforts by the research community have focused on testing model-to-model (M2M) transformations for which having explicit model representations for the input and output domain is assumed. There are different approaches that can be classified attending to their characteristics as black-box vs. white-box and static vs. dynamic. Depending on the concrete situation, the transformation developer needs to make the decision of what mechanism to use. When black-box dynamic approaches such as Tracts [4] are the best option, the developer finds that they do allow the testing of model transformations but they do not track where the problem is in the implementation, i.e., they reveal that there is a problem but they do not point to where it is or what is producing it.

Furthermore, text-to-model (T2M) and model-to-text (M2T) transformations are extensively used [5] for code generation and reverse engineering for the modernization of legacy applications [6]. However, they have received little attention so far by the research community.

The contribution presented in this paper is twofold. First, we have extended the Tract approach for M2T and T2M transformations. We have created a generic metamodel that represents text repositories and inject the text into a model that conforms to that metamodel. Once both source and target domains count on a concrete and well-defined representation, M2T and T2M transformations are reduced to M2M transformations. Therefore, Tracts can be used for checking their correctness.

Second, we define a mechanism based on *matching tables* that permit relating the rules of a model transformation with its Tracts, i.e., aligning the model transformation implementation with its specification. By analysing the matching tables, the rules that cause a fault can be identified, hence realizing a useful tracking mechanism for locating faults in model transformations.

The structure of the paper is as follows. Section II introduces the concepts in which this work stands and the related work. Section III presents the core of our contribution: the extension of Tracts for M2T and T2M transformations and how the matching tables are computed and interpreted. Finally, Section IV shows the results we have obtained and the contributions we have made.

II. Background and Related Work

The need for systematic verification of model transformations has been studied in previous works and the challenges it has to deal with have been outlined [7], [8]. Many approaches ranging from lightweight certification to full verification have been proposed to reason about different kinds of properties of M2M transformations [2], [3]. One of them is the use of contracts [4], [9], [10].

Tracts, which are a particular case of contracts, are a black-box testing mechanism for M2M transformations. They consist of a set of constraints on the source and target metamodels, a set of source-target constraints, and a test suite, i.e., a collection of source models. They provide modular pieces of specification, each one focusing on a particular transformation scenario. This permits each model transformation to be specified by means of a set of Tracts, each one covering a specific use case. Usually, they are seen as unit tests, which means that developers identify the scenarios of interest and define a Tract

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2. CALIDAD Y NÚMERO DE PROYECTOS Y CONTRATOS DE INVESTIGACIÓN

a. PARTICIPACIÓN EN PROYECTOS DE INVESTIGACIÓN Y/O EN CONTRATOS DE INVESTIGACIÓN

1) Proyectos de Investigación Nacionales

Certificado de participación en proyectos de la UMA

Juan Teodomiro López Navarrete, Vicerrector de Investigación y Transferencia de la Universidad de Málaga

INFORMA: Que según los datos que constan en este Vicerrectorado, **Dª. Dolores Burgueño Caballero** con D.N.I. 25346121 Y ha participado en las siguientes actividades y/o proyectos:

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de enero hasta el 30 de septiembre de 2017, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de octubre de 2017 hasta el 28 de febrero de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de marzo hasta el 30 de septiembre de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha sido Personal Investigadora en Formación (FPI) de referencia BES-2012-057064 financiado por el MINECO, con cargo al Proyecto TIN2011-23795, desde el 2 de enero de 2013 hasta el 31 de diciembre de 2016, cuyo investigador principal fue Manuel Díaz Rodríguez.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 16 de noviembre de 2011 hasta el 31 de marzo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 1 de abril hasta el 31 de mayo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia P07-TIC-003184, desde el 1 de junio hasta el 31 de agosto de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha formado parte del equipo de trabajo según consta en el Informe anual del Proyecto de Investigación de referencia TIN2008-03107 denominado “Diseño y Monitorización Dirigido por Modelos de Sistemas Empotrados y de Tiempo Real” financiado por el MICINN, desde el 16 de noviembre de 2011 hasta el 30 de junio de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha formado parte del equipo de trabajo en el Proyecto de Investigación de referencia TIN2014-52034-R denominado “Un marco dirigido por modelos para el diseño e integración de sistemas de gestión de infraestructuras críticas” financiado por el MINECO, desde el 1 de marzo de 2015 hasta el 30 de septiembre de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

Y para que conste donde proceda a los efectos oportunos en Málaga a 08 de abril de 2021

Certificado de participación en proyectos de la UOC

Barcelona, 21 de octubre de 2021

MIREIA RIERA DURAN, con DNI 52592145-T, como directora del Área de Investigación e Innovación de la UOC (ARI), y con suficiente capacidad de representación legal de la Fundació per a la Universitat Oberta de Catalunya.

CERTIFICA que:

Lola Burgueño ha participado en los siguientes proyectos:

Formando parte del equipo de trabajo:

- ***"Open Data for All: an API-based infrastructure for exploting online data sources"*** (número de referencia expediente TIN2016-75944-R) financiado por el Ministerio de Ciencia, innovación y Universidades; con fecha de inicio el 30 de diciembre de 2016 y fecha fin el 30 de junio de 2021.

Formando parte del equipo de investigación:

- ***"The beginnings of cognified MDE Platform"*** (número de referencia expediente ERC MODEL-IA Ref. C30884) financiado por el Commissariat à l'Energie Atomique et aux Energies Alternatives; con fecha de inicio el 1 de septiembre de 2018 y fecha fin el 31 de agosto de 2020.
- ***"Low-code development of smart software (LOCOSS)"*** (número de referencia expediente PID2020-114615RB-I00) financiado por el Ministerio de Ciencia, innovación y Universidades; con fecha de inicio el 1 de septiembre de 2021 y fecha fin el 31 de agosto de 2024.

Y, para que este certificado tenga validez, es firmado por la representante legal de la Entidad, Mireia Riera.

Mireia Riera Duran
Directora del Área de Investigación e Innovación de la UOC (ARI)

TIN2008-03107

Histórico de Proyectos de Investigación de la Universidad de Málaga Cofinanciados por el Plan Nacional de Investigación y el Fondo Europeo de Desarrollo Regional

Invest. Princ.	Conv	Referencia	Financiación Concedida	Financiación FEDER	Denominación del Proyecto
Alba Torres, Enrique	2008	TIN2008-06491-C04-01	105.028,00 €	105.028,00 €	MSTAR: METAHEURISTICAS MULTIOBJETIVO E INGENIERIA DEL SOFTWARE
Altamirano Jeschke, María	2008	CGL2008-01549	148.104,00 €	103.672,80 €	ANALISIS DE LA EXPANSION DE ALGAS EXOTICAS INVASORAS EN LAS COSTAS ANDALUZAS: ORIGEN, PROCESO INVASIVO, EVALUACION DE IMPACTO Y ESTRATEGIAS DE PREVENCION EN UN ESCENARIO DE CAMBIO CLIMATICO
Bandera Rubio, Antonio Jesús	2008	TIN2008-06196	139.150,00 €	97.405,00 €	SISTEMA DE PERCEPCION VISUAL PARA INTERACCION HOMBRE-ROBOT Y NAVEGACION DE ROBOTS MOVILES
Botella Mesa, Miguel Ángel	2008	BIO2008-01709	260.150,00 €	182.105,00 €	ANALISIS DE NUEVOS GENES Y PROCESOS IMPLICADOS EN LA TOLERANCIA A ESTRES ABIOTICO Y SU APLICACION BIOTECNOLOGICA

Calle Martín, Adelaida de la	2008	BFU2008-02030	157.300,00 €	110.110,00 €	INTERACCION DE LOS RECEPTORES DOPAMINERGICOS D4 Y MU OPIOIDES EN LAS ADAPTACIONES CELULARES Y MOLECULARES PRODUCIDAS POR EL CONSUMO CRONICO DE MORFINA
Cazorla López, Francisco Manuel	2008	AGL2008-05453-C02-01	312.180,00 €	218.526,00 €	APROXIMACION INTEGRAL AL CONTROL BIOLOGICO DE ROSELLINIA NECATRIX EN AGUACATE: MECANISMOS DE LAS INTERACCIONES BIOTICAS EN LA RIZOSFERA
Fuentes Fernández, Lidia	2008	TIN2008-01942	150.040,00 €	105.028,00 €	AUTOMATIZACION DEL PROCESO DE DESARROLLO DE APLICACIONES ORIENTADAS A ASPECTOS USANDO UN ENFOQUE DIRIGIDO POR MODELOS
García Cerezo, Alfonso	2008	DPI2008-00553	303.952,00 €	212.766,40 €	ESTRATEGIAS PARA MANIOBRAS-3D EN UN ROBOT TELE-AUTONOMO DE BUSQUEDA Y RESCATE OPERANDO EN ESCENARIOS NATURALES Y DE DESASTRE
González Jiménez, Javier	2008	DPI2008-03527	188.034,00 €	131.623,80 €	CONSTRUCCION DE MAPAS VISUALES METRICO-TOPOLOGICOS EN ROBOTICA MOVIL

López Figueroa, Félix	2008	CGL2008-05407-C03-01	189.244,00 €	132.470,80 €	ESTADO ECOLOGICO Y VULNERABILIDAD DE ECOSISTEMAS ACUATICOS MEDITERRANEOS AL CAMBIO CLIMATICO: INDICADORES FUNCIONALES Y RESPUESTAS ADAPTATIVAS AL ESTRES (TEMPERATURA, RADIACION UV Y NUTRIENTES)
Mercado Carmona, José Ángel	2008	AGL2008-02356	148.830,00 €	104.181,00 €	EVALUACION DEL PAPEL DE ENZIMAS PECTINASAS EN EL REBLANDECIMIENTO DE FRUTOS DE FRESA ASOCIADO A LA MADURACION
Morales Bueno, Rafael	2008	TIN2008-06582-C03-03	179.080,00 €	125.356,00 €	SECUENCIAS SIMBOLICAS: ANALISIS, APRENDIZAJE, MINERIA Y EVOLUCION - MALAGA
Moriñigo Gutierrez, Miguel Ángel	2008	AGL2008-05119-C02-02	108.900,00 €	76.230,00 €	ESTUDIO POR TECNICAS MOLECULARES DE LAS COMUNIDADES MICROBIANAS DE PIEL E INTESTINO DE DORADAS Y LENGUADOS CULTIVADOS. INFLUENCIA DEL USO DE PROBIOTICOS Y PREBIOTICOS
Muñoz-Chápuli Oriol, Ramón	2008	BFU2008-02384	157.300,00 €	47.190,00 €	EL EPICARDIO: DESARROLLO, MULTIPOTENCIALIDAD Y APLICACIONES BIOMEDICAS.

Niell Castanera, F. Xavier	2008	CTM2008-04453	423.500,00 €	296.450,00 €	PUNTOS DEBILES PARA EL CONOCIMIENTO DEL CICLO DEL CARBONO EN SISTEMAS ESTUARICOS:RELACIONES SUMIDERO-EMISION.
Pérez Rodríguez, Josefa	2008	CGL2008-01848	149.798,00 €	104.858,60 €	EVOLUCION MOLECULAR SUBYACENTE A LA ESPECIALIZACION DEL PETALO EN LA POLINIZACION POR ABEJA EN LAMIALES
Pimentel Sánchez, Ernesto	2008	TIN2008-05932	405.350,00 €	283.745,00 €	COMPOSICION DE SOFTWARE FIABLE EN ENTORNOS UBICUOS
Puerta Notario, Antonio	2008	TEC2008-06598	109.263,00 €	32.778,00 €	APLICACION DE TECNICAS DE DIVERSIDAD ESPACIAL Y OPTICA ADAPTATIVA EN ENLACES OPTICOS ATMOSFERICOS
Ramos Rodríguez, Cayo Juan	2008	AGL2008-05311-C02-02	183.920,00 €	128.744,00 €	ANALISIS GENOMICO FUNCIONAL DE LA INTERACCION PSEUDOMONAS SAVASTANOI PV. SAVASTANOI - OLIVO

Reul, Andreas	2008	CTM2008-05695-C02-02	123.420,00 €	86.394,00 €	CONTROL FISICO-BIOLOGICO DE LA ESTRUCTURA DE TAMAÑOS DEL PLANCTON E INTERCAMBIO DE CO2 ATMOSFERA/OCEANO EN UNA REGION FRONTAL CON ACCIDENTADA BATIMETRIA: CABO DE GATA.
Sánchez Jiménez, Francisca	2008	SAF2008-02522	205.700,00 €	143.990,00 €	AVANCES HACIA UNA VISION SISTEMICA DEL METABOLISMO DE AMINOACIDOS CATIONICOS EN CELULAS DE MAMIFEROS. APLICACIONES EN BIOMEDICINA
Vadillo Pérez, José Miguel	2008	CTQ2008-02197	110.110,00 €	77.077,00 €	EXCITACION LASER PARA LA ESPECTROMETRIA DE MASAS ANALITICA DE SUPERFICIES
Vallecillo Moreno, Antonio	2008	TIN2008-03107	268.620,00 €	188.034,00 €	DISEÑO Y MONITORIZACION DIRIGIDO POR MODELOS DE SISTEMAS EMPOTRADOS Y DE TIEMPO REAL

Juan Teodomiro López Navarrete, Vicerrector de Investigación y Transferencia de la Universidad de Málaga

INFORMA: Que según los datos que constan en este Vicerrectorado, **Dª. Dolores Burgueño Caballero** con D.N.I. 25346121 Y ha participado en las siguientes actividades y/o proyectos:

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de enero hasta el 30 de septiembre de 2017, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de octubre de 2017 hasta el 28 de febrero de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de marzo hasta el 30 de septiembre de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha sido Personal Investigadora en Formación (FPI) de referencia BES-2012-057064 financiado por el MINECO, con cargo al Proyecto TIN2011-23795, desde el 2 de enero de 2013 hasta el 31 de diciembre de 2016, cuyo investigador principal fue Manuel Díaz Rodríguez.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 16 de noviembre de 2011 hasta el 31 de marzo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 1 de abril hasta el 31 de mayo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría profesional de Titulado Superior a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia P07-TIC-003184, desde el 1 de junio hasta el 31 de agosto de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

Y para que conste donde proceda a los efectos oportunos en Málaga a 25 de marzo de 2021

SECRETARÍA DE ESTADO DE INVESTIGACIÓN, DESARROLLO E INNOVACIÓN

SECRETARÍA GENERAL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN

DIRECCIÓN GENERAL DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE PROYECTOS DE INVESTIGACIÓN

INFORME ANUAL DE PROYECTOS DE I+D+i

Como paso previo a la realización del informe, se ruega lean detenidamente las **instrucciones de elaboración de los informes de seguimiento científico-técnico de proyectos** disponible en la página web del ministerio.

A. Datos del proyecto

Relacione los datos del proyecto. En caso de que haya algún cambio, indíquelo cambiando de color el texto

Referencia	TIN2008-03107
Investigador principal	Dr. Antonio Vallecillo Moreno
Título	Diseño y monitorización dirigido por modelos de sistemas. MDD MERT
Entidad	Universidad de Málaga
Centro	E.T.S.I. Informática
Fecha de inicio	01-01-2009
Fecha final	30-06-2012 (era 31-12-2011 pero fue prorrogado a junio de 2012)
Duración	3 años y medio
Total concedido	222.000,00€

B. Informe de progreso y resultados del proyecto

B1. Desarrollo de los objetivos planteados Describa los objetivos y el grado de cumplimiento de los mismos (en porcentaje respecto al objetivo planteado y, en su caso, con indicación de lo que queda por realizar en cada uno de ellos)	
1. Explore the use of existing DSLs for: (a) specifying a set of PIMs for real-time and embedded systems, proposing extensions to existing notations to cope with the specification of the dynamic behaviour of metamodels (to allow simulation and validation activities on the models); (b) specifying platform models (PMs) of existing middlewares for this kind of systems, such as the ones we have developed in our previous projects; (c) specifying model transformations for the derivation of the appropriate PSMs from the PIMs and PMs, so that QoS and RT requirements are preserved.	(a) Se han definido un conjunto de notaciones, basados en el concepto de “observador”, y se ha estudiado su expresividad para la especificación de propiedades no funcionales, en particular de performance y reliability. También se ha estudiado cómo es posible usar ese concepto para la especificación de propiedades de auto-adaptación de sistemas. (b) Se han desarrollado modelos de plataformas, sobre todo en el el dominio de las redes de sensores, uno de nuestros dominios objetivo. (c) Se han desarrollado las transformaciones de modelos que se pretendían, comprobando su viabilidad. Como resultado de este objetivo se han obtenido varias publicaciones, que se recogen en esta memoria de seguimiento, y en las de anualidades anteriores.
2. Make use of MDD techniques to generate, from the system PIMs, the instrumentation code required for the effective runtime monitoring of the system. This includes defining high-level models for existing instrumentation infrastructures, and specifying the appropriate model transformations.	Este objetivo también se ha conseguido, siendo capaces de generar a partir de los observadores el código de monitorización.

3. Develop an algebraic monitoring framework based on rewriting logic and Maude that is able to implement the monitoring processes based on the analysis of the event traces provided by the instrumentation infrastructure, checking them against the QoS and RT requirements defined for the system. This objective also includes the specification of the model transformations required to automatically convert the PIMs' QoS and RT requirements into the appropriate formulae (expressed in LTL, RT-LTL, and other logics) used to check the runtime traces.	Este objetivo se terminó completamente del todo, pues nos centramos en otros objetivos – ya que este ha sido desarrollado por otros grupos y hemos preferido focalizar nuestros recursos en otros temas y herramientas de análisis, como por ejemplo las de Redes de Colas para realizar análisis de prestaciones de los sistemas, algo no contemplado en el proyecto original pero que descubrimos que era muy interesante. Ahora mismo tenemos un artículo en revisión en una revista indexada precisamente sobre este nuevo tema.
4. Define notations, mechanisms, policies and processes for the specification and enforcement of the appropriate self-adaptive behaviour of the system, according to the changing conditions of its environment as detected by the monitoring framework.	Objetivo realizado. Hemos publicado un par de congresos de alto nivel, y actualmente tenemos otra publicación en una revista indexada sobre este tema
5. Demonstrate the proposal by developing two real-life industrial applications that serve as validation and proof-of-concept for the proposed approach	Esta realizado sobre varios tipos de redes de sensores, un dominio de aplicación en el que nos hemos centrado, para estudiar varios tipos de propiedades, que incluyen performance, reliability and energy-efficiency (cada tipo de red es más apropiada para una o más de esas características. También se ha concluido la aplicación sobre la monitorización de radiación durante las paradas de recarga de combustible.

Cree tantas filas como necesite

B2. Actividades realizadas y resultados alcanzados
Describa las actividades científico-técnicas realizadas para alcanzar los objetivos planteados en el proyecto. Indique para cada actividad los miembros del equipo que han participado. **Extensión máxima 2 páginas**

Aunque el proyecto funcionó bien durante los tres años que inicialmente fueron concedidos, y los objetivos están casi todos cumplidos, decidimos solicitar una extensión del proyecto de 6 meses más puesto que queríamos acabar algunas herramientas en marcha y contábamos con un pequeño remanente del proyecto que podíamos aprovechar para mantener contratada una persona unos meses más para que termine las herramientas.

Dichas herramientas fueron terminadas a tiempo, y ahora mismo se encuentran a disposición pública en la página web del proyecto,

- Tracts tool: http://atenea.lcc.uma.es/index.php/Main_Page/Resources/Tracts
- Tracts constraint matcher: http://atenea.lcc.uma.es/index.php/Main_Page/Resources/Tracts-ATL

Las personas que han desempeñado funciones en el proyecto y sus acrónimos son:

- Antonio Vallecillo Moreno (AVM) ; Jose María Troya Linero (JMT); Manuel Díaz Rodríguez (MDR); Francisco Durán Muñoz (FDM); Bartolomé Rubio Muñoz (BRM); Enrique Soler Castillo (ESC); José M. Álvarez Palomo (JMA); Luis M. LLopis Torres (LLT); Manuel Fernández Bertoa (MFB); Manuel Roldán Castro (MRC); Natalia Moreno Vergara (NMV); José E. Rivera Cabaleiro (ERC); Ana Reyna Fortes (ARF); Eduardo Cañete Carmona (ECC); Fernando Lopez Romero (FLR); Jaime Chen Hing Fong (JCH); Jesús Manuel Rodríguez Sánchez (MRS); Daniel Mérida Barquero

(DMB); José María Bautista Moguel (JBM); Juan Ignacio Jaén Mariñas (JJM); Dolores Burgueño Caballero (DBC)

En cuanto a las tareas en las que han trabajado, se ha seguido el esquema de paquetes de trabajo que se planteaba en la memoria original del proyecto:

WP0: Project Management: AVM, JMT, MDR; FDM
WP1: Domain Specific Modeling: JTC, ERC
WP2: Infraestructura de Instrumentalización: FDM, MFB, NMV
WP3: Monitoring Framework/QNM simulation: JTC, JMB,
WP4: Self-Adaptive mechanisms: ERC, MRC, JMA
WP5: Transformations: FLR, DBC, ARF,
WP6: Applications and Validations: MDR, JJM, JHC, MRS, BRM, ESC, DBC

En esta anualidad, DBC es la persona que fue contratada para terminar las herramientas.

En caso de incluir figuras, cítelas en el texto e insértelas en la última página

B3. Problemas y cambios en el plan de trabajo
Describa las dificultades y/o problemas que hayan podido surgir durante el desarrollo del proyecto, así como cualquier cambio que se haya producido respecto a los objetivos o el plan de trabajo inicialmente planteados. **Extensión máxima 1 página**

Como hemos mencionado anteriormente, solicitamos una extensión de 6 meses para el proyecto, que nos fue concedida, porque queríamos acabar algunas herramientas en marcha y contábamos con un pequeño remanente del proyecto que podíamos aprovechar para mantener contratada una persona unos meses más para que termine las herramientas.

B4. Colaboraciones con otros grupos de investigación directamente relacionadas con el proyecto
Relacione las colaboraciones con otros grupos de investigación y el valor añadido para el proyecto. Describa, si procede, el acceso a equipamientos o infraestructuras de otros grupos o instituciones.

Con el Prof. Steffen Zschaler, del King's College London estamos colaborando en la especificación modular de propiedades no funcionales. Hemos publicado un artículo [3] y tenemos varios en preparación.

Con Peter Linington (U. Kent), Akira Tanaka (View LCC, Japón) y Zoran Milosevic (Deontik Ltd, Australia) hemos escrito un libro [14] sobre el modelado y especificación de sistemas abiertos y distribuidos, publicador por Taylor/Francis y CRC Press.

Con el Prof. José R. Romero, de la Universidad de Córdoba, mantenemos un estrecho contacto en el desarrollo de herramientas para el modelado y especificación de sistemas abiertos y distribuidos, lo que se ha traducido este año en un artículo de revista [1].

Con el grupo BIG (Business Information Group) de la Universidad Técnica de Viena (Austria), dirigido por la Prof. Gerti Kappel hemos empezado a tener una excelente colaboración a raíz de la estancia post-doctoral de Manuel Wimmer en nuestro grupo durante 15 meses. Esto se ha traducido en una serie de publicaciones conjuntas [6,10,13].

Con el grupo de Informática Aplicada de la Universidad de Almeria dirigido por el Prof. Luis Iribarne hemos comenzado a trabajar en el uso de observadores para la especificación de las propiedades no funcionales de los sistemas que ellos desarrollan, lo que ha dado lugar a varias visitas y a varias publicaciones conjuntas: [4,5]

Javier Troya realizó una estancia de 4 meses en Canadá, visitando al profesor Krzysztof Czarnecki.

Como resultado, este año se ha publicado un artículo [8] y hay varios en revisión.

Con el grupo de la Universidad de Bremen dirigido por el Prof. Martin Gogolla mantenemos una estrecha y fructífera colaboración sobre la especificación modular de transformaciones de modelos. Además de varias visitas, esta colaboración se ha visto reflejada en varias publicaciones conjuntas: [7,15,16]

Finalmente, con el grupo de la Universidad Politécnica de Cartagena mantenemos una línea de trabajo con la profesora Cristina Vicente-Chicote (ahora en la Universidad de Extremadura), sobre el uso de Maude para la especificación de robots y sistemas empotrados, lo que ha llevado a una publicación conjunta este año: [12]

B5. Colaboraciones con empresas o sectores socioeconómicos
Relacione las colaboraciones con empresas o sectores socioeconómicos y el valor añadido para el proyecto, la transferencia de conocimientos o resultados del mismo.

Durante este último año se han seguido llevando a cabo las colaboraciones que teníamos con las siguientes empresas:

- **Tecnatom, S.A**. Como estaba previsto, la empresa ha colaborado como EPO en el desarrollo de la aplicación de monitorización ambiental en centrales nucleares. Para el desarrollo se partió de los resultados desarrollados en el proyecto europeo SMEPP en el que nuestro grupo colaboró con esta empresa en el desarrollo de un nodo inalámbrico para detección de radiación.
- **EDP, e INOV (Portugal)**. Esta colaboración se ha llevado a cabo a partir de los resultados del proyecto europeo WSAN4CIP, en el que nuestro grupo también ha participado en el desarrollo de un middleware para monitorización de infraestructuras críticas mediante sensores inalámbricos. Se ha seguido desarrollando un sistema SCADA para sensores inalámbricos genérico que ha sido adaptado a dos aplicaciones de monitorización: redes de distribución eléctrica y redes de distribución de agua. El sistema ha sido desarrollado utilizando la plataforma de software libre para desarrollo de SCADA Mango (http://mango.serotoninsoftware.com/) y utilizando tecnologías MDD.
- **Abengoa Water-Abeima.**. Nuestro grupo colabora con estas empresas en el proyecto CENIT TecoAgua. En el contexto de este proyecto se ha están desarrollando sistemas de ayuda a la decisión en tiempo real para gestión de cuencas hidrográficas. Durante el desarrollo se han utilizado técnicas MDD con el objetivo de poder adaptar con facilidad las herramientas de análisis y visualización a los distintos códigos de simulación que se utilizan (hidrológicos, hidrodinámicos, gestión de embases) y de las distintas fuentes de datos (SCADA en tiempo real, datos históricos). El diseño de las herramientas se ha llevado a cabo mediante el uso de modelos independientes de la plataforma, que posteriormente serán adaptados a las características de las cuencas concretas.
- **Cemosa, S. A.** La colaboración con esta empresa tiene el objetivo el poder validar la infraestructura de redes de sensores desarrollada en el contexto de MMD-MERTS en aplicaciones reales. CEMOSA lleva a cabo inspecciones de infraestructuras críticas para detección de defectos, por lo que utiliza sistemas de monitorización en tiempo real (por ej. en infraestructuras ferroviarias, puentes,…). El coste del cableado y los sensores en estas aplicaciones es muy elevado, por lo que la empresa considera atractiva la posibilidad de utilizar metodologías inalámbricas, siempre que estas tengan las garantías de fiabilidad adecuadas y permitan cumplir los requisitos de tiempo real, que estas aplicaciones son muy estrictos. Tras la presentación de los resultados del proyecto MMD-MERTS, se ha iniciado una colaboración que ha dado lugar a la petición de un proyecto europeo (Certain) y un proyecto Motriz de la Junta de Andalucía.

B6. Actividades de formación y movilidad de personal
Indique las actividades de formación y movilidad de personal relacionadas con el desarrollo del proyecto. Además, si procede, las actividades realizadas en colaboración con otros grupos o con

actividades de formación en medianas o grandes instalaciones.			
	Nombre	Tipo (becario, técnico, contratado con cargo al proyecto, posdoctoral, otros)	Descripción de las actividades de formación
1	Javier Troya	FPI del proyecto	Estancia en la Universidad de Waterloo (Canada)
2			

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B7. Actividades de internacionalización y otras colaboraciones relacionadas con el proyecto Indique si ha colaborado con otros grupos o si ha concurrido, y con qué resultado, a alguna de las convocatorias de ayudas (proyectos, formación, infraestructuras, otros) del Programa Marco de I+D de la UE y/o a otros programas internacionales, en temáticas relacionadas con la de este proyecto. Indique el programa, socios, países y temática y, en su caso, financiación recibida.

C. Difusión de los resultados del proyecto

Relacione únicamente los resultados derivados de este proyecto

C1. Publicaciones científico-técnicas (con peer-review) derivadas del proyecto y patentes

Autores, título, referencia de la publicación…

C1.1 Revistas internacionales:

1. José Raul Romero, Juan Ignacio Jaén, A. Vallecillo. “A Tool for the Model-Based Specification of Open Distributed Systems”. *The Computer Journal*, March 2012. http://dx.doi.org/10.1093/comjnl/bxs021
2. Francisco Durán and José Meseguer, "On the Church-Rosser and Coherence Properties of Conditional Order-Sorted Rewrite Theories", Journal of Logic and Algebraic Programming 81(7-8): 816-850 (2012), DOI: 10.1016/j.jlap.2011.12.004

C1.2 Artículos en congresos internacionales:

3. Francisco Durán, Steffen Zschaler, Javier Troya. "On the Reusable Specification of Non-functional Properties in DSLs". Proceedings of the 5th Internatinal Conference on Software Language Engineering (**SLE 2012**). **LNCS** 7745, Springer 2012. pp. 332-351. ISBN: 978-3-642-36088-6, 978-3-642-36089-3. Desden, Germany, Sept. 25th - 28th, 2012.
4. Javier Criado, Luis Iribarne, Nicolás Padilla, J. Troya, A. Vallecillo. “Runtime Monitoring and Adapting Component-based Systems: Application to WIMP User Interface Architectures”. In Proc. of the 38th **Euromicro Conference** on Software Engineering and Advanced Applications (SEAA 2012), September 5-8, 2012 Cesme, Izmir, Turkey. IEEE CS Press.
5. Javier Criado, Luis Iribarne, Nicolás Padilla, Javier Troya, Antonio Vallecillo. "An MDE approach for Runtime Monitoring and Adapting Component-based Systems: Application to WIMP User Interfaces Architectures". Proceedings of the 38th **Euromicro Conference** on Software Engineering and Advanced Applications (SEAA 2012). IEEE Computer Society, 150-157. ISBN: 978-1-4673-2451-9. Cesme, Izmir, Turkey, September 5-8, 2012
6. Manuel Wimmer, Nathalie Moreno, A. Vallecillo. “Viewpoint co-evolution through coarse-grained changes and coupled transformations”. In Proc. of **TOOLS Europe 2012**, **LNCS** 7304, pp. 337–353, Prague, Czech Republic, May 29-31, 2012. Springer.
7. Martin Gogolla and Antonio Vallecillo. “Typing Transformations using Tracts”. In Proc. of the Fifth International Conference on Model Transformations (**ICMT 2012**), **LNCS** 7307, pp. 56-71, Prague, Czech Republic, May 28-29, 2012. Springer
8. Moisés Castelo Branco, Javier Troya, Krzysztof Czarnecki, Jochen Küster, Hagen Völzer. "Matching Business Process Workflows Across Abstraction Levels". Proceedings of the ACM/IEEE 15th International Conference on Model Driven Engineering Languages and Systems (**MODELS 2012**). Springer Verlag, **LNCS**, 626-641. ISBN: 978-3-642-33665-2. Innsbruck,

Austria, Sept. 30th - Oct. 5th, 2012.

C1.3 Artículos en workshops internacionales:

9. Javier Troya and Antonio Vallecillo. “A DSVL for Modeling Power-Aware Reliability Metrics in WSNs”. In Proc. of the NFPinDSML2012 workshop at MODELS 2012, Innsbruck, Austria, October 2012. ACM 2012, 3:1-3:6. ISBN: 978-1-4503-1807-5
10. Loli Burgueño, Manuel Wimmer and Antonio Vallecillo. Towards Tracking Guilty Transformation Rules. In Proc. of the AMT 2012 workshop at MODELS 2012, Innsbruck, Austria, October 2012.

C1.4 Artículos en congresos nacionales:

11. Javier Troya and Antonio Vallecillo. “On the Modular Specification of Non-Functional Properties in DSVLs”. XVII Jornadas de Ingeniería del Software y Bases de Datos, JISBD 2012, Septiembre 2012, Almería, España.
12. Juan F. Inglés-Romero, Cristina Vicente-Chicote, Javier Troya and Antonio Vallecillo. “Prototyping component-based self-adaptive systems with Maude” XVII Jornadas de Ingeniería del Software y Bases de Datos, JISBD 2012, Septiembre 2012, Almería, España.
13. Manuel Wimmer, Loli Burgueño and Antonio Vallecillo. “Prueba de Transformaciones de Modelos con TractsTool”. XVII Jornadas de Ingeniería del Software y Bases de Datos, JISBD 2012, Septiembre 2012, Almería, España.

C2. Asistencia a congresos, conferencias o workshops relacionados con el proyecto

Nombre del congreso, tipo de comunicación (invitada, oral, póster), autores

– **TOOLS Europe 2012**, Prague, Czech Republic, May 29-31, 2012. [Artículo]. Manuel Wimmer, Nathalie Moreno, A. Vallecillo.
– **ICMT 2012**: Fifth International Conference on Model Transformations, Prague, Czech Republic, May 28-29, 2012. [Artículo]. Martin Gogolla and Antonio Vallecillo.

C3. Tesis doctorales finalizadas relacionadas con el proyecto

Nombre del doctor, director de tesis, título, calificación, organismo…

– Nathalie Moreno Vergara “WEI: Integración de aplicaciones externas en sistemas Web mediante modelos”. Director: Antonio Vallecillo. Universidad: Málaga, ETSI Informática. 7 de Mayo 2012. Calificación: Apto Cum Laude.

C4. Otras publicaciones derivadas de colaboraciones mantenidas durante la ejecución del proyecto y que pudieran ser relevantes para el mismo, así como artículos de divulgación libros, conferencias

Autores, título, referencia de la publicación…

C4.1 Libros:

14. Peter F. Linington, Zoran Milosevic, Akira Tanaka, Antonio Vallecillo. “Building Enterprise Systems with ODP. An Introduction to Open Distributed Processing” Chapman & Hall/CRC Press. 2012. ISBN: 978-1-4398-6625-2. http://theodpbook.lcc.uma.es http://www.crcpress.com/product/isbn/9781439866252;jsessionid=0G6aDE25guukegI5WQRAxQ**

C4.2 Capítulos de libros:

15. Antonio Vallecillo, Martin Gogolla, Loli Burgueño, Manuel Wimmer and Lars Hamman. “Formal

Specification and Testing of Model Transformation". In: Formal Methods for Model-Driven Engineering, **LNCS** 7320, pp. 399–437, Springer, Junio 2012.

C4.3 Seminarios y cursos:

16. "**Formal Specification and Testing of Model Transformations**". Lecture at SMF-12: 12th International School on Formal Methods: Model-Driven Engineering. Bertinoro, Italy, 18-23 June 2012.

C4.4 Charlas invitadas

17. "**Performance Analysis of Domain Specific Visual Models**". Conferencia invitada en la Universidad Politécnica de Valencia, 13 de febrero de 2012.

C4.5 Herramientas
- Tracts tool: http://atenea.lcc.uma.es/index.php/Main_Page/Resources/Tracts
- Tracts constraint matcher: http://atenea.lcc.uma.es/index.php/Main_Page/Resources/Tracts-ATL

C4.6 Organización de eventos:
- EMCFA 2012: PC Chair
- QoSA 2012: PC chair
- WRLA 2012: PC Chair

D. Personal activo en el proyecto

Relacione la situación de todo el personal de las entidades participantes que haya prestado servicio en el proyecto en la anualidad que se justifica, o **que no haya sido declarado anteriormente**, y cuyos costes (salariales, dietas, desplazamientos, etc.) se imputen al mismo.

					Si no incluido en solicitud original:		
	Nombre	NIF/NIE	Catg.ª profesional	Incluido en solicitud original (S/N)	Función en el proyecto	Fecha de alta	Observaciones
1							
2							

Cree tantas filas como necesite

-En este capítulo solo debe incluir al personal vinculado de las entidades participantes en el proyecto. Los gastos de personal externo (colaboradores científicos, autónomos…) que haya realizado tareas para el proyecto deben ser incluidos en el capítulo de "Varios".
-Las "Altas" y "Bajas" deben tramitarse de acuerdo con las instrucciones para el desarrollo de los proyectos de I+D+i expuestas en la página web del ministerio.

E. Gastos realizados durante la anualidad

Debe cumplimentarse este apartado independientemente de la justificación económica enviada por la entidad

Se recomienda consultar las instrucciones para la elaboración de los informes de seguimiento científico-técnico de proyectos

E1. Gastos de personal (indique número de personas, situación laboral y función desempeñada)

	Nombre	Situación laboral	Función desempeñada	Importe
1	Dolores Burqueño Caballero	Técnico superior	Desarrollo de herramientas	7.966,39€
Total gastos de personal				7.966,39€

Cree tantas filas como necesite

E2. Material inventariable (describa el material adquirido)

	Identificación del equipo	Descripción del equipo	Importe	Previsto en la sol. original (S/N)
1				
2				
Total gastos material inventariable			**0,00€**	

Cree tantas filas como necesite

E3. Material fungible (describa el tipo de material por concepto o partida, p. ej., reactivos, material de laboratorio, consumibles informáticos, etc.)

	Concepto	Importe	Previsto en la sol. original (S/N)
1			
Total gastos material fungible		**0,00€**	

Cree tantas filas como necesite

E4. Viajes y dietas (describa la actividad del gasto realizado y las personas que han realizado la actividad). Debe incluir aquí los gastos derivados de la asistencia a congresos, conferencias, colaboraciones, reuniones de preparación de propuestas relacionados con este proyecto, etc.)

	Concepto	Importe	Nombre del participante	Previsto en la sol. original (S/N)
1	Asistencia TOOLS12 en Praga	369,65€	Antonio Vallecillo	S
2	Asistencia CompAch12 en Bertinoro, Italia	878,46€	Antonio Vallecillo	S
3	Reunión en Valencia	97,27€	Antonio Vallecillo	S
Total viajes y dietas		**1.345,38€**		

Cree tantas filas como necesite

E5. Otros gastos (describa por concepto; debe incluir aquí, entre otros, los gastos derivados de personal no incluido en el equipo de trabajo indicando la actividad a la que corresponde dicho gasto, así como el gasto derivado de la inscripción a congresos o conferencias)

	Concepto	Importe	Nombre del participante	Previsto en la sol. original (S/N)
1				
2				
Total otros gastos		**0,00**		

Cree tantas filas como necesite

E6. Total ejecutado (costes directos únicamente)	
Importe total ejecutado durante la anualidad	**9.311,47€**

E7. Descripción de gastos no contemplados en la solicitud original (si ha realizado algún gasto no contemplado en la solicitud original, justifique la necesidad de su adquisición en este apartado)

F. Gastos realizados desde el inicio del proyecto

Importe total ejecutado (costes directos únicamente)	**221.660,56 €**

TIN2011-23795

III. OTRAS DISPOSICIONES

MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

1299 *Resolución de 11 de enero de 2012, de la Dirección General de Investigación y Gestión del Plan Nacional de I+D+i, por la que se publican las ayudas y subvenciones concedidas en el cuarto trimestre de 2011.*

En cumplimiento de lo dispuesto en el artículo 18.1 de la Ley 38/2003, de 17 de noviembre, General de Subvenciones,

Esta Dirección General de Investigación y Gestión del Plan Nacional de I+D+i, ha resuelto ordenar la publicación en el «Boletín Oficial del Estado» de las ayudas y subvenciones concedidas en el cuarto trimestre de 2011, relacionadas en el anexo adjunto.

Madrid, 11 de enero de 2012.–La Directora General de Investigación y Gestión del Plan Nacional de I+D+i, Montserrat Torné i Escasany.

cve: BOE-A-2012-1299

BENEFICIARIO	CIF	REFERENCIA	TÍTULO	PRIMERA ANUALIDAD (EUROS)	SEGUNDA ANUALIDAD (EUROS)	TERCERA ANUALIDAD (EUROS)	TOTAL (EUROS)	% FEDER
UNIVERSIDAD DE LLEIDA	Q7550001G	AGL2011-30529-C02-02	DESARROLLO DE GERMOPLASMA Y NUEVOS MÉTODOS DE INTERÉS PARA LA MEJORA GENÉTICA DE LA CEBADA PARA PIENSO Y ALIMENTACIÓN HUMANA	31.145,40	-	55.369,60	86.515,00	0
UNIVERSIDAD DE LLEIDA	Q7550001G	SAF2011-22908	LA ESCLEROSIS LATERAL AMIOTRÓFICA COMO ENFERMEDAD PROTEINOPÁTICA Y NEUROINFLAMATORIA: ESTRATEGIAS DE INMUNOTERAPIA	82.372,00	-	62.828,00	145.200,00	0
UNIVERSIDAD DE MALAGA	Q2918001E	HAR2011-25461	LOS ORÍGENES DE LA HISTORIOGRAFÍA SOBRE PAGANISMO TARDOANTIGUO (SIGLOS XVI-XVIII)	15.975,20	10.494,40	12.250,40	38.720,00	0
UNIVERSIDAD DE MALAGA	Q2918001E	DPI2011-25390	ANALISIS Y DESARROLLO DE SISTEMAS MULTIFASICOS DE CONVERSION DE LA ENERGIA EOLICA	114.520,45	11.271,15	13.358,40	139.150,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TEC2011-29106-C02-01	TECNOLOGIA ASISTIVA PARA REHABILITACION COLABORATIVA	100.776,00	9.916,61	11.756,39	122.453,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TEC2011-25473	CANALES INALAMBRICOS SUBACUATICOS: MODELOS Y TECNICAS DE TRANSMISION	74.587,67	7.340,05	8.700,28	90.628,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TEC2011-26395	INTERFACES CEREBRALES APLICADAS A PERSONAS CON DISCAPACIDAD MOTORA	97.383,43	8.585,98	11.325,59	117.295,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-27512-C05-01	PERCEPCION, APRENDIZAJE Y ACCION PARA UN ROBOT DE ENTRENAMIENTO Y REHABILITACION MEDICA	9.340,00	-	-	9.340,00	0
UNIVERSIDAD DE MALAGA	Q2918001E	DPI2011-25483	NUEVOS DESARROLLOS HACIA UN ROBOT EN CASA	121.481,26	11.867,22	14.171,52	147.520,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-23795	SISTEMAS INALAMBRICOS DE GESTION DE INFORMACION CRITICA	105.284,94	10.481,47	12.405,89	128.226,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-24141	DETECCION DE ACTIVIDADES ANOMALAS EN SECUENCIAS DE VIDEO MEDIANTE SISTEMAS NEURONALES AUTOORGANIZADOS	13.410,51	2.851,24	16.473,75	32.735,50	0
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-25840	GESTION, ANALISIS Y EXPLOTACION EFICIENTE DE DATOS VINCULADOS	124.602,23	12.263,40	14.534,41	151.400,04	70,30000132
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-26598	ISAO DE LAS EMPRESAS PARA SU SOSTENIBILIDAD:UNA PLATAFORMA DE VALOR PARA LA GESTION DE LA REPUTACION CORPORATIVA PARA LAS MULTINACIONALES COTIZADAS Y EMPRESAS PUBLICAS	109.541,38	10.781,18	12.777,60	133.100,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-25584	TRATAMIENTO DE LA INCERTIDUMBRE EN INFORMACION SEMIESTRUCTURADA DISTRIBUIDA	54.173,15	5.331,74	6.319,11	65.824,00	70
UNIVERSIDAD DE MALAGA	Q2918001E	TIN2011-28194	FUNDAMENTOS PARA LA APLICACION DE METAHEURISTICAS A PROBLEMAS REALES: EL CASO DE LAS REDES VEHICULARES	83.949,72	8.232,84	9.757,44	101.940,00	70

TIN2014-52034-R

III. OTRAS DISPOSICIONES

MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

11308 *Resolución de 6 de octubre de 2015, de la Dirección General de Investigación Científica y Técnica, por la que se publican las ayudas y subvenciones concedidas en el tercer trimestre de 2015.*

En cumplimiento de lo dispuesto en el artículo 18.1 de la Ley 38/2003, de 17 de noviembre, General de Subvenciones,

Esta Dirección General de Investigación Científica y Técnica ha resuelto ordenar la publicación en el «Boletín Oficial del Estado» de las ayudas y subvenciones concedidas en el tercer trimestre de 2015 relacionadas en el anexo adjunto.

Madrid, 6 de octubre de 2015.–La Directora General de Investigación Científica y Técnica, Marina Pilar Villegas Gracia.

cve: BOE-A-2015-11308
Verificable en http://www.boe.es

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	PERIODO EJECUCIÓN		CONTRATOS PREDOC. PROP.	FINANCIACIÓN CONCEDIDA (euros)							
								Total	% FEDER	Por concepto de gasto		Por anualidad			
					FECHA INICIO	FECHA FIN				Costes Directos	Costes Indirectos (21 %)	Primera anualidad	Segunda anualidad	Tercera anualidad	Cuarta anualidad
TIN2014-52034-R	UN MARCO DIRIGIDO POR MODELOS PARA EL DISEÑO E INTEGRACION DE SISTEMAS DE GESTION DE INFRAESTRUCTURAS CRITICAS	UNIVERSIDAD DE MALAGA	ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA	Q2918001E	01-01-15	31-12-17	1	216.953,00	80,0	179.300,00	37.653,00	167.921,62	31.241,23	17.790,15	0,00
TIN2014-53465-R	VIDEOVIGILANCIA MEDIANTE BUSQUEDA ACTIVA DE SUCESOS ANOMALOS	UNIVERSIDAD DE MALAGA	ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA	Q2918001E	01-01-15	31-12-18	0	123.299,00	80,0	101.900,00	21.399,00	89.021,87	18.248,26	8.137,73	7.891,14
TIN2014-57341-R	METAHEURISTICAS, INTELIGENCIA HOLISTICA Y MOVILIDAD INTELIGENTE	UNIVERSIDAD DE MALAGA	ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA	Q2918001E	01-01-15	31-12-17	1	133.705,00	80,0	110.500,00	23.205,00	103.487,67	19.253,52	10.963,81	0,00
TIN2014-58304-R	SEMANTICA EN UNA PLATAFORMA DE ANALISIS DEL BIG DATA	UNIVERSIDAD DE MALAGA	ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA	Q2918001E	01-01-15	31-12-17	1	156.090,00	80,0	129.000,00	27.090,00	120.813,66	22.476,96	12.799,38	0,00
TIN2014-58516-C2-1-R	DISEÑO DE ESTRATEGIAS ADAPTATIVAS EN SENSORES INTELIGENTES Y APLICACION A LA PREDICCION DE CONTAMINANTES ATMOSFERICOS EN ENTORNOS LOCALES.	UNIVERSIDAD DE MALAGA	ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA	Q2918001E	01-01-15	31-12-17	0	83.611,00	80,0	69.100,00	14.511,00	64.714,91	12.039,99	6.856,10	0,00
AGL2014-51839-C5-2-R	AVANCES EN EL CONOCIMIENTO GENOMICO DEL PROBIOTICO SHEWANELLA PUTREFACIENS PDP11, EN SUS INTERACCIONES CON LOS PATOGENOS Y EN SU APLICACION EN EL CULTIVO DE SOLEA SENEGALENSIS	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	0	151.250,00	80,0	125.000,00	26.250,00	117.067,50	21.780,00	12.402,50	0,00
AGL2014-52518-C2-1-R	APRENDIENDO DE LAS INTERACCIONES MULTITROFICAS EN LA RIZOSFERA DE AGUACATE PARA AVANZAR EN EL CONTROL BIOLOGICO CONTRA ROSELLINIA NECATRIX	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	1	314.600,00	80,0	260.000,00	54.600,00	243.500,40	45.302,40	25.797,20	0,00
AGL2014-53242-C2-1-R	GENOMICA Y EVOLUCION DE LA ESPECIFICIDAD DE HUESPED EN PSEUDOMONAS SAVASTANOI: PATOVARES	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	1	229.900,00	80,0	190.000,00	39.900,00	177.942,60	33.105,60	18.851,80	0,00
AGL2014-54532-C2-1-R	PATOGENICIDAD DE BETANODAVIRUS EN LENGUADO CULTIVADO (SOLEA SENEGALENSIS) Y SU RELACION CON LA RESPUESTA INMUNE DEL HOSPEDADOR	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	0	169.400,00	80,0	140.000,00	29.400,00	131.115,60	24.393,60	13.890,80	0,00
AGL2014-55784-C2-1-R	IDENTIFICACION Y ANALISIS FUNCIONAL DE GENES QUE REGULAN PROCESOS RELACIONADOS CON LA CALIDAD ORGANOLEPTICA Y LAS CARACTERISTICAS ESTRUCTURALES DEL FRUTO DE FRESA	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	1	157.300,00	80,0	130.000,00	27.300,00	121.750,20	22.651,20	12.898,60	0,00
BIA2014-57658-C2-2-R	OPTIMIZACION Y CARACTERIZACION AVANZADA DE ECOCEMENTOS BASADOS EN YE'ELIMITA	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS	Q2918001E	01-01-15	31-12-17	0	96.800,00	80,0	80.000,00	16.800,00	74.923,20	13.939,20	7.937,60	0,00

TIN2016-75944-R

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2016 - PROYECTOS I+D+I
PROGRAMA ESTATAL DE INVESTIGACIÓN, DESARROLLO E INNOVACIÓN ORIENTADA A LOS RETOS DE LA SOCIEDAD

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	AÑOS	PERIODO EJECUCIÓN		CONT. PRED. PROP.	FINANCIACIÓN CONCEDIDA (euros)							
						FECHA INICIO	FECHA FIN		Total	% FEDER	Por concepto de gasto: Costes Directos	Costes Indirectos	Por anualidad: Primera anualidad	Segunda anualidad	Tercera anualidad	Cuarta anualidad
DPI2016-80283-C2-2-R	CARACTERIZACION CLINICA, RADIOLOGICA Y ANALITICA DEL PACIENTE CON ARTROSIS DE RODILLA Y NECESIDAD DE ARTROPLASTIA	FUNDACIO INSTITUT MAR D'INVESTIGACIONS MEDIQUES	INSTITUT HOSPITAL DEL MAR D INVESTIGACIONS MEDIQUES (IMIM)	G60072253	3	30-12-16	29-12-19		168.190,00	50,0	139.000,00	29.190,00	88.299,75	8.409,50	25.228,50	46.252,25
SAF2016-75613-R	ESPECIFICACION DE CELULA MADRE HEMATOPOYETICA Y LEUCEMICA	FUNDACIO INSTITUT MAR D'INVESTIGACIONS MEDIQUES	INSTITUT HOSPITAL DEL MAR D INVESTIGACIONS MEDIQUES (IMIM)	G60072253	3	30-12-16	29-12-19	1	435.600,00	50,0	360.000,00	75.600,00	228.690,00	21.780,00	65.340,00	119.790,00
SAF2016-76461-R	ENTENDIENDO EL PAPEL DE SNAIL1 EN LA METASTASIS: ANALISIS DE LA ACCION DE LOS FIBROBLASTOS ACTIVOS	FUNDACIO INSTITUT MAR D'INVESTIGACIONS MEDIQUES	INSTITUT HOSPITAL DEL MAR D INVESTIGACIONS MEDIQUES (IMIM)	G60072253	3	30-12-16	29-12-19	1	423.500,00	50,0	350.000,00	73.500,00	222.337,50	21.175,00	63.525,00	116.462,50
SAF2016-80726-R	PAPEL DE LA SEROTONINA EN LAS TERAPIAS DE RECUPERACION COGNITIVA: ESTUDIO IN VIVO DE LA DINAMICA DE REDES NEURONALES EN MODELOS MURINOS DE SINDROME DE DOWN Y ESQUIZOFRENIA	FUNDACIO INSTITUT MAR D'INVESTIGACIONS MEDIQUES	INSTITUT HOSPITAL DEL MAR D INVESTIGACIONS MEDIQUES (IMIM)	G60072253	3	30-12-16	29-12-19		181.500,00	50,0	150.000,00	31.500,00	95.287,50	9.075,00	27.225,00	49.912,50
TIN2016-75944-R	OPEN DATA PARA TODOS: UNA INFRAESTRUCTURA BASADA EN APIS PARA LA EXPLOTACION DE FUENTES DE DATOS ONLINE	FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA	INSTITUTO INTERDISCIPLINARIO DE INTERNET, IN3	G60667813	4	30-12-16	29-12-20		77.198,00		63.800,00	13.398,00	3.859,90	7.719,80	23.159,40	42.458,90
DPI2016-80119-C3-1-R	NUEVAS TECNOLOGIAS PARA LA IMPRESION 3D DE MATERIALES AVANZADOS	FUNDACIO PRIVADA CENTRE CIM	OFICINA TRANSFERENCIA DE RESULTADOS DE INVESTIGACION (OTRI)	G63749162	3	30-12-16	29-12-19		129.712,00		107.200,00	22.512,00	6.485,60	12.971,20	38.913,60	71.341,60

Universitat Oberta de Catalunya   uoc.edu

Barcelona, 19 de Noviembre de 2019

MIREIA RIERA DURAN, con DNI 52592145T, como Directora de la Oficina de Apoyo a la Investigación y la Transferencia de la Universitat Oberta de Catalunya,

CERTIFICA que:

Lola Burgueño ha participado formando parte del equipo de trabajo de los siguiente proyectos:

- "***Open Data for All: an API-based infrastructure for exploting online data sources***" (numero de referencia expediente TIN2016-75944-R) financiado por el Ministerio de Ciencia, innovación y Universidades; con fecha de inicio el 30 de diciembre de 2016 y fecha fin el 29 de diciembre de 2020 siendo Jordi Cabot su Investigador Principal.
- "***The beginnings of cognified MDE Platform***" (número de referencia expediente: ERC MODEL-IA Ref C30884) financiado pór el Commissariat à l'Energie Atomique et aux Energies Alternatives; con fecha de inicio el 1 de septiembre de 2018 y fecha fin el 31 de Agosto de 2020.

Y, para que así conste, firmo el presente certificado.

Universitat Oberta de Catalunya

Mireia Riera Duran

Directora Oficina de Apoyo a la Investigación y la Transferencia

2) Redes Nacionales e Internacionales

COST Action IC1404

University of Antwerp

MPM4CPS cost

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DATE	SUBJECT
21 April 2018	Certification Letter Dr. Loli Burgueño

To whom it may concern,

I am the chair of COST Action IC1404 “Multi-Paradigm Modelling for Cyber-Physical Systems” (MPM4CPS).

You may find more information on this Action at

http://www.cost.eu/COST_Actions/ict/IC1404

and at

http://mpm4cps.eu/

The action runs from 25 November 2014 until 24 November 2018. We organize workshops, Training Schools and Short Term Scientific Missions.

I hereby want to certify that since the the start of the Action, Dr. Loli Burgueño has been a very active contributer to our activities. An example is Dr. Burgueño’s participation in the Young MPM4CPS Researchers workshop held at the University of Twente 17-18 December 2015 while she was a PhD student at the University of Malaga. Dr. Burgueño has also been one of the main organizers of the Malaga MPM4CPS workshop 24-25 November 2016.

Please do not hesitate to contact me if you desire further information.

Sincerely,

European Cooperation
in the field of Scientific
and Technical Research
- COST -

Brussels, 15 May 2014

COST 044/14

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action IC1404: Multi-Paradigm Modelling for Cyber-Physical Systems (MPM4CPS)

Delegations will find attached the Memorandum of Understanding for COST Action IC1404 as approved by the COST Committee of Senior Officials (CSO) at its 190th meeting on 14 May 2014.

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as

COST Action IC1404
MULTI-PARADIGM MODELLING FOR CYBER-PHYSICAL SYSTEMS (MPM4CPS)

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4114/13 “COST Action Management” and document COST 4112/13 “Rules for Participation in and Implementation of COST Activities” , or in any new document amending or replacing them, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to enhance the quality, visibility and impact of European research and industrial adoption in the trans-disciplinary area of Cyber-Physical Systems (CPS) by unification through Multi-Paradigm Modelling.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 76 million in 2014 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of section *2. Changes to a COST Action* in the document COST 4114/13.

A. ABSTRACT AND KEYWORDS

Truly complex, designed systems, known as Cyber Physical Systems (CPS), are emerging that integrate physical, software, and network aspects. To date, no unifying theory nor systematic design methods, techniques and tools exist for such systems. Individual (mechanical, electrical, network or software) engineering disciplines only offer partial solutions.

Multi-paradigm Modelling (MPM) proposes to model every part and aspect of a system explicitly, at the most appropriate level(s) of abstraction, using the most appropriate modelling formalism(s). Modelling languages' engineering, including model transformation, and the study of their semantics, are used to realize MPM. MPM is seen as an effective answer to the challenges of designing CPS.

The Action aims to promote the sharing of foundations, techniques, and tools and to provide educational resources, to both academia and industry. This will be achieved by bringing together and disseminating knowledge and experiments on CPS problems and MPM solutions.

Keywords: Cyber-Physical Systems (CPS), Complex Systems Development, Multi-paradigm Modelling (MPM), Model-Based Systems Engineering (MBSE), (co-)Simulation, Control Systems, Control Theory, Embedded Systems, Systems-of-Systems, Mechatronics, Networks, Distributed Systems, Software-Intensive Systems.

B. BACKGROUND

B.1 General background

In virtually any area of human activity, truly complex, designed systems, known as Cyber Physical Systems (CPS), are emerging. These multi-disciplinary systems deeply integrate collaborating physical, software, and network parts.

Tackling the complexity involved in developing software intensive and embedded systems (SiS/ES) is a topic of intense research and development. The complexity faced when engineering CPS is however several orders of magnitude higher, mostly due to the plethora of cross-disciplinary design alternatives and inter-domain interactions. The solutions for SiS/ES challenges that the systems and software engineering communities have come up with (e.g., multi-resolution modelling of physical systems, computationally a-causal modelling of multi-physics systems, aspectual multi-view modularization) are simply no match for the complexity observed in CPS. As a consequence, to date, no unifying theory nor systematic design methods, techniques or tools exist for CPS.

Individual (mechanical, electrical, software) engineering disciplines (in the form of theories, methods and tools) only offer partial solutions.
The foundational infrastructure that is able to glue together in a consistent way the several disciplines of CPS is Multi-Paradigm Modelling (MPM). MPM is a research field focused on breaking the inherent complexity of large-scale and complex systems into different levels of abstraction and views (i.e., rigorous models of some physical or logical reality), each expressed in appropriate modelling formalisms. By appropriate, not only cognitive aspects (which impacts learnability and usability of the used formalism) are understood, but also technical ones such as tractability for debugging and analysis.
Modelling language engineering (using model transformations), and the study of their formal semantics, is used to realize MPM, by combining multiple models of computation such as continuous-time, discrete-event, and synchronous data flow. MPM, viewed as the logical continuation of Model-Based Systems Engineering (MBSE) and Model-Driven Engineering (MDE), is becoming a successful approach by providing processes as well as software tools that are able to combine, couple, and integrate each of the views that compose a system.
The main goals are to analyse (for safety and reliability), to simulate (for optimization purposes) and, where appropriate, synthesize these systems.
Research activities focusing on Modelling of CPS are typically based on national activities and generally lack a concerted approach at European level. A dedicated interdisciplinary and inter-institutional platform for scientific information exchange, consensus building, and model improvement is thus required. COST provides the best available mechanism for broad European networking and capability-building. A COST Action is the most appropriate framework since only in a non-competitive, interdisciplinary environment it will be possible to identify and verbalize the weaknesses and uncertainties related to CPS modelling approaches, to develop common strategies for improving the performance of such tools and to develop and broaden the available research expertise.
The intended COST Action will involve, support and harmonize the various existing national activities around CPS modelling, and will benefit from the results of previous COST Actions, such as IC0901 and IC285. One innovative aspect of the Action is the effort of bringing together scientists and experts in Mechatronics, Smart-Cities, CPS, Software Modelling and Engineering, and Multi-Paradigm Modelling, in order to push development and implementation of state-of-the-art scientifically justified methodologies of CPS modelling in several application domains such as automotive and avionics. In order to ensure a direct impact of the scientific output, the Action is characterized by a high level of specialization and is aiming at a well defined target. Based on the

joint expertise and contacts with international programmes, the Action will harmonize with the most recent developments in the USA and Canada and indeed world-wide.

B.2 Current state of knowledge

Cyber-physical systems (CPS) enable the physical world to merge with the virtual, leading to an Internet of Things, data and services. One example of CPS is an intelligent manufacturing line, where the machine can perform many work processes by communicating with the components. Using sensors, the embedded systems monitor and collect data from physical processes, such as steering of a vehicle, energy consumption or human health functions. The systems are networked, making the data globally available. Cyber-physical systems make it possible for software applications to directly interact with events in the physical world, for example to measure and react to changes in blood pressure or peaks in energy consumption.

The problems related to CPS were identified in several application areas – from automotive to avionics – all around Europe, and therefore are certainly international. However, each application (at a national level) is developing different techniques – from mechatronics to embedded systems – lacking the ability to systematically share and reuse any of the acquired techniques and lessons learned among them.

Entire conferences, initially conceived in the US, but now increasingly in Europe, on the topic of CPS exist and have led to a vast body of published work. A pertinent example is the CPS week, held in Berlin this year, which groups 5 conferences, 10 workshops and 4 tutorials. Similarly, MPM, as a part of the Model-Driven Engineering and Model-Based Systems Engineering community also has a very active community. The combination of both communities will lead to the much-needed breakthroughs in unified (i.e., not rooted in specific application domains or solution techniques) dealing with complexity.

The need for a tighter integration of research – both with respect to the technological and the application domains – to ensure the competitiveness of the European industry has already been recognized on the strategic level of Horizon2020. A stronger cooperation in ARTEMIS, Eniac, and EPoSS as core technology domains of CPS is a clear indicator for this as well as the targeting of cross-domain issues such as smart energy and traffic. However, currently many of the research projects established in this field have a limited focus, addressing only few domains and their models needed to solve a specific problem (e.g., e-mobility for cars in POLLUX). Those few integration projects with a broader scope of models – like iFEST or CEASAR – limit their scope to tool coupling, but much less on an integration of modelling paradigms of different domains. On the national level, research agendas such as the German agenda CPS sponsored by the BMBF, have expressed the need for a cross-domain systems theory, integration the models for the individual domains. First research projects – like within the German Industrie 4.0 framework – addressed this need for specific domains like production and automotive. Here, this COST Action provides the necessary framework for connecting and extending these projects, establishing the necessary inter-domain understanding to enable the innovation potential of CPS.

B.3 Reasons for the Action

It is timely to introduce the Action since many related national research activities are under way. Information about state-of-the-art embedded systems, mechatronics for avionics, mechatronics for automotive, etc., is already exchanged among European countries, mostly via independent application-specific industrial standards. There is a clear need to bring different solutions from different technology and application domains together around CPS. The MPM perspective which advocates modelling every part and aspect of a problem explicitly, using the most appropriate formalisms and abstractions, with explicitly modelled processes, is seen as the main enabler. We wish to guide the further development and dissemination of MPM and CPS at the European level. This task can, however, be extremely difficult to complete without a strong large-scale collaboration, mostly due to a non-obvious convergence of proper problem and solution models (and their techniques) and due to the multiplication of efforts in the distributed groups.
The Action is needed now, because ongoing research will benefit immediately in the context of the conceptual and application-oriented improvements achieved by the Action. The dissemination of the scientific results and the best practice recommendations produced by the Action, through publications and special sessions at conferences and workshops, will have an immediate impact on applied CPS modelling and CPS industrial development.
The present COST action aims at creating the conditions necessary for promoting the sharing of resources, by integrating, under a common umbrella (i.e., in a consistent and systematic way with a common terminology), the knowledge and experiments across several research projects around Europe (and beyond). In addition, this COST action provides a unique opportunity to establish international cooperation, and to exchange materials (data, models, insights) and compare results. Finally, this Action is expected to have an important impact on European policy with respect to regulations of the methodologies and procedures to develop and certify this kind of systems, combining national and international legislation. Also, better dissemination and collaboration will contribute to harmonising these procedures among EU member states. In this way, transfer to the

international level would be highly beneficial for the internationalisation of CPS within the EU Industry. Here is a unique opportunity to determine appropriate ways of dealing with CPS in different industrial environments.

B.4 Complementarity with other research programmes

This Action focuses on MPM for CPS, and these aspects combined are not covered by other COST Actions or EU-projects. As the Action necessarily has to include many aspects of CPS (e.g., mechatronics in several application domains, etc.), there will be links with other research programmes as indicated:

a) Links and complementarity with (the results of) other COST Actions: IC0901 - Rich-Model Toolkit - An Infrastructure for Reliable Computer and IC285 - Modelling and Simulation Tools for Research in Emerging Multiservice Telecommunications

b) Links with other EU research programmes:
- ‘Cyber Physical Systems European Roadmap and Strategy’ (CyPhERS). FP7 project.
- CPS Action Line “Cypher Physical Systems” of the EIT ICT KIC.
- ‘Industrial Framework for Embedded Systems Tools’ (iFEST).
- ‘Combined Model-based Analysis and Testing of Embedded Systems’ (MBAT).

C. OBJECTIVES AND BENEFITS
C.1 Aim

The main objective of this Action is to enhance the quality, visibility and impact of European research and industrial adoption in the trans-disciplinary area of CPS. This goal is pursued by building a network of researchers, educators, industrial practitioners and policy makers in order to establish the foundations and methods of CPS Engineering enabled by MPM. This will allow coordinating and shaping the efforts on research, education and application in this emerging research field.

C.2 Objectives

Secondary objectives:

- To 1) develop hypotheses based on exchange of results from national research and development, 2) coordinate proposing benchmark experiments in each application domain, and 3) disseminate information and results within several areas.
- To apply the MPM approach by developing common acceptance for combinations of different models, modelling languages, simulation and verification tools and assert their applicability in the Industry.
- To evaluate the interdisciplinary know-how required from a software/system's engineer in order to develop and maintain such kind of systems at the European scale, and if necessary develop new course materials in order to cope with such needs.
- To develop research-based guidelines for evaluating and characterizing cyber-physical systems.
- To evaluate software engineers' practice and system engineers' methods and thereby establish an approach to engineer and maintain these systems.

C.3 How networking within the Action will yield the objectives?

The following, concrete instruments will be employed to pursue the Action's objectives:
- Organize regular coordination meetings (at least two per year, following each MC meeting) giving particular emphasis to technical discussions and presentations; representatives from EU projects and externals experts will be regularly invited to participate in the technical discussion;
- Organize a series of yearly workshops and symposia, while inviting key speakers, lecturers on software modelling and MPM, as well as CPS experts, from both academy and industry. These events will widen the information input and foster the immediate dissemination of results produced by the Action;
- Produce a series of Annual Reports surveying the state-of-art on MPM for CPS and reporting case studies on the adoption of CPS technology in real-world, complex applications;
- Organize yearly Summer Schools for young researchers;
- Organize Short Term Scientific Missions (STSM) for junior and senior participants;
- A website will be established for efficient information exchange between the members of the Action, and dissemination of results with the public. This implies an efficient setup of a portal and associated electronic collaborations tools (thematic discussion forums and mailing lists).

C.4 Potential impact of the Action

- Formation of a dedicated trans-disciplinary, cross-national pool of information exchange intended

to last far beyond the lifetime of the Action;
- Increased quality and level of inter-disciplinarity of MPM for CPS (MPM4CPS) research;
- Reducing fragmentation of research through the definition of a common research agenda on MPM for CPS, and by bringing together experts from both research and industry (MPM4CPS community building);
- Promoting MPM and CPS education by defining the MPM4CPS discipline, while identifying: the required profile for CPS expertise, and the core of topics, competences and specialities in MPM4CPS education;
- Synergy between industrial partners from different application domains around CPS (expected economical benefits for the European region and leadership establishment of the European institutions in the MPM4CPS area - namely by means of patents and standards);
- Enhanced competitiveness of European ICT industry by: 1) fostering the adoption of the MPM4CPS practices and methodologies, capable of boosting the productivity of the development process of existing and new complex application domains; and 2) creating new markets for CPS tooling (hence also the presence of tool builder industrial partners of this Action).

C.5 Target groups/end users

The Action will provide a forum for exchange of knowledge and expertise between system engineers, software engineers, and researchers from different areas: simulation, mechatronics, embedded systems, networks, distributed systems, systems of systems, and software modelling.

System Engineers:
- Definition of appropriate modeling, monitoring and control tools for cyber-physical systems.

Cyber-physical systems testing authorities:
- Recommendations for new testing and listing procedures for testing Cyber-physical systems
- Procedures for combining existing information (e.g., weather, social information) in order to simulate and test Cyber-physical systems.

Software Engineers and Software Industry:
- An established MPM4CPS discipline: a roadmap for high quality MPM4CPS education in Europe.
- Increased productivity in developing a Cyber-physical system as a whole.
- Increased stability and quality of the developed Cyber-physical systems.

- Heterogeneity: New strategies for exploitation on different computation platforms.

Researchers:
- A European Network supporting researcher mobility to ensure interaction on planning of experiments and on analyses of results as well as publication of common papers.
- A European Network within which applications for European project funding can be generated.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

This Action will focus on both syntax and semantics principles of modelling language engineering. The scientific innovation in this Action will mainly result from the combination of research activities that focus on these particular scientific topics.
Syntax: Currently the design of a CPS solution is made from scratch using dedicated tools which are rather specialized to a particular application domain (e.g., automotive CAD) or technique (e.g., FPGA EDA tools for embedded systems). Their lack of interoperability features brings enormous problems, both conceptually and from a tooling point of view, when trying to combine different techniques and/or application domains. The Action will develop an unified framework/language for facilitating a sound integration of such kind of CPS methods, techniques and tools (both existing and new). The existence of ontologies, including behavioural descriptions, for CPS will partly help this development. The main scientific contributions of the Action in this topic will be the conceptualization of techniques and tools for improving interoperability, new ontologies and formalisms (and the link between them) to deal with the heterogeneity and perform the integration of the problems resulting from several application domains, under a common MPM4CPS umbrella.
Semantics: The major weakness of current system's analysis, is both the completeness and soundness of the analysis. The Action envisions to exploit the semantically rich MPM4CPS framework to dynamically instrument and compose existing analysis tools (e.g., generic symbolic model checkers, co-simulators), in order to reach valid and pertinent conclusions about the CPS under analysis in an economically realistic time. The main scientific contributions of the Action in this topic are the conceptualization of dynamic search heuristics for instrumenting and composing together analysis tools designed for simulation and co-simulation, design-space exploration, model checking and verification of safety properties, and efficiency/optimization, that are currently being used in the context of both CPS development and certification.
The major tasks in this Action are:

1) To review the current suite of methods, techniques, tools and models that are currently used in practice while building and developing complex Cyber-Physical Systems.
2) To identify deficiencies in the used tools and underlying modelling languages that limit their effectiveness, usability and operational use in developing and maintaining complex CPS.
3) To determine the minimal required information for a CPS language, in order to glue CPS descriptions expressed in multiple formalisms and deployed in multiple and distinct application domains.

The Action is arranged to address these three tasks in a comprehensive and scientific way. Both developers and users of CPS have a mutual interest in increasing the performance, usability, interoperability and reliability of tools applied for building CPS. In order to classify current CPS development activities and extrapolate a rather general foundational framework around CPS development, a detailed study of the current suite of tools is needed. Hence, one of the first scientific deliverables of the Action will be a modeling-oriented characterization (report) of CPS tools and formalisms currently used in the different CPS application domains (e.g. industrial scenarios, etc.).

A second task to be coordinated and worked on by the Action is the setup of a dedicated comprehensive inventory of CPS models that are applicable to several different application domains such as the industrial automotive and avionics scenarios. In many cases, National and/or institutional inventories have been compiled but a complete and consistent European catalogue of tools and modelling languages is not yet available. Considering the variety of models, modelling languages and tools to be listed now and in the future, it will be a task of the Action to start the initial design of a flexibly structured CPS model repository (inspired by the REMODD initiative in the US). This will enable efficient and unambiguous access to the information on a given CPS, such as physical background, computational demands and information on model verification or related performance measures.

A key task of the Action is to identify the main gaps, deficiencies and limitations in presently available CPS development tools and their underlying modelling languages, and to determine the directions for the development of the next generation of CPS modelling languages and supporting tools (based on MPM principles). Future CPS modelling tools will not be just improving the integration and interoperability between the different CPS disciplines, but fundamentally they will provide better performance in the tasks of analysing, understanding, simulating and maintaining a CPS under development. Formalisms such as Modellica are still found inadequate to fully address these tasks in what matters to usability and computational power.

A further scientific task to be addressed by the Action is the integration of current modelling, simulation and verification tools that can be seamlessly used on the case of CPS. In this context it is important to consider not only the tools made for software, but also for electronic and embedded devices, and continuous control systems as well. With the fast-changing application domains and eager for new technology (like the automotive), it is of special importance to consider the definition and documentation of commonly accepted CPS modelling languages. Collecting and integrating as much as possible information from outside of the Action for example by organizing workshops as mentioned in Section C will enable the information input to the Action to be maximized.

D.2 Scientific work plan methods and means

In this section the WG aims and activities are described. Further information on WGs can also be found in section E.2.

WG 0: Cross-WG Activities, Showcases
WG0 plays a special role within this Action by bundling cross-WG activities in order to ensure their cohesion, boost interdisciplinary collaborations, while avoiding the natural clustering (e.g., the creation of micro-communities per workgroup) within the large network formed by this Action. Specifically, this WG will be in charge of the integration of the remaining four WGs so that researchers in these different fields can share their common expertise, favouring cross-fertilization and minimizing fragmentation and duplication of research and efforts. Exchanges between the WGs will be promoted, also by financially supporting inter-WG visits.
Furthermore, this WG will oversee tasks related to dissemination towards end users, including the design and development of the showcases of the Action.

WG 1: Foundations - Intra and inter-Disciplinary Interaction
The objectives of WG1 is to apply and mostly combine MPM, Control, Hybrid Systems, ... techniques while dealing with the heterogeneity of CPS, and identifying common formalisms, and ontologies used in CPS development. WG1 will characterize/categorize existing modelling languages on the different disciplines using typical industrial CPS scenarios. WG1 will compile, evaluate, possibly complete and document existing modelling tools for CPS modelling. Specific research questions asked and tasks to be performed will include:
- What are the currently CPS methodologies and what is the current state-of-the-art in CPS modelling and development?
- Which kind of CPS tools and formalisms/disciplines are currently under development and

favoured for future application?

- What is the current generic modus-operandi of a typical industrial CPS developer.
- Define a standard terminology (Domain Ontology) for CPS.

The deliverables of WG1 will be based on previous and ongoing research work, and will include a state-of-the-art report on current formalisms used on CPS development. This report will include: 1) a structured catalogue of tools and modelling languages; and 2) a glossary of terms to be used throughout CPS modeling language's development, evaluation and application.

WG 2: Techniques

The objective of WG2 is to conceptualize usable and efficient MPM integrated environments for CPS development, while increasing CPS development's productivity (e.g., by means of increased interoperability, and use of visual modelling languages) and reducing the complexity of CPS testing, simulation and certification procedures. Secondary objectives of WG2 is to investigate CPS Standards that can be used by Europeans regulators in order to increase performance, security and safety of industrial CPS in Europe, and worldwide.

Specific problems to be solved by WG2 are:

- Which kind of MPM modelling tools are currently under development (e.g., software engineering, embedded systems, complex control systems, etc.) and favoured for future application in CPS?
- Developing tools, standards and best practices that can be virtually integrated in a conceptual MPM environment.
- Demonstrating and evaluating the increase of efficiency of such modelling environments on CPS (i.e., not only in what matters to development speed, but also on certification speed).

Accordingly, the deliverables of WG2 will include: 1) a report of standards and best practices in MPM modelling on CPS; 2) a state of the art on MPM modelling tools used in different disciplines; 3) a report containing considerations for future MPM modelling tools; and 4) an efficiency evaluation of MPM modelling tools on CPS (e.g., versus non-modelling approaches of CPS development and certification, etc.).

WG 3: Application Domains

WG3 will focus on the practical constraints in the use of MPM modeling in two representative and distinct CPS application domains: 1) embedded systems, control systems where CPS has emerged from (e.g., automotive, aeroespatial); 2) or more networked, unanticipated changes (both structure and behaviour) and less of the traditional plant/controller architecture, which may have emergent behaviour (e.g., smart-cities, complex traffic management). The specific needs of the industry in these domains have to be taken into account in order to successfully implement the scientific improvements gained by the Action. WG3 will work together with industrial partners to ensure a bilateral feedback between the scientific and industrial CPS communities. The main tasks covered in WG3 are:

- Definition of Benchmark Case Studies.
- To access the current state of CPS and CPS modeling at a national level.
- To collect the requests and requirements of each application domain, and rewrite them into a CPS perspective.
- To assess the suitability of the different application domain models while being expressed in CPS perspective (e.g., completeness, usability, interoperability with existing tools, etc.).
- To give recommendations on the proper use of different models and methodologies and the reliable assimilation of current application domain models in the perspective of CPS modeling.

Guidance and training documents will be produced. The Action's intention is not only to evolve scientific contents, but also to provide immediate practical prototype tools. This will be emphasized by delivering and publishing:

- A documentation of recommended procedures for the use of CPS models in the context of several application domains.
- Information on what type of model(s) or approach (es) to be used for which type of scenario.
- Practical guidance for the optimum use of CPS models or MPM modelling approaches required to improve the quality and efficiency on each application domain.
- Report of the current state of the art of CPS and CPS modeling at a national level.

In the last year of the Action, a summarizing report will be finalized, peer-reviewed and published. It will be the task of the members of the Management Committee (MC) throughout the entire Action to actively promote the techniques, tools, strategies and standards developed by the Action. The commonly accepted application recommendations for specific application domain models and CPS modelling strategies will put pressure on model developers to carry out and document a commonly accepted CPS development and quality assurance procedure/process and to improve modeling capabilities, not solely driven by commercial interests. The Action is expected not only to improve the quality and efficiency of CPS development in a large scope of application domains, but also to develop the 'culture' of using such tools for example by a scientifically justified selection of proper tools for a specific release scenario.

WG 4: CPS Education and Dissemination

The WG4 will focus on the crystallization of MPM4CPS contents into a suitable format for educational purposes. The specific tasks covered in WG 4 are:

- to Identify the adequate profile(s) of CPS experts (i.e., the minimum required knowledge);
- to Identify existing courses in the realm of CPS and MPM4CPS in Europe, and the need for new courses on topics relevant to CPS not yet covered by the European Universities;
- set the base for an European Master/Phd Program in MPM4CPS involving several European leading Universities and set up the respective discipline roadmap;
- promote Literature on the topic (books, articles), while defining course material (online, etc);
- promote thematic Summer Schools on MPM4CPS for researchers;
- make young students (future researchers and practitioners) aware of an enthusiastic about the topic of CPS in events such as a “CPS Hacker School”;

E. ORGANISATION

E.1 Coordination and organisation

The Action is planned to last 4 years and is operated with a organizational structure in full accordance with COST guidelines.

The activities within the Action will be co-ordinated by the Management Committee (MC). The MC will elect 5 Working Groups (WGs; detailed in Section E.2) and approve the Leader and Co-Leader of each. Each participating country will have up to two representatives on the MC. Wherever possible, gender representation and representation from Western and Eastern European countries will be balanced on the MC; and gender representation, representation from Western and Eastern European countries, and Early Stage Researchers (ESR) status on the WGs.

A Core Group (CG) will consist of the Chair and a Vice-Chair of the MC and the Leaders of each WGs. The CG will meet for one day preceding the two biannual (one-and-a-half day) meetings of the MC.

The CG and ultimately the Chair will have responsibility for ensuring that the Action is schedule and that specified objectives are met.

Where appropriate, and within the COST funding rules, the MC and WGs will consider inviting guest lecturers/advisors to a meeting of the MC, WGs, Summer Schools or conference at Year 4.

During the first meeting of the Management Committee the implementation of tasks described in the Memorandum of Understanding will be particularized, complemented and finally agreed on. The Working Group Chairs, Vice-Chairs and Rapporteurs will be elected and the participants will be requested to specify their contribution and goals by an Expression of Commitment.
As a first milestone, within the first six months of the Action a dedicated website will be established to provide access to the Action's results, promotion and products. In particular, news about activities/events promoted by the Action, research papers, technical reports, educational material, will be published on this website as soon as they are available and released by the Action.
In order to facilitate information exchange within the Action and with other experts from outside the Action, a workgroup list (email list, ...) will be established and maintained.
The next milestone of the Action will be the first workshop/symposium after the first year of the Action, focusing on the state-of-the-art report on MPM for CPS in Europe.
In order to intensify the dissemination of the results of the Action, the annual symposia will be accompanied by Training Schools/Summer Schools on MPM for CPS subtopics. These events will be the opportunity for Working Groups to present the results of their work, involving lecturers from all three participating communities.
The intention is to familiarize both junior and senior researchers and qualified users with the new concepts and improving their practical implementation as they are developed by the Action.
The Training Schools will provide an ideal platform for establishing dedicated think tanks, formed by young scientists.
In order to maximize the efficiency of work, and minimize the costs for travelling, it is intended to combine MC meetings with joint Working Group meetings.

Governance:
The Management Committee (MC) consists of up to two representatives of each COST Country having accepted the MoU of the Action. MC Members are nominated by the COST National Coordinators (CNC) of the COST Countries they represent. The Action MC decides upon all budget-related questions, devises the general Action strategy and manages the organisation of the Action’s scientific and technological activities.

Frequency: yearly in-person meeting, co-located with yearly workshop; on-demand teleconference meetings

The Core Group (CG) consists of the Chair and a Vice-Chair of the MC and the Leaders of each

WGs.

Objectives: Quality Control: CG and ultimately the Chair will ensure that the Action is on schedule and that specified WG objectives are met.

Activities: (teleconference) meetings to assess and take action when needed, meet in-person at MC meeting

Frequency: frequent (once per month)

Deliverables: reports to MC

The Industry Advisory Board is highly relevant, but covered by the large industry participation in this Action External Experts will be invited to selected workshops and CG/MC/WG meetings

The Editorial Board

Description: During the production of the State-of-Art report, Final Report and Promotional Material (such as a leaflet), an Editorial Board, nominated by MC, will coordinate the work and collect the necessary information from the Working Group members.

Objectives: Preparing documents for Dissemination

Activities: support to WG leaders and MC

Frequency: when needed (depends on frequency of reports etc.)

Deliverables: Newsletter. Leaflet. State-of-Art. Reports.

The STSM Selection Committee

Description: Very high priority will be given to Short Term Scientific Missions (STSM) to foster personal contacts between researchers and diverse communities .Highest priority will be given to Early-Stage Researchers (ESR) and female applicants. The STSM Evaluation Committee is nominated by the MC. I will assess the impact of the scientific visits and their output. Calls for proposals will be regularly (twice per year) planned. The CG decides on allocation.

Objectives: Selection of applicants for Short-Term Scientific Missions (STSM).

Activities: Selection of the STSM applicants from the action and reporting to CG/MC. Frequency: when needed (twice per year)

Deliverables: To select STSM applicants

The Training/Summer Schools Committee

Description: Training/Summer Schools will take, when possible, be organized co-located with the workshops organized by the COST Action. The challenges, concepts, methods, techniques and tools

of MPM4CPS will be taught. The intended audience are PhD students and early-stage researchers (ESR)(including from industry),.
Objectives: Organization Training Schools and their programme.
Activities: Prepare Program of Training Summer Schools (Lecturers, Trainees, Place, Venue, Location, etc.) and reporting to the MC.
Frequency: when Training/Summer Schools are organized (once per year)
Deliverables: four Training/Summer Schools (one per year)

The Gender Balance Committee
Description: the technological and scientific sector is male-dominated. A balanced participation of women and men will be sought.
Objectives: Definition and promotion of gender balance in all parts of the Action's operation
Activities: Prepare a Plan to promote involvement of Women; active outreach (such as talks)
Frequency: continuous activity; in-person meeting once per year
Deliverables: To increase female participation rate in the COST Action through new inclusions

E.2 Working Groups

Each WG will have a coordinator/chair vice-coordinator and a 'Rapporteur'. The ‘Rapporteur’ is responsible for collecting results within the WG, presenting them during joint wrap-up meetings promoted by WG0 and ensuring all valuable results to be included in reports.
When organizing the Working Groups it will be intentionally avoided to separate and cluster participants in each of the 4 groups (1 to 4). In fact, it will be promoted and encouraged a direct interaction of all four interrelated communities involved in the topic by nominating representatives to be part of WG 0 whose mission is to bundle cross-WG activities in order to ensure their cohesion and boost interdisciplinary collaborations.

WG 0: Cross-WG Activities, Showcases
Objectives:

- Bundle cross-WG activities in order to ensure their cohesion, boost inter-disciplinary collaborations, while avoiding the natural clustering (e.g., the creation of micro-communities per workgroup) within the large network formed by the Action

Activities:

- Monitor possible duplication of efforts across WGs
- Be a conduit for passing information between WGs
- Encourage and sponsor inter-WG visits and presentations

Deliverables:

- Report of activities (define and measure success of cross-WG activities) (yearly)
- Showcases (Y3 - Y4)

WG 1: Foundations - Intra and Inter-Disciplinary Interaction

Objectives:

- Develop MPM foundations for CPS

Activities:

- Characterize/categorize (“chart”) existing modelling languages used in the different disciplines using typical industrial CPS scenarios (see also WG 4)
- Develop MPM framework to relate/combine (unify) modelling languages and techniques
- Apply and mostly combine MPM, Control, Hybrid Systems, … while dealing with the heterogeneity of CPS, and identifying common formalisms and ontologies used in CPS

Deliverables:

- Report. State-of-the-art report on current formalisms used in CPS development:
  1) a structured catalogue of tools and modelling languages (Y1, updated yearly)
  2) a glossary of terms (domain ontology) to be used throughout CPS (Y2, update yearly)
- Report (yearly). Framework to relate/combine modelling languages and techniques

WG 2: Techniques

Objectives:

- Conceptualize usable and efficient MPM integrated environments for CPS development while increasing CPS development’s productivity (e.g., by means of increased interoperability, and use of visual modelling languages) and reducing the complexity of CPS testing, simulation and certification procedures. Secondary objective: CPS standards that can be used by Europeans regulators in order to increase performance, security and safety of industrial CPS in Europe, and worldwide.

Activities:

- Investigate current standards and best practices (modelling languages, interfaces for interoperability, processes, ...) used in CPS
- Survey state-of-the art on MPM tools and techniques used in different disciplines for CPS development including an efficiency evaluation of MPM tools and techniques on CPS
- Investigate requirements for future MPM4CPS modelling tools and techniques

Deliverables:

- Reports:

  1) current standards and best practices used in CPS, suggest where new standards might be beneficial (Y1, updated yearly)
  2) state-of-the art on MPM tools and techniques used in different disciplines for CPS development including an efficiency evaluation of MPM tools and techniques on CPS (Y3)
  3) suggestions for future MPM4CPS modelling tools and techniques (Y4)

WG 3: Application Domains

Objectives:

- Investigate practical constraints in the use of MPM modeling in two representative and distinct CPS application domains: 1) embedded systems, control systems, mechatronics, ... where CPS has emerged from (e.g.,automotive, aerospatial) 2) more networked, unanticipated changes (both structure and behaviour) and less of the traditional plant/controller architecture, which may have emergent behaviour (e.g., smart-cities, complex traffic management).
- The specific needs of the industry in these domains have to be taken into account in order to successfully implement the scientific improvements gained by the Action. WG3 will work together with industrial partners to ensure a bilateral feedback between the scientific and industrial CPS communities.

Activities:

- Definition of Benchmark Case Studies
- Assess the current industrial state of CPS and CPS modelling at a national level

- Collect the requests and requirements of each application domain, and rewrite them from a CPS perspective, look for commonalities/differences.
- Assess the suitability of the different application domain models from a CPS perspective (e.g., completeness, usability, interoperability with existing tools, etc.)
- Compile recommendations on the proper use of different models and methodologies and the reliable assimilation of current application domain models in the perspective of CPS modeling.

Deliverables:

- Benchmark Case Studies (Y1 preliminary, Y3 fully developed)
- Reports:
  1) current industrial state of CPS (Y2)
  2) requirements of each application domain (Y2)
  3) suitability of the different application domain models from a CPS perspective (Y3)
  4) recommendations on the proper use of different models and methodologies (Y4)

WG 4 : CPS Education and Dissemination

Objectives:

- Bring MPM4CPS contents (from WGs 1 – 3) into a suitable format for educational and dissemination purposes. Targets: academia (students, young/senior researchers), industry, commission

Activities:

- Identify the adequate profile(s) of CPS experts (i.e., the minimum required knowledge)
- Identify existing courses in the realm of CPS and MPM4CPS in Europe, and the need for new courses on topics relevant to CPS not yet covered by the European Universities
- Lay basis for an European Master/Phd Program in MPM4CPS involving several European leading Universities (and companies) and set up the respective discipline roadmap
- Promote literature on the topic (books, articles), while defining course material (online, etc)
- Promote and organize thematic Training/Summer Schools on MPM4CPS

- Make young students (future researchers and practitioners) aware of and enthusiastic about the topic of CPS in events such as a “CPS Hacker School”

Deliverables:

- Reports1

  1) profile of CPS expert (Y1)
  2) list of existing MPM4CPS courses, description of needs (Y1, updated yearly)
  3) plan for European Master/Phd Program in MPM4CPS (Y1-Y4)4) annotated bibliography, annotated who's who, WG reports, (non-)technical publications (Y2, updated yearly)
- MPM4CPS workshop (yearly)
- MPM4CPS poster, leaflet (Y1)
- www.mpm4cps.eu (beginning of Action, updated regularly)
- Thematic Training/Summer Schools on MPM4CPS (yearly)
- Engaging event such as a “CPS Hacker School” (yearly, from Y3)

E.3 Liaison and interaction with other research programmes

This Action focus on MPM for CPS, and these aspects combined are not covered by other COST Actions or EU-projects. As the Action necessarily has to include many aspects of CPS (e.g., mechatronics in several application domains, etc.), there will be links with other research programmes as indicated:

a) Links and complementarity with other COST Actions

- IC0901 - Rich-Model Toolkit - An Infrastructure for Reliable Computer

- IC285 - Modelling and Simulation Tools for Research in Emerging Multiservice Telecommunications

b) Links with other EU research programmes

- ‘Cyber Physical Systems European Roadmap and Strategy’ (CyPhERS). Whereas CyPhERS charts not only technical, but also economic aspects of CPS, MPM4CPS aims to come up with a unified view of modelling for CPS.

- CPS Action Line “Cypher Physical Systems” of the EIT ICT KIC.

- ‘Industrial Framework for Embedded Systems Tools’ (iFEST).

- ‘Combined Model-based Analysis and Testing of Embedded Systems’ (MBAT).

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.

The leading role of responsibility in the chairing positions, in the MC and in the WGs will be assigned with a gender balanced approach, as well as with the special concern to involve early stage researchers, whenever possible, on the basis of personal availability.

Identified as potential driving forces for this network, young researchers will be involved in the core of the COST action since its beginning. The Action will provide and encourage young scientists' participation also by arranging for Short Term Scientific Missions (STSM), particularly for early-stage researchers. Their contributions will be presented at the annual Symposia/Conference. It will also be promoted a dedicated track in the Symposia “doctoral Symposium” to involve all the doctoral students involved with the network.

The Training Schools, organized by the Action, as well as the engagement in the management of Working Groups is intended to stimulate the interest of young scientists during the most crucial stages in their scientific career.

The MC will reflect efforts to ensure gender balance during the organization of the symposia in invitations, also for key notes, for WG management and for lead authorship of reports and publications. Early stage researchers will be asked to take care of after-Symposia tasks (preparation of reviews, data collection, etc.), preferentially within the scope of STSMs combined with research visits at guest institutes.

F. TIMETABLE

The Action is planned to run for 4 years.

In the first semester the mission of the Action MC is to particularize, complete and finally agree on the implementation of tasks described in the Memorandum of Understanding.

In the first year, a kick-off workshop will be organized and the basis for the projected scientific work will be established.

On average, one joint MC and WG meeting per year will be held to maintain the momentum of the Action and to closely follow after the Members' activities. Each year, the results achieved within the

Action will be released in a jointly published document available at the Symposium.
In order to state the leading role of CPS Europe, an annual workshop/symposium will provide a suitable platform to disseminate the results to a wider scientific, industry and institutional community. Well known scientists, industry and stakeholders from CPS communities around the world will be invited to take part.
We can summarize the Action in the following manner:
1st year
Schools: Euro-MPM4CPS School (as detailed in H.3.)
Meetings: Working meetings (MC+WG 1 (Kickoff) + 1)
STSM: 3
Annual Workshop MPM4CPS
Industry: Talks at industry events (as detailed in H.2.)
Deliverables:

- Report of activities (define and measure success of cross-WG activities)
- Report on the State-of-the-art of current formalisms used in CPS development: a structured catalogue of tools and modelling languages (updated yearly)
- Draft proposal for a Framework to relate/combine modelling languages and techniques
- Report on current standards and best practices used in CPS, suggest where new standards might be beneficial (updated yearly)
- Benchmark Case Studies proposal (preliminary)
- Report describing the profile of a CPS expert
- A list of existing MPM4CPS courses, with description of education needs

2nd year
Schools: Euro-MPM4CPS School
Meetings: Working meetings (MC/WG 2)
STSM: 3
Annual Workshop MPM4CPS
Industry: Talks at industry events (as detailed in H.2.)
Deliverables:

- Report of activities (define and measure success of cross-WG activities)

- Report on the State-of-the-art of current formalisms used in CPS development: a glossary of terms (domain ontology) to be used in CPS
- Proposal for a Framework to relate/combine modelling languages and techniques
- Report on current standards and best practices used in CPS, suggest where new standards might be beneficial (updated yearly)
- Report on the current industrial state of CPS
- Reports on requirements of each application domain
- List of existing MPM4CPS courses, description of needs (updated version)
- Plan for European Master/Phd Program in MPM4CPS
- Annotated bibliography, annotated who's who, WG reports, (non-)technical publications (updated)

3rd year
Schools: Euro-MPM4CPS School
Meetings: Working meetings (MC/WG 2)
STSM: 3
Annual Workshop MPM4CPS
Industry: Talks at industry events (as detailed in H.2.)
Deliverables:

- Report of activities (define and measure success of cross-WG activities)
- Report of Showcases
- Framework to relate/combine modelling languages and techniques
- Current standards and best practices used in CPS, suggest where new standards might be beneficial (updated yearly)
- State-of-the art on MPM tools and techniques used in different disciplines for CPS development including an efficiency evaluation of MPM tools and techniques on CPS
- Benchmark Case Studies
- Suitability of the different application domain models from a CPS perspective
- List of existing MPM4CPS courses, description of needs (updates)

- Plan for European Master/Phd Program in MPM4CPS.
- Annotated bibliography, annotated who's who, WG reports, (non-)technical publications (updated)

4th year
Schools: Euro-MPM4CPS School
Meetings: Working meeting (MC/WG 2)
STSM: 3
Annual Workshop MPM4CPS
Industry: Talks at industry events (as detailed in H.2.)
Deliverable:

- Report of activities (define and measure success of cross-WG activities)
- Report of Showcases
- Framework (MPM) to relate/combine modelling languages and techniques
- Current standards and best practices used in CPS, suggest where new standards might be beneficial (final, plan for post-Action deployment)
- Suggestions for future MPM4CPS modelling tools and techniques
- Recommendations on the proper use of different models and methodologies in industry case studies
- List of existing MPM4CPS courses, description of needs (updates)
- Start implementation of European Master/Phd Program in MPM4CPS

The Action will support other non-planned events (such as thematic Workshops, Schools, at reputed conferences) as the need and opportunity arises. Best practice guidance and user training documents as well as annual technical reports will be developed jointly within the Action and for release.
The Panel of External Experts will participate in the Symposia and key MC/WG meetings.
Year 4 of the Action will be dedicated to the compilation of a final document summarizing the achieved goals.

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, BE, CH, DE, ES, FI, FR, HU, IT, LV, NL, NO, PL, PT, RS, SE, SI, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 76 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

- International Research community in:
  * Multi-Paradigm Modeling, its methods, techniques and tools (e.g., language engineering, multi-formalism integration, model transformation tools, consistency)
  * CPS, its methods, techniques and tools (e.g., concurrent engineering, co-simulation)
- CPS/MPM4CPS Practitioners and Professionals, and their applications (starting from embedded systems, mechatronics, hybrid systems, etc.)
- Industrial players at a national level
- CPS application domains (e.g., Automotive, Aeronautics, Transports, Health applications, Smartcities, Home Automation);
- tool builders (such as LMS, 20Sim, Dassault, Modelon, IDA, Vector)
- EU projects and related initiatives in the areas of MPM and CPS and w.r.t. research, tools and applications
- National (governmental) policy makers: national science foundations, national professional/industrial organizations (e.g., Agoria@Flanders)
- Standards and certification authorities (e.g., Modelica standardisation, OMG, IEEE, ACM)

H.2 What?

The dissemination of the results achieved by this Action will be based on the following methods.

(1) Annotated bibliography (including a Glossary);

(2) Annotated list of Research Centers, Laboratories, and Researchers;

(3) Working Group reports (including state of the art reports, interim reports, case study reports, guidelines, manuals, final reports);

(4) Articles and non-technical publications for general technical audience (engineers and industry);
(5) Scientific Publications (classification, surveys) for research audience;
(6) Publications (tutorials) for an education audience;

H.3 How?

- Web portal www.mpm4cps.eu, thematic mailing list and discussion forums: for all the methods described in H.2.;
- Participation to forums and booths at major events (workshops and conferences such as CPSweek, etc., organised by the MC): for methods (4) and (5);
- Yearly workshop (one per year), co-located with the CPS week, when in Europe, with published proceedings: for methods (4) and (5);
- Yearly talk at relevant reputed industry events (e.g., Design Automation and Testing: http://www.date-conference.com, Society of Automotive Engineers: http://www.sae.org/events/automotive/): for methods (4) and (5);
- Technical magazines with broad dissemination (e.g., IEEE-Computer): for method (4);
- Peer-reviewed scientific and technical Journals (e.g., SoSym, ASE, ...): for method (5);
- Summer school and Hackerschool: for method (6);

In particular, for the research audience, the Action will provide conferences, workshops and electronic forums, as well as reports and peer-reviewed articles authored by members of the Action and published on major scientific venues. For the educational audience, we will provide online tutorials and books, and organize competitions, and summer schools. Finally, the Action will organize Industrial-driven Tech-Summits on MPM4CPS in order to involve the Industrial audiences.

Research audience:
a) New conference: MPM4CPS Europe (last year of the Action)
b) Participation in existing Workshops: MPM, Modelica, ModProd
c) Participation in existing conferences: CPSweek (when in Europe)
d) Publications: at major conferences and Journals (SoSym)

Education audience:
a) Undergraduate/Graduate level: Tutorials, DSLs4CPS competition, HackerSchool (free, non-commercial, open source modeling tools to build CPS);

b) Doctoral level: Euro-MPM4CPS Summer School (building on and extending the established DSM-TP Summer School organized by the MPM4CPS initiators);
c) Action Think Tank of Early Stage Researchers which will report to the MC and 4 WGs;
d) Co-supervision of doctoral (PhD) students.

Industry audience:
a) Invite major European Industrial application domains around CPS: Avionics, Automotive, Drone Technology, Transportation, Energy, Health, Smart Cities, etc.
b) Stimulate and guide project proposals, seeded by the Action partners, in the EU Framework Programme.

TIN2014-53555-REDT

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
BFU2014-55738-REDT	GENERANDO DIVERSIDAD NEURONAL	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	CENTRO DE BIOLOGIA MOLECULAR SEVERO OCHOA (CBM)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	32.000,00	20.771,20	11.228,80
BFU2014-57703-REDC	DE LOS GENES A LA FORMA: ANALISIS DE LA MORFOGENESIS EN DROSOPHILA Y VERTEBRADOS	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	CENTRO DE BIOLOGIA MOLECULAR SEVERO OCHOA (CBM)	Q2818002D	CONSOLIDER	01-12-14	30-11-16	71.000,00	46.086,10	24.913,90
AGL2014-58205-REDC	ALIMENTOS FUNCIONALES PARA UNA NUTRICION PERSONALIZADA	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	CENTRO DE EDAFOLOGIA Y BIOLOGIA APLICADA DEL SEGURA (CEBAS)	Q2818002D	CONSOLIDER	01-12-14	30-11-16	51.000,00	33.104,10	17.895,90
SAF2014-56716-REDT	RED DE EXCELENCIA PARA LA EXPLOTACION DE BACTERIAS CON FINES TERAPEUTICOS	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	CENTRO NACIONAL DE BIOTECNOLOGIA (CNB)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	32.000,00	20.771,20	11.228,80
CGL2014-54582-REDC	RED TOPOIBERIA-IBERARRAY: ESTUDIOS INTEGRADOS DE GEODINAMICA Y ESTRUCTURA DE LA PLACA IBERICA	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE CIENCIAS DE LA TIERRA JAUME ALMERA (ICTJA)	Q2818002D	CONSOLIDER	01-12-14	30-11-16	39.000,00	25.314,90	13.685,10
CTM2014-59111-REDC	HERRAMIENTAS WEB Y REDES SOCIALES DE CARACTER PROFESIONAL Y CIENTIFICO EN LA RED CONSOLIDER GRACCIE	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE DIAGNOSTICO AMBIENTAL Y ESTUDIOS DEL AGUA	Q2818002D	CONSOLIDER	01-12-14	30-11-16	39.000,00	25.314,90	13.685,10
CSO2014-59301-REDT	RED SOBRE TRANSFERENCIAS INTERGENERACIONALES DE BIENESTAR. LA PERSPECTIVA DE LAS REDES DE APOYO EN LA VEJEZ EN LA EUROPA DEL SUR	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE ECONOMÍA, GEOGRAFÍA Y DEMOGRAFÍA (IEGD)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	35.000,00	22.718,50	12.281,50
FPA2014-52623-REDT	RED PARA EL ESTUDIO DE LAS INICIATIVAS DE FISICA DE PARTICULAS, ASTROPARTICULAS Y NUCLEAR: PARTICIPACION ESPAÑOLA EN GRANDES INFRAESTRUCTURAS Y EXPERIMENTOS INTERNACIONALES	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE FISICA CORPUSCULAR (IFIC)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	30.000,00	19.473,00	10.527,00

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
FIS2014-53592-REDT	RED DE INFORMACION CUANTICA EN ESPAÑA	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE FISICA FUNDAMENTAL	Q2818002D	TEMÁTICA	01-12-14	30-11-16	24.981,00	16.215,17	8.765,83
HAR2014-56259-REDT	RED DE ESTUDIOS MIGRATORIOS EN PERSPECTIVA COMPARADA	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE HISTORIA (IH)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	40.000,00	25.964,00	14.036,00
AGL2014-53190-REDC	RED DE EXCELENCIA DE BIOTECNOLOGIA EN ACUICULTURA	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE INVESTIGACIONES MARINAS (IIM)	Q2818002D	CONSOLIDER	01-12-14	30-11-16	54.500,00	35.375,95	19.124,05
BIO2014-56153-REDT	SISTEMAS DE TRANSPORTE DE SODIO Y POTASIO EN PLANTAS	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO DE RECURSOS NATURALES Y AGROBIOLOGIA (IRNASE)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	19.000,00	12.332,90	6.667,10
CGL2014-51721-REDT	RED DE VARIABILIDAD Y CAMBIO CLIMATICO	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	INSTITUTO PIRENAICO DE ECOLOGIA (IPE)	Q2818002D	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
TIN2014-52608-REDC	SUPERCOMPUTACION Y ECIENCIA	BARCELONA SUPERCOMPUTING CENTER CENTRO NACIONAL DE SUPERCOMPUTACION	BARCELONA SUPERCOMPUTING CENTER - CENTRO. NACIONAL DE SUPERCOMPUTACION	S0800099D	CONSOLIDER	01-12-14	30-11-16	59.000,00	38.296,90	20.703,10
BIO2014-54481-REDT	RED DE FLORACION	CENTRE DE RECERCA EN AGRIGENOMICA CSIC-IRTA-UAB-UB (CRAG)	DPTO. GENETICA MOLECULAR	Q0801214H	TEMÁTICA	01-12-14	30-11-16	28.000,00	18.174,80	9.825,20
FIS2014-59264-REDC	RED ESPAÑOLA SOBRE CIENCIA, APLICACIONES Y TECNOLOGIA DE LOS LASERES ULTRA RAPIDOS	CONSORCIO DEL CENTRO DE LASERES PULSADOS ULTRACORTOS ULTRAINTENSOS	AGR-CONSORCIO DE LASERES PULSADOS ULTRACORTOS ULTRAINTENSOS	S3700007B	CONSOLIDER	01-12-14	30-11-16	35.000,00	22.718,50	12.281,50

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
CTQ2014-52974-REDC	ENCARANDO LOS RETOS QUE LA SOCIEDAD TIENE PLANTEADOS MEDIANTE INVESTIGACION COLABORATIVA EN CATALISIS	FUNDACIO INSTITUT CATALA D INVESTIGACIO QUIMICA (ICIQ)	AGR-FUNDACIO PRIVADA INSTITUT CATALA D INVESTIGACIO QUIMICA (ICIQ)	G43619550	CONSOLIDER	01-12-14	30-11-16	53.000,00	34.402,30	18.597,70
BFU2014-52586-REDT	RED DE EXCELENCIA EN MECANOBIOLOGIA	FUNDACIO INSTITUT DE BIOENGINYERIA DE CATALUNYA	FUNDACIO INSTITUT DE BIOENGINYERIA DE CATALUNYA	G64045719	TEMÁTICA	01-12-14	30-11-16	28.000,00	18.174,80	9.825,20
BFU2014-52125-REDT	BIOLOGIA FUNCIONAL Y DE SISTEMAS DE LA PROLIFERACION CELULAR	FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS	G81972242	TEMÁTICA	01-12-14	30-11-16	32.000,00	20.771,20	11.228,80
SAF2014-56720-REDT	SENESCENCIA CELULAR PARA TERAPIA DEL CANCER	FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS	G81972242	TEMÁTICA	01-12-14	30-11-16	28.000,00	18.174,80	9.825,20
SAF2014-57791-REDC	BIOLOGIA DEL CANCER	FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS	G81972242	CONSOLIDER	01-12-14	30-11-16	45.000,00	29.209,50	15.790,50
ENE2014-52280-REDT	NUEVOS DESAFIOS EN LA PRODUCCION DE COMBUSTIBLES SOLARES	FUNDACION IMDEA ENERGIA	AGR-FUNDACION IMDEA ENERGIA	G84912716	TEMÁTICA	01-12-14	30-11-16	18.000,00	11.683,80	6.316,20
SAF2014-53563-REDT	RED DE INMUNOTERAPIA DEL CANCER	FUNDACION PARA LA INVESTIGACION MEDICA APLICADA	CENTRO DE INVESTIGACION MEDICA APLICADA	G82198524	TEMÁTICA	01-12-14	30-11-16	32.000,00	20.771,20	11.228,80
AYA2014-53365-REDT	RED DE INFRAESTRUCTURAS DE ASTRONOMIA	INSTITUT D ESTUDIS ESPACIALS DE CATALUNYA	AGR-INSTITUT D ESTUDIS ESPACIALS DE CATALUNYA	G61051710	TEMÁTICA	01-12-14	30-11-16	77.807,00	50.504,52	27.302,48
ESP2014-57382-REDT	CARTOGRAFIADOS PARA LA FISICA DE LA ACCELERACION Y ESTRUCTURA A GRAN ESCALA DEL UNIVERSO	INSTITUT D ESTUDIS ESPACIALS DE CATALUNYA	AGR-INSTITUT D ESTUDIS ESPACIALS DE CATALUNYA	G61051710	TEMÁTICA	01-12-14	30-11-16	5.356,00	3.476,58	1.879,42

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
SAF2014-52624-REDT	RED PARA EL ESTUDIO DE LA SINAPSIS EN EL CONTEXTO DE LA DISFUNCION COGNITIVA	INSTITUT DE RECERCA DE L HOSPITAL DE LA SANTA CREU I SANT PAU	AGR-INSTITUT DE RECERCA DE L HOSPITAL DE LA SANTA CREU I SANT PAU	G60136934	TEMÁTICA	01-12-14	30-11-16	32.000,00	20.771,20	11.228,80
FIS2014-55563-REDC	NANOLIGHT.ES - LIGHT CONTROL ON THE NANOSCALE	INSTITUTO DE CIENCIAS FOTONICAS	INSTITUTO DE CIENCIAS FOTONICAS	G62819537	CONSOLIDER	01-12-14	30-11-16	39.000,00	25.314,90	13.685,10
AGL2014-51742-REDC	RED DE EXCELENCIA CONSOLIDER "PRODUCTOS CARNICOS SEGUROS, NUTRITIVOS Y SALUDABLES"	INSTITUTO NACIONAL DE INVESTIGACIÓN Y TECNOLOGÍA AGRARIA Y ALIMENTARIA (INIA)	DEPARTAMENTO DE TECNOLOGIA DE ALIMENTOS	Q2821013F	CONSOLIDER	01-12-14	30-11-16	72.500,00	47.059,75	25.440,25
DPI2014-51731-REDT	RED TEMATICA EN INGENIERIA DE CONTROL	UNIVERSIDAD AUTONOMA DE BARCELONA	ESCUELA TECNICA SUPERIOR DE INGENIERIA - ETSE	Q0818002H	TEMÁTICA	01-12-14	30-11-16	22.000,00	14.280,20	7.719,80
TEC2014-53909-REDT	RED TEMATICA EN VARIBILIDAD EN NANOELECTRONICA	UNIVERSIDAD AUTONOMA DE BARCELONA	ESCUELA TECNICA SUPERIOR DE INGENIERIA - ETSE	Q0818002H	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
MAT2014-57866-REDT	VIDRIOS Y ESTABILIDAD	UNIVERSIDAD AUTONOMA DE BARCELONA	FACULTAD DE CIENCIAS	Q0818002H	TEMÁTICA	01-12-14	30-11-16	6.779,00	4.400,24	2.378,76
MTM2014-54516-REDT	DINAMICA, ATRACTORES, NO LINEALIDAD, CAOS Y ESTABILIDAD	UNIVERSIDAD AUTONOMA DE BARCELONA	FACULTAD DE CIENCIAS	Q0818002H	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
TIN2014-53555-REDT	RED DE EXCELENCIA EN INGENIERIA DEL SOFTWARE DIRIGIDA POR MODELOS	UNIVERSIDAD AUTONOMA DE MADRID	ESCUELA POLITECNICA SUPERIOR	Q2818013A	TEMÁTICA	01-12-14	30-11-16	13.000,00	8.438,30	4.561,70
FFI2014-55256-REDT	EPISTEMOLOGIA Y SOCIEDAD. DEL CONOCIMIENTO PERSONAL AL CONOCIMIENTO DISTRIBUIDO	UNIVERSIDAD AUTONOMA DE MADRID	FACULTAD DE FILOSOFIA Y LETRAS	Q2818013A	TEMÁTICA	01-12-14	30-11-16	40.000,00	25.964,00	14.036,00
DER2014-53503-REDT	EL TIEMPO DE LOS DERECHOS	UNIVERSIDAD CARLOS III DE MADRID	INSTITUTO DE DERECHOS HUMANOS BARTOLOME DE LAS CASAS	Q2818029G	TEMÁTICA	01-12-14	30-11-16	35.000,00	22.718,50	12.281,50
FIS2014-57026-REDT	FISICA HADRONICA	UNIVERSIDAD COMPLUTENSE DE MADRID	FACULTAD DE CIENCIAS FISICAS	Q2818014I	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
CGL2014-54117-REDT	MAGIBER: PALEOMAGNETISMO EN IBERIA Y CANARIAS	UNIVERSIDAD COMPLUTENSE DE MADRID	UNIVERSIDAD COMPLUTENSE DE MADRID	Q2818014I	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50
CTM2014-53485-REDC	RED CONSOLIDER TRAGUA	UNIVERSIDAD DE ALCALA	FACULTAD DE CIENCIAS	Q2818018J	CONSOLIDER	01-12-14	30-11-16	65.000,00	42.191,50	22.808,50
TIN2014-57675-REDT	RED DE MODELADO SEMANTICO Y GESTION DE GRANDES VOLUMENES DE DATOS	UNIVERSIDAD DE ALICANTE	DPTO. LENGUAJES Y SISTEMAS INFORMATICOS	Q0332001G	TEMÁTICA	01-12-14	30-11-16	24.000,00	15.578,40	8.421,60
MAT2014-55778-REDT	BIOPOLIMEROS Y MATERIALES COMPUESTOS SOSTENIBLES	UNIVERSIDAD DE ALICANTE	FACULTAD DE CIENCIAS	Q0332001G	TEMÁTICA	01-12-14	30-11-16	5.000,00	3.245,50	1.754,50
AGL2014-55260-REDT	RED TEMATICA SOBRE INVESTIGACION EN AGRICULTURA, GANADERIA Y SELVICULTURA ECOLOGICAS	UNIVERSIDAD DE BARCELONA	FACULTAD DE BIOLOGIA	Q0818001J	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
FIS2014-57117-REDT	RED DE FISICA ESTADISTCIA DE NO EQUILIBRIO Y SUS APLICACIONES MULTIDISCIPLINARES	UNIVERSIDAD DE BARCELONA	FACULTAD DE FISICA	Q0818001J	TEMÁTICA	01-12-14	30-11-16	30.000,00	19.473,00	10.527,00
MTM2014-55580-REDT	RED DE INSTITUTOS UNIVERSITARIOS DE MATEMATICAS	UNIVERSIDAD DE BARCELONA	INSTITUTO DE MATEMATICAS	Q0818001J	TEMÁTICA	01-12-14	30-11-16	25.880,00	16.798,71	9.081,29
MAT2014-59069-REDT	RED INTERNACIONAL EN SUBSTITUCION DE MATERIAS PRIMAS CRITICAS	UNIVERSIDAD DE BURGOS	VICERRECTORADO DE INVESTIGACION Y RELACIONES INTERNACIONALES	Q0968272E	TEMÁTICA	01-12-14	30-11-15	5.000,00	5.000,00	0,00
MTM2014-53828-REDT	RED TEMATICA: LOCALIZACION Y PROBLEMAS AFINES	UNIVERSIDAD DE CADIZ	FACULTAD DE CIENCIAS	Q1132001G	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
CTQ2014-55716-REDT	VALORIZACION QUIMICA SOSTENIBLE DE DIOXIDO DE CARBONO	UNIVERSIDAD DE CANTABRIA	ESCUELA TECNICA SUPERIOR DE INGENIEROS INDUSTRIALES	Q3918001C	TEMÁTICA	01-12-14	30-11-16	28.000,00	18.174,80	9.825,20
TIN2014-54170-REDC	RED DE EXCELENCIA DE ARQUITECTURA DE COMPUTADORES Y COMUNICACIONES AVANZADAS	UNIVERSIDAD DE CASTILLA-LA MANCHA	ESCUELA SUPERIOR DE INGENIERIA INFORMATICA	Q1368009E	CONSOLIDER	01-12-14	30-11-16	27.000,00	17.525,70	9.474,30

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
TRA2014-57696-REDT	RED DE EXCELENCIA EN INGENIERIA DEL TRANSPORTE	UNIVERSIDAD DE CASTILLA-LA MANCHA	ESCUELA TECNICA SUPERIOR DE INGENIEROS DE CAMINOS	Q1368009E	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
MTM2014-53152-REDT	RED DEANALISIS FUNCIONAL Y APLICACIONES	UNIVERSIDAD DE EXTREMADURA	FACULTAD DE CIENCIAS	Q0618001B	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
TIN2014-56425-REDT	BIG DATA Y ANALISIS DE DATOS ESCALABLE	UNIVERSIDAD DE GRANADA	E.T.S. DE INGENIERIAS INFORMATICA Y DE TELECOMUNICACION	Q1818002F	TEMÁTICA	01-12-14	30-11-16	13.500,00	8.762,85	4.737,15
MTM2014-57309-REDT	RED ESPAÑOLA DE ANALISIS GEOMETRICO	UNIVERSIDAD DE GRANADA	FACULTAD DE CIENCIAS	Q1818002F	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
CTQ2014-55571-REDT	RED DE EXCELENCIA EN CATALISIS ASIMETRICA	UNIVERSIDAD DE LAS ISLAS BALEARES	FACULTAD DE CIENCIAS	Q0718001A	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
AGL2014-55068-REDT	BIOMARCADORES NUTRIGENOMICOS Y DECLARACIONES DE PROPIEDADES SALUDABLES EN ALIMENTOS	UNIVERSIDAD DE LAS ISLAS BALEARES	LABORATORIO DE BIOLOGÍA MOLECULAR, NUTRICIÓN Y BIOTECNOLOGIA	Q0718001A	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50
ECO2014-57673-REDT	MERCADOS ORGANIZACIONES MECANISMOS Y AGENTES	UNIVERSIDAD DE MALAGA	FACULTAD DE CIENCIAS ECONOMICAS Y EMPRESARIALES	Q2918001E	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
HAR2014-52449-REDT	ARCA COMUNIS. RED DE INVESTIGACION SOBRE PODER, SISTEMAS FISCALES Y SOCIEDADES	UNIVERSIDAD DE MALAGA	FACULTAD DE FILOSOFIA Y LETRAS	Q2918001E	TEMÁTICA	01-12-14	30-11-16	30.000,00	19.473,00	10.527,00
TIN2014-53986-REDT	RED EN CIENCIA E INGENIERIA DE SERVICIOS	UNIVERSIDAD DE SEVILLA	DPTO. DE LENGUAJES Y SISTEMAS INFORMATICOS	Q4118001I	TEMÁTICA	01-12-14	30-11-16	10.225,00	6.637,05	3.587,95
DPI2014-56547-REDT	RED TEMATICA DE GESTION DE ACTIVOS FISICOS	UNIVERSIDAD DE SEVILLA	ESCUELA TECNICA SUPERIOR DE INGENIEROS	Q4118001I	TEMÁTICA	01-12-14	30-11-16	20.692,00	13.431,18	7.260,82
HAR2014-51919-REDT	FORTIFICACIONES EN EL CARIBE. PROTOCOLOS INTERDISCIPLINARES DE PROTECCION Y PUESTA EN VALOR PARA EL PATRIMONIO MILITAR	UNIVERSIDAD DE SEVILLA	FACULTAD DE GEOGRAFIA E HISTORIA	Q4118001I	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
MTM2014-56142-REDT	REDEACA RED TEMATICA DE CALCULO SIMBOLICO, ALGEBRA COMPUTACIONAL Y APLICACIONES	UNIVERSIDAD DE SEVILLA	INSTITUTO UNIVERSITARIO DE INVESTIGACION DE MATEMATICAS DE LA UNIVERSIDAD DE SEVILLA (IMUS)	Q4118001I	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
BFU2014-51672-REDC	INESTABILIDAD GENOMICA	UNIVERSIDAD DE SEVILLA	UNIVERSIDAD DE SEVILLA	Q4118001I	CONSOLIDER	01-12-14	30-11-16	39.000,00	25.314,90	13.685,10
ECO2014-51759-REDT	RED DE ANALISIS DE LA SOLVENCIA EXTERIOR EN EUROPA LA UE	UNIVERSIDAD DE VALENCIA	FACULTAD DE ECONOMIA	Q4618001D	TEMÁTICA	01-12-14	30-11-16	15.000,00	9.736,50	5.263,50
AGL2014-52648-REDT	RED NACIONAL SOBRE LAS MICOTOXINAS Y HONGOS TOXIGENICOS Y SUS PROCESOS DE DESCONTAMINACION	UNIVERSIDAD DE VALENCIA	FACULTAD DE FARMACIA	Q4618001D	TEMÁTICA	01-12-14	30-11-16	27.000,00	17.525,70	9.474,30
PSI2014-56303-REDT	INVESTIGACION EN PROCESOS, MECANISMOS Y TRATAMIENTOS PSICOLOGICOS PARA LA PROMOCION DE LA SALUD MENTAL	UNIVERSIDAD DE VALENCIA	FACULTAD DE PSICOLOGIA	Q4618001D	TEMÁTICA	01-12-14	30-11-16	40.000,00	25.964,00	14.036,00
MAT2014-52919-REDC	RED DE EXCELENCIA CONSOLIDER EN NANOCIENCIA MOLECULAR	UNIVERSIDAD DE VALENCIA	INSTITUTO DE CIENCIA MOLECULAR	Q4618001D	CONSOLIDER	01-12-14	30-11-16	37.000,00	24.016,70	12.983,30
TIN2014-53522-REDT	RED DE COMPUTACION DE ALTAS PRESTACIONES EN ARQUITECTURAS HETEROGENEAS (CAPAP-H5)	UNIVERSIDAD DE VALLADOLID	ESCUELA TECNICA SUPERIOR DE INGENIEROS DE INFORMATICA	Q4718001C	TEMÁTICA	01-12-14	30-11-15	11.000,00	11.000,00	0,00
CGL2014-53840-REDT	ECOMETAS. RED DE ECOLOGIA TERRESTRE PARA AFRONTAR LOS RETOS DEL CAMBIO GLOBAL	UNIVERSIDAD DE VALLADOLID	ESCUELA UNIVERSITARIA INGENIERIA TEC. AGRICOLA. SORIA	Q4718001C	TEMÁTICA	01-12-14	30-11-16	30.000,00	19.473,00	10.527,00
DPI2014-51763-REDT	RED ESPAÑOLA DE INVESTIGACION EN BIOMECANICA	UNIVERSIDAD DE ZARAGOZA	ESCUELA DE INGENIERIA Y ARQUITECTURA	Q5018001G	TEMÁTICA	01-12-14	30-11-16	23.000,00	14.929,30	8.070,70

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
BIO2014-57314-REDT	COMPRENSION, PREDICCION Y VALIDACION DEL FENOTIPO DE LAS MUTACIONES PATOLOGICAS: TRANSFORMANDO LOS RESULTADOS BASICOS EN HERRAMIENTAS DE DIAGNOSTICO	UNIVERSIDAD DE ZARAGOZA	INSTITUTO DE BIOCOMPUTACION Y FISICA DE SISTEMAS COMPLEJOS	Q5018001G	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50
CTQ2014-51912-REDC	RED ORFEO-CINQA "CENTRO DE INNOVACION EN QUIMICA AVANZADA"	UNIVERSIDAD DE ZARAGOZA	INSTITUTO DE SÍNTESIS QUÍMICA Y CATÁLISIS HOMOGÉNEA	Q5018001G	CONSOLIDER	01-12-14	30-11-16	41.000,00	26.613,10	14.386,90
CSO2014-52862-REDT	INVESTIGACIONES SOCIOTERRITORIALES Y DESARROLLO RURAL	UNIVERSIDAD NACIONAL DE EDUCACION A DISTANCIA	FACULTAD DE CIENCIAS POLITICAS Y SOCIOLOGIA	Q2818016D	TEMÁTICA	01-12-14	30-11-16	15.000,00	9.736,50	5.263,50
TIN2014-56409-REDT	RED TEMATICA EN TECNOLOGIAS DE COMPUTACION NATURAL/ARTIFICIAL	UNIVERSIDAD POLITÉCNICA DE CARTAGENA	ESCUELA TECNICA SUPERIOR DE INGENIERIA DE TELECOMUNICACION	Q8050013E	TEMÁTICA	01-12-14	30-11-16	10.200,00	6.620,82	3.579,18
CSO2014-51705-REDT	RED PARA LA INVESTIGACION DE LOS PAISAJES CULTURALES DE ESPAÑA	UNIVERSIDAD POLITECNICA DE MADRID	CENTRO INTERNACIONAL DE ESTUDIOS SOBRE PATRIMONIO CULTURAL	Q2818015F	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
TIN2014-53161-REDT	RED TEMATICA ESPAÑOLA DE DATOS ABIERTOS EN LAS CIUDADES INTELIGENTES	UNIVERSIDAD POLITECNICA DE MADRID	FACULTAD DE INFORMATICA	Q2818015F	TEMÁTICA	01-12-14	30-11-16	24.000,00	15.578,40	8.421,60
TIN2014-56381-REDT	LOGICA DIFUSA Y SOFT COMPUTING	UNIVERSIDAD PUBLICA DE NAVARRA	ESCUELA TECNICA SUPERIOR ING.INDUSTRIALES Y TELECOMUNICACION	Q3150012G	TEMÁTICA	01-12-14	30-11-16	11.700,00	7.594,47	4.105,53
TEC2014-54968-REDT	RED PARA LA INNOVACION EN EL SECTOR DE LA DEFENSA Y LA SEGURIDAD	UNIVERSIDADE DA CORUÑA	FACULTAD DE INFORMATICA	Q6550005J	TEMÁTICA	01-12-14	30-11-16	30.000,00	19.473,00	10.527,00
CTQ2014-51693-REDC	EVALUACION DE TECNOLOGIAS INNOVADORAS PARA EL TRATAMIENTO DE AGUAS RESIDUALES	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	ESCUELA TECNICA SUPERIOR DE INGENIERIA	Q1518001A	CONSOLIDER	01-12-14	30-11-16	41.000,00	26.613,10	14.386,90

ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2014 - ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA"
PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA
SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO

REFERENCIA	TÍTULO	BENEFICIARIO	CENTRO	CIF	TIPO DE RED	PERIODO EJECUCIÓN		FINANCIACIÓN CONCEDIDA (euros) Costes directos		
						FECHA INICIO	FECHA FIN	Total	Primera anualidad	Segunda anualidad
EDU2014-51720-REDT	RED 14: RED DE INVESTIGACION EN ENSEÑANZA DE LAS CIENCIAS SOCIALES	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	FACULTAD DE CIENCIAS DE LA EDUCACION	Q1518001A	TEMÁTICA	01-12-14	30-11-16	40.000,00	25.964,00	14.036,00
EDU2014-51756-REDT	UNIVERSIDAD, INNOVACION Y APRENDIZAJE EN LA SOCIEDAD DEL CONOCIMIENTO	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	FACULTAD DE CIENCIAS DE LA EDUCACION	Q1518001A	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50
FFI2014-51873-REDT	ENGLISH LINGUISTICS CIRCLE	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	FACULTAD DE FILOLOGIA	Q1518001A	TEMÁTICA	01-12-14	30-11-16	15.000,00	9.736,50	5.263,50
MTM2014-52555-REDT	RED TEMATICA MATEMATICA-INDUSTRIA	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	FACULTAD DE MATEMATICAS	Q1518001A	TEMÁTICA	01-12-14	30-11-16	25.880,00	16.798,71	9.081,29
DPI2014-55814-REDT	RED NACIONAL DE ROBOTICA	UNIVERSITAT JAUME I DE CASTELLO	DPTO. DE INGENIERIA Y CIENCIA DE LOS COMPUTADORES	Q6250003H	TEMÁTICA	01-12-14	30-11-15	20.000,00	20.000,00	0,00
MAT2014-52905-REDT	RED DE INVESTIGACION PARA EL DESARROLLO DE IMPLANTES DE TITANIO FUNCIONALIZADOS	UNIVERSITAT POLITÈCNICA DE VALÈNCIA	CENTRO DE BIOMATERIALES E INGENIERIA TISULAR	Q4618002B	TEMÁTICA	01-12-14	30-11-16	10.000,00	6.491,00	3.509,00
TEC2014-56469-REDT	AVANCES DE REDES DE COMUNICACIONES DE 5ªGENERACION	UNIVERSITAT POLITÈCNICA DE VALÈNCIA	INSTITUTO DE TELECOMUNICACIONES Y APLICACIONES MULTIMEDIA - ITEAM	Q4618002B	TEMÁTICA	01-12-14	30-11-16	20.000,00	12.982,00	7.018,00
TIN2014-54728-REDC	RED DE EXCELENCIA MULTIMODAL INTERACTION IN PATTERN RECOGNITION AND COMPUTER VISION	UNIVERSITAT POLITÈCNICA DE VALÈNCIA	UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Q4618002B	CONSOLIDER	01-12-14	30-11-16	37.000,00	24.016,70	12.983,30
FFI2014-51675-REDT	SIGNIFICADO Y GRAMATICA	UNIVERSITAT POMPEU FABRA CCT	DPTO. TRADUCCION Y FILOLOGIA	Q5850017D	TEMÁTICA	01-12-14	30-11-16	25.000,00	16.227,50	8.772,50

DEPARTAMENTO DE INGENIERIA INFORMATICA

A quien corresponda,

Certifico que Dña. Dolores Burgueño Caballero, con DNI 12383819-K ha participado como miembro en la red nacional de excelencia en Ingeniería del Software Dirigida por Modelos (MDE), con código TIN2014-53555-REDT, que se desarrolló desde el 1/12/2014 hasta el 30/11/2016.

Madrid, 1 de Febrero de 2018.

Juan de Lara Jaramillo
Responsable de la red de Excelencia MDE
Departamento de Ingeniería Informática
Universidad Autónoma de Madrid
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e-mail: Juan.deLara@uam.es
Tel.: 91 497 22 77

TIN2016-81836-REDT

MINISTERIO
DE ECONOMÍA, INDUSTRIA
Y COMPETITIVIDAD

RESOLUCIÓN DE LA PRESIDENCIA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN POR LA QUE SE CONCEDEN AYUDAS PARA LAS ACCIONES DE DINAMIZACIÓN "REDES DE EXCELENCIA", CORRESPONDIENTES AL PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA, SUBPROGRAMA ESTATAL DE GENERACIÓN DE CONOCIMIENTO, EN EL MARCO DEL PLAN ESTATAL DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA Y DE INNOVACIÓN 2013-2016.

Por Orden ECC/1779/2013 (en adelante, orden de bases reguladoras), de 30 de Septiembre de 2013 publicada en el Boletín Oficial del Estado de 02/10/2013, se regulaban las bases del régimen de ayudas y la gestión de ayudas públicas de varios subprogramas del Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016. El 6 de Junio de 2016 se publicó en el Boletín Oficial del Estado el extracto de la Resolución de 31 de Mayo de 2016, con numero de identificador 307844 en la Base de Datos Nacional de Subvenciones (BDNS), de la Secretaría de Estado de Investigación, Desarrollo e Innovación, por la que se aprobaba la convocatoria para el año 2016 del procedimiento de concesión de ayudas de las acciones de dinamización "Redes de Excelencia", del Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia, Subprograma Estatal de Generación de Conocimiento, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016.

Mediante el Real Decreto 1067/2015, de 27 de noviembre, se creó la Agencia Estatal de Investigación (en adelante, la Agencia) y se aprobó su Estatuto, quedando constituida de manera efectiva mediante la celebración de la sesión constitutiva de su Consejo Rector, el día 20 de junio de 2016.

Por resolución de 24 de junio de 2016, de la Secretaría de Estado de Investigación, Desarrollo e Innovación, se acordó la modificación de algunas resoluciones de convocatorias de ayudas aprobadas en el año 2016, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016, para su adaptación a la estructura orgánica de la Agencia Estatal de Investigación. El artículo 2. Segundo de dicha resolución de modificación, establece que el órgano competente para la instrucción de los procedimientos de las modalidades de actuación contenidas en la resolución de 31 de mayo de 2016, citada en el segundo párrafo, será la Subdivisión de Planificación y Gestión Administrativa y que el órgano competente para la resolución del procedimiento de concesión de las ayudas será la Presidencia de la Agencia Estatal de Investigación.

Examinadas las solicitudes presentadas y de conformidad con lo establecido en los artículos 18 y 19 de la orden de bases reguladoras y en el artículo 16 de la resolución de la convocatoria, el órgano instructor, a la vista del expediente y del informe de la comisión de selección nombrada al efecto, dictó la correspondiente propuesta de resolución provisional, que se publicó en la sede electrónica de la Secretaría de Estado de I+D+I el 23 de febrero de 2017. Una vez evacuado el trámite de audiencia y previa aceptación de los interesados, el órgano instructor ha elevado propuesta de resolución definitiva de concesión a la Presidencia de la Agencia Estatal de Investigación.

Por todo ello, una vez cumplidos los trámites establecidos, esta Presidencia

RESUELVE:

Conceder, con cargo a las aplicaciones presupuestarias 27.13.463B.730 , 27.13.463B.750 , 27.13.463B.740 , 27.13.463B.780, según la naturaleza de los beneficiarios y el tipo de ayudas, o aquellas que las sustituyan en ejercicios presupuestarios posteriores al corriente, las ayudas que se especifican en el anexo I, correspondientes a las acciones de dinamización "Redes de Excelencia", del Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia, Subprograma Estatal de Generación de Conocimiento, por importe de 2.373.000,00, distribuido en las siguientes anualidades:

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PARTIDAS	1ª ANUALIDAD (2017)	2ª ANUALIDAD (2018)	TOTAL
27.13.463B.730	154.750,00	154.750,00	309.500,00
27.13.463B.740	20.000,00	20.000,00	40.000,00
27.13.463B.750	944.250,00	944.250,00	1.888.500,00
27.13.463B.780	67.500,00	67.500,00	135.000,00
TOTAL	1.186.500,00	1.186.500,00	2.373.000,00

Denegar el resto de ayudas solicitadas, según se detalla en el anexo II, al no haber alcanzado las solicitudes la prioridad suficiente para su financiación de acuerdo con los criterios establecidos en la convocatoria.

Condiciones de la concesión:

1. Pago de las ayudas. El pago de las ayudas se realizará conforme a lo establecido en el artículo 25 de la orden de bases reguladoras y el artículo 20 de la resolución de convocatoria. El primer pago se tramitará con motivo de la resolución de concesión. El segundo pago estará condicionado a la presentación de la justificación económica intermedia y a la presentación de la justificación científico-técnica intermedia, de acuerdo con el calendario de seguimiento científico-técnico descrito en el artículo 22.2 de la resolución de convocatoria y a su evaluación positiva.

Asimismo, el pago de las anualidades quedará condicionado a que exista constancia por parte del órgano gestor de que el beneficiario cumple con los requisitos exigidos en el artículo 34.5 de la Ley 38/2003, de 17 de noviembre, General de Subvenciones.

En el caso de que no conste la situación del beneficiario respecto a tales obligaciones, se le requerirá para que en el plazo máximo de quince días desde el día siguiente a la notificación del requerimiento aporte los oportunos certificados.

De existir miembros asociados, el pago se realizará a favor del beneficiario principal.

2. Ejecución. La ejecución de la acción incentivada y su justificación deberán sujetarse a lo dispuesto en la orden de bases reguladoras, la resolución de convocatoria, la presente resolución de concesión y las "Instrucciones de ejecución y justificación" que se encuentran disponibles en la página web la Agencia (http://www.aei.gob.es/).

3. Justificación, seguimiento y comprobación de las ayudas. La justificación del empleo de las ayudas concedidas (esto es, que el gasto ha sido efectivamente realizado, desembolsado y aplicado al fin para el que se concedió la ayuda) se realizará de acuerdo con lo establecido en el artículo 30 de la Ley 38/2003, de 17 de noviembre, General de Subvenciones, en el artículo 26 de la orden de bases reguladoras, en el artículo 23 (modificado por la resolución de 29 junio de 2016) de la resolución de convocatoria y en las "Instrucciones de ejecución y justificación" que se encuentran disponibles en la página web de la Agencia.

4. Emisión de informes. Son exigibles dos tipos de informes de seguimiento: los científico-técnicos, que dan cuenta del estado de avance del proyecto en relación con sus objetivos, y los económicos, que recogen las inversiones y gastos efectivamente realizados y pagados relativos al proyecto.

Cuando las actuaciones tengan carácter plurianual, los beneficiarios deberán presentar un informe de seguimiento científico-técnico intermedio según el plazo indicado en el artículo 22 de la resolución de convocatoria y una memoria económica justificativa anual, en los plazos establecidos en el artículo 23 de la resolución de convocatoria.

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Asimismo, los beneficiarios presentarán un informe científico técnico final y una memoria económica justificativa final dentro del plazo de tres meses desde la fecha de finalización del proyecto.

5. Documentación justificativa: Los informes científico-técnicos serán aportados por el investigador principal y enviados mediante firma electrónica por el representante legal de la entidad beneficiaria. La documentación para la justificación económica deberá ser presentada al órgano concedente de la ayuda por el representante legal de la entidad beneficiaria. Los informes se presentarán haciendo uso de los modelos de impresos normalizados y los medios telemáticos facilitados en los servidores de información de la página web de la Agencia.

a) Informe científico-técnico, que deberá contener la siguiente información:

1.º Desarrollo de las actividades, cumplimiento de objetivos propuestos en la actuación, así como el impacto de los resultados obtenidos, evidenciados, entre otros, mediante la difusión de resultados en publicaciones, revistas científicas, libros y presentaciones en congresos; las acciones de transferencia; patentes; internacionalización de las actividades; y colaboraciones con grupos nacionales e internacionales.

2.º cualquier cambio respecto a los gastos contemplados en el presupuesto incluido en la solicitud inicial de la ayuda, justificando adecuadamente su necesidad para la consecución de los objetivos científico-técnicos de la actuación subvencionada.

3.º cualquier modificación en la composición del equipo de investigación, siempre que haya sido autorizada por la Subdirección General de Proyectos de Investigación y cualquier incorporación de personal a la actuación, mediante la contratación a la que se refiere el artículo 8.3. a)

b) Memoria económica justificativa del coste de las actividades realizadas, que contendrá:

1.º Fichas justificativas normalizadas y certificación de los gastos y pagos realizados. Los documentos acreditativos del gasto y del pago quedarán en poder de los beneficiarios a disposición de los órganos de comprobación y control.

2.º en su caso, relación donde se especifiquen otros ingresos o ayudas percibidos que hayan contribuido a financiar la actuación incentivada, con indicación de su importe y procedencia.

3.º En su caso, acreditación del reintegro de remanentes no aplicados

La comprobación formal para la liquidación de la subvención se realizará de modo exhaustivo sobre las cuentas justificativas presentadas. Las facturas o documentos de valor probatorio análogo que sustenten dichos informes serán objeto de comprobación en los cuatro años siguientes sobre la base de una muestra representativa, a cuyo fin el órgano gestor podrá requerir a los beneficiarios la remisión de los justificantes que compongan dicha muestra, así como realizar los controles recogidos en cada uno de los planes anuales de actuación mencionados en el artículo 85 del Real Decreto 887/2006, de 21 de julio, por el que se aprueba el Reglamento de la Ley 38/2003, de 17 de noviembre, General de subvenciones.

6. Custodia de la documentación. El beneficiario deberá garantizar la conservación de la documentación original justificativa de la ejecución del proyecto. El lugar de custodia deberá reflejarse en la información a remitir a la Agencia Estatal de Investigación con motivo de la rendición de los correspondientes informes. Dicha documentación deberá conservarse el periodo resultante de la aplicación del artículo 39 de la Ley 38/2003, de 17 de noviembre, General de Subvenciones.

7. Modificación de las condiciones de la ayuda. Las condiciones de modificación de la ayuda se regirán con carácter general por el artículo 24 de la orden de bases y en particular por el artículo 19 de la resolución de convocatoria (modificado por la resolución de 29 de junio de 2016). Para cualquier modificación de las condiciones de la ayuda, el investigador principal presentará una solicitud, al menos dos meses antes de que finalice el plazo de ejecución de actuación, con el visto bueno del representante legal de la entidad beneficiaria, a la Subdivisión de Programas Temáticos Científico-Técnicos de la Agencia, de acuerdo con los formatos disponibles en la web de la Agencia.

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8. Compatibilidad con otras ayudas. La percepción de estas ayudas será compatible con la percepción de otras subvenciones, ayudas, ingresos o recursos para la misma finalidad, procedentes de cualesquiera de las Administraciones o entes públicos o privados, nacionales, internacionales, o de la Unión Europea. Esta compatibilidad estará condicionada a que el importe total de la ayuda recibida en ningún caso pueda ser de tal cuantía que, aisladamente o en concurrencia con otras supere el importe solicitado inicialmente. En caso de que los beneficiarios reciban otras ayudas de fondos públicos o privados para la misma actuación y con conceptos semejantes una vez presentada la solicitud inicial de ayuda, deberán hacerlo constar en las memorias económicas de seguimiento y finales correspondientes a la presente convocatoria, de manera que no incurran en el supuesto de doble financiación.

9. Publicidad: Los beneficiarios en todos las actuaciones deberán dar publicidad a las ayudas recibidas en los contratos de servicios y laborales, publicaciones y otros resultados de la investigación, ponencias, equipos inventariables y actividades de difusión de resultados financiados con ellas, debiéndose mencionar a la Agencia Estatal de Investigación (AEI) como entidad financiadora. En todos los casos se mencionará la referencia de la actuación seguida de (AEI).

10. Incumplimiento: el incumplimiento total o parcial de las condiciones establecidas para el desarrollo del proyecto en esta resolución, en la orden de convocatoria y demás normas aplicables dará lugar, previa incoación del oportuno expediente, al reintegro de las cuantías indebidamente percibidas más los correspondientes intereses de demora y, en su caso, a la pérdida por el beneficiario del derecho al cobro de los importes pendientes de percibir.

La presente resolución se publicará en la sede electrónica de I+D+I del Ministerio de Economía, Industria y Competitividad (https://sede.micinn.gob.es), surtiendo todos los efectos de notificación practicada. Adicionalmente, los interesados podrán recibir un aviso en la dirección de correo electrónico que conste en su solicitud de la ayuda, mediante el cual se le indicará que se ha producido una notificación a cuyo contenido podrá acceder a través de la Carpeta Virtual de Expedientes (FACILIT@), ubicada en la misma sede electrónica.

Esta resolución de concesión podrá ser recurrida potestativamente en reposición, en el plazo de un mes desde el día siguiente a su notificación y ante el mismo órgano que dictó la resolución impugnada, conforme a los artículos 123 y 124 de la Ley 39/2015, de 1 de octubre, del Procedimiento Administrativo Común de las Administraciones Públicas.

Sin perjuicio de lo anterior, contra esta resolución cabe interponer recurso contencioso administrativo ante Sala de lo Contencioso-Administrativo de la Audiencia Nacional, en el plazo de dos meses a contar desde el día siguiente a la fecha de su notificación si el acto fuera expreso, o de seis meses si no lo fuera a contar a partir del día siguiente a aquél en que, de acuerdo con su normativa específica, se produzca el acto presunto, de acuerdo con los artículos 11.1.a) y 46 de la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso-Administrativa.

LA PRESIDENTA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN (P.D. Resolución 21-06-2016, B.O.E. 24-06-2016)
LA DIRECTORA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN,

MARINA PILAR VILLEGAS GRACIA

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ANEXO I. AYUDAS CONCEDIDAS - CONVOCATORIA 2016 - REDES EXCELENCIA PROGRAMA ESTATAL DE FOMENTO DE LA INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE EXCELENCIA

ENTIDAD SOLICITANTE	CENTRO	CIF	REFERENCIA	TIPO	TITULO	AÑOS	FECHA INICIO	FECHA FIN	COSTES DIRECTOS CONCEDIDOS		
									TOTAL	ANUAL. 1 (2017)	ANUAL. 2 (2018)
ASOC. INVESTIGACION INDUSTRIA JUGUETE, CONEXAS Y AFINES	DPTO. DE LABORATORIO	G03182862	CGL2016-81939-REDE	Estratégica	POSICIONAMIENTO Y COORDINACION DE CLIMATE-KIC EN SISTEMAS DE PRODUCCION SOSTENIBLE	2	01-07-17	30-06-19	60.000	30.000	30.000
FUNDACIO INSTITUT CATALA D INVESTIGACIO QUIMICA (ICIQ)	AGR-FUNDACIO PRIVADA INSTITUT CATALA D INVESTIGACIO QUIMICA (ICIQ)	G43619550	CTQ2016-81923-REDC	Consolider	ENCARANDO LOS RETOS QUE LA SOCIEDAD TIENE PLANTEADOS MEDIANTE INVESTIGACION COLABORATIVA EN CATALISIS	2	01-07-17	30-06-19	41.500	20.750	20.750
UNIVERSITAT RAMON LLULL, FUNDACIO PRIVADA	VICERRECTORADO DE INVESTIGACION Y TECNOLOGIA	G59069740	CSO2016-81882-REDT	Temática	HACIA UN PERIODISMO INCLUSIVO. CONVERGENCIA Y ROL DEL PERIODISMO ESPAÑOL EN EL ESCENARIO DE LA COMUNICACION GLOBAL	2	01-07-17	30-06-19	20.000	10.000	10.000
FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA	INSTITUTO INTERDISCIPLINARIO DE INTERNET, IN3	G60667813	TIN2016-81836-REDT	Temática	RED DE EXCELENCIA EN INGENIERIA DEL SOFTWARE DIRIGIDA POR MODELOS	2	01-07-17	30-06-19	15.000	7.500	7.500
FUNDACIO CENTRE DE REGULACIO GENOMICA	AGR-FUNDACIO PRIVADA CENTRE DE REGULACIO GENOMICA	G62426937	BFU2016-81721-REDE	Estratégica	ALIANZA SEVERO OCHOA Y MARIA DE MAEZTU: CENTROS Y UNIDADES DE EXCELENCIA ESPAÑOLES	2	01-07-17	30-06-19	120.000	60.000	60.000
FUNDACIO CENTRE DE REGULACIO GENOMICA	AGR-FUNDACIO PRIVADA CENTRE DE REGULACIO GENOMICA	G62426937	BFU2016-81912-REDC	Consolider	ORGANIZACION COMPARTIMENTAL Y TRANSPORTE	2	01-07-17	30-06-19	41.500	20.750	20.750
INSTITUTO DE CIENCIAS FOTONICAS	INSTITUTO DE CIENCIAS FOTONICAS	G62819537	FIS2016-81740-REDC	Consolider	NANOLIGHT.ES - LIGHT CONTROL ON THE NANOSCALE	2	01-07-17	30-06-19	41.500	20.750	20.750
FUNDACION CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS CARLOS III	CENTRO NACIONAL DE INVESTIGACIONES ONCOLOGICAS	G81972242	SAF2016-81975-REDT	Temática	INTERACCION ENTRE METABOLISMO SISTEMICO Y CELULAR EN CANCER	2	01-07-17	30-06-19	20.000	10.000	10.000
FUNDACION PARA LA INVESTIGACION MEDICA APLICADA	CENTRO DE INVESTIGACION MEDICA APLICADA	G82198524	SAF2016-81937-REDT	Temática	RED DE INMUNOTERAPIA DEL CANCER	2	01-07-17	30-06-19	20.000	10.000	10.000
FUNDACION IMDEA NANOCIENCIA	INSTITUTO MADRILEÑO DE ESTUDIOS AVANZADOS EN NANOCIENCIA	G84909068	CTQ2016-81911-REDT	Temática	MATERIALES ORGANICOS OPTOELECTRONICOS PARA LA ENERGIA	2	01-07-17	30-06-19	18.000	9.000	9.000
FUNDACION IMDEA ENERGIA	FUNDACION IMDEA ENERGIA	G84912716	ENE2016-82025-REDT	Temática	NUEVOS DESAFIOS EN LA PRODUCCION DE COMBUSTIBLES SOLARES	2	01-07-17	30-06-19	19.000	9.500	9.500
UNIVERSIDAD DE ALICANTE	ESCUELA POLITECNICA SUPERIOR	Q0332001G	TIN2016-81739-REDT	Temática	RED DE DINAMIZACION DE ACTIVIDADES EN TECNOLOGIAS DE PROCESAMIENTO DEL LENGUAJE NATURAL	2	01-07-17	30-06-19	10.000	5.000	5.000
UNIVERSIDAD DE ALICANTE	FACULTAD DE EDUCACION	Q0332001G	EDU2016-81994-REDT	Temática	RED8-EDUCACION MATEMATICA Y FORMACION DE PROFESORES	2	01-07-17	30-06-19	20.000	10.000	10.000
UNIVERSIDAD DE EXTREMADURA	FACULTAD DE CIENCIAS	Q0618001B	MTM2016-81726-REDT	Temática	RED NACIONAL DE ANALISIS FUNCIONAL Y APLICACIONES	2	01-07-17	30-06-19	11.000	5.500	5.500

A quien pueda interesar,

Hago constar que la Dra. **Loli Burgueño Caballero** (DNI 25346121Y) participa en la Red Temática en Ingeniería del Software Dirigida por Modelos (MDE), como miembro del **Grupo de Investigación ATENEA** (Departamento de Lenguajes y Ciencias de la Computación, Universidad de Málaga), coordinado por el Dr. Antonio Vallecillo.

Esta red es financiada por la acción de dinamización "Redes de Excelencia" **TIN2016-81836-REDT** (01/07/2017-30/06/2019) en el Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia del Ministerio de Economía, Industria y Competitividad.

Y para que conste a los efectos oportunos, firmo la presente en

Barcelona, 24 de marzo de 2018

Robert Clarisó

Dr. Robert Clarisó Viladrosa
rclariso@uoc.edu
Coordinador de la Red Temática MDE
Universitat Oberta de Catalunya

PID2020-114615RB-I00

MINISTERIO
DE CIENCIA
E INNOVACIÓN

AGENCIA ESTATAL DE INVESTIGACIÓN

COMUNICACIÓN DE LA PUBLICACIÓN DE LA RESOLUCIÓN DE LA PRESIDENCIA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN, POR LA QUE SE CONCEDEN AYUDAS CORRESPONDIENTES A LA CONVOCATORIA 2020 DE «PROYECTOS DE I+D+i» EN EL MARCO DE LOS PROGRAMAS ESTATALES DE GENERACIÓN DE CONOCIMIENTO Y FORTALECIMIENTO CIENTÍFICO Y TECNOLÓGICO DEL SISTEMA DE I+D+i Y DE I+D+i ORIENTADA A LOS RETOS DE LA SOCIEDAD.

REFERENCIA: PID2020-114615RB-I00

ENTIDAD SOLICITANTE: FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA

CENTRO: INSTITUTO INTERDISCIPLINARIO DE INTERNET, IN3

TÍTULO: DESARROLLO LOW-CODE DE SISTEMAS INTELIGENTES

DURACIÓN EN AÑOS: 3

Se ha publicado en la página web de la Agencia Estatal de Investigación la resolución por la que se conceden ayudas correspondientes a la convocatoria 2020 de «Proyectos de I+D+i» de los Programas Estatales de Generación de Conocimiento y Fortalecimiento Científico y Tecnológico del Sistema de I+D+i y de I+D+i Orientada a los Retos de la Sociedad.

En el caso de los proyectos aprobados, todas las condiciones económicas y de ejecución de los proyectos se encuentran en la resolución de concesión publicada en la citada sede.

En el caso de los proyectos aprobados tipo JIN, las entidades beneficiarias dispondrán de un plazo de 20 días hábiles a contar desde el día siguiente al de la publicación de la resolución de concesión para formalizar el contrato con el/la investigador/a principal, según lo establecido en los artículos 9.3.a) y 18.3 de la convocatoria, y presentarlo a través de Facilit@, mediante la acción de "Instancia".

La resolución publicada es definitiva en vía administrativa y contra la misma cabe interponer, potestativamente, recurso de reposición ante el mismo órgano que la dictó en el plazo de un mes, de acuerdo con lo dispuesto en los artículos 123 y 124 de la Ley 39/2015, de 1 de octubre, del Procedimiento Administrativo Común de las Administraciones Públicas; o directamente, recurso contencioso-administrativo ante los Juzgados Centrales de lo Contencioso-Administrativo, en el plazo de dos meses, conforme a lo establecido en los artículos 9.1.c) y 46.1 de la Ley 29/1998, de 13 de julio, Reguladora de la Jurisdicción Contencioso-Administrativa.

Agencia Estatal de Investigación

b. OTROS MÉRITOS RELACIONADOS CON LA CALIDAD Y NÚMERO DE PROYECTOS Y CONTRATOS DE INVESTIGACIÓN

Miembro del banco de expertos evaluadores de la Agencia Estatal de Investigación (AEI).

JULIO BRAVO DE PEDRO, JEFE DE LA SUBDIVISIÓN DE COORDINACIÓN Y EVALUACIÓN

CERTIFICA:

Que D/Dª **Lola Burgueño Caballero**, con D.N.I.: 25346121Y, Investigador de Internet Interdisciplinary Institute de UNIVERSITAT OBERTA DE CATALUNYA, pertenece al banco de expertos de la Agencia Estatal de Investigación.

Y para que así conste se expide este certificado, a petición del interesado.

Madrid, 30 de marzo de 2021

SUBDIVISIÓN DE COORDINACIÓN
Y EVALUACIÓN
DIVISION DE COORDINACIÓN,
EVALUACIÓN Y SEGUIMIENTO
CIENTÍFICO Y TÉCNICO
Calle Torrelaguna 58 bis. Planta 5ª
28027 Madrid

3. MOVILIDAD DEL PROFESORADO

a. ESTANCIAS EN CENTROS DE INVESTIGACIÓN

Univerity of Alabama (EEUU)

MINISTERIO
DE ECONOMÍA Y
COMPETITIVIDAD

SECRETARÍA DE ESTADO
DE INVESTIGACIÓN
DESARROLLO E INNOVACIÓN

SECRETARÍA GENERAL
DE CIENCIA, TECNOLOGÍA
E INNOVACIÓN

DIRECCIÓN GENERAL
DE INVESTIGACIÓN
CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL
DE RECURSOS HUMANOS PARA
LA INVESTIGACIÓN

Resolución de 4 de diciembre de 2013 de la Secretaría de Estado de Investigación, Desarrollo e Innovación, por la que se conceden ayudas a la movilidad predoctoral para la realización de estancias breves en Centros de I+D, convocatoria 2013.

La Orden ECC/1402/2013, de 22 de julio, aprueba las bases reguladoras para la concesión de ayudas en el marco del Programa Estatal de Promoción del Talento y su Empleabilidad del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016.

La Resolución de 9 de agosto de 2013, de la Secretaría de Estado de Investigación, Desarrollo e Innovación, aprueba la convocatoria, correspondiente al año 2013, de diversas actuaciones contempladas en el Subprograma Estatal de Formación y en el Subprograma Estatal de Movilidad, del Programa Estatal de Promoción del Talento y su Empleabilidad, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016.

Cumplidos los requisitos establecidos en la citada Orden de bases y de acuerdo con lo dispuesto en el artículo 10 de la resolución de convocatoria, esta Secretaría de Estado de Investigación, Desarrollo e Innovación

RESUELVE:

1. Conceder las ayudas que se relacionan en el Anexo de la resolución cuyo importe asciende a 5.385.030,00 euros. En el Anexo de la resolución se recogen las condiciones de las ayudas. Su financiación se imputará a las aplicaciones presupuestarias del presupuesto de gastos del Ministerio de Economía y Competitividad, del ejercicio 2013, que se indican a continuación, según el siguiente desglose:

Aplicación presupuestaria	Importe
27.13.463B.713	112.899,00
27.13.463B.731	1.343.388,00
27.13.463B.740	43.574,00
27.13.463B.750	3.618.438,00
27.13.463B.780	266.731,00
Total	5.385.030,00

2. Desestimar la concesión de ayudas al resto de solicitudes presentadas.

Contra la presente Resolución, que pone fin a la vía administrativa, se podrá interponer, potestativamente, recurso de reposición ante el órgano que la dictó, en el plazo de un mes, si la resolución fuera expresa, o de tres meses si no lo fuera, de acuerdo con lo dispuesto en los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra la resolución del procedimiento de concesión cabe interponer recurso contencioso-administrativo ante la Sala de lo Contencioso-Administrativo de la Audiencia Nacional, en el plazo de dos meses, si la resolución fuera expresa, o de seis meses si no lo fuera, de acuerdo con lo dispuesto en los artículos 11.1.a) y 46 de la Ley 29/1998, de 13 de julio, de la Jurisdicción Contencioso-Administrativa.

Madrid, 4 de diciembre de 2013. – La Secretaria de Estado de Investigación, Desarrollo e Innovación. (PD. Resolución de la Secretaría de Estado de Investigación, Desarrollo e Innovación de 19 de noviembre. BOE de 20 de noviembre de 2012), el Director General de Investigación Científica y Técnica, Juan María Vázquez Rojas.

Razón social (org. origen)	Referencia EEBB-Centro	Referencia EEBB	Apellidos y Nombre	País	Duración concedida	coste días	coste VIAJE	coste concedido	Org receptor	Centro receptor
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-09054	BENÍTEZ HIDALGO, ANA CARMEN	ITALIA	61	41	600	3.101,00	Universidad Roma Tre	Facultad de Letras
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-08709	BURGUEÑO CABALLERO, DOLORES	ESTADOS UNIDOS DE AMERICA	120	44	1200	6.480,00	Universidad de Alabama	Department of Computer Science
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-08785	CABALLO PONCE, ELOY	ESPAÑA	91	25	90	2.365,00	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-08768	CARRASCO GARCÍA, IRENE MARÍA	IRLANDA	92	32	600	3.544,00	Dublin City University	
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-09090	FERNÁNDEZ DÍAZ, CARMEN ROCÍO	ESTADOS UNIDOS DE AMERICA	90	44	1200	5.160,00	Suffolk University	School of Law
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-08188	HIJANO REYES, ANTONIO JESÚS	FRANCIA	120	40	600	5.400,00	Institut de Mécanique des Fluides de Toulouse	
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-08133	JAIMEZ TARIFA, MARIANO	ALEMANIA	120	41	600	5.520,00	Universidad Técnica de Munich	Facultad de Informática
UNIVERSIDAD DE MALAGA	EEBB-C-14-00504	EEBB-I-14-07903	NIETO JIMENEZ, ANA	GRECIA	93	26	600	3.018,00	Computer and Communication Systems Laboratory	University of the Aegean

MINISTERIO
DE ECONOMÍA Y
COMPETITIVIDAD

SECRETARÍA DE ESTADO DE INVESTIGACIÓN DESARROLLO E INNOVACIÓN
SECRETARÍA GENERAL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN

DIRECCIÓN GENERAL DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE RECURSOS HUMANOS PARA LA INVESTIGACIÓN

AYUDAS A LA MOVILIDAD PREDOCTORAL PARA LA REALIZACIÓN DE ESTANCIAS BREVES EN CENTROS DE I+D ESPAÑOLES Y EXTRANJEROS 2013

CERTIFICADO DE REALIZACIÓN DE ESTANCIA BREVE

Apellidos, nombre: Burgueno Caballero, Dolores	NIF/NIE: 25346121-Y
Referencia de la ayuda: BES-2012-057064	Referencia del proyecto: TIN2011-23795
Centro de I+D de la ayuda FPI: UNIVERSIDAD DE MALAGA / ESCUELA TECNICA SUPERIOR DE INGENIERIA INFORMATICA / DPTO. LENGUAJES Y CIENCIAS DE LA COMPUTACION	
ORGANISMO DE I+D RECEPTOR: Universidad de Alabama /	
CENTRO: Department of Computer Science	
DEPARTAMENTO: Software Engineering Group	
PAÍS: Estados Unidos de América	

El abajo firmante certifica que el/la investigador/a en formación a quien se refiere el presente documento ha permanecido en el centro de trabajo desde el día 14 de enero de 2014 hasta el día 15 de mayo de 2014 (*)

Nombre y apellidos del firmante: Jeff Gray / Eugene Syriani

Cargo: Catedrático de Universidad / Profesor ayudante

Fecha: 15 mayo de 2014

Jeff Gray

Firma y sello

(*) TO BE COMPLETED BY THE HOST RESEARCH DIRECTOR

The undersigned certifies that the scholar has remained in this centre from January 15th, 2014 until May 15th, 2014.

Este informe, junto con la memoria de la estancia, deberá presentarse en el plazo de 10 dias hábiles a contar desde el siguiente a su regreso, en su Centro de I+D de adscripción, quien deberá conservar la documentación justificativa a los efectos de auditoria o comprobación.

MINISTERIO
DE ECONOMÍA Y
COMPETITIVIDAD

SECRETARÍA DE ESTADO DE INVESTIGACIÓN DESARROLLO E INNOVACIÓN

SECRETARÍA GENERAL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN

DIRECCIÓN GENERAL DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE RECURSOS HUMANOS PARA LA INVESTIGACIÓN

AYUDAS A LA MOVILIDAD PREDOCTORAL PARA LA REALIZACIÓN DE ESTANCIAS BREVES EN CENTROS DE I+D ESPAÑOLES Y EXTRANJEROS 2013

MEMORIA A REALIZAR DESPUÉS DE FINALIZAR LA ESTANCIA BREVE

Apellidos, nombre: Burgueño Caballero, Dolores	NIF/NIE: 25346121Y
Referencia de la ayuda: BES-2012-057064	Referencia del proyecto: TIN2011-23795
Centro de I+D de la ayuda FPI: Universidad de Málaga	
Centro de I+D receptor: University of Alabama	

Indique las actividades realizadas y los resultados obtenidos en el centro receptor.

La tesis doctoral se enmarca en el campo del Desarrollo de Software Dirigido por Modelos (DSDM) y el objetivo que persigue es la escalabilidad y eficiencia en la ejecución de las transformaciones de modelos. El problema que motiva la tesis doctoral es que, a pesar de que las máquinas y las arquitecturas actuales permiten almacenar modelos en la nube y ejecutar en paralelo dichas transformaciones de modelos, hasta el momento no hay ningún lenguaje de transformación de modelos ni ninguna herramienta disponible para ello.

Con anterioridad a la estancia, se trabajó en una plataforma de ejecución concurrente y distribuida, llamada LinTra, y en la representación de modelos para la misma. Durante el periodo de esta estancia, se ha definido un conjunto mínimo de operadores (primitivas) necesario para (re)construir cualquier lenguaje de transformación de modelos out-place y unidireccional. Cada una de las primitivas encapsula el código LinTra de bajo nivel necesario para ejecutar cierta funcionalidad. De este modo, los lenguajes de alto nivel existentes podrán ser compilados a este conjunto de primitivas y por tanto, los modelos, ya se encuentren distribuidos o no, podrían ser transformados en paralelo con LinTra.

Durante el periodo de la estancia se ha trabajado con el grupo visitante en las siguientes publicaciones que están pendientes de aceptación:

- Primitive Operators for the Concurrent Execution of Model Transformations Based on LinTra. Loli Burgueño, Eugene Syriani, Manuel Wimmer, Jeff Gray, Antonio Vallecillo. Enviado a XIV Jornadas en Ingeniería del Software y Bases de Datos (JISBD 2014).
- LinTraP: Primitive Operators for the Execution of Model Transformations with LinTra. Loli Burgueño, Eugene Syriani, Manuel Wimmer, Jeff Gray, Antonio Vallecillo. Enviado al II International Workshop on Big MDE (BigMDE 2014) junto con STAF 2014

En Málaga a, 26 de Mayo de 2014

(Lugar, fecha y firma)

Este informe, junto con el certificado de realización de estancia del centro receptor, deberá presentarse en el plazo de 10 días hábiles a contar desde el siguiente a su regreso, en su Centro de I+D de adscripción, quien deberá conservar la documentación justificativa a los efectos de auditoría o comprobación.

Vanderbilt University (EEUU)

MINISTERIO
DE ECONOMÍA
Y COMPETITIVIDAD

SECRETARÍA DE ESTADO DE INVESTIGACIÓN
DESARROLLO E INNOVACIÓN

SECRETARÍA GENERAL DE CIENCIA,
TECNOLOGÍA
E INNOVACIÓN

DIRECCIÓN GENERAL DE INVESTIGACIÓN
CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE RECURSOS
HUMANOS PARA LA INVESTIGACIÓN

TO WHOM IT MAY CONCERN

Since 2012, BURGUEÑO CABALLERO, DOLORES has been granted a fellowship of the Programme for the Training of Researchers of the Ministry of Economy and Competitiveness of Spain, whose monthly gross income is 1368,5€.

He/She has applied for an aid for a 120 days stay in UNITED STATES OF AMERICA during the year 2016, and this application has been favourably informed.

The grant for that aid is 6280 € for travel (1000€) and other expenses (5280€), being this aid compatible with the reception of the monthly income provided by his/her fellowship.

During his/her stay in UNITED STATES OF AMERICA the fellow will be covered by the insurance policy for accidents and medical assistance signed by the Ministry of Economy and Competitiveness of Spain.

THE TECHNICAL ADVISOR

Gemma Espinosa Expósito

MINISTERIO
DE ECONOMÍA
Y COMPETITIVIDAD

SECRETARÍA DE ESTADO DE INVESTIGACIÓN
DESARROLLO E INNOVACIÓN
SECRETARÍA GENERAL DE CIENCIA,
TECNOLOGÍA E INNOVACIÓN
DIRECCIÓN GENERAL DE INVESTIGACIÓN
CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE RECURSOS
HUMANOS PARA LA INVESTIGACIÓN

AYUDAS A LA MOVILIDAD PREDOCTORAL PARA LA REALIZACIÓN DE ESTANCIAS BREVES EN CENTROS DE I+D ESPAÑOLES Y EXTRANJEROS 2016

CERTIFICADO DE REALIZACIÓN DE ESTANCIA BREVE

Apellidos, nombre: Burgueño Caballero, Dolores	NIF/NIE: 25346121Y
Referencia de la ayuda: EEBB-I-16-10799	Referencia del proyecto: TIN2011-23795
Centro de I+D de la ayuda predoctoral: Universidad de Málaga	
ORGANISMO DE I+D RECEPTOR: Vanderbilt University	
CENTRO: School of Engineering / Institute for Software Integrated Systems	
DEPARTAMENTO: -	
PAÍS: Estados Unidos de América	

El abajo firmante certifica que el/la investigador/a en formación a quien se refiere el presente documento ha permanecido en el centro de trabajo desde el día 2 de mayo de 2016 hasta el día 31 de julio de 2016 (*)

Nombre y apellidos del firmante: Gabor Karsai
Cargo: Responsable del centro I+D receptor
Fecha: 21 de julio de 2016

Gabor Karsai

KRISTY M KRUSE
STATE OF TENNESSEE NOTARY PUBLIC
DAVIDSON COUNTY

State of: Tennessee
County of: Davidson
Subscribed and sworn to before me this 1st day of August in the year 2016
Kristy M. Kruse
Kristy M. Kruse, Notary Public
My Commission Expires March 6, 2018

Firma y sello

(*) TO BE COMPLETED BY THE HOST RESEARCH DIRECTOR
The undersigned certifies that the scholar has remained in this centre from 2 of May of 2016 until 31 of July of 2016.

Este informe, junto con la memoria de la estancia, una vez cargados en la aplicación de justificación, deberá presentarse en el plazo de 10 días hábiles a contar desde el siguiente a su regreso, en su Centro de I+D de adscripción, quien deberá conservar la documentación justificativa a los efectos de auditoría o comprobación.

MINISTERIO
DE ECONOMÍA Y
COMPETITIVIDAD

SECRETARÍA DE ESTADO DE INVESTIGACIÓN
DESARROLLO E INNOVACIÓN

SECRETARÍA GENERAL DE CIENCIA, TECNOLOGÍA
E INNOVACIÓN

DIRECCIÓN GENERAL DE INVESTIGACIÓN
CIENTÍFICA Y TÉCNICA

SUBDIRECCIÓN GENERAL DE RECURSOS
HUMANOS PARA LA INVESTIGACIÓN

AYUDAS A LA MOVILIDAD PREDOCTORAL PARA LA REALIZACIÓN DE ESTANCIAS BREVES EN CENTROS DE I+D ESPAÑOLES Y EXTRANJEROS 2015

MEMORIA A REALIZAR DESPUÉS DE FINALIZAR LA ESTANCIA BREVE

Apellidos, nombre: Burgueño Caballero, Dolores	NIF/NIE: 25346121Y
Referencia de la ayuda: EEBB-I-16-10799	Referencia del proyecto: TIN2011-23795
Centro de I+D de la ayuda predoctoral: Universidad de Málaga	
Centro de I+D receptor: Vanderbilt University	

Indique las actividades realizadas y los resultados obtenidos en el centro receptor.

La presente tesis doctoral, enmarcada en el campo del Desarrollo de Software Dirigido por Modelos (DSDM), persigue la mejora en la escalabilidad y eficiencia en la ejecución de las transformaciones de modelos. El problema que la motiva es que, a pesar de que las máquinas y las arquitecturas actuales permiten almacenar modelos en la nube y ejecutar en paralelo y de forma distribuida dichas transformaciones de modelos, hasta el momento únicamente hay trabajos preliminares y propuestas teóricas que intentan resolver alguno de los sub-problemas que se plantean pero no hay ningún lenguaje de transformación de modelos maduro ni ninguna herramienta disponible para ello.

Con anterioridad a la estancia, se trabajó en una plataforma de ejecución concurrente y distribuida, llamada LinTra, y en la representación de modelos para la misma. En [1] se describe dicha plataforma y se prueba que su rendimiento supera en la mayoría de los casos a todos los motores de ejecución más usados en práctica.

El grupo de la Universidad Vanderbilt cuenta con un entorno de modelado web llamado WebGME (webgme.org). La herramienta soporta la edición de modelos de forma colaborativa, el control de versiones, la visualización personalizada, etc. pero no proveía los mecanismos correspondientes para la transformación de modelos.

Durante la estancia se han adaptado los conceptos de LinTra a la herramienta WebGME y se ha creado un motor de ejecución para la misma. Para ello, ha sido necesario salvar los requisitos de diseño impuestos por WebGME que en ocasiones eran contrarios a las bases de LinTra y buscar la alternativa más adecuada. Por ejemplo, LinTra asigna a cada entidad del modelo un identificador único con un formato específico que usa para guardar las trazas de forma implícita durante el proceso de transformación, mientras que WebGME también usa identificadores con el propósito de organizar la jerarquía de elementos pertenecientes a los modelos. Al tener los identificadores formatos incompatibles en LinTra y en WebGME, ha sido necesario extender el enfoque planteado en LinTra y añadir al motor de ejecución para WebGME una nueva estructura de datos que permite almacenar las trazas de forma explícita.

Tanto el motor de ejecución de LinTra como el de WebGME están implementados usando lenguajes de propósito general: Java y JavaScript respectivamente. Aunque sería posible desarrollar una transformación de modelos en dichos lenguajes, sería tedioso y requeriría que el desarrollador conociera exhaustivamente el lenguaje y todos los detalles de implementación de la plataforma. Para evitar estos impedimentos, en general, las transformaciones de modelos suelen ser escritas usando lenguajes de dominio específico (DSL). Por este motivo, se ha diseñado un prototipo de un lenguaje de dominio específico inspirado en lenguajes existentes como ATL (http://www.eclipse.org/atl/atlTransformations/) o ETL (http://www.eclipse.org/epsilon/doc/etl/) que comparte características con estos lenguajes como el uso del estándar de la OMG OCL (http://www.omg.org/spec/OCL/) o el hecho de que las transformaciones estén compuestas por reglas. Entre las diferencias podemos destacar la sintaxis y la semántica de algunas operaciones, además de la incorporación de nueva funcionalidad como la opción de que los filtros de las reglas sean o no exclusivos, es decir, que un mismo elemento pueda ser transformado por una y solo una regla o por el contrario por varias reglas.

Para la creación del lenguaje de dominio específico para la transformación de modelos se ha hecho uso del framework Xtext (https://eclipse.org/Xtext/). Xtext proporciona un lenguaje para definir la gramática del lenguaje y además incorpora Xtend que es un lenguaje basado en plantillas (template-based) que es usado como generador de texto para crear el compilador desde nuestro lenguaje hasta el correspondiente código JavaScript que es finalmente ejecutado por WebGME.

Hasta el momento únicamente se ha creado el compilador para el motor de transformaciones WebGME pero se prevé crear el correspondiente para LinTra y publicarlo en algún congreso de calidad o bien en una revista de los cuartiles primero o segundo.

[1] Loli Burgueño, Manuel Wimmer, Antonio Vallecillo, A Linda-based platform for the parallel execution of out-place model transformations. Information and Software Technology, Volume 79, November 2016, Pages 17-35.

En Málaga a, 9 de agosto de 2016

(Lugar, fecha y firma)

Este informe, junto con el certificado de realización de estancia del centro receptor, una vez cargados en la aplicación de justificación, deberán presentarse en el plazo de 10 días hábiles a contar desde el siguiente a su regreso, en su Centro de I+D de adscripción, quien deberá conservar la documentación justificativa a los efectos de auditoría o comprobación.

b. OTROS MÉRITOS RELACIONADOS CON LA MOVILIDAD DEL PROFESORADO

Visita corta a TU Wien en 2013 (10 días, invitada por el profesor Manuel Wimmer)

TECHNISCHE
UNIVERSITÄT
WIEN

March 27, 2018

To whom it may concern,

This letter is to confirm that I, Prof. Manuel Wimmer, and the Business Informatics Group at TU Wien invited Dr. Loli Burgueño to visit our institution covering all her travel and accommodation expenses from December 03, 2013 until December 13, 2013.

During her visit we worked on topics related to her PhD thesis in the context of Model-Driven Engineering. Her visit helped strengthen the past and current collaborations between our two research groups and resulted into a series of publications in competitive venues and journals.

Sincerely,

Prof. Dr. Manuel Wimmer

Visita corta a TU Wien en 2017 (17 días, financiada por el proyecto COST IC1404)

Short Term Scientific Report COST_IC1404

Title of the STMS: Integrating units, precision and uncertainty in software models
Working Group: 1 (Foundations)
Beneficiary: Loli Burgueño, University of Málaga, Spain
Host: Manuel Wimmer, TU Wien, Austria
Period: March 15 - March 22, 2017
Reference code: COST-STSM-ECOST-STSM-IC1404-200317-083908

1. Initial purpose of the visit

The visit was planned to carry out discussions about further research to extend UML/OCL software models to support the representation of elements of cyber-physical systems. Both the host and the applicant institution were previously working on this topic.

By the moment in which the STSM started, the two research groups had already created a prototype of a library extending the type *Real* and providing operations for specifying and performing computations with measurement uncertainty and units in attributes representing properties of entities of the physical world. This prototype had been implemented for USE, OCLinEclipse and SysML.

2. Description of the work carried out during the STSM

During this STSM, we worked on concrete models of CPS to discuss what needs to be added to our proposal to make it more complete and concise. Apart from our own experience, when designing our solution, we took into account the experience and feedback from people from companies such as Siemens (which we also met thanks to this COST project). With all these insights, after several sessions of discussions we came up with different possible optimizations for our proposal.

First of all, we saw the need to include magnitudes to our measures so that quantities can be represented not only base units (meters, seconds, etc.) but also in the different orders of magnitudes (kilometers, centimeters, milliseconds, etc.). Then, we discussed the way to apply operations such as the multiplication or the addition of two quantities represented in different orders of magnitude.

Apart from gaining expressiveness, the use of magnitudes helps solve the problem of the precision of the values. When a CPS uses very small of very large numbers, an important problem that arises is whether the software systems and/or platforms in which they are being modelled are precise enough to represent them or whether there will be some data loss due to the rounding. Representing a number in the proper order of magnitude can avoid this data loss.

We also extended our approach to consider, not only SI units, but also the units defined in the ISO/IEC 80000, which includes types to represent data storage information, the entropy of an information system, traffic intensity, etc.

We have deeply studied existing cases studies provided by SysML and MARTE and have detected inconsistencies regarding the type system. We plan to replace their type system by ours and prove the improvements that our approach provides to their solutions. We have also worked on the definition of new case studies in order to cover all the aspects that can appear in different situations and/or systems.

We have also discussed several lines of future work such as including uncertainty in Boolean values, for instance, to be able to say what is the reliability with which we can affirm that two uncertain values are equal. That would need the inclusion of fuzzy logic functions.

Although not directly related to CPS but related to modelling, we have also developed ideas to create a compiler from the model transformation language ATL to the efficient model transformation engine LinTra and to automatically generate classifying terms for testing model transformations.

3. Description of the main results obtained

As the results of this STSM we can highlight our fruitful discussions in which we came up with a solution for problems we already were aware of and, the definition of new lines of work to improve and extend our proposal.

In a more technical level, the software products implemented during this visit are the extension of our library of units in order to support magnitudes and the units defined in the ISO/IEC 800000 and, the case studies that we have selected and created to prove the effectiveness of our approach.

4. Future collaboration with the host institution (if applicable)

As we have been doing since 2012, we plan to continue working together as we consider that our research is being fruitful. This report already mentioned the future work on which we plan to work next.

5. Foreseen publications/articles and other contributions (e.g., tools, software, etc.) resulting from the STSM (if applicable)

We have decided to submit the work about units once it is ready to a good quality journal, in concrete to Information & Software Technology, which is indexed in the first quartile of the Journal Citation Report (JCR) with an impact of 1,569 in 2015.

The mapping from ATL to LinTra will be submitted to Transaction on Software Engineering, a journal indexed in the JCR with an impact factor of 1,614 in 2014.

Finally, the work about classifying terms will be submitted to a workshop.

6. Confirmation by the host institution of the successful execution of the STSM

I, Manuel Wimmer, confirm that we have realized our goals concerning the following topics: (i) extension of the unit metamodel for computer science related quantities, (ii) conceptual framework to reason about uncertain values in comparison operations, (iii) establishment of mappings between ATL and Lintra concepts, (iv) reformulation of classifying terms development as an optimization problem.

I also confirm that the next steps will be publishing our results in two journal publications (i+ii)(iii) as well as a workshop publication (iv).

7. Other comments (if any)

4. OTROS MÉRITOS RELACIONADOS CON LA ACTIVIDAD INVESTIGADORA

a. Organizadora de eventos científicos

A continuación se listan los eventos organizados y el rol llevado a cabo. Los justificantes se han adjuntado en la sección de Congresos.

- Estudiante voluntario en MODELS'13
- Estudiante voluntario en MODELS'14
- Organizadora local de la reunión en Málaga del proyecto científico COST Action IC1404 en 2016
- Organizadora local del congreso ICSOC'17
- PhD Symposium chair del congreso ICSOC'17
- Educators Symposium chair en el congreso MODELS'18
- Organizadora del workshop MDE Intelligence 2019
- Chair del Junior Researcher Community (JCR) event junto con STAF'19
- Organizadora del workshop MDE Intelligence 2020
- Publicity chair en SLE'20
- Workshop chair en STAF'20
- PC Chair de ECMFA'20
- Organizadora del taller ISDM en las XXV Jornadas de Ing. del Software y Bases de Datos (JISBD'21) organizadas anualmente por SISTEDES
- Responsable de Comunicación y redes sociales del VI Congreso Español de Informática (CEDI 20/21)
- Student Volunteer chair en MODELS'21
- Coummunication co-chair de STAF'21
- Chair de la ACM Student Research Competition en MODELS'22
- PC chair de SLE'22

b. Editora de monografías

A continuación se listan las monografías y actas de congresos editadas. Los justificantes se han adjuntado en la sección de Congresos.

- Editora de las actas del congreso ICSOC'2017
- Proceedings chair (es decir, editora de las actas) de MODELS'17
- Proceedings chair (es decir, editora de las actas de los eventos satélite) de MODELS'18
- Proceedings chair (es decir, editora de las actas) de MODELS'19
- Editora de las actas de STAF'19
- Editora de las actas de STAF'20

c. Miembro de la Editorial Board de la revista SoSyM

La revista Software and Systems Modeling (SoSyM) está indexada en el segundo cuartil del JCR en la categoría de ingeniería del software. Prueba de este mérito es que dicha información está disponible en la web de SoSyM: `https://www.sosym.org/`

Software and Systems Modeling
https://doi.org/10.1007/s10270-021-00871-4

EDITORIAL

SoSyM reflections: the 2020 "State of the Journal" report

Huseyin Ergin[1] · Jeff Gray[2] · Bernhard Rumpe[3] · Martin Schindler[3]

When writing the "2019 State of the Journal Report" at this same time last year, we could not have predicted the global changes that would beset us with so many challenges from the emergence of the COVID-19 pandemic. Some of us lost loved ones, friends, and colleagues, while the entire world adapted to working from home, participating in remote classrooms, and adopting safety precautions as a new means of daily life. The research community was also affected, with the cessation of travel leading to virtual conferences. Thanks to the heroic efforts of many conference chairs[1] adapting to the quick pace of change, scientific discussions continued, but sometimes in a less personable form. Journals also experienced changes with submissions on the rise, but fewer reviewers available to assist with the evaluation because of personal challenges faced by many.

Yet, in the presence of a global pandemic, scientific contributions continued in the software and systems modeling community. The number of SoSyM submissions over the past year saw an increase, while the general health of the journal remains strong. Measures put in place recently, such as the second year of moving to six issues per year, have helped to reduce the time to publication significantly. The Open Access movement is also progressing, with Springer announcing new initiatives to make SoSyM publications more accessible to a broader community of researchers. The rest of this editorial summarizes the progress made by the journal during this unprecedented situation.

Our hope is that you remain safe and have a productive 2021!

1 2020 summary statistics

The six SoSyM issues published in 2020 contained 17 Regular papers, 33 Special Section papers, 6 Theme Section papers, 4 Expert Voices, and 9 Guest Editorials. In total, 1587 pages were published in volume 19.

We are very happy to report that the 2-year Impact Factor (IF) for SoSyM continues to be very respectable at 1.876 (previously at 2.66 in 2019 and 1.722 in 2018), with the 5-year IF holding at 1.915. Furthermore, the h-5 Google Scholar ranking places SoSyM at #12 among all conferences and journals related to software engineering and programming languages.

There are two new positive "records" set for SoSyM in 2020 related to submissions and downloads. Over the past year, SoSyM received 372 submissions—the largest number for any year in our history (over 100 submissions over the average of the past three years). Furthermore, at the time of this writing, there were over 164,316 downloads from January through the end of November 2020. This is well beyond the 2019 download numbers (which was also a record at that time) of 136,378. These two observations suggest the growing interest in SoSyM among the research community.

The acceptance rate in 2020 was 19%, which is a respectable rate for a high-quality journal such as SoSyM. The average time from submission to the final decision (accept or reject) has slightly increased to 146 days (128 days in 2019 and 138 days in 2018).

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1 The modeling community is indebted to the efforts of Eugene Syriani and Houari Sahraoui in hosting MODELS 2020 as a virtual conference.

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2 SoSyM's ten-year most influential paper Awards

MODELS 2020 was originally planned to be held in Montreal, Canada, but due to the safety concerns with COVID-19, the conference was held virtually in October 2020. We thank the MODELS 2020 organizers (Eugene Syriani and Houari Sahraoui) and the PC co-Chairs (Silvia Abrahão and Juan de Lara) for collaborating with SoSyM. We were able to host another awards session with paper presentations of the Best SoSyM Papers over the past 10 years during a special virtual session of MODELS 2020. The selection was based on the ISI citation index among papers published in SoSyM since 2010. More information about the awards can be found at: http://www.sosym.org/awards/.

The **SoSyM 2020 "Ten-year most influential Regular paper award"** was given to:

Jeff Offutt and Ye Wu, "Modeling presentation layers of web applications for testing," In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 9, Issue 2, pp. 257–280, Springer, April 2010.

https://doi.org/10.1007/s10270-009-0125-4

The **SoSyM 2020 "Ten-year most influential Theme Section paper award"** was given to:

Nicolas Anquetil, Uira Kulesza, Ralf Mitschke, Ana Moreira, Jean-Claude Royer, Andreas Rummler, and Andre Sousa, "A model-driven traceability framework for software product lines," In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 9, Issue 4, pp. 427–451, Springer, September 2010.

https://doi.org/10.1007/s10270-009-0120-9

2.1 SoSyM's Journal-First papers at MODELS 2020

The continuous collaboration between SoSyM and the MODELS conference in organizing the SoSyM "Journal-First" was successfully continued. This enables authors of recent SoSyM papers to present their work across the core conference sessions at MODELS. Through this collaboration, SoSyM authors have the opportunity to reach a broader audience to present their work. This also benefits the MODELS conference program by including research talks that explore more depth through analytical and empirical evidence than can be presented in a traditional conference submission. The virtual nature of MODELS 2020 allowed for more SoSyM papers to be selected for presentation. At MODELS 2018, four articles were presented. At MODELS 2019, we increased this number to seven articles and at MODELS 2020 to ten articles (papers that were accepted from July 2019 through June 2020). The SoSyM "Journal-First" papers presented at MODELS 2020 were the following (note: Some of the papers are available online but have not yet received an assignment to an issue):

- Yinling Liu, Tao Wang, Haiqing Zhang, and Vincent Cheutet. "An improved approach on the model checking for an agent-based simulation system." In: *Journal on Software and Systems Modeling (SoSyM)*, Springer, in press, 2020. https://doi.org/10.1007/s10270-020-00807-4
- Simin Cai, Barbara Gallina, Dag Nyström, and Cristina Seceleanu. "Specification and automated verification of atomic concurrent real-time transactions." In: *Journal on Software and Systems Modeling (SoSyM)*, Springer, in press, 2020. https://doi.org/10.1007/s10270-020-00819-0
- Karim Jahed, Mojtaba Bagherzadeh, and Juergen Dingel. "On the benefits of file-level modularity for EMF models." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 20, Issue 1, Springer, January 2021. https://doi.org/10.1007/s10270-020-00804-7
- Stefan Götz, Matthias Tichy, and Raffaela Groner. "Claimed Advantages and Disadvantages of (dedicated) Model Transformation languages: A Systematic Literature Review." In: *Journal on Software and Systems Modeling (SoSyM)*, Springer, in press, 2020. https://doi.org/10.1007/s10270-020-00815-4
- Anthony Anjorin, Thomas Buchmann, Bernhard Westfechtel, Zinovy Diskin, Zinovy, Hsiang-Shang Ko, Romina Eramo, Georg Hinkel, Leila Samimi-Dehkordi, and Albert Zuendorf. "Benchmarking bidirectional transformations: theory, implementation, application, and assessment." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 3, pp. 647–691, Springer, May 2020. https://doi.org/10.1007/s10270-019-00752-x
- Milena Guessi, Flavio Oquendo, and Elisa Yumi Nakagawa. "Ark: A constraint-based method for architectural synthesis of smart systems." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 3, pp.

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741–762, Springer, May 2020. https://doi.org/10.1007/s10270-019-00764-7

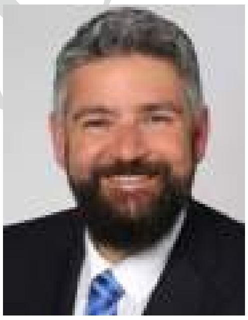
- Enyo Gonçalves, Camilo Almendra, Miguel Goulão, João Araújo, and Jaelson Castro. "Using empirical studies to mitigate symbol overload in iStar extensions." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 3, pp. 763–784, Springer, May 2020. https://doi.org/10.1007/s10270-019-00770-9
- Nicolas Hili, Mojtaba Bagherzadeh, Karim Jahed, and Juergen Dingel. "A model-based architecture for interactive run-time monitoring." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 4, pp. 959–981, Springer, July 2020. https://doi.org/10.1007/s10270-020-00780-y
- Juan C. Vidal, Paulo Carreira, Vasco Amaral, Joao Aguiam, and João Sousa. "Towards high-level fuzzy control specifications for building automation systems." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 3, pp. 625–646, Springer, May 2020. https://doi.org/10.1007/s10270-019-00755-8
- Bence Graics, Vince Molnár, András Vörös, István Majzik, and Dániel Varró. "Mixed-semantics composition of statecharts for the component-based design of reactive systems." In: *Journal on Software and Systems Modeling (SoSyM)*, Volume 19, Issue 6, pp. 1483–1587, Springer, November2020. https://doi.org/10.1007/s10270-020-00806-5

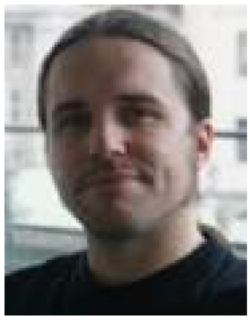
3 Changes to the editorial board

Each year, Editors who served the SoSyM community for many years retire from the SoSyM Editorship with distinction of service and our deep appreciation. In 2020, Dorina Petriu announced that she desired to step down as an Editor after many years of service. Thanks Dorina for all of your contributions to SoSyM!

As mentioned earlier in this report, SoSyM received a record number of submissions this year (372), which requires us to grow the Editorial Board. We are very happy to welcome the following new SoSyM Editors and look forward to working with them in the future.







Loli Burgueño	Jan Ringert	Andreas Wortmann	Tao Yue	Steffen Zschaler

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4 Reviewers in 2020

A strong research community depends on the efforts of volunteers who help serve as reviewers. The software and systems modeling community has always risen to the request for help from SoSyM. We appreciate all of the help that the reviewers provided in service to the modeling community! We would also like to offer special recognition to the following reviewers, who were recommended as the SoSyM Best Reviewers of 2020, based on the technical depth and feedback provided to authors over the past year—congratulations! We will send a certificate of recognition to each of the following reviewers:

Juergen Dingel, Antonio García-Domínguez (twice!), Marcus Gerhold, Mario Gleirscher, Sylvain Hallé, Stefan Klikovits, Thomas Kühne, Hugo A. López, Florian Matthes, Libero Nigro, Bentley Oakes, Stefan Sauer, Harald Störrle, Valentín Valero, Steven van Kervel, and Simon Van Mierlo.

Below is a list of those who reviewed one or more papers for the journal in the last year. The complete list of reviewers can also be found on our website http://www.sosym.org/people/.

Rasmus Adler, Paulo Alencar, Ian Alexander, Joao Paulo Almeida, Ahmad Salim Al-Sibahi, Juliana Alves Pereira, Vasco Amaral, Elske Ammenwerth, Moussa Amrani, Daniel Amyot, Kelly Androutsopoulos, Anthony Anjorin, Muhammad Anwar, Vincent Aranega, Joao Araujo, Paolo Arcaini, Chetan Arora, Cyrille Artho, Wesley K. G. Assuncao, Colin Atkinson, Vanessa Ayala-Rivera, Thomas Baar, Onder Babur, Mojtaba Bagherzadeh, Mira Balaban, Torsten Bandyszak, Luciano Baresi, Kamel Barkaoui, Jiri Barnat, Angela Barriga, Francesco Basciani, María Bastarrica, Dinesh Batra, Steffen Becker, Mitra Tabaei Befrouei, David Benavides, Luca Berardinelli, Gabor Bergmann, Simona Bernardi, Ilia Bider, Robert Bill, Olivier Biot, Karsten Boehm, Francis Bordeleau, Dominik Bork, Artur Boronat, Saida Boukhedouma, Frederic Boulanger, Erwan Bousse, Drazen Brdjanin, Uwe Breitenbuecher, Ruth Breu, Jean-Michel Bruel, Davide Brugali, Hugo Bruneliere, Andrea Burattin, Erik Burger, Loli Burgueño, Arvid Butting, Cristina Cabanillas, Josè Campos, Laurent Capocchi, Jan Carlson, Victorio Carvalho, Roberto Casadei, Ana Cavalcanti, Graziana Cavone, Moharram Challenger, Mohammad Chami, Michel Chaudron, Franck Chauvel, Stanislav Chren, Antonio Cicchetti, Federico Ciccozzi, Robert Clarisó, Tony Clark, Peter Clarke, Manuel Clavel, Rolland Colette, Nelly Condori-Fernández, Maxime Cordy, Carl Corea, Mario Cortes-Cornax, Jesús Sánchez Cuadrado, Alberto da Silva, Fabiano Dalpiaz, Marian Daun, Nancy Day, Alfonso de la Vega, Juan de Lara, Romulo De Oliveira, Julien DeAntoni, Patrick Delfmann, Romain Demangeon, Joerg Desel, Xavier Devroey, Juri Di Rocco, Davide Di Ruscio, Marcos Didonet Del Fabro, Aleksandar Dimovski, Crystal Din, Juergen Dingel, Zinovy Diskin, Lydie Du Bousquet, Francisco Duran, Alexander Egyed, Maged Elaasar, Eduard Enoiu, Romina Eramo, Huseyin Ergin, Maria Escalona, Lorenz Esch, Elisabet Estevez, Bedilia Estrada, Dirk Fahland, Michalis Famelis, Anna Rita Fasolino, Andreas Fellner, Peter Fettke, Barabara Fila, Hans-Georg Fill, John Fitzgerald, Ulrich Frank, Martin Fränzle, Agnès Front, Frederik Gailly, Antonio García-Domínguez, Gregory Gay, Sebastien Gerard, Marcus Gerhold, Mario Gleirscher, Martin Gogolla, Aniruddha Gokhale, Thomas Goldschmidt, Claudio Gomes, Cesar Gonzalez-Perez, Catarina Gralha, Peter Green, Joel Greenyer, Paul Grefen, Raffaela Groner, Georg Grossmann, Lars Grunske, Esther Guerra, Renata Guizzardi, Jens Gulden, Jin Guo, Simon Hacks, Sylvain Hallé, Stefan Hallerstede, Oystein Haugen, Jane Hayes, Xiao He, Regina Hebig, Reiko Heckel, Constance Heitmeyer, Loic Helouet, Martin Henkel, James Hill, Georg Hinkel, Nico Hochgeschwender, Jennifer Horkoff, Christopher Hoyle, Ludovico Iovino, Muhammad Zohaib Iqbal, Karim Jahed, Amin Jalali, Phillip James, Cyrille Jegourel, Manfred A. Jeusfeld, Christian Johansen, Monika Kaczmarek, Bernhard Kaiser, Sungwon Kang, Dimitris Karagiannis, Gabor Karsai, Evangelia Kavakli, Timo Kehrer, Udo Kelter, Wael Kessentini, Djamel Eddine Khelladi, Ferhat Khendek, Marite Kirikova, Stefan Klikovits, Alexander Knapp, Jan Kofron, Shekoufeh Kolahdouz-Rahimi, Dimitrios Kolovos, Dimitris Kolovos, Harald König, Nikolai Kosmatov, Stefan Kugele, Thomas Kühne, Akhil Kumar, Katsiaryna Labunets, Yngve Lamo, Kevin Lano, Xavier Le Pallec, Choonhwa Lee, Henrik Leopold, Shuai Li, Sotirios Liaskos, Crescencio Lima, Lukas Linsbauer, Guanjun Liu, Malte Lochau, Hugo A. López, Ernesto López-Mellado, Florian Lorber, Mass Soldal Lund, Fernando Macías, Frédéric Mallet, Beatriz Marín, Andrea Marrella, Florian Matthes, Raimundas Matulevicius, Claudio Menghi, Gergely Mezei, Faida Mhenni, Judith Michael, Miguel Mira da Silva, Raffaela Mirandola, Michael Möhring, Brice Morin, Sebastien Mosser, Christian Moya, Seyyedeh Atefeh Musavi, Gunter Mussbacher, Andreas Naderlinger, Pascal Négros, Bernd Neumayr, Phu Nguyen, Phuong Nguyen, Libero Nigro, Alexander

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Nolte, Arne Nordmann, Markus Nüttgens, Bentley Oakes, Peter Ölveczky, Andreas Opdahl, Mert Ozkaya, Richard Freeman Paige, Marc Pantel, Jovanka Pantovic, Nick Papoulias, Raul Pardo, Chris Partridge, Oscar Pastor, Patrizio Pelliccione, David Pereira, Diego Perez-Palacin, Barbara Pernici, Justyna Petke, Alfonso Pierantonio, Ingo Pill, Elias Pimenidis, Geert Poels, Pascal Poizat, Fiona Polack, Gregor Polančič, Luigi Pomante, Saheed Popoola, Sam Procter, Luise Pufahl, Ahsan Qamar, Truong Ho Quang, Ansgar Radermacher, Akshay Rajhans, Alexander Raschke, Muhammad Rashid, Daniel Ratiu, Gil Regev, Gianna Reggio, Manfred Reichert, Hajo Reijers, Wolfgang Reisig, Guizzardi Renata, Jan Oliver Ringert, Roberto Rodríguez-Echeverría, Marcela Ruiz, Adrian Rutle, Renaud Rwemalika, Aymen Saied, Gwen Salaun, Cesar Sanchez, Jesús Sánchez Cuadrado, Kurt Sandkuhl, Alceste Scalas, Axel Scheithauer, Johannes Schobel, Stefan Schönig, Ulrik Schultz, Christoph Schütz, Cristina Seceleanu, Ed Seidewitz, Lionel Seinturier, Bran Selic, Sagar Sen, Eltefaat Shokri, Natalia Sidorova, Anthony Simons, Monique Snoeck, Stefan Sobernig, Pnina Soffer, Hui Song, Wei Song, Matthew Stephan, Janis Stirna, Volker Stolz, Harald Störrle, Eleni Stroulia, Daniel Strüber, Patrick Stünkel, Arnon Sturm, Andreas Symeonidis, Eugene Syriani, Gabor Szarnyas, Jérémie Tatibouet, Michael Tautschnig, Ramin Tavakoli Kolagari, Martin Thibault, Matthias Tichy, Ulyana Tikhonova, Massimo Tisi, Saurabh Tiwari, Jake Tom, Hanh Nhi Tran, Javier Troya, Christos Tsigkanos, Valentín Valero, Antonio Vallecillo, Han van der Aa, Steven van Kervel, Simon Van Mierlo, Irene Vanderfeesten, Juan Manuel Vara, Tullio Vardanega, Daniel Varro, Gabriel Wainer, Pengyuan Wang, Barbara Weber, Ron Weber, Heike Wehrheim, Marco Wehrmeister, Jun Wei, Andrew Weinert, Georg Weissenbacher, Bernhard Westfechtel, Anton Wijs, Manuel Wimmer, Karsten Wolf, Uwe Wolter, Murray Woodside, Andreas Wortmann, Franz Wotawa, Jin-Long Wu, Sobhan Yassipour-Tehrani, Sira Yongchareon, Shin Yoo, Bahman Zamani, Anna Zamansky, Jelena Zdravkovic, Bernard P. Zeigler, Man Zhang, Alois Zoitl, Athanasios Zolotas, Steffen Zschaler, and Albert Zuendorf.

5 Contents of this issue

The contents of this issue are as follows:

1. **Expert's Voice**
   - "The triptych of conceptual modeling—A framework for a better understanding of conceptual modeling" by Heinrich C. Mayr and Bernhard Thalheim
2. **EMMSAD 2019 Special Section**
   - Guest Editors: Iris Reinhartz-Berger and Jelena Zdravkovic
3. **Regular Papers**
   - "Generation of hazard relation diagrams: Formalization and tool support" by Bastian Tenbergen and Thorsten Weyer
   - "A framework for automated multi-stage and multi-step product configuration of cyber-physical systems" by Safdar Aqeel Safdar, Hong Lu, Tao Yue, Shaukat Ali, and Kunming Nie
   - "On the benefits of file-level modularity for EMF models" by Karim Jahed, Mojtaba Bagherzadeh, and Jürgen Dingel

We wish you a Happy New Year with the hope that you enjoy reading the papers in this issue!

Huseyin Ergin, Jeff Gray, Bernhard Rumpe, and Martin Schindler

Funding Open Access funding enabled and organized by Projekt DEAL.

Journal : Large 10270 | Article No : 871 | Pages : 5 | MS Code : 871 | Dispatch : 12-2-2021

d. Revisión de artículos de revistas indexadas

Se adjunta justificante de la web Publons. La mayoría de estas revistas están indexadas en el primer y segundo cuartil del JCR (p.ej., TSE, EMSE, IST, SoSyM, etc.).

Publons CV
Prepared by Publons on January 27th 2021

Loli Burgueño

https://publons.com/researcher/L-3817-2014/
Web of Science ResearcherID: L-3817-2014
ORCiD: 0000-0002-7779-8810

Current affiliations:

- Internet Interdisciplinary Institute (IN3), Open University of Catalonia (UOC)/ NOTUS: Applied Social Research from 2018 until present
- CEA LIST from 2018 until present

Verified reviews

REVIEWER SUMMARY

(5) Software and Systems Modeling WOS	(2) Empirical Software Engineering WOS
(2) International Journal of Parallel Progra... WOS	(2) Computer Science Education WOS
(2) Journal of Systems and Software WOS	(2) IET Software WOS
(1) IEEE Transactions on Software Enginee... WOS	(1) Computer Standards & Interfaces WOS

Juez en el panel evaluador de la ACM Student Research Competition en MODELS'20 La ACM Student Research Competition (`https://src.acm.org/`) es una competición en los que estudiantes de grado, máster y doctorado presentan su investigación ante un panel de jueces en conferencias patrocinadas ACM. Estos estudiantes compiten en una serie de pruebas que se derrollan durante la conferencia por tres premios (medalla de oro, plata y bronce). MODELS es una conferencia clase 2 - rating A.

23rd International Conference on Model-Driven Engineering Languages and Systems

MODELS 20

acm

IEEE

Certificate
ACM Student Research Competition

I, hereby, confirm that

Lola Burgueño

has been part of the Program Committee and a member of the JUDGING PANEL of the ACM Student Research Competition co-located with ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems from October 16th to 23rd, 2020

Davide Di Ruscio
MODELS2020 ACM SRC Chair

II. ACTIVIDAD DOCENTE O PROFESIONAL

1. DEDICACIÓN DOCENTE

a. PUESTOS DOCENTES OCUPADOS

Docencia en enseñanzas regladas Docencia en enseñanzas regladas en la Universidad de Málaga

UNIVERSIDAD DE MÁLAGA

ANDALUCÍA TECH
Campus de Excelencia Internacional

DON MIGUEL PORRAS FERNÁNDEZ, SECRETARIO GENERAL DE LA UNIVERSIDAD DE MÁLAGA

CERTIFICA:

Que Dª DOLORES BURGUEÑO CABALLERO, con D.N.I. 25.346.121-Y, de acuerdo con la documentación existente en esta Universidad, ha desempeñado la actividad docente que se especifica a continuación,

Curso Académico/ Cuatrimestre o Semestre	**Puesto Ocupado**	**Titulación**	**Asignatura**	**Curso o Ciclo de la Titulación**	**Tipo de Enseñanza**	**Nº de Horas Totales (en las que ha colaborado la interesada)**	**Total Horas en las que ha Colaborado por Curso Académico**
2014/2015 2º Semestre	P.I.F.	Graduado/a en Ingeniería Informática	Programación Orientada a Objetos	Primer Curso	Práctica	18,6	37,2
	P.I.F.	Graduado/a en Ingeniería del Software	Introducción a la Ingeniería del Software	Segundo Curso	Práctica	18,6	
2015/2016 1º Semestre	P.I.F.	Graduado/a en Terapia Ocupacional	Tecnología de la Información y Comunicación Aplicadas a la Terapia Ocupacional	Primer Curso	Teoría	31	60
	P.I.F.	Graduado/a en Biología	Informática	Primer Curso	Práctica	10,4	
	P.I.F.	Graduado/a en Ingeniería del Software	Ingeniería de Requisitos	Tercer Curso	Práctica	18,6	

Y para que así conste y surta los efectos oportunos, expido y firmo el presente certificado en Málaga, a veinticinco de abril de dos mil diecisiete

Vº Bº DEL JEFE DE SERVICIO DE ORDENACIÓN ACADÉMICA

Fdo.: Enrique Rincón Almendral

EL SECRETARIO GENERAL

UNIVERSIDAD DE MÁLAGA

Miguel Porras Fernández

EFQM AENOR

bequal

UNIVERSIDAD DE MÁLAGA

ANDALUCÍA TECH
Campus de Excelencia Internacional

Dª DOLORES BURGUEÑO CABALLERO

Curso Académico/ Cuatrimestre o Semestre	Puesto Ocupado	Titulación	Asignatura	Curso o Ciclo de la Titulación	Tipo de Enseñanza	Nº de Horas Totales (en las que ha colaborado la interesada)	Total Horas en las que Ha Colaborado por Curso Académico
2017/2018 1º Semestre	Investigadora Contratada con Cargo a Proyectos	Graduado/a en Ingeniería del Software	Métodos Formales para la Ingeniería del Software	Cuarto Curso	Práctica	20	20

Y para que así conste y surta los efectos oportunos, expido y firmo el presente certificado en Málaga, a quince de marzo de dos mil dieciocho.

Vº Bº DEL JEFE DE SERVICIO DE ORDENACIÓN ACADÉMICA

Fdo.: Enrique Rincón Almendral

El SECRETARIO GENERAL

Miguel Porras Fernández

UNIVERSIDAD DE MÁLAGA

Departamento de Lenguajes y
Ciencias de la Computación.

MARÍA VICTORIA BELMONTE MARTÍNEZ, DIRECTORA DEL DEPARTAMENTO DE LENGUAJES Y CIENCIAS DE LA COMPUTACIÓN.

INFORMA:

Que en relación a la actividad docente certificada por el Secretario General de la Universidad de Málaga:

Curso académico 2014-2015.

Semestre	Puesto Ocupado	Titulación	Asignatura	Curso de la Titulación	Tipo de Enseñanza	Nº de Horas (en las que ha colaborado la interesada)	Total Horas en las que ha Colaborado
2º Semestre	P.I.F.	Graduado/a en Ingeniería Informática	Programación Orientada a Objetos	1º Curso	Práctica	18,6	37,2
	P.I.F.	Graduado/a en Ingeniería del Software	Introducción a la Ingeniería del Software	2º Curso	Práctica	18,6	

Curso académico 2015-2016.

Semestre	Puesto Ocupado	Titulación	Asignatura	Curso de la Titulación	Tipo de Enseñanza	Nº de Horas (en las que ha colaborado la interesada)	Total Horas en las que ha Colaborado
1º Semestre	P.I.F.	Graduado/a en Terapia Ocupacional	Tecnología de la Información y Comunicación Aplicadas a la Terapia Ocupacional	1º Curso	Teoría	31	60
	P.I.F.	Graduado/a en Biología	Informática	1º Curso	Práctica	10,4	
	P.I.F.	Graduado/a en Ingeniería del Software	Ingeniería de Requisitos	3º Curso	Práctica	18,6	

Curso académico 2017-2018.

Semestre	Puesto Ocupado	Titulación	Asignatura	Curso de la Titulación	Tipo de Enseñanza	Nº de Horas (en las que ha colaborado la interesada)	Total Horas en las que ha Colaborado
1º Semestre	Investigadora Contratada con Cargo a Proyectos	Graduado/a en Ingeniería del Software	Métodos Formales para la Ingeniería del Software	4º Curso	Práctica	20	20

Dª Dolores Burgueño Caballero, con DNI 25346121Y, ha desempeñado, siendo personal adscrito a dicho Departamento, la actividad docente antes mencionada como Personal Colaborador Docente, tal y como recoge el Plan de Ordenación Docente de la Universidad de Málaga ((**https://www.uma.es/servicio-ordenacion-academica/cms/menu/plan-de-ordenacion-docente/**) y de acuerdo al puesto ocupado por la misma en el momento del desempeño de dicha actividad (Personal Investigador en Formación (PIF) e Investigadora Contratada con Cargo a Proyecto)

Málaga, a 12 de noviembre de 2021.

Fdo.: María Victoria Belmonte Martínez.
Directora del Departamento

Docencia en enseñanzas regladas en Marbella International University Centre (MIUC) MIUC es una universidad privada oficial e internacional de habla inglesa

MARBELLA INTERNATIONAL UNIVERSITY CENTRE B93225472 WEBSITE www.miuc.org
ADDRESS Avenida Don Jaime de Mora y Aragón s/n TEL (+34) 952 860 000
Finca El Pinillo 29601, Marbella | Málaga | Spain E-MAIL info@miuc.org

Marbella, November 3, 2021

To whom it may concern,

I, Beata Fröhlich, Dean of Marbella International University Centre, hereby certify that Dr. Lola Burgueño Caballero worked at Marbella International University Center during the following dates from 02/11/2017 to 27/11/2017 of the first semester of the academic year 2017/2018.

As her contract stated, she was hired as part of the professional group "Profesores Universitarios" and her responsibilities were "Clases 1º semestre". In particular, and also stated in her contract, she was in charge of the courses:

- Business Intelligence and Decision-Making (20UK Credits, 10 ECTS)
- Information Systems and Business Analytics (20UK Credits, 10 ECTS)

She was the modules' leader and the only member of the teaching team. Her academic responsibilities were to design and create the content of the courses (i.e., study guides and materials), give the lectures, guide and evaluate the students.

Beata Fröhlich

Dean of Marbella International University Centre

MARBELLA INTERNATIONAL UNIVERSITY CENTRE

MMXIII

Docencia en enseñanzas regladas en la Universitat Oberta de Catalunya (UOC)

D. Carles Sigalés Conde, Vicerrector de Docencia y Aprendizaje de la Universitat Oberta de Catalunya, certifica

Que Doña Lola Burgueño Caballero, con DNI 25346121Y, presta sus servicios por cuenta ajena en esta Universidad desde el 1 de octubre de 2018, mediante un contrato temporal a tiempo completo.

Que, de acuerdo con el vigente sistema de clasificación profesional, se encuadra en el Grupo Profesional de Personal Investigación - Investigadora Sénior en Internet Interdisciplinary Institute (IN3).

Que en calidad de personal investigador postdoctoral, ha colaborado como profesora responsable de asignatura

Que de acuerdo con el modelo educativo de la universidad, el cual se sustenta en el diseño de los contenidos y de las actividades de aprendizaje cada asignatura, y el seguimiento personalizado del estudiante, la actividad docente del Profesor Responsable de Asignatura se desarrolla en torno a las siguientes funciones básicas: Diseñar la asignatura y planificar la acción docente; implantar el diseño y hacer el seguimiento de la acción docente; valorar la acción docente y hacer propuestas de mejora

PUESTOS OCUPADOS Y DOCENCIA IMPARTIDA – OFERTA OFICIAL

Curso/ Semestre	Puesto ocupado	Asignatura	Titulación	Teor./ Prac.	Crèditos Asignatura	Créditos Impartidos *
Curso 2019/20 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
Curso 2020/21 Sem 1	Investigadora postdoctoral	Ingeniería de Requisitos	Grado en Ingeniería informática	Teoría	6	6
Curso 2020/21 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
Curso 2020/21 Sem 2	Investigadora postdoctoral	Desarrollo de aplicaciones para dispositivos Android	MU Desarrollo de aplicaciones para dispositivos móviles	Teoría	6	6
Curso 2021/22 Sem 1	Investigadora postdoctoral	Ingeniería de Requisitos	Grado en Ingeniería informática	Teoría	6	6
Curso 2021/22 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
			Grado de Técnicas de Aplicaciones de Software			

CALIDAD DE LA ACTIVIDAD DOCENTE

Curso/ Semestre	Asignatura	Titulación	Tasa de rendimiento	Satisfacción estudiantes
2019-2020 Sem 2	Análisis y diseño de patrones	Grado en Ingeniería informática	87,9%	69,8%
		Grado en Multimedia		
2020-2021 Sem 1	Ingeniería de requisitos	Grado en Ingeniería informática	95%	89,2%

2020-2021 Sem 2	Análisis y diseño de patrones	Grado en Ingeniería informática	81,8%	62,5%
		Grado en Multimedia	60,9	33,33%
2020-2021 Sem 2	Desarrollo de aplicaciones para dispositivos Android	MU Desarrollo de aplicaciones para dispositivos móviles	60%	66,7%

Y para que así conste y a los efectos oportunos, expido y firmo el presente certificado en Barcelona, a 16 de febrero de 2022

Fdo. Carles Sigalés Conde
Vicerrector de Docencia y Aprendizaje

(*) Actualmente se comunica a UNEIX de la Generalitat la acción docente del Profesorado Responsable de Asignatura considerando un crédito equivalente a 10 horas. Esta información está en proceso de revisión.

Docencia en enseñanzas no regladas Docencia impartida en titulaciones propias (másteres y cursos en convenio con empresas) en la Universiadad de Málaga (81 horas). En concreto en el "Máster Universitario en Ingeniería Web", el curso "Nuevas tendencias en el diseño y desarrollo de aplicaciones con tecnologías Java" y el curso de "Extensión Universitaria en Desarrollo Avanzado de Aplicaciones Web usando Java y DevOps".

GASPAR GARROTE BERNAL, VICERRECTOR DE ESTUDIOS DE POSGRADO DE LA UNIVERSIDAD DE MÁLAGA,

Informa,

Que Don/ña **Dolores Burgueño Caballero**
con D.N.I. número 25346121Y , ha impartido 2,45 créditos en el Título Propio: 81506547

II CURSO DE EXTENSIÓN UNIVERSITARIA EN DESARROLLO AVANZADO DE APLICACIONES WEB USANDO JAVA Y DEVOPS

de 15 créditos europeos de duración, en el curso académico 2017/2018 , según la documentación obrante en este Vicerrectorado.

COMPROBADO Y CONFORME: La Jefa de Servicio de Titulaciones Propias, María de las Mercedes Domínguez González.

Málaga, a 06 de abril de 2018
El Vicerrector de Estudios de Posgrado

Fdo: Gaspar Garrote Bernal

Pabellón de Gobierno, 3ª planta. Campus El Ejido.
29071 MÁLAGA
Tel.: 952 13 11 10 / 25 60
E-mail: tp@uma.es

UNIVERSIDAD DE MÁLAGA
Vicerrectorado de Proyectos Estratégicos

ANDALUCÍA TECH
Campus de Excelencia Internacional
Campus of International Excellence

CORITEL

CURSO "NUEVAS TENDENCIAS EN EL DISEÑO Y DESARROLLO DE APLICACIONES CON TECNOLOGÍAS JAVA"

Victor Muñoz Martínez, Vicerrector de Proyectos Estratégicos, hace constar que

Dolores Burgueño Caballero

Ha impartido 24 horas de docencia en el curso "Nuevas tendencias en el diseño y desarrollo de aplicaciones con tecnologías JAVA" organizado por Coritel S.A. y la Universidad de Málaga, en el marco del proyecto Campus de Excelencia Internacional Andalucía TECH, celebrado del 17 de octubre al 16 de diciembre de 2016.

En consecuencia, para que surta los efectos oportunos firmo la presente en

Málaga, 9 de junio de 2017

UNIVERSIDAD DE MÁLAGA

Victor Muñoz Martínez

Vicerrector de Proyectos Estratégicos

UNIVERSIDAD DE MÁLAGA

UNIVERSIDAD
DE MÁLAGA

ANDALUCÍA TECH
Campus de Excelencia Internacional

Vicerrectorado de Estudios de Posgrado
Servicio Titulaciones Propias

GASPAR GARROTE BERNAL, VICERRECTOR DE ESTUDIOS DE POSGRADO DE LA UNIVERSIDAD DE MÁLAGA,

Informa,

Que Don/ña **Dolores Burgueño Caballero**
con D.N.I. número 25346121Y , ha impartido 1,25 créditos en el Título Propio:

81418547

VI MÁSTER PROPIO UNIVERSITARIO EN INGENIERÍA WEB (RIAtec)

de 120 créditos europeos de duración, en el curso académico 2015/2017, según la documentación obrante en este Vicerrectorado.

Y para que conste y a los efectos oportunos, expido el presente informe en Málaga, a 13 de junio de 2017

El Jefe de Sección de Titulaciones Propias
Francisco Jiménez Torres

UNIVERSIDAD DE MÁLAGA
VICERRECTORADO DE ESTUDIOS DE POSGRADO

Vicerrector de Estudios de Posgrado
Gaspar Garrote Bernal

EFQM AENOR

bequal

Pabellón de Gobierno, 3ª planta. Campus El Ejido. 29071.
Tel.: 952 13 11 10 / 25 60 Fax: 952 13 78 39 E-mail: tp@uma.es

UNIVERSIDAD
DE MÁLAGA

Málaga, 13 de Junio de 2017

Antonio Jesús Nebro Urbaneja, director académico del estudio propio de Postgrado de la Universidad de Málaga MÁSTER UNIVERSITARIO EN INGENIERÍA WEB (RIAtec)

CERTIFICA QUE Dña. Dolores Burgueño Caballero, con NIF 25345121Y, ha impartido la docencia que se enumera a continuación en dicho máster:

- IV edición (2013-2015): 10 horas en el Módulo de Ingeniería Web (Modelado)
- V edición (2014-2016): 10 horas en el Módulo de Ingeniería Web (Modelado)

UNIVERSIDAD DE MÁLAGA

Fdo. Antonio Jesús Nebro Urbaneja

UNIVERSIDAD
DE MÁLAGA

Málaga, 13 de Junio de 2017

Antonio Jesús Nebro Urbaneja, director académico del estudio propio de Postgrado de la Universidad de Málaga MÁSTER UNIVERSITARIO EN INGENIERÍA WEB (RIAtec)

CERTIFICA QUE Dña. Dolores Burgueño Caballero, con NIF 25345121Y, ha impartido la docencia que se enumera a continuación en dicho máster:

- VI edición (2015-2017): 10 horas en el Módulo de Ingeniería Web (Modelado)

Fdo. Antonio Jesús Nebro Urbaneja

b. DIRECCIÓN DE TESIS DOCTORALES

Dirección en curso de tesis doctoral Dirección de la tesis (en curso) de Jorge Perianez Pascual. Actualmente, en su primer año, ya hay dos publicaciones que avalan la tesis. Dichas publicaciones son en el congreso SLE (clase 3 en el ranking GGS) y en el workshop BotSE del congreso ICSE. Pueden verse los justificantes en la sección de Congresos.

Dª Carmen Masot Gómez-Landero, Jefa del Servicio de Becas, Estudios de Posgrado y Títulos Propios de la Universidad de Extremadura,

HACE CONSTAR: que según los antecedentes que obran en el Servicio de Becas,Estudios de Posgrado y Títulos Propios, resulta que **Dª. LOLA BURGUEÑO CABALLERO** ha sido asignado por la Comisión Académica del programa como director/codirector de los doctorandos que se relacionan a continuación a efectos de la elaboración de la tesis doctoral, de conformidad con lo establecido en el artículo 12 del Real Decreto 99/2011, de 28 de enero , por el que se regulan las enseñanzas oficiales de doctorado (BOE del 10 de febrero)

PROGRAMA:	R016	PROGRAMA DE DOCTORADO EN TECNOLOGÍAS INFORMÁTICAS (TIN)			
Exp.	Dni:	Alumno:	Fecha Alta	Fecha Baja	Rol:
[illegible]	[illegible]	PERIAÑEZ PASCUAL, JORGE	[illegible]		CODIRECTOR
				TOTAL :	1

Y para que conste y surta efectos, extiendo la presente en 26 de Noviembre de 2019

c. DIRECCIÓN DE TRABAJOS AVANZADOS

UNIVERSIDAD
DE MÁLAGA

E.T.S.
INGENIERÍA
INFORMÁTICA

AGUSTÍN VALVERDE RAMOS, SECRETARIO DE LA E.T.S. DE INGENIERÍA INFORMÁTICA DE LA UNIVERSIDAD DE MÁLAGA

CERTIFICA:

Que **Dª. Dolores Burgueño Caballero** ha dirigido el siguiente Proyecto Fin de Carrera, cuya carga lectiva es de 6 créditos.

Título: Implementación de la Arquitectura Kappa para el cálculo de métricas en tiempo real sobre streams de datos

Calificación: Sobresaliente
Centro: E.T.S. Ingeniería Informática
Titulación: Ingeniería Informática
Año: 2017

Para que conste, y a petición del interesado, firmo la presente en Málaga, a veintidós de marzo de dos mil dieciocho.

El Secretario

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

Agustín Valverde Ramos

Bulevar Louis Pasteur 35, 29071 – Málaga, tfno. 952 13 33 96, fax 952 13 26 13
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UNIVERSIDAD
DE MÁLAGA

E.T.S.
INGENIERÍA
INFORMÁTICA

AGUSTÍN VALVERDE RAMOS, SECRETARIO DE LA E.T.S. DE INGENIERÍA INFORMÁTICA DE LA UNIVERSIDAD DE MÁLAGA

CERTIFICA:

Que **Dª. Dolores Burgueño Caballero** ha tutorizado los siguientes Trabajos Fin de Grado, con una carga de 12 créditos ECTS en cada uno de los títulos de Grado indicados:

Título: 2TRAIN. Análisis deportivo de la ciudad de Málaga
Calificación: Matrícula de Honor
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2018

Título: Análisis de programas de procesamiento de eventos complejos
Calificación: Matrícula de Honor (9.8)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2018

Título: Aplicación Android para la estimación del tiempo de espera en consultas médicas y urgencias
Calificación: Notable (8.9)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería de la Salud
Año: 2018

Título: Árbol genealógico de la informática
Calificación: Sobresaliente (9.3)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2018

Título: Sistema de información para la gestión de socios de Sistedes
Calificación: Sobresaliente (9)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2018

Título: Extensión de USE para soportar incertidumbre de medida en los datos primitivos OCL/UML
Calificación: Matrícula de Honor (9.4)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2019

Título: Incorporación de incertidumbre de la medida en modelos UML para la Industria 4.0
Calificación: Sobresaliente (9.7)

ESCUELA TÉCNICA SUPERIOR INGENIERÍA INFORMÁTICA

Bulevar Louis Pasteur 35, 29071 – Málaga; tfno. 952 13 33 96; fax 952 13 26 73
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UNIVERSIDAD
DE MÁLAGA

E.T.S.
INGENIERÍA
INFORMÁTICA

Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2019

Título: Simulación de diagramas de secuencia con la herramienta de modelado USE
Calificación: Matrícula de Honor (9.7)
Centro: E.T.S. Ingeniería Informática
Titulación: Grado en Ingeniería del Software
Año: 2019

Para que conste, y a petición de la interesada, firmo la presente en Málaga, a veintiuno de octubre de dos mil diecinueve.

El Secretario

ESCUELA TÉCNICA SUPERIOR INGENIERÍA INFORMÁTICA

Agustín Valverde Ramos

e

d. OTROS MÉRITOS RELACIONADOS CON LA ACTIVIDAD DOCENTE

2. CALIDAD DE LA ACTIVIDAD DOCENTE

a. EVALUACIONES POSITIVAS DE SU ACTIVIDAD

En la Universidad de Málaga

UNIVERSIDAD
DE MÁLAGA

Servicio de Calidad, Planificación
Estratégica y Responsabilidad
Social

UNIVERSIDAD DE MALAGA
REGISTRO GENERAL
Salida
Nº. 201800100007714
01/06/2018 12:50:38

D./D.ª DOLORES BURGUEÑO CABALLERO
DPTO. DE LENGUAJES Y CC. COMPUTACION
E.T.S.I. DE INFORMATICA

Adjunto le remito el Certificado de la Calidad de la Actividad Docente y el Informe emitido por la Comisión de Evaluación de la Calidad, conforme a lo dispuesto en el Real Decreto 1312/2007, de 5 de octubre, por el que se establece la acreditación nacional para el acceso a los cuerpos docentes universitarios.

Málaga, 31 de mayo de 2018
Gerente

María Jesús Morales Caparrós

CERTIFICADO DE LA CALIDAD DE LA ACTIVIDAD DOCENTE

Recibida en el Servicio de Calidad, Planificación Estratégica y Responsabilidad Social de la Universidad de Málaga la solicitud de D. / D. ª DOLORES BURGUEÑO CABALLERO, para obtener la evaluación necesaria sobre la calidad de la actividad docente desarrollada a efectos de dar cumplimiento a lo establecido en el Real Decreto 1312/2007, de 5 de octubre, por el que se establece la acreditación nacional para el acceso a los cuerpos docentes universitarios.

Visto el informe remitido por la Comisión de Evaluación de la Calidad, que ha actuado conforme a los criterios de evaluación establecidos en el “Procedimiento para la Evaluación de la Actividad Docente del Profesorado de la Universidad de Málaga”.

Considerando que el mencionado informe, de carácter vinculante y cuyo original se adjunta como Anexo inseparable, informa Desfavorable/Favorable/Excelente sobre la solicitud presentada por el interesado/a, se RESUELVE CERTIFICAR que la calidad de la actividad docente del mismo es:

EXCELENTE

Contra este informe, podrá presentarse reclamación ante la Comisión de Evaluación de esta Universidad en el plazo estipulado en la Convocatoria, contado a partir de la recepción del presente informe.

Málaga, 31 de mayo de 2018
Gerente

María Jesús Morales Caparrós

INFORME DE EVALUACIÓN DE LA ACTIVIDAD DOCENTE

(A cumplimentar por la Comisión de Evaluación)

Se cumplimentará tomando como referencia las valoraciones recogidas en el Protocolo de Evaluación.

DATOS RELATIVOS AL SOLICITANTE Y SU ACTIVIDAD DOCENTE

Apellidos: BURGUEÑO CABALLERO

Nombre: DOLORES

NIF: 25346121Y

Área de Conocimiento: LENGUAJES Y SISTEMAS INFORMÁRT

Departamento: LENGUAJES Y CC. COMPUTACION

VALORACIÓN DE LA DOCENCIA EN EL PERIODO EVALUADO

La Comisión de Evaluación, teniendo en cuenta la información que obra en su poder acerca de las dimensiones de la actividad docente del Profesor/a de D./D.ª DOLORES BURGUEÑO CABALLERO, con relación al periodo evaluado y de acuerdo con las puntuaciones obtenidas que se muestra en la siguiente tabla:

DIMENSIONES OBJETO DE EVALUACIÓN	EVALUACIÓN	PUNTUACIÓN OBTENIDA
PLANIFICACIÓN Y DESARROLLO DE LA DOCENCIA	Favorable=1/Desfavorable=0 Decano/Director	1 + 1
ENCUESTA DE SATISFACCIÓN DEL ALUMNADO	Favorable = 2,5 puntos o más	1
MEJORA/INNOVACIÓN DE LA ACTIVIDAD DOCENTE	Favorable=1/Desfavorable=0	1
TOTAL		4

Y a efectos de dar cumplimiento a lo establecido en el Real Decreto 1312/2007, de 5 de octubre, por el que se establece la acreditación nacional para el acceso a los cuerpos docentes universitarios emite una valoración (Desfavorable -0/1-; Favorable -2-; Excelente -3/4-) de su actividad docente de:

EXCELENTE

Málaga, 31 de mayo de 2018

Gerente

María Jesús Morales Caparrós

En la Universitat Oberta de Catalunya

D. Carles Sigalés Conde, Vicerrector de Docencia y Aprendizaje de la Universitat Oberta de Catalunya, certifica

Que Doña Lola Burgueño Caballero, con DNI 25346121Y, presta sus servicios por cuenta ajena en esta Universidad desde el 1 de octubre de 2018, mediante un contrato temporal a tiempo completo.

Que, de acuerdo con el vigente sistema de clasificación profesional, se encuadra en el Grupo Profesional de Personal Investigación - Investigadora Sénior en Internet Interdisciplinary Institute (IN3).

Que en calidad de personal investigador postdoctoral, ha colaborado como profesora responsable de asignatura

Que de acuerdo con el modelo educativo de la universidad, el cual se sustenta en el diseño de los contenidos y de las actividades de aprendizaje cada asignatura, y el seguimiento personalizado del estudiante, la actividad docente del Profesor Responsable de Asignatura se desarrolla en torno a las siguientes funciones básicas: Diseñar la asignatura y planificar la acción docente; implantar el diseño y hacer el seguimiento de la acción docente; valorar la acción docente y hacer propuestas de mejora

PUESTOS OCUPADOS Y DOCENCIA IMPARTIDA – OFERTA OFICIAL

Curso/ Semestre	**Puesto ocupado**	**Asignatura**	**Titulación**	**Teor./ Prac.**	**Crèditos Asignatura**	**Créditos Impartidos ***
Curso 2019/20 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
Curso 2020/21 Sem 1	Investigadora postdoctoral	Ingeniería de Requisitos	Grado en Ingeniería informática	Teoría	6	6
Curso 2020/21 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
Curso 2020/21 Sem 2	Investigadora postdoctoral	Desarrollo de aplicaciones para dispositivos Android	MU Desarrollo de aplicaciones para dispositivos móviles	Teoría	6	6
Curso 2021/22 Sem 1	Investigadora postdoctoral	Ingeniería de Requisitos	Grado en Ingeniería informática	Teoría	6	6
Curso 2021/22 Sem 2	Investigadora postdoctoral	Análisis y diseño de patrones	Grado en Ingeniería informática	Teoría	6	6
			Grado en Multimedia			
			Grado de Técnicas de Aplicaciones de Software			

CALIDAD DE LA ACTIVIDAD DOCENTE

Curso/ Semestre	**Asignatura**	**Titulación**	**Tasa de rendimiento**	**Satisfacción estudiantes**
2019-2020 Sem 2	Análisis y diseño de patrones	Grado en Ingeniería informática	87,9%	69,8%
		Grado en Multimedia		
2020-2021 Sem 1	Ingeniería de requisitos	Grado en Ingeniería informática	95%	89,2%

2020-2021 Sem 2	Análisis y diseño de patrones	Grado en Ingeniería informática	81,8%	62,5%
		Grado en Multimedia	60,9	33,33%
2020-2021 Sem 2	Desarrollo de aplicaciones para dispositivos Android	MU Desarrollo de aplicaciones para dispositivos móviles	60%	66,7%

Y para que así conste y a los efectos oportunos, expido y firmo el presente certificado en Barcelona, a 16 de febrero de 2022

Fdo. Carles Sigalés Conde
Vicerrector de Docencia y Aprendizaje

(*) Actualmente se comunica a UNEIX de la Generalitat la acción docente del Profesorado Responsable de Asignatura considerando un crédito equivalente a 10 horas. Esta información está en proceso de revisión.

b. MATERIAL DOCENTE ORIGINAL Y PUBLICACIONES DOCENTES

COMPUTER SCIENCE EDUCATION, 2018
https://doi.org/10.1080/08993408.2018.1462000

Routledge
Taylor & Francis Group

Check for updates

Teaching UML and OCL models and their validation to software engineering students: an experience report

Loli Burgueño[a], Antonio Vallecillo[a] and Martin Gogolla[b]

[a]Departamento de Lenguajes y Ciencias de la Computación, Universidad de Málaga, Málaga, Spain; [b]Department for Mathematics and Computer Science, University of Bremen, Bremen, Germany

ABSTRACT
Models are expanding their use for many different purposes in the field of software engineering and, due to their importance, universities have started incorporating modeling courses into their programs. Being a relatively new discipline, teaching modeling concepts brings in new challenges. Our contribution in this paper is threefold. First, we list and describe the main issues we have come across when teaching modeling in a dedicated Software Engineering course. We then present a simple case study that we have developed and successfully used in class, which permits students specify a system and its views, simulate them, check their relations, and perform several kinds of analyses on the overall system specifications. For this, we use a combination of UML and OCL. Finally, we report on the results of a survey we conducted among the students of the last two years to evaluate our proposal, and the lessons we have learned.

ARTICLE HISTORY
Received 9 December 2017
Accepted 30 March 2018

KEYWORDS
Computer science education; teaching modeling; UML; OCL; model views

1. Introduction

Model-Driven Engineering (MDE) is a prominent area in the software engineering field. Over the years, a new trend of approaches has emerged advocating languages, standards, tools, and well-defined practices. These include UML Booch, Rumbaugh, and Jacobson (2005) and OCL (OMG, 2000). MDE raises the level of abstraction in software utilizing *models* that focus only on the features of interest alleviating the complexity. These models are applied as a means of communication as well as for code generation and checking the correctness of a solution. The application of MDE increases the automation of software development and permits the detection of problems in early stages of the development cycle. MDE also permits the application of an agile methodology as they both can be combined in what is called Agile Modeling.

Despite their growing relevance and increasing acceptance in industry to build software at the right level of abstraction, with less effort and errors, models are not yet properly appreciated by many software engineering students. In

CONTACT Loli Burgueño loli@lcc.uma.es

the University of Dortmund and the Technical University of Braunschweig. In his group, foundational work on the semantics of and the tooling for UML, OCL and general modeling languages has been carried out. The group develops the OCL and UML tool USE (UML-based Specification Environment) since about 15 years. The tool is internationally and nationally widely accepted and employed for research and teaching and in software production.

ORCID

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Antonio Vallecillo http://orcid.org/0000-0002-8139-9986

References

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Introduction to patterns

PID_00273621

Jordi Pradel i Miquel
José Antonio Raya Martos

Universitat Oberta de Catalunya

Jordi Pradel i Miquel

Computer Engineer by the Universitat Politècnica de Catalunya (Polytechnic University of Catalonia, UPC). Founding member and Software Engineer at Agilogy. He is also a Software Engineering professor in the Languages and Computer Systems Department at the UPC and Computer Science and Multimedia Studies course instructor at the Universitat Oberta de Catalunya.

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The assignment and creation of this UOC Learning Resource have been coordinated by the lecturers: Elena Planas Hortal, Lola Burgueño

First edition: September 2020

Av. Tibidabo, 39-43, 08035 Barcelona
Authorship: Jordi Pradel i Miquel, José Antonio Raya Martos
Production: FUOC

Contents

Patterns catalogue

PID_00273624

Jordi Pradel i Miquel
José Antonio Raya Martos

Universitat Oberta de Catalunya

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First edition: September 2020
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Production: FUOC

Contents

Case study of pattern application

PID_00273625

Jordi Pradel i Miquel
José Antonio Raya Martos

Universitat
Oberta
de Catalunya

Jordi Pradel i Miquel

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Authorship: Jordi Pradel i Miquel, José Antonio Raya Martos
Production: FUOC

Contents

Máster en Ingeniería
Web y Tecnologías RIA

MÓDULO 4

Ingeniería Web. Modelado

Antonio Vallecillo
av@lcc.uma.es

Loli Burgueño
loli@lcc.uma.es

Nathalie Moreno
moreno@lcc.uma.es

Índice

Bibliografía

- UML - UWE: http://uwe.pst.ifi.lmu.de/
- MagicUWE: http://uwe.pst.ifi.lmu.de/toolMagicUWE.html

Tema 1
Introducción a los ordenadores

Técnicas de Información y Comunicación

Grado en Terapia Ocupacional

Curso 2015/16

UNIVERSIDAD
DE MÁLAGA

Loli Burgueño
Carlos Canal

Contenidos

- Introducción a la Informática
  - Informática y procesamiento informático: el ordenador
  - historia
- Codificación de la información
  - codificación de números y caracteres
  - conversión decimal / binario
- El sistema informático
  - hardware y software
- El hardware
  - esquema de los elementos hardware
- El software
  - tipos de software
  - el sistema operativo

Tema 1
Introducción a los ordenadores

Técnicas de Información y Comunicación

Grado en Terapia Ocupacional

Curso 2015/16

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Web: salud.cv.uma.es

Nuevas tendencias en el diseño y desarrollo de aplicaciones con tecnologías Java

Módulo 3: DevOps

Tema 10: Herramientas para el desarrollo de software

Loli Burgueño

Índice

- Gestión de código fuente con Git
- Construcción de código con Maven
- Integración continua en Jenkins

Referencias

- Git: https://git-scm.com/
- Maven: https://maven.apache.org/
- Jenkins: https://jenkins.io/

FORM I

Module Study Guide

AY2017-2018

Business Intelligence and Decision-Making

MIUC

Module Code	BIDM
Level	6
Credits	20UK Credits (10 ECTS)

Marbella International University Centre (MIUC)

Business Intelligence and Decision-Making

Module Study Guide

Contents

Page Nº

Section A. Overview and Content

Section B. Assessment and Feedback

Section C. Module Course

Module Leader ,Teaching Team and Module Administrator Details

Module Leader	Lola Burgueño
Field/Subject and School	Computer Science and Engineering
Email	lola@miuc.org
Phone	952860000
Location	MIUC
Name	Jelena Krajacic
Job title	Module Administration
Email	jelena.krajacic@miuc.org
Phone	952860000
Location	MIUC

External Examiner(s)

The External Examiner(s) for this module are listed below. Please note that this is provided for information only; students are **not** permitted to enter into any correspondence about their marks with External Examiners.

Name	TBC
Job Title	
Institution	

Further Information

Total Guided Learning Hours	200
Consisting of:	
Contact Hours	56
Independent Study Hours	144

Assessment:	
Percentage of final marks assessed by:	
Midterm Project: Creation of Dashboards	40%
Final project: Business Analytical Project	60%

Section

A

Overview and Content

1. Welcome and Introduction to the Module

Every day companies collect more and more data from its transitions, sales, customers, etc. The exploitation of data is an essential task to obtain valuable information that helps improve the business and detect problems. Interactive dashboards offer business users key performance indicators in a visual interface.

In this module, the student will become familiar with the construction and use of reporting systems and dashboards. They will study the importance and the impact this tools have in business intelligence, both from a strategic and operational point of view. Furthermore, they will conceptually be introduced to the frameworks and technologies on which they are based, such as data warehouses.

The module is composed mainly of tutorials and seminars and will run throughout the semester (14 weeks).

2. Timetable/Venue/Rooms

First Point of Contact

A personal tutor will be allocated to you at the beginning of the programme

If you need to discuss any issue to do with this module, the first point of contact is the module leader, who is named at the start of this guide. If the module leader is unable to deal with the problem, you should then raise it with your course leader.

All classes will take place at MIUC, classrooms will be advertised on the module's Blackboard space

3. Aims of the Module

This module aims to:

- Develop a comprehensive understanding of the importance and the applications of business intelligence.
- Develop a systematic understanding of the relationships between databases, data warehouses and dashboards and reports.
- Develop in the students the ability to construct reporting systems and dashboards with a business analytics dashboard and platform.
- Develop in the students the ability to make use of reports and dashboards to improve organizational performance.

4. Learning Outcomes

On successful completion of this module you will be able to:

LO1. Systematically understand the relationships between databases, data warehouses, and dashboards and reports.
LO2. Design proper data architectures for business analysis: data warehouses, data marts and OLAP cubes from heterogeneous data sources (databases, spreadsheets, etc.).
LO3. Build reports and dashboards from a data warehouse with a business analytics dashboard and platform.
LO4. Design meaningful reports and dashboards to improve organizational performance.

5. Content of the Module

Interactive dashboards can offer business users key performance indicators in a highly graphical visual interface to improve organizational performance. With this module, the student will become familiar with the construction and use of reporting systems and dashboards, both from a strategic and operational point of view, as well as from the conceptual frameworks on which they are based. The student will carry on hands-on practice with a business analytics dashboard and platform, exploring its different features and building a dashboard from a data warehouse.

6. Learning Resources

University provision
Library resources and Academic Support Librarian

Marbella International University Center (MIUC) Library was founded in 2014 as a key element for the development of the institution, providing necessary resources to satisfy the information and learning needs, both academic and in terms of research, of students and faculty.

MIUC Library offers the following services:

- Provide a basic collection in accordance with the students' need for an introduction to scientific knowledge.
- Provide a specialized collection for the different subject that covers the MIUC curriculum, available for students and professors.
- Offer information, instruction and reference services in order to promote and improve the use of the library and the optimal use of its resources.

- Offer a research support service with access to specialized databases, specialized bibliography orientation and the access to the original document.
- Promote access to the surrounding culture and the era, through scheduling activities for the collection and dissemination of science and culture.

The library is located on the ground floor of the center. It covers an area of about 80 m^2 with a total of 18 reader and study seats. Moreover, the library has 2 computer seats that provide access to the Internet and to searching the Koha catalogue and the electronic collection. In addition, the library offers Wi-Fi access throughout the room and provides users the necessary electronic equipment for displaying and listening to CDs / DVDs: external CD/DVD readers and headphones. Printing, copying and scanning facilities are also provided.

All students are automatically members of the MIUC Library and can use the services provided by the library and have free access to its collection of documents and its databases. Access to the catalog is available 24 hours, allowing students to suggest acquisitions of new materials, renewing loans or holding on materials.

Our collection is composed of specialized funds in the subjects: Marketing & Advertising, International Relations, International Business and Journalism & Mass Media. Among our collection we can find reference books, monographs, journals, electronic resources (ebooks, CDs, DVDs and Blu-ray) and databases.

The largest numbers of items for each discipline are monographs and reference works, about 800 volumes. Moreover, the audiovisual collection has around 300 volumes.

At the same time, the library has access to 3 databases of EBSCOhost®, supplied by EBSCO Publishing. These databases provide full-text and secondary information of thousands of electronic journals, monographs, reports and other publications.

Student learning resources

MIUC Library (see above)
Blackboard e-learning Platform*

Section
B

Assessment and Feedback

7. Assessment: General Information

Summative Assessments

Assessment 1: Midterm Project: Creation of Dashboards

In the eighth week, you will have to submit a project in which you will have to prove that you understood the Business Intelligence concepts studied in class until that moment, and how to use the Pentaho framework to create basic dashboards.
You will be given a company description and its database (or any other data source) and you will have to create a basic dashboard that contains some of the elements studied in class.

Assessment 2: Final Project: Business Analytics Project

By the end of the module, you will have to submit a final project in which you will have to prove that you understood how to apply Business Intelligence by means of exploiting the business data and creating dashboards and reports using the Pentaho framework.
You will be given a company description and its database and you will have to study its data in order to create meaningful dashboards and reports that help users have an overview of their business and make decisions.

Formative Assessments

Practical exercises

During the different sessions, you will be provided with further practical exercises in order to prepare you for the summative assessments. The nature of these exercises will depend on the different aspects that the majority of the students may need to reinforce.

8. Details of Assessment

Assessment 1: Midterm Project: Creation of Dashboards

Weighting: 40%

Date/time/method of submission: Week 8.

Word count or equivalent: N/A

Assessment 2: Final Project: Business Analytics Project

Weighting: 60%

Date/time/method of submission: Week 15.

Word count or equivalent: N/A

Assessment criteria:

Assessment 1: Midterm Project: Creation of Dashboards

- Knowledge and understanding (20%). Given the case study described, the student understands the data the business stores and how it is related. He/she knows how to exploit the data by means of dashboards in order to extract meaningful information that helps make decisions.
- Cognitive skills (30%). The student is able to use the Pentaho framework for creating basic dashboards.
- Practical and professional skills (30%). Given a database, the student is able to select the most appropriate data to show and the best graphical representation for it.
- Transferrable and key skills (20%). Given a dashboard, the student is able to extract conclusions and point to the strengths and weakness of the business under study.

Assessment 2: Final Project: Business Analytics Project

- Knowledge and understanding (20%). Given the case study described, the student understands the data the business stores and how it is related. He/she knows how to exploit the data by means of business intelligence tools in order to extract meaningful information that helps make decisions.
- Cognitive skills (30%). The student is able to use business intelligence frameworks, such as Pentaho, for creating dashboards and reports.
- Practical and professional skills (30%). Given a data-driven decision-making problem and plain data, the student is able to select the most appropriate information to show and the best representation for it.
- Transferrable and key skills (20%). The student is able to extract conclusions from the information obtained after applying business intelligence techniques, i.e., he/she is able to point to the strengths and weakness of the business under study.

Further details on the assessment criteria will be uploaded to blackboard the first week of the semester.

9. Summative Assessment Grid

Type of assessment	Module learning outcome	Word count or equivalent	Due date	Threshold	Pass mark	Weighting
Midterm Project: Creation of dashboards	LO1, LO2	N/A	Week 8	N/A	40%	40%
Final project: Business Analytics Project	LO1, LO2, LO3, LO4	N/A	Week 15	N/A	40%	60%

10. Statement on Plagiarism

Plagiarism is defined as the practice of taking someone else's work and passing them off as their own.[1] It is presenting someone else's work as one's own irrespective of intention. Close paraphrasing; copying from the work of another person, including another student; using the ideas of another person without proper acknowledgement; and repeating work that you have previously submitted – at the University of West London or at another institution - without properly referencing yourself (known as 'self-plagiarism') shall also constitute plagiarism.

For further information please refer to the Student Handbook Section 3. University Regulations and Student Code of Conduct

For further advice on plagiarism go to the UWL website:
http://www.uwl.ac.uk/students/current-students/Advice-students-plagiarism

11. Evaluation of the Module

You will be invited to take part in the standard module evaluation survey at the end of the module. In addition you will have the opportunity to offer feedback on the module during the teaching term.

12. Personal Development Plan (PDP)

PDP is an integrated part of the module and the skills needed to successfully complete the assignments demonstrates a working towards the UWL graduate attributes.

[1] Oxford Advanced Learner's Dictionary - http://www.oxforddictionaries.com/definition/english/plagiarism - accessed 18.05.15

Section

C

Module Schedule

13 Guide to Learning Sessions

All taught sessions:

Delivery method:
1.5-hour seminar + 1.5-hour seminar.
Some of the seminars may include a brief lecture too.

Formative/summative assessment opportunities:
During the different sessions, you will be provided with practical exercises in order to prepare you for the final assessment. The nature of these exercises will depend on the different aspects that the majority of the students may need to reinforce.

Essential reading for sessions:
The literature for each of the sessions is specified below. This literature includes the main sources on which the lessons are based. As a result, the module leader will upload on blackboard slides for each session and further links/sources of information that may ease the understanding of each of the topics.

Independent study:
After some sessions, you will be expected to complete independently some practical tasks provided in class (and uploaded to blackboard). You are also encouraged to read further literature -apart from the ones specified below- related to the different topics covered in class.

Week 1: Introduction to Business Intelligence.

Venue: MIUC

Key concepts/issues: Benefits; Contributions to Business; Strategies; Maturity Models; Technologies: Data warehouse, Data Integration; Analysis; Reporting.

Literature for this session:

- Davenport, Thomas H., y Harris, Jeanne G. (2007). Competing on Analytics: The New Science of Winning. Nueva York: Harvard Business Press.
- Davenport, Thomas H., Harris, Jeanne G., Morison, Robert (2010). Analytics at Work: Smarter Decisions, Better Results. Nueva York: Harvard Business Press.
- Module Study Guide

Independent Study:

Recommended readings provided in class.

Description:

This session will introduce you to the module organization, structure and assessments. You will be exposed to the time commitments you will need to make and the skills you will develop through the duration of the module. Furthermore, you will get an understanding of the importance of business intelligence nowadays.

Week 2: Data Sources. Data Warehouse, OLAP, Metadata.

Venue: MIUC

Key concepts/issues: Data Warehouse: Elements, Architecture; Connection to Data Bases; Metadata; OLAP Cubes; OLAP Types.

Literature for this session:

- Bouman, R., Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Inmon, W. H. (2005). Building the Data Warehouse, 4th Edition. Hoboken: John Wiley & Sons.
- Inmon, W. H., Strauss, D., y Neushloss, G. (2008). DW 2.0: The Architecture for the Next Generation of Data Warehousing. Burlington: Morgan Kaufman Series.

Description:

In these sessions, you will be introduced to the different technologies and software solutions used in business intelligence. You will study data warehouses, databases, OLAP cubes and the relationship among them conceptually and you will see them working in practice.

Week 3: Data Warehouse: Design and ETL Processes.

Venue: MIUC

Key concepts/issues: Design of Data Warehouse; Tables; Dimensions; Metrics; Data Integration with ETL; ETL Processes.

Literature for this session:

- Bouman, R., Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Bouman, R., Casters M., Van Dongen, J. (2010). Pentaho® Kettle Solutions. Indianapolis: Wiley Publishing.

- Inmon, W. H. (2005). Building the Data Warehouse, 4th Edition. Hoboken: John Wiley & Sons.
- Inmon, W. H., Strauss, D., y Neushloss, G. (2008). DW 2.0: The Architecture for the Next Generation of Data Warehousing. Burlington: Morgan Kaufman Series.

Description:

In these sessions, you will deepen on the study of data warehouses. You will be able to learn how the data is stored and how to deal with it by means of ETL processes in order to obtain information from it.

Week 4: OLAP: Design and Analysis.

Venue: MIUC

Key concepts/issues: Analysis with OLAP; OLAP Elements; OLAP Rules; Pentaho and OLAP.

Literature for this session:

- Bouman, R., Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Thomsen, E. (2002). OLAP Solutions: Building Multidimensional Information Systems. Hoboken: John Wiley & Sons.
- Wrembel, R. (2006). Datawarehouses and OLAP: Concepts, Architectures and Solutions. Hersbey: IGI Globals.

Description:

In these sessions, you will study OLAP from both a conceptual and a practical point of view. You will also be introduced to Pentaho, the tool that we will use in this module for analyzing data, and you will study the relation between OLAP and Pentaho.

Week 5: Dashboards.

Venue: MIUC

Key concepts/issues: Creation; Monitoring Tool; Elements; Good Practices; Open Source Dashboards.

Literature for this session:

- Few, S. (2006). Information Dashboard Design: The Effective Visual Communication of Data. Sebastopol: O'Reilly Media.
- Rassmussen, N., et al. (2009). Business Dashboards: A Visual Catalog for Design and Deployment. Hoboken: Wiley Publishing.

Description:

In these sessions, you will study what dashboards are and how they are used in the context of business intelligence and business analytics. You will also study different open source widely used.

Weeks 6 and 7: Pentaho Dashboard.

Venue: MIUC

Key concepts/issues: Community Dashboard Framework; Pentaho Dashboard Designer.

Literature for this session:

- Bouman, R., Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Material of previous lessons

Description:

In this session, you will explore dashboards in Pentaho and its dashboard designer. You will learn how to create proper and useful dashboards.

Week 8: Pentaho Dashboard: Case Study.

Venue: MIUC

Key concepts/issues: Creation of Dashboard; Pentaho.

Literature for this session:

- Bouman, R., Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Material of previous lessons

Description:

In these sessions, you will apply the knowledge acquired in previous sections. You will work on a real case study on you own. This will give you the chance to work on a real problem and ask questions to answer the arising problems you might find.

Week 9: Reports in Business Intelligence.

Venue: MIUC

Key concepts/issues: Types of reports; Elements in a Report; Metrics; Graphics/Charts. Open Source Tools: Pentaho, JasperReports, Pentaho, BIRT, SpagoBI.

Literature for this session:

- Danciu, T., y Chirita, L. (2007). The Definitive Guide to JasperReports. Nueva York: Apress.
- Bouman, R. y Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.

Description:

In this session, you will get to know the kind of reports that can be obtained by applying Business Analytics techniques. You will analyze different reports in order to be aware of the different elements a report might contain. Finally, you will be introduce to well-known open-source tools for implementing business intelligence.

Weeks 10 and 11: Pentaho Reports.

Venue: MIUC

Key concepts/issues: Types of reports; Elements in a Report; Metrics; Graphics/Charts.

Literature for this session:

- Bouman, R. y Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Material of previous lessons

Description:

In this session, you will explore the Pentaho reporting system. You will study the kind of reports that can be obtained using Business Analytics in Pentaho, the different elements a report might contain, how to obtain and/or create metrics and the value added with the inclusion of visual elements such as graphics and charts.

Week 12: Pentaho Reports: Case Study.

Venue: MIUC

Key concepts/issues: Design of Reports; Creation of Reports

Literature for this session:

- Bouman, R. y Van Dongen, J. (2009). Pentaho® Solutions: Business Intelligence and Data Warehousing with Pentaho® and MySQL. Indianapolis: Wiley Publishing.
- Material of previous lessons

Description:

Once you are familiar with the elements of a report and the Pentaho technology, in these sessions, you will learn and work on the design and creation of reports using Pentaho, not only from a technical point of view, but also using your business skills to create a useful business report.

Week 13: Balanced Scoreboard.

Venue: MIUC

Key concepts/issues: Dashboards vs. Balanced Scoreboard; Use; Adoption; Indicators; Real Examples.

Literature for this session:

- Kaplan, R. S., Norton, D. P. (1996). The Balance Scorecard: Translating Strategy into Action. Boston: Harvard Business School Press.
- Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. Harvard business review, 74(1), 75-85.
- Material of previous lessons

Description:

In this session, you will be introduced to Balance Scoreboards and will see the differences, similarities and relationships between them and dashboards.

Week 14: Recapitulation, Remarks, Doubts.

Venue: MIUC

Key concepts/issues: Recapitulation, Remarks, Doubts

Literature for this session:

- Material of previous lessons

Description:

In this session, we will review the material covered in class and you will have the opportunity to solve your doubts to deepen your knowledge.

MARBELLA INTERNATIONAL UNIVERSITY CENTRE

Business Intelligence and Decision-Making
–
Advanced Data Visualization and Decision Making

Presentation of the module

2017-2018

Lola Burgueño

lola@miuc.org

Schedule

Week 1	Introduction to Business Intelligence
Week 2	Data Sources. Data Warehouse, Metadata, OLAP
Week 3	Data Warehouse: Design and ETL Processes
Week 4	OLAP: Design and Analysis
Week 5	Dashboards in Business Intelligence
Week 6 Week 7	Pentaho Dashboard
Week 8	Pentaho Dashboards: Case Study
Week 9	Reports
Week 10 Week 11	Pentaho Reports
Week 12	Pentaho Reports: Case Study
Week 13	Balanced Scorecard
Week 14	Recapitulation, Remarks, Doubts + Final Project

FORM I

Module Study Guide

AY2017-2018

Information Systems and Business Analytics

MIUC

Module Code	ISBA
Level	3
Credits	20UK Credits (10 ECTS)

Marbella International University Centre (MIUC)

Information Systems and Business Analytics

Module Study Guide

Contents

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Section A. Overview and Content

Section B. Assessment and Feedback

Section C. Module Course

Module Leader ,Teaching Team and Module Administrator Details

Module Leader	Lola Burgueño
Field/Subject and School	Computer Science and Engineering
Email	lola@miuc.org
Phone	952860000
Location	MIUC
Name	Jelena Krajacic
Job title	Module Administration
Email	jelena.krajacic@miuc.org
Phone	952860000
Location	MIUC

External Examiner(s)

The External Examiner(s) for this module are listed below. Please note that this is provided for information only; students are **not** permitted to enter into any correspondence about their marks with External Examiners.

Name	TBC
Job Title	
Institution	

Further Information

Total Guided Learning Hours	200
Consisting of:	
Contact Hours	56
Independent Study Hours	144

Assessment:

Percentage of final marks assessed by:

Midterm Project: Data Handling	40%
Final Exam: Practical Problems/Questions about case studies	60%

Section

A

Overview and Content

1. Welcome and Introduction to the Module

In the last years, company data has become more important than ever since information is extracted from it. The information is crucial for the success of companies since it helps taking the right decisions. Thus, companies need tools and mechanisms that deal with data easily and efficiently. Innovation and the application and management of technology creates value for a business in the increasingly fierce competition in global markets. Information systems first and business analytics later were born to cover the companies' needs.

This module is aimed at introducing the key concepts, elements, processes and technologies required for information systems and business analytics. It will cover how IT can be effectively used in business, and the different approaches to collect and analyse data in order to obtain information that is represented to drive decision-making.

The module is composed mainly of tutorials and seminars and will run throughout the semester (14 weeks).

2. Timetable/Venue/Rooms

First Point of Contact

A personal tutor will be allocated to you at the beginning of the programme

If you need to discuss any issue to do with this module, the first point of contact is the module leader, who is named at the start of this guide. If the module leader is unable to deal with the problem, you should then raise it with your course leader.

All classes will take place at MIUC, classrooms will be advertised on the module's Blackboard space

3. Aims of the Module

This module aims to:

- Develop an understanding of the key elements and processes and technologies related to information systems.
- Develop an understanding of the importance of business analytics.
- Develop an understanding of the current approaches to collect, analyse and represent the data to drive decision making.

- Ensure that students are exposed to technology and business trends impacting information systems and business analytics.

4. Learning Outcomes

On successful completion of this module the student will be able to:

LO1. Apply the concepts learnt about Information Systems to choose the most suitable software that fulfils the business requirements.
LO2. Understand the different types of databases and transform the data stored in them by means of ETL processes in order to build a data warehouse.
LO3. Apply the most popular business analytics algorithms to process data and obtain relevant information for the business.
LO4. Be aware of the functionality that the most popular tools for Business Intelligence offer and how they help analyse and represent the data to drive decision-making.

5. Content of the Module

Nowadays, computers are essential in businesses for management of vital information. Every day is gaining importance innovation and the application and management of technology to create value for a business in this increasingly fierce competition in global markets.
This module introduces key concepts, elements, processes and technologies required for information systems and business analytics. It will cover how IT can be effectively used in business, and the different approaches to collect, analyse and represent the data to drive decision making.

6. Learning Resources

University provision
Library resources and Academic Support Librarian

Marbella International University Center (MIUC) Library was founded in 2014 as a key element for the development of the institution, providing necessary resources to satisfy the information and learning needs, both academic and in terms of research, of students and faculty.

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The library is located on the ground floor of the center. It covers an area of about 80 m^2 with a total of 18 reader and study seats. Moreover, the library has 2 computer seats that provide access to the Internet and to searching the Koha catalogue and the electronic collection. In addition, the library offers Wi-Fi access throughout the room and provides users the necessary electronic equipment for displaying and listening to CDs / DVDs: external CD/DVD readers and headphones. Printing, copying and scanning facilities are also provided.

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The largest numbers of items for each discipline are monographs and reference works, about 800 volumes. Moreover, the audiovisual collection has around 300 volumes.

At the same time, the library has access to 3 databases of EBSCOhost®, supplied by EBSCO Publishing. These databases provide full-text and secondary information of thousands of electronic journals, monographs, reports and other publications.

Student learning resources

MIUC Library (see above)
Blackboard e-learning Platform*

Section
B

Assessment and Feedback

7. Assessment: General Information

<u>Summative Assessments</u>

Assessment 1: Midterm Project: Data Handling

In the eighth week, you will have to submit a project in which you will have to prove that you understood and know how to apply the key aspects of information systems and business intelligence studied in class until that moment. Given a company description and its database, the student will have to prove that he/she knows how to deal with the data in order to obtain a data warehouse for the company.

Assessment 2: Final Exam: Practical Problems/Questions about case studies

By the end of the module, you will carry out an exam that intends to assure your understanding of the concepts covered in the module, and your ability to apply them. It will encourage you to answer questions within a timeframe and in a precise and concise manner. The assessment will mainly consist on different questions related to the concepts and applications of information systems and the techniques used for business analysis (theory and practice).

The exam will be composed by several questions in which realistic problems and situations will be presented (information systems used in companies, databases used, business intelligence architectures, etc.). The students will be asked to resolve or plan solutions to the problems in which the contents studied over the module apply.

<u>Formative Assessments</u>

Practical exercises

During the different sessions, you will be provided with further practical exercises in order to prepare you for the summative assessments. The nature of these exercises will depend on the different aspects that the majority of the students may need to reinforce.

8. Details of Assessment

Assessment 1: Midterm Project: Data Handling

Weighting: 40%

Date/time/method of submission: Week 8.

Word count or equivalent: N/A

Assessment 2: Final Exam: Practical Problems/Questions about case studies

Weighting: 60%

Date/time/method of submission: Week 16.

Word count or equivalent: 2 hours

Assessment criteria:

Assessment 1: Midterm Project: Data Handling

- Knowledge and understanding (20%). The problem to solve is understood and both the information provided in the description of the problem and the structure of the database and the data stored in it, are used to design the most appropriate and efficient data warehouse for the business.
- Cognitive skills (30%). The student knows how to use the data integration functionality of Pentaho and puts it into practice showing that he is able to connect and query the provided database and develop ETL processes.
- Practical and professional skills (30%). Not only the student is familiar with Pentaho, but he uses it remarkably for building ETL processes in the most clear and efficient way.
- Transferrable and key skills (20%). The student is able to extract conclusions and come up with improvements that the business could incorporate.

Assessment 2: Final Exam: Practical Problems/Questions about case studies

- Knowledge and understanding (20%). Given the case study presented in the exam, the student understands the information systems described and is able to detect how business intelligence and analytics are/can be applied to them.
- Cognitive skills (30%). The student is able to apply the methods and algorithms studied in class to the problems presented.
- Practical and professional skills (30%). Given a problem, the student is able to select the method or algorithm that better solves it among all the methods/algorithms presented in class.
- Transferrable and key skills (20%). The student is able to extract conclusions from the information extracted after applying business analytics techniques.

Further details on the assessment criteria will be uploaded to blackboard the first week of the semester.

9. Summative Assessment Grid

Type of assessment	Module learning outcome	Word count or equivalent	Due date	Threshold	Pass mark	Weighting
Midterm Exam: multiple-choice questions + short answer questions	LO1, LO2, LO3	2 hours	Week 8	N/A	40%	40%
Final Exam: multiple-choice questions + short answer questions	LO1, LO2, LO3, LO4	2 hours	Week 16	N/A	40%	60%

10. Statement on Plagiarism

Plagiarism is defined as the practice of taking someone else's work and passing them off as their own.[1] It is presenting someone else's work as one's own irrespective of intention. Close paraphrasing; copying from the work of another person, including another student; using the ideas of another person without proper acknowledgement; and repeating work that you have previously submitted – at the University of West London or at another institution - without properly referencing yourself (known as 'self-plagiarism') shall also constitute plagiarism.

For further information please refer to the Student Handbook Section 3. University Regulations and Student Code of Conduct

For further advice on plagiarism go to the UWL website:
http://www.uwl.ac.uk/students/current-students/Advice-students-plagiarism

11. Evaluation of the Module

You will be invited to take part in the standard module evaluation survey at the end of the module. In addition you will have the opportunity to offer feedback on the module during the teaching term.

[1] Oxford Advanced Learner's Dictionary - http://www.oxforddictionaries.com/definition/english/plagiarism - accessed 18.05.15

12. Personal Development Plan (PDP)

PDP is an integrated part of the module and the skills needed to successfully complete the assignments demonstrates a working towards the UWL graduate attributes.

Section
C

Module Schedule

13 Guide to Learning Sessions

All taught sessions:

Delivery method:
1.5-hour lecture + 1.5-hour seminar.
Some of the seminars may include a brief lecture too.

Formative/summative assessment opportunities:
During the different sessions, you will be provided with practical exercises in order to prepare you for the final assessment. The nature of these exercises will depend on the different aspects that the majority of the students may need to reinforce.

Essential reading for sessions:
The literature for each of the sessions is specified below. This literature includes the main sources on which the lessons are based. As a result, the module leader will upload on blackboard slides for each session and further links/sources of information that may ease the understanding of each of the topics.

Independent study:
After some sessions, you will be expected to complete independently some practical tasks provided in class (and uploaded to blackboard). You are also encouraged to read further literature -apart from the ones specified below- related to the different topics covered in class.

Week 1: Introduction to Information Systems.

Venue: MIUC

Key concepts/issues: Software Applications: Types, Use, Security, Licensing considerations and ethics; Appropriate use of resources; Networks; Hardware.

Literature for this session:

- R. Kelly Rainer, Brad Prince (2015). Introduction to Information Systems, 6th Edition. Chapter 1.
- Van Der Aalst, Wil, and Christian Stahl. "Information Systems: Introduction and Concepts." In Modeling Business Processes: A Petri Net-Oriented Approach, 1-40. MIT Press, 2011.
- Module Study Guide

Description:

This session will introduce you to the module organization, structure and assessments. You will be exposed to the time commitments you will need to make and the skills you will develop through the duration of the module. Furthermore, you will get an understanding of what Information Systems are, their uses and importance.

Week 2: Analysis and Design of Information Systems through Practical Exercises.

Venue: MIUC

Key concepts/issues: Study of existing information systems; Design techniques, System Development Life Cycle, Design Specification Tools.

Literature for this session:

- Arthur M. Langer (2008). Analysis and Design of Information Systems, 3rd Edition. Chapters 1-2.
- Satzinger, J. W., Jackson, R. B., & Burd, S. (2007). Systems Analysis & Design In A Changing World, Fourth Edition. Chapter 1.

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will study real and successful information systems. You will also learn the main design techniques for building them properly as well as the practices that can make them fail, with all that this implies.

Week 3: Introduction to Business Intelligence.

Venue: MIUC

Key concepts/issues: Concepts; Life Cycle; Project Management; Data; Reporting.

Literature for this session:

- Grossmann, Wilfried, Rinderle-Ma, Stefanie (2015). Fundamentals of Business Intelligence. Springer. Chapters 1 and 9.

Description:

In this session, you will be introduced to Business Intelligence. You will study the lifecycle of business intelligence projects, the processes involved in the extraction of information and how this information is represented and interpreted.

Weeks 4 and 5: Data handling and Business Intelligence

Venue: MIUC

Key concepts/issues: ETL Processes; Data Warehouse; Metadata; OLAP.

Literature for this session:

- Grossmann, Wilfried, Rinderle-Ma, Stefanie (2015). Fundamentals of Business Intelligence. Springer. Chapter 3.

Description:

In these sessions, you will study how the data is stored in the data warehouses and how to handle it and transform it when needed by means of ETL processes. You will also study what the metadata is and the kind of information it keeps. Finally, you will be introduced to OLAP and the value it adds to the business.

Week 6: Balanced Scorecard and Strategy Indicators.

Venue: MIUC

Key concepts/issues: Concepts; Users; Types of Data warehouse; Architecture.

Literature for this session:

- Readings: Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. Harvard business review, 74(1), 75-85.
- Grossmann, Wilfried, Rinderle-Ma, Stefanie (2015). Fundamentals of Business Intelligence. Springer. Chapter 3.

Description:

In this session, you will learn/deepen in the concept of balanced scoreboard and how it is used for managing and translating the strategy into a set of strategy indicators.

Week 7: Business Analytics: Data clustering.

Venue: MIUC

Key concepts/issues: Hierarchical clustering; Clustering k-means;

Literature for this session:

- Rokach, Lior, and Oded Maimon. "Clustering methods." Data mining and knowledge discovery handbook. Springer US, 2005. 321-352.

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will learn the most common and used algorithms for data clustering in business analysis. You will understand, apply and compare these two algorithms for data clustering: hierarchical clustering and k-means.

Week 8: Business Analytics: Principal component analysis + Exam

Venue: MIUC

Key concepts/issues: PCA algorithm; Comparison with data clustering.

Literature for this session:

- Jolliffe, I.T. (2002). Principal Component Analysis, 2nd Edition. Springer. Chapter 7.
- Material of previous lessons

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will learn when and how to apply the algorithm used in business analisys for reducing data dimensions: Principal Component Analysis.

Week 9: Business Analytics: Data Classification.

Venue: MIUC

Key concepts/issues: Classification problems; Supervised learning; Decision trees; Support vector machines.

Literature for this session:

- Quinlan, J. R., (1986). Induction of Decision Trees. Machine Learning 1: 81-106, Kluwer Academic Publishers.
- Kecman, Vojislav, (2001). Learning and Soft Computing — Support Vector Machines, Neural Networks, Fuzzy Logic Systems, The MIT Press, Cambridge, MA.
- Material of previous lessons

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will learn the most common and used algorithms for data classification in business analysis. You will understand, apply and compare the following techniques/algorithms: Supervised learning, Decision trees and Support vector machines.

Week 10: Business Analytics: Practical exercises.

Venue: MIUC

Key concepts/issues: Application of business intelligence algorithms; Decision of best algorithm to solve specific problems.

Literature for this session:

- Jolliffe, I.T. (2002). Principal Component Analysis, 2nd Edition. Springer.
- Quinlan, J. R., (1986). Induction of Decision Trees. Machine Learning 1: 81-106, Kluwer Academic Publishers.
- Kecman, Vojislav, (2001). Learning and Soft Computing — Support Vector Machines, Neural Networks, Fuzzy Logic Systems, The MIT Press, Cambridge, MA.
- Material of previous lessons

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will deepen in what you learned in previous lessons by means of practical exercises. You will learn to decide which technique is more appropriate in each case.

Week 11: Introduction to Big Data.

Venue: MIUC

Key concepts/issues: Concepts; Relation between Big Data and Business Intelligence; Technology.

Literature for this session:

- Peter Kinnaird, Inbal Talgam-Cohen, (2012). "Big Data". XRDS: Crossroads, The ACM Magazine for Students. No. 19 (1). ACM.

Independent Study:

Complete the practical exercises provided in class.

Description:

In this session, you will be introduced to Big Data. You will learn how, thanks to Big Data, it is possible to count on the current mechanisms that Business Intelligence applies nowadays. Apart from the concepts and the general view, you will see the concrete technology that supports both paradigms.

Week 12: NoSQL Databases.

Venue: MIUC

Key concepts/issues: Types; Uses; Data Models; MapReduce.

Literature for this session:

- Pramod J. Sadalage, Martin Fowler, (2013). “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, 1st Edition. Chapter 1.
- Material of previous lessons

Description:

In this session, you will learn how data is stored in databases. The types of NoSQL databases and the comparison between them and relational databases. You will be able to decide which type of database is more appropriate depending on the data to be stored and the use that will be given to it. Finally, you will study one of the most successful algorithms that is applied almost in every company making use of BigData: MapReduce.

Week 13: Software for Business Intelligence.

Venue: MIUC

Key concepts/issues: Open source tools; Success factors.

Literature for this session:

- Cindi Howson (2007). Successful Business Intelligence, Second Edition: Unlock the Value of BI & BigData. 2nd Edition. Chapter 1.
- Hawking, Paul and Sellitto, Carmine, (2010). "Business Intelligence (BI) Critical Success Factors". ACIS 2010 Proceedings.
- Pentaho Tutorials. Available online: https://help.pentaho.com/Documentation/7.1/0J0 (Accessed: August, 2017).

Description:

This session will give you hands-on training with open source software for Business Intelligence. You will get to know the characteristics of different tools and will be able to compare the functionality that each one offers. We will present and/or come up with the success factors and factors that make companies fail.

Week 14: Recapitulation, Remarks, Doubts.

Venue: MIUC

Key concepts/issues: Recapitulation, Remarks, Doubts

Literature for this session:

- Material of previous lessons

Description:

In this session, we will review the material covered in class and you will have the opportunity to solve your doubts to deepen your knowledge.

Information Systems and Business Analytics

Presentation of the module

2017-2018

Lola Burgueño

lola@miuc.org

Information Systems and Business Analytics

Schedule

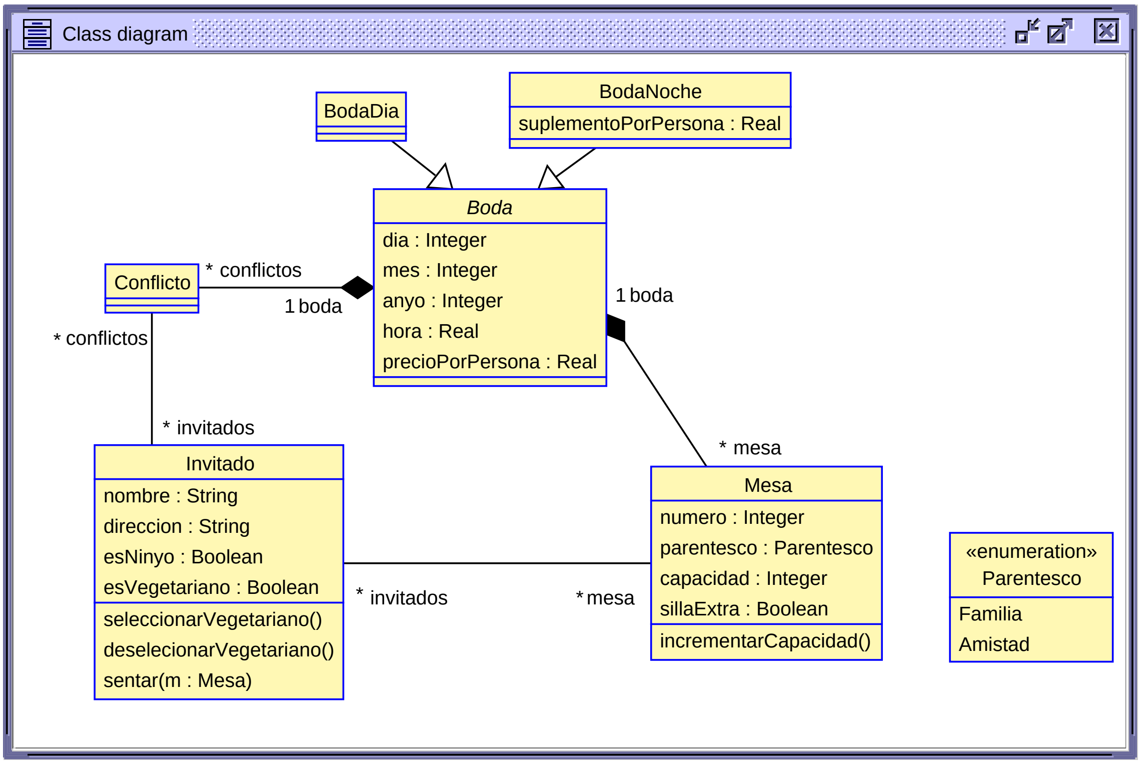
Week 1	Introduction to Information Systems
Week 2	Design of Information Systems through Problem Solving
Week 3	Introduction to Business Intelligence
Week 4	Data handling and Business Intelligence
Week 5	
Week 6	Balanced Scorecard and Strategy Indicators
Week 7	Business Analytics: Data clustering
Week 8	Business Analytics: Principal component analysis (2h) + Exam (2h)
Week 9	Business Analytics: Data Classification
Week 10	Business Anaytics: Pratical exercices
Week 11	Introduction to BigData
Week 12	NoSQL Databases
Week 13	Business Intelligence Software
Week 14	Recapitulation, Remarks and Doubts

Métodos formales para la Ingeniería del Software
(4º curso del grado Ingeniería del Software)
Dpto. de Lenguajes y Ciencias de la Computación
E.T.S.I. INFORMÁTICA
Tercera Práctica Evaluable-OCL

El objetivo de esta práctica es el modelado y la especificación de una serie de propiedades para un sistema de gestión de bodas muy simplificado.

Descripción del modelo UML

Describe el modelo UML del sistema utilizando el lenguaje textual de la herramienta USE y siguiendo el diagrama de clases que se ilustra en la siguiente figura. Al final del enunciado hay un ejemplo de un pequeño diagrama de objetos instancia del sistema.



Define las siguientes clases:

1. La clase `Boda` es la clase central de este sistema de organización de eventos. Contiene datos de importancia como la fecha de la boda (día, mes, año y hora) y el precio del menú por persona. Esta clase no debe ser instanciable. La hora de la boda se codifica como un atributo de tipo Real que indica los segundos transcurridos desde las 0:00:00 horas, es decir, por ejemplo las 14:00 se representan como 50400.

2. De la clase `Boda` heredan dos clases instanciables: `BodaDia` `BodaNoche`. Se considera que una boda es de día siempre y cuando se celebre antes de las 14:00, y de noche en caso contrario. Cuando las bodas son celebradas en horario de noche, la empresa organizadora cobra un suplemento por cada asistente.

3. La clase `Invitado` recoge información de los asistentes a la boda. En concreto, para cada uno de ellos, la clase recoge su nombre completo, su direccion y si es niño o adulto. También tiene un atributo `esVegetariano` de tipo Booleano y dos operaciones `seleccionarVegetariano()` y `desseleccionarVegetariano()` que modifican dicho atributo.

4. Los objectos de la clase `Mesa` representan cada una de las mesas en la celebración de una boda en concreto. Nótese que esta clase no representa a una mesa física. Para cada mesa se guarda en el atributo `numero` el número que identifica a la mesa y en el atributo `capacidad` número de asientos disponibles. El atributo `parentesco` denota la relación de la gente sentada en la mesa con los novios, su valor puede ser `Familiar` o `Amigo` tal y como recoge el enumerado `Parentesco`. Además, la clase tiene un atributo `sillaExtra` que por defecto será inicializado al valor `false`. La clase tiene una operación `incrementarCapacidad()` que permite añadir una silla extra a la mesa, lo cual se refleja en el incremento del valor de su capacidad en una unidad y en el cambio del atributo `sillaExtra` a `true`.

5. La clase `Conflicto` Guarda información sobre los conflictos que puedan existir entre los invitados, de forma que estos conflictos se puedan tener en cuenta a la hora de sentar a la gente en las mesas.

Define las siguientes relaciones entre clases:

1. Una relación de composición entre las clases `Boda` y `Mesa` que define las mesas que tiene cada boda.
2. Una asociación entre las clases `Mesa` e `Invitado` que recoge los invitados sentados en cada mesa.
3. Una relación de composición entre las clases `Boda` y `Conflicto`.
4. Una asociación entre las clases `Conflicto` e `Invitado` que recoge los grupos de invitados con ciertos conflictos entre ellos.

Crea un fichero .soil de objetos y asociaciones entre objetos que sea una instancia no trivial del modelo implementado.

Especificación de los invariantes OCL

Sobre el sistema modelado escribe los siguientes invariantes OCL:

1. El número de invitados en cada mesa debe ser inferior o igual al número de asientos en la mesa.
2. Las bodas de día y de noche tienen que ser consistentes con sus horarios, es decir, las bodas de día deben tener un horario anterior a las 14:00 y las bodas de noche posterior.
3. En cada mesa que haya al menos un niño, debe haber al menos un adulto.
4. No debe haber personas con conflictos sentados en la misma mesa.
5. Un invitado a una boda debe estar sentado a lo sumo en una mesa de dicha boda. (Un invitado puede estar sentado en más de una mesa, pero debe ser en bodas diferentes)
6. Cada día, a lo sumo hay dos bodas, una de día y otra de noche.
7. Para que una boda sea rentable para el salón de bodas, es necesario que el precio total de la misma sea igual o superior a 10000 euros.

Especificación de pre y post condiciones OCL

1. Para las operación `seleccionarVegetariano()` de la clase `Invitado` establece las siguientes pre/-post condiciones:
   a) Pre: El invitado no es vegetariano
   b) Post: El invitado es vegetariano
2. Para las operación `deseleccionarVegetariano()` de la clase `Invitado` establece las siguientes pre/post condiciones:
   a) Pre: El invitado es vegetariano

b) Post: El invitado no es vegetariano

3. Para la operación `incrementarCapacidad` de la clase `Mesa` establece las siguientes pre/post condiciones:

   a) Pre: No he ha colocado ninguna silla extra con anterioridad (`sillaExtra` tiene el valor `false`.

   b) Post: Se ha colocado una silla extra.

   c) Post: La capacidad se ha incrementado en una unidad.

4. Para la operación `sentar(m : Mesa)` de la clase `Invitado` establece las siguientes pre/post condiciones:

   a) Pre: El invitado no está sentado en ninguna mesa

   b) Pre: Hay al menos una silla libre en la mesa donde se quiere sentar

   c) Pre: No hay ninguna persona sentada en la misma mesa que entre en conflicto con él

   d) Post: El invitado está sentado en la mesa

Documentos a entregar

Recuerda que esta es una práctica que debéis hacer en parejas. Los dos componentes deben participar IGUALMENTE en el desarrollo de la práctica, y además la documentación entregada DEBE ser el fruto del trabajo EXCLUSIVO de cada pareja. Cualquier anomalía que se detecte en este sentido se tendrá en cuenta en la evaluación de la práctica.

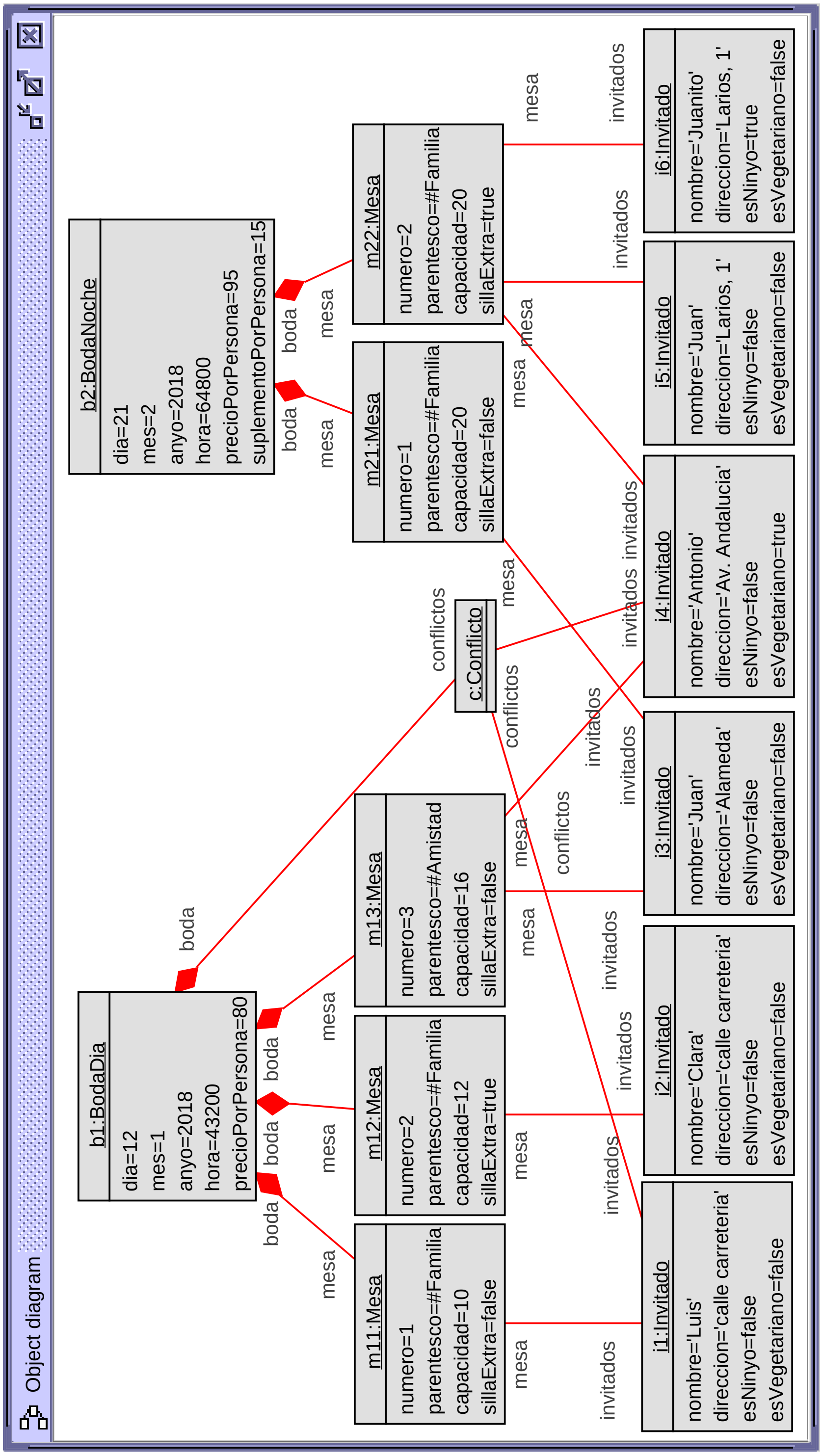
D1. El código USE/OCL de con las clases, relaciones, invariantes pre/post condiciones debidamente anotadas.

D2. Un fichero script (.soil) para la creación de objetos y asociaciones entre objetos que sea una instancia no trivial del modelo implementado

D2. Ficheros con layouts adecuados para visualizar el diagrama de clases y el diagrama de objetos de la instancia porporcionada.

Referencias

[1] Dimitrios S. Kolovos, Jordi Cabot: Towards a Corpus of Use-Cases for Model-Driven Engineering Courses. EduSymp/OSS4MDE@MoDELS 2016: 14-18.



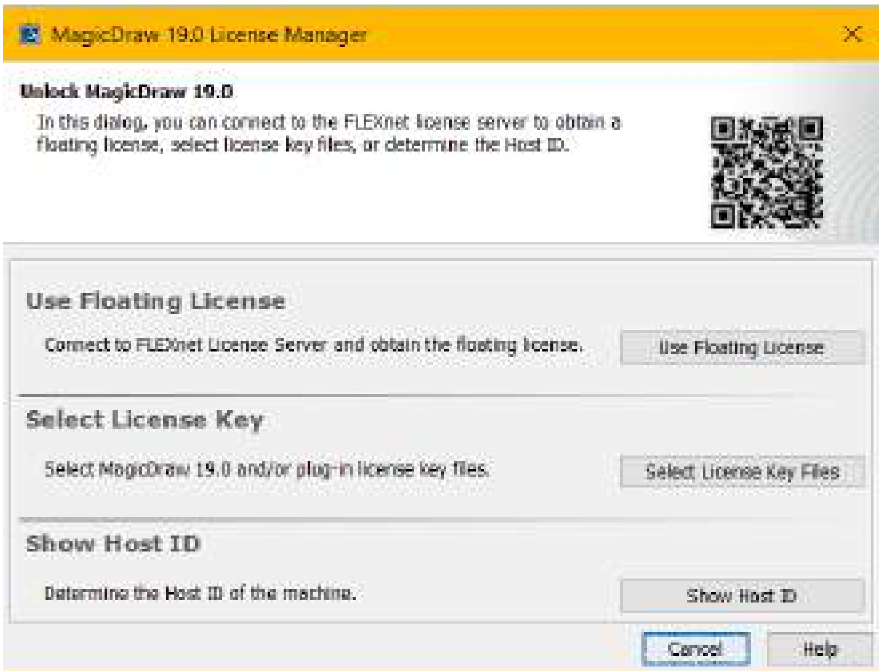
Object diagram
b1:BodaDia
dia=12
mes=1
anyo=2018
hora=43200
precioPorPersona=80
b2:BodaNoche
dia=21
mes=2
anyo=2018
hora=64800
precioPorPersona=95
suplementoPorPersona=15
m11:Mesa
numero=1
parentesco=#Familia
capacidad=10
sillaExtra=false
m12:Mesa
numero=2
parentesco=#Familia
capacidad=12
sillaExtra=true
m13:Mesa
numero=3
parentesco=#Amistad
capacidad=16
sillaExtra=false
m21:Mesa
numero=1
parentesco=#Familia
capacidad=20
sillaExtra=false
m22:Mesa
numero=2
parentesco=#Familia
capacidad=20
sillaExtra=true
c:Conflicto
i1:Invitado
nombre='Luis'
direccion='calle carreteria'
esNinyo=false
esVegetariano=false
i2:Invitado
nombre='Clara'
direccion='calle carreteria'
esNinyo=false
esVegetariano=false
i3:Invitado
nombre='Juan'
direccion='Alameda'
esNinyo=false
esVegetariano=false
i4:Invitado
nombre='Antonio'
direccion='Av. Andalucia'
esNinyo=false
esVegetariano=true
i5:Invitado
nombre='Juan'
direccion='Larios, 1'
esNinyo=false
esVegetariano=false
i6:Invitado
nombre='Juanito'
direccion='Larios, 1'
esNinyo=true
esVegetariano=false
boda
mesa
invitados
conflictos

Ingeniería de Requisitos

Tutorial: Validación de restricciones OCL en MagicDraw

Para hacer uso de la funcionalidad de validación de restricciones OCL, necesitaremos tener instalado **MagicDraw Standard 19.0**. La descarga la podéis hacer desde: https://www.magicdraw.com/download/magicdraw, y para ello os tenéis que registrar.

Una vez instalado, cuando lo ejecutemos por primera vez, aparecerá una ventana como la que se muestra a continuación que os pedirá que introduzcáis el fichero con la licencia que os hemos proporcionado en el aula.



Para hacer uso de la funcionalidad de validación de restricciones OCL, en este tutorial partimos de la base de que ya hemos creado un modelo de clases y un modelo de objetos. Sirvan como ejemplo los modelos que se muestran a continuación:

Referencias

1. MagicDraw 19.0 LTR Documentation. https://docs.nomagic.com/display/MD190/MagicDraw+Documentation. Accedido en octubre 2020.

2. Object Management Group. (2014, February). Object Constraint Language (OCL) Specification. Version 2.4. (OMG Document formal/2014-02-03) Object Management Group. (2015, March).

3. Unified Modeling Language (UML) Specification. Version 2.5. (OMG document formal/2015-03-01)

Parte del material anterior está disponible públicamente. El siguiente documento muestra los links de acceso.

Publicado en el Repositorio RiUMA

Ingeniería Web. Modelado

Material disponible en: https://hdl.handle.net/10630/15585

Tecnología de la Información y la Comunicación Aplicada a la Terapia

Ocupacional Material disponible en: https://hdl.handle.net/10630/15582

DevOps: Herramientas para el Desarrollo de Software

Material disponible en: https://hdl.handle.net/10630/15583

Métodos Formales para la Ingeniería del Software

Material disponible en: https://hdl.handle.net/10630/15584

Material docente Marbella International University Center

Information Systems and Business Analytics

Material no disponible públicamente. Una versión personal del plan docente y los materiales elaborados pueden ser consultadas en: http://www.lcc.uma.es/~loli/downloads/ISBA.pdf

Business Intelligence and Decision-Making

Material no disponible públicamente. Una versión personal del plan docente y los materiales elaborados pueden ser consultadas en: http://www.lcc.uma.es/~loli/downloads/BIDM.pdf

Material Editorial UOC

Ingeniería de requisitos

Material no disponible públicamente. Accesible únicamente a los alumnos de la asignatura.

c. PROYECTOS DE INNOVACIÓN DOCENTE

d. OTROS MÉRITOS RELACIONADOS CON LA CALIDAD DE LA ACTIVIDAD DOCENTE

3. CALIDAD DE LA FORMACIÓN DOCENTE

a. PARTICIPACIÓN, COMO PONENTE, EN CONGRESOS ORIENTADOS A LA FORMACIÓN DOCENTE UNIVERSITARIA

Dipartimento di Ingegneria e Scienze
dell’Informazione e Matematica

Università degli Studi dell’Aquila

This is to certify that Dr. Loli Burgueno, from the University of Malaga (Spain), ha attended and participated in the 13th Educators Symposium at MoDELS (EduSymp’17), that has taken place in Austin (Texas) on September 19th, 2017.

The EduSymp’17 organizers

Alfonso Pierantonio
Peter J. Clarke

Prof. Alfonso Pierantonio
Dipartimento di Ingegneria e Scienze dell’Informazione
Università degli Studi dell’Aquila

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MODELS 2017
austin, tx

Teaching Model Views with UML and OCL

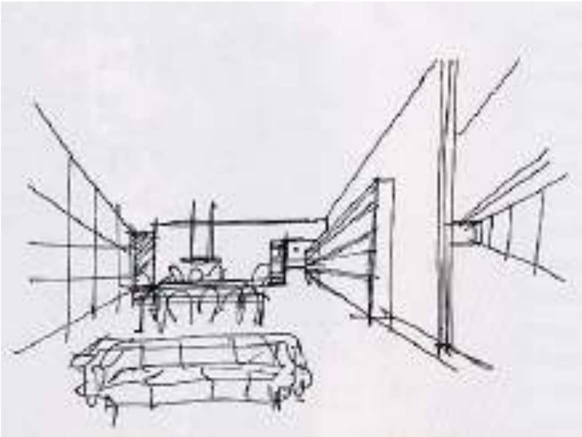
Loli Burgueño,
Antonio Vallecillo,
Martin Gogolla

SEPTEMBER 19, 2017

— 13th Educators Symposium at MODELS —

A couple of recurrent problems

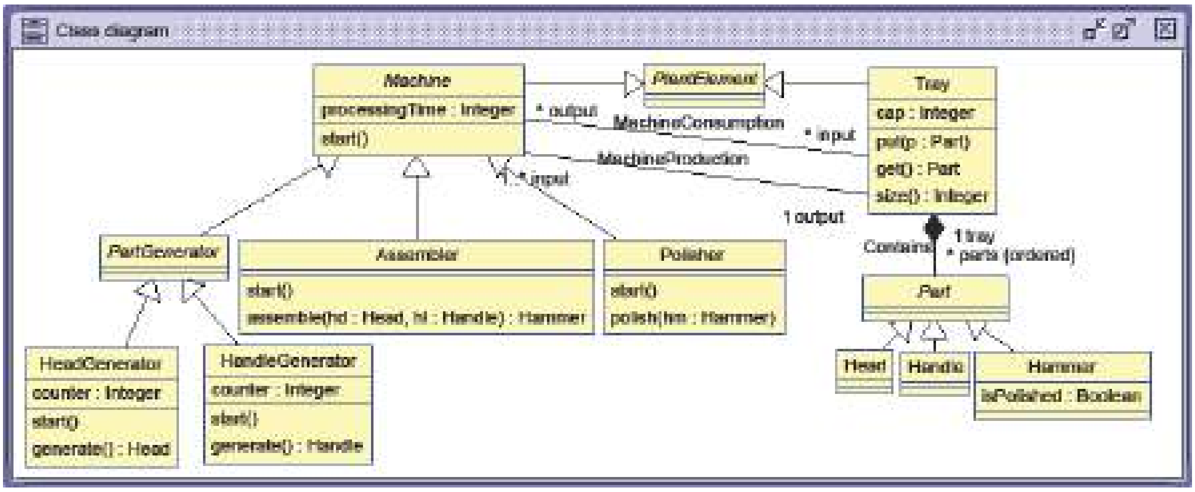
- Students tend to see/use models as drawings
  - Less precise and formal than programs
  - No software artefacts, just sketches
  - No clear idea of the relationships between different “views”
  - Platonic vs. Aristotelian approach



- How to make students aware of the fact that:
  - Models are software artefacts
  - Models can be instantiated/executed/simulated
  - Views of the same system are strongly inter-related

A case study we use in class

- Specifies different views of the same system
- Uses UML to specify the system and OCL/USE to verify and simulate the specifications



Behaviour: pre-post conditions

put(p:Part)

pre notFull: self.parts->size()<cap

post ElementAdded: self.parts=self.parts@pre->append(p)

get():Part

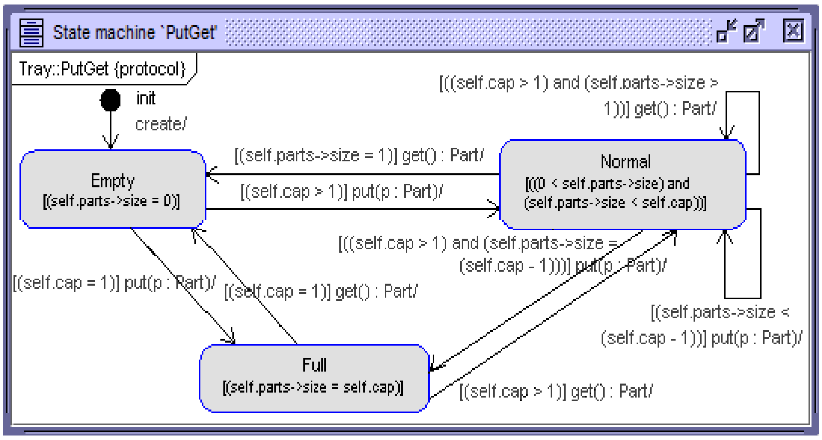
pre notEmpty: self.parts->size()>0

post FirstElementRemoved:

result=self.parts@pre->at(1) and

self.parts@pre=self.parts->prepend(result)

Behaviour: State Machines




```
psm PutGet
  states
    init: initial
    Empty  [self.parts->size()=0]
    Normal [0<self.parts->size() and self.parts->size()<self.cap]
    Full   [self.parts->size()=self.cap]
  transitions
    init -> Empty { create }
    Empty -> Normal { [self.cap>1] put() }
    Normal -> Normal { [self.parts->size()<cap-1] put() }
    Normal -> Full { [self.cap>1 and self.parts->size()=cap-1] put() }
    Empty -> Full { [self.cap=1] put() }
    Full -> Empty { [self.cap=1] get() }
    Full -> Normal { [self.cap>1] get() }
    Normal -> Normal { [self.cap>1 and self.parts->size()>1] get() }
    Normal -> Empty { [self.parts->size()=1] get() }
end
```

Behaviour: Body of operations (SOIL)

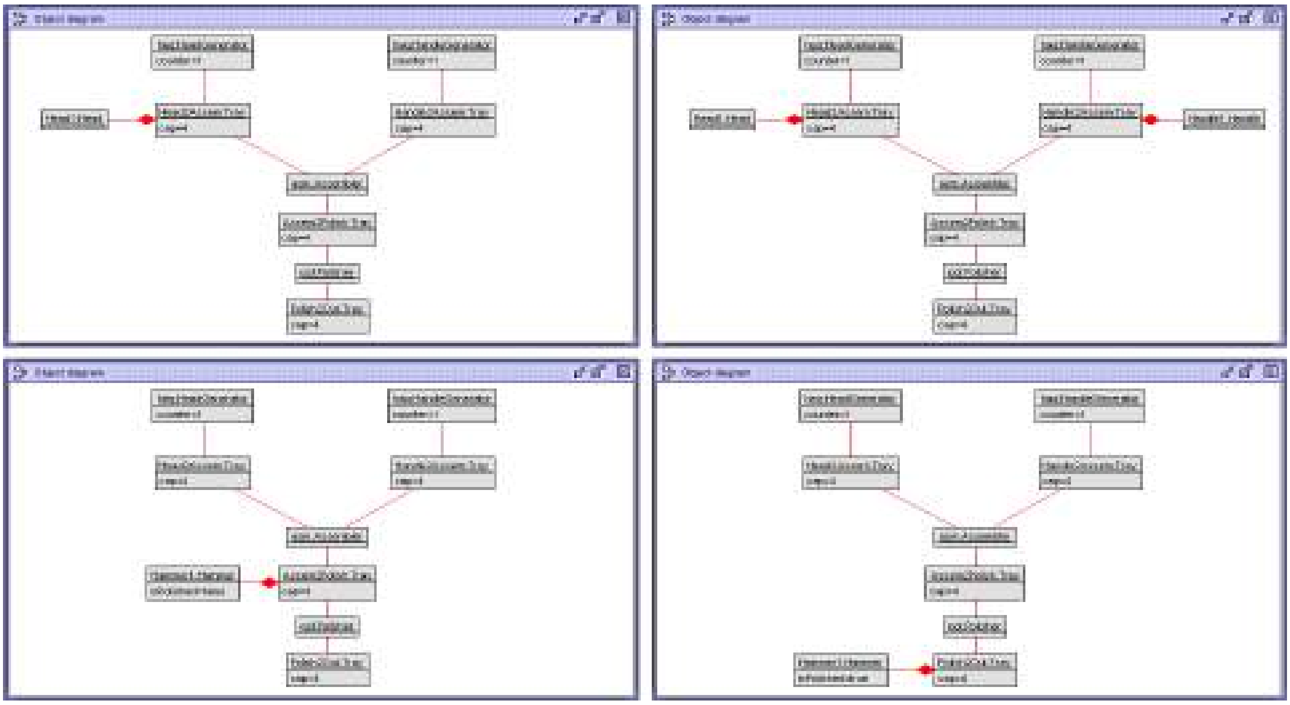
```
Assembler::start()
begin
  declare hd:Part, hl:Part, hm:Hammer;
  hd:= self.input->select(t|t.parts->size>0 and
         t.parts->forAll(oclIsTypeOf(Head)))->single().get();
  hl := self.input->select(t|t.parts->size>0 and
          t.parts->forAll(oclIsTypeOf(Handle)))->single().get();
  hm:=self.assemble(hd.oclAsType(Head),hl.oclAsType(Handle));
  self.output.put(hm);
 end
```

Executing the specifications (1)

```
-- Machines
!new HandleGenerator('hag')
!new HeadGenerator('heg')
!new Assembler('asm')
!new Polisher('pol')
-- Trays
!new Tray('Handle2Assem')
!Handle2Assem.cap:=4;
!new Tray('Head2Assem')
!Head2Assem.cap:=4;
!new Tray('Assem2Polish')
!Assem2Polish.cap:=4;
!new Tray('Polish2Out')
!Polish2Out.cap:=4;
```

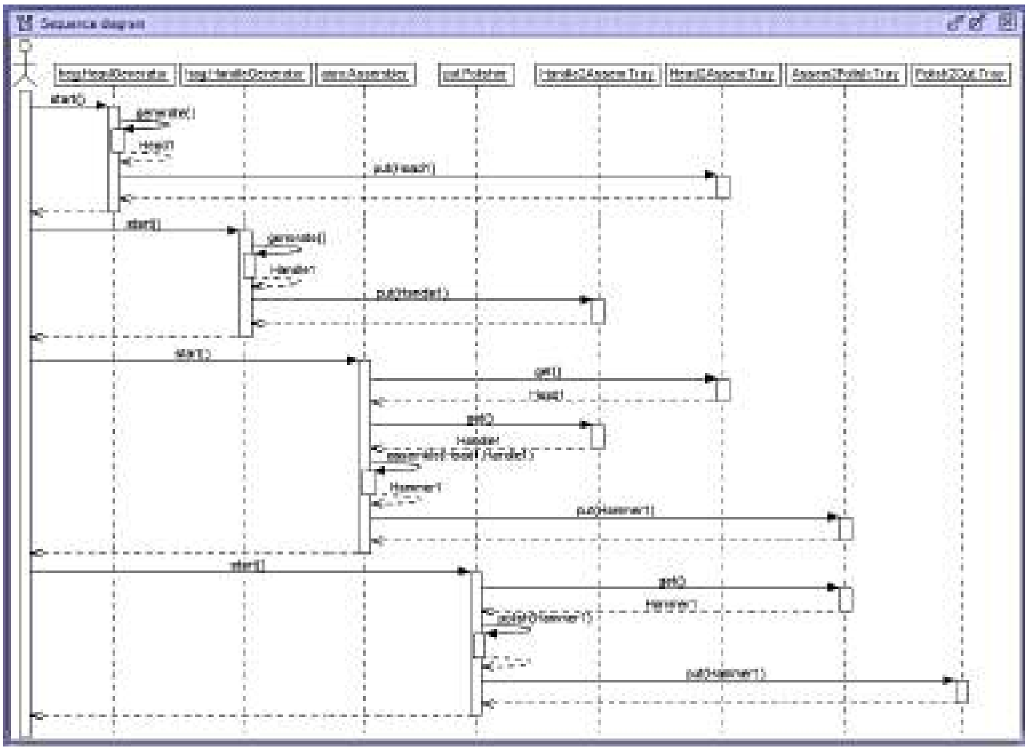
```
-- Production Line Connections
!insert (hag,Handle2Assem) into MachineProduction
!insert (heg,Head2Assem) into MachineProduction
!insert (Handle2Assem,asm) into MachineConsumption
!insert (Head2Assem,asm) into MachineConsumption
!insert (asm,Assem2Polish) into MachineProduction
!insert (Assem2Polish,pol) into MachineConsumption
!insert (pol,Polish2Out) into MachineProduction
-- Process
!heg.start()
!hag.start()
!asm.start()
!pol.start()
```

Executing the specifications

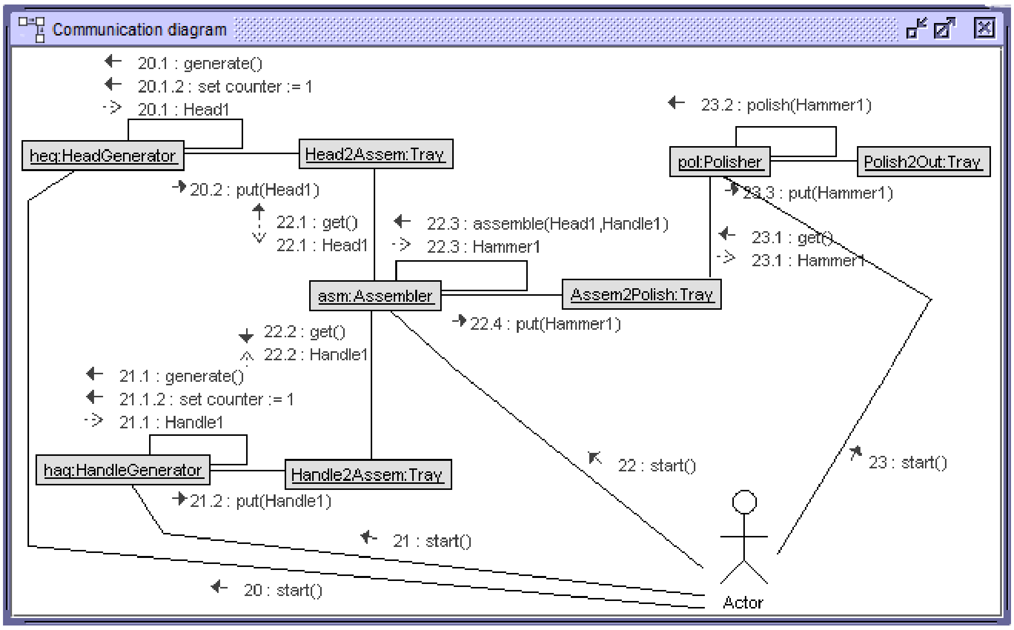


http://atenea.lcc.uma.es/Descargas/EduSymp17/3Hammers.mp4?dl=0

Object interactions – Sequence diagram

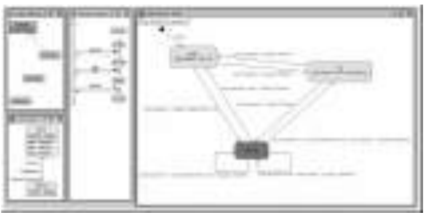


Object interactions – Communication diagram



Demo time!

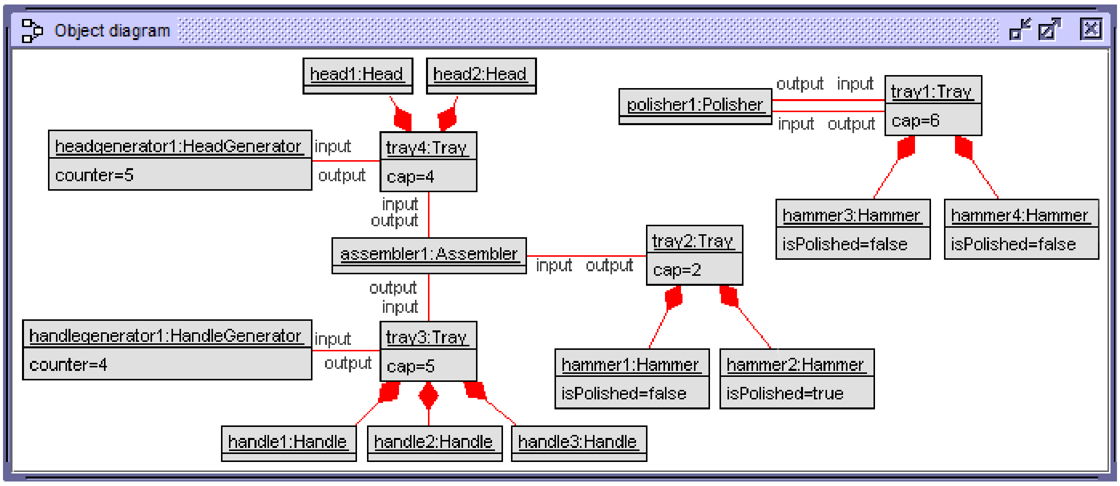
- http://atenea.lcc.uma.es/Descargas/EduSymp17/3Hammers.mp4?dl=0



- http://atenea.lcc.uma.es/Descargas/EduSymp17/snapshots-buffer.pdf?dl=0

Structural tests

- Generating object models using the metamodel



The produced system is wrong. The polisher is not connected to any tray!

Further analysis

- execution and simulation of scenarios (operation call sequences)
- checking structural properties of the system within states by OCL queries (e.g. calculating the number of finally produced parts)
- checking behavioral properties (e.g., testing the executability of an operation by testing its pre-conditions)
- checking for weakening or strengthening model properties (invariants, contracts, guards) by executing a scenario with modified constraints
- proving general properties within the finite search space with the USE model validator, such as structural consistency (i.e. all classes are instantiable)
- behavioral consistency (i.e. all operations can be executed)
- deadlocks (e.g. construction of deadlock scenarios due to inadequate buffer capacities)
- The relationships between the views can also be explored with this approach: for instance, when one of the views is changed

Lessons Learned

- The students discover the advantages of checking that the models they are building are correct
- They discover the intimate relations between the different views of a system, and how changes in the model manifest in the views
- Advantages of incremental development process for building the models
- Models are more than pictures

Thanks!

MODELS 2017
austin, tx

Teaching Model Views with UML and OCL

Loli Burgueño,
Antonio Vallecillo,
Martin Gogolla

SEPTEMBER 19, 2017

13th Educators Symposium at MODELS

Vol-2019
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MODELS-SE 2017
MODELS 2017 Satellite Events

- **Workshops**
- **Posters**
- **Doctoral Symposium**
- **13th Educator Symposium at MODELS**
- **ACM Student Research Competition**
- **Tools and Demonstrations**

Proceedings of MODELS 2017 Satellite Event: Workshops (ModComp, ME, EXE, COMMitMDE, MRT, MULTI, GEMOC, MoDeVVa, MDETools, FlexMDE, MDEbug), Posters, Doctoral Symposium, Educator Symposium, ACM Student Research Competition, and Tools and Demonstrations
co-located with ACM/IEEE 20th International Conference on Model Driven Engineering Languages and Systems (MODELS 2017)

Austin, TX, USA, September, 17, 2017.

Edited by

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Davide Di Ruscio, University of L'Aquila (ACM Student Research Competition Chair)

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COMMItMDE - 2nd International Workshop Collaborative Modelling in MDE

MRT - 12th International Workshop on Models@run.time

MULTI - 4th International Workshop on Multi-Level Modelling

GEMOC - 5th Workshop on the Globalization of Modeling Languages

MoDeVVa - 14th Model Driven Engineering, Verification and Validation. Integrating Verification and Validation in MDE

MDETools - Model-Driven Engineering Tools

FlexMDE - 3rd Flexible MDE Workshop

MDEbug - 1st International Workshop on Debugging in Model-Driven Engineering

Posters

Doctoral Symposium

13th Educator Symposium at MODELS

ACM Student Research Competition

Tools and Demonstrations

Teaching Model Views with UML and OCL

Loli Burgueño[1 2], Antonio Vallecillo[1], and Martin Gogolla[3]

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Abstract. The specification of any non-trivial system is normally composed of a set of models. Each model describes a different view of the system, focuses on a particular set of concerns, and uses its own notation. For example, UML defines a set of diagrams for modelling the structure and behavior of any software system. One of the problems we perceived with our students is that they are able to understand each one of these diagrams, but they have problems understanding how they are related, their intimate dependencies, and how the overall system specifications actually work when composed of a set of views. This paper presents a simple case study that we have developed and successfully used in class, which permits students developing the principal views of a system and to understand their relationships. We use a combination of UML and OCL and the simulation possibilities that the OCL/USE tool provides. We also teach the students to perform several kinds of analyses on the overall system specifications.

1 Introduction

The specification of any non-trivial system is normally composed of a set of models. Each model describes a different view of the system, focuses on a particular set of concerns, and uses its own notation. For example, UML defines a set of diagrams for modelling a system that permit describing its structure (class diagrams), the behavior of its individual objects (state machines), the collective behavior of collections of objects (communication and sequence diagrams), etc. One of the problems we perceived with our students is that they are able to understand each one of these diagrams, but they have problems understanding how they are related, their intimate dependencies, and how the overall system specifications actually work when composed of a set of views.

This paper presents a simple case study that we have developed and successfully used in class, which permits students to develop the principal views of a system and to understand their relationships. We use a combination of UML and OCL and the simulation possibilities that the OCL/USE tool [2] provides. Furthermore, we not only teach the students how to build the views, but also how to perform several kinds of analyses on the overall system specifications they have developed.

In fact, students from engineering disciplines work better with hands-on experiences—they need to be able to build and manipulate the corresponding never crash"). But they progressively discover the advantages of being able to check that the models they are building are correct. Furthermore, they discover the intimate relations between the different views of a system, and how changes in the model manifest in the views.

Another interesting benefit of our approach is that we can follow an incremental development process for building the models. Starting from a simple class diagram we can incrementally add classes, associations, attributes, operations, invariants, contracts, soil operation implementations and protocol state machines. Another feature that students like very much is creating object models. They then discover that models are more than *pictures*, but assertions on the objects that conform a system (and their relationships). They enjoy developing growing sets of scenarios, defined by means of soil command sequences that build sequences of system states (object diagrams). This incremental development process supports direct feedback and model improvements. They discover that modelling is similar to programming, in the sense that you write a program and execute it to check whether its behavior is as you expected. Students can check their models using various functionalities available in USE: the diagrams, the evaluation browser, the class extent, the single object window, the class invariants window, etc. And they also learn that views are not completely independent. On the contrary, they are all *projections* of an underlying model.

4 Conclusions

In this paper we have presented a case study modeled with UML and OCL that has been successfully used to teach modeling in class. It does not only focus on the different views of the system but also on the relationships the different models have among them. Furthermore, we disclose several of the advantages of modeling with UML/OCL and USE.

Acknowledgments *This work is partially funded by the Spanish Research Project TIN2014-52034-R.*

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Proceedings

21th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings

MODELS-Companion ’18

Proceedings Chairs: Önder Babur, Daniel Strüber

Tools and Demos Chairs: Sahar Kokaly, Dimitris Kolovos

Posters Chairs: Tanja Mayerhofer, Mansooreh Zahedi

Educators Symposium Chairs: Loli Burgueño, Martin Gogolla

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Copenhagen, Denmark, October 14-19, 2018

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Preface to the 19th International ACM/IEEE Conference on Model Driven Engineering Languages and Systems

Welcome to MODELS 2018, the 21st International ACM/IEEE Conference on Model Driven Engineering Languages and Systems, October 14-19, 2018 in Copenhagen, Denmark. Copenhagen is the capital of Denmark, and its most populous city. It features beautiful channels and architecture, wonderful music, and fine food. It's the perfect location to host MODELS, the premier conference series for model-based software and systems engineering. It covers all aspects of modeling, from languages and methods to tools and applications, and has done so since 1998.

Attendees of MODELS come from diverse backgrounds, including researchers, academics, engineers and industrial professionals; we have strived to put together a program, from the ground up, that reflects this. MODELS 2018 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems. This year's edition provides an opportunity for the modeling community to further advance the foundations of modeling, and come up with innovative applications of modeling in emerging areas of cyber-physical systems, embedded systems, socio-technical systems, cloud computing, big data, security, open source, and sustainability.

We put together a fascinating program for researchers, industrial practitioners, students, and educators in the field of model-driven engineering. MODELS 2018 comprises two main tracks: the Foundations track with two subcategories technical papers, new ideas/vision papers, and the Practice and Innovation track. Both tracks invited full, scholarly papers of the highest quality, and submissions were reviewed in accordance with the highest established standards of scientific rigor applied in peer review. Each paper was reviewed by at least three members of the program committee. The reviewers assessed the submissions in terms of their novelty, significance and potential impact, and were instructed to carefully consider weightings across these criteria (e.g., an extremely novel paper that may not have impact for a long time may be acceptable, as may a paper with less novelty, but substantial significance and short-term potential impact).

In 2018, the PC Chairs removed the rebuttal phase, which had been used in MODELS for a number of years. A longer discussion period was used instead. The evidence is that there was deeper discussion and more constructive reviews as a result. The review discussions were overseen by members of a program board, and decisions were finalized in a virtual meeting on 3--4 July 2018. Out of 101 papers submitted to the Foundations Track, the PC and PB accepted 29 (acceptance rate 29%). Out of 38 papers submitted to the PI Track, 13 were accepted (acceptance rate 34%).

The main conference also hosts 17 workshops, 12 tutorials, the educator and doctoral symposia, an Industry Day, the SAM2018 conference (Languages, Methods, and Tools for Systems Engineering), and a number of co-located industry events: xtUML Days, a Model-Based Systems Engineering meeting, an MPS Day organised by JetBrains, an event on Models, Agile and DevOps organized by HCL Technologies. The conference program includes demo sessions, and the presentation of four papers that had first been published in the predominant journal in the field, the Journal of Software Systems Modeling, or SOSYM.

We are honored to furthermore feature three distinguished keynote speakers: Noelle Eckley Selin will reflect on “Modeling air pollution: Informing policies to address a global environmental challenge”; Jim Cordy will consider the “Genetics of Computer Programs'”; and Martijn Wisse will take us into the world of modeling and robotics, in his talk “Models for motion prediction; robotic brains versus biological brains”.

MODELS 2018 would not have been possible without the significant contributions of many individuals and organisations. The MODELS Steering Committee provided invaluable assistance and guidance, whilst the Program Committee and the Program Board undertook with dedication the critical tasks of reviewing and discussing the submissions. We are also grateful to members of the Organising Committee for making the necessary arrangements and helping to publicize the conference and prepare the proceedings. We thank the authors for their efforts in writing and revising their papers in accordance with feedback from the reviewers.

We would also like to thank our numerous sponsors: the Gold sponsors JetBrains, MPS, the Eclipse Foundation, and the Papyrus Industry Consortium; the Silver sponsor HCL. In addition there are our sustainable sponsors, the ACM, ACM Sigsoft, the IEEE, the IEEE Computer Society, our supporting publisher Springer, and our institutional patron, the IT University of Copenhagen.

Enjoy the conference!

Andrzej Wąsowski, General Chair
IT University of Copenhagen
Denmark

Richard Paige, Foundations Track Chair
University of York
United Kingdom

Øystein Haugen, Practice and Innovation Track Chair Østfold University College
Norway

Message from the Educators Symposium Chairs

The 14th Educators Symposium at MODELS 2018 was held on October 16, 2018 in Copenhagen, Denmark. The symposium provided educators, researchers and practitioners a forum to discuss approaches to better address the issues facing the appropriate use of models and related technologies in the classroom.

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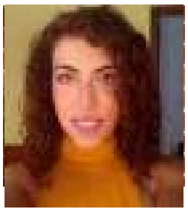
We gratefully acknowledge the support of the contributors to the Educator Symposium and express our great esteem to the keynote speaker and program committee members for the time and effort they have put in reviewing papers.



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Spain

Martin Gogolla, Educators Symposium Chair
University of Bremen
Germany

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— XXVII Jornadas sobre la Enseñanza Universitaria de la Informática

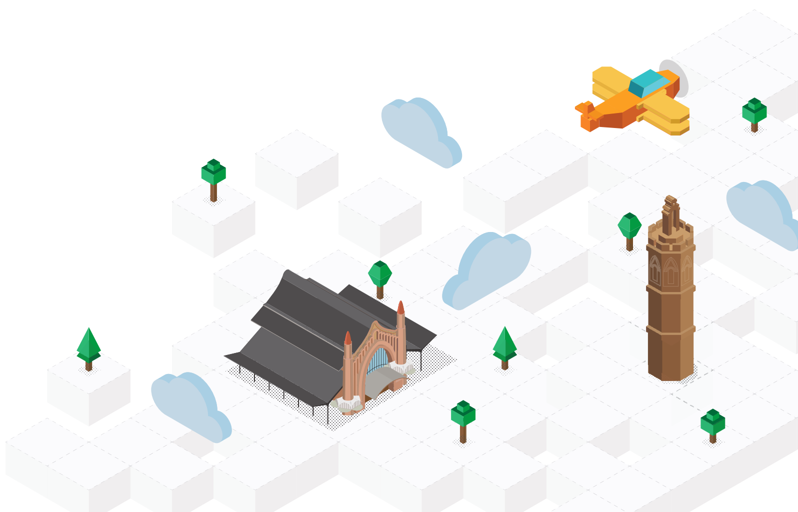
Certificado de presentación

Introducción de una herramienta OCL en la asignatura de Ingeniería de Requisitos

Loli Burgueño, Javier Luis Canovas Izquierdo, Elena Planas y Jordi Cabot

Francisco Grimaldo Moreno

Coordinador del comité organizador
Universitat de València



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AENUI

MODELS 2021 Fukuoka

24th International Conference on Model-Driven Engineering Languages and Systems

MODELS 2021

Educators Symposium at MODELS 2021

Certificate of attendance

We hereby confirm that

Lola Burgueño

has attended and presented in the Educators Symposium at the ACM/IEEE 24th International Conference on Model Driven Engineering Languages and Systems on October 12th, 2021

Dr. Steffen Zschaler
Chair

b. PARTICIPACIÓN, COMO ASISTENTE, EN CONGRESOS ORIENTADOS A LA FORMACIÓN DOCENTE UNIVERSITARIA

Dipartimento di Ingegneria e Scienze
dell'Informazione e Matematica

Università degli Studi dell'Aquila

This is to certify that Dr. Loli Burgueno, from the University of Malaga (Spain), ha attended and participated in the 13th Educators Symposium at MoDELS (EduSymp'17), that has taken place in Austin (Texas) on September 19th, 2017.

The EduSymp'17 organizers

Alfonso Pierantonio
Peter J. Clarke

Prof. Alfonso Pierantonio
Dipartimento di Ingegneria e Scienze dell'Informazione
Università degli Studi dell'Aquila

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Proceedings

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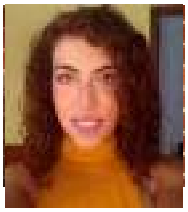

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Certificate of Attendance

This is to certify that

Lola Burgueño, Open University of Catalonia

attended the

Educator's Symposium 2019 (EDUSYMP 2019)
at MODELS 2019,
Tuesday September 17, 2019, München

Arend Rensink, Programme Chair

23rd International Conference on
Model-Driven Engineering Languages and Systems
MODELS 20

acm

IEEE

Educators Symposium at MODELS 2020

Certificate of attendance

We hereby confirm that

Lola Burgueño

has attended the Educators Symposium at the
ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems
on October 20th, 2020

Daria Bogdanova
Chair

Michalis Famelis
Chair

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XXVII Jornadas sobre la Enseñanza Universitaria de la Informática

Certificado de participación

Este certificado se otorga a:

Lola Burgueño Caballero

Por su participación en las XXVII Jornadas sobre la Enseñanza Universitaria de la Informática.

Francisco Grimaldo Moreno

Coordinador del comité organizador
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Chair

c. ESTANCIAS EN CENTROS DOCENTES

d. OTROS MÉRITOS RELACIONADOS CON LA CALIDAD DE LA FORMACIÓN DOCENTE

Institute of Software Engineering and Programming Languages

Current topics in software technology from research and practice

Software technology in science and practice is thematically very broad. The aim of the event is to show the students the breadth of software technology in science and practice and to look at individual topics in greater depth. The event is divided into a lecture part and a homework part. In the lecture part, experts from research and industry explain current issues in software technology. In the term paper part, the students work independently and in depth on a chosen topic from the lecture part and write an independent scientific paper on it.

learning goals

The students know a selection of the thematic breadth of software technology from research and practice. For a specific topic, the students know the state of research in detail and can systematically report on it in an elaboration.

Lectures in WS 21/22

date	Lecturer		topic	language
10/22/21	Dr. Elmar Juergens	CQSE GmbH	From DAX corporation to church: experience from 10 years of software quality analysis in research and practice	German
10/29/21	Prof. Dr.-Ing. Janet Siegmund	Chemnitz University of Technology	A Look into Programmers' Heads: Measuring Program Comprehension with Magnetic Resonance Imaging	German
11/05/21	Lola Burgueño & Jesús Sánchez-Cuadrado	Universitat Oberta de Catalunya / Universidad de Murcia	A neural network architecture to infer heterogeneous model transformations / Efficient execution of ATL model transformations	English

date	Lecturer		topic	language
11/12/21	Vadim Zaytsev	University of Twente	The Dead Code Hunt - Staring into the Abyss of COBOL and ECMAScript	English
12/03/21	Jun.-Prof. Dr. Andreas Wortmann	University of Stuttgart	Model-Driven Development of Digital Twins	German
12/10/21	Prof. Dr. Stefan Sobernig	University of Economy Vienna	Software Languages as Families and Product Lines	German
12/17/21	Dr. Andreas Angerer	XITASO GmbH	Agile development and durable software architecture - how do they fit together?	German
02/04/22	Dr.-Ing. Frederik Kramer	Otto-von-Guericke University Magdeburg	Business models and open source	German

Other speakers will follow. Status: 10/22/2021

Classification in courses

- Master's program in Computer Science FSPO 2014 / Core Subject / Practical and Applied Computer Science
- Master's degree in computer science FSPO 2014 / specialization / software engineering and compiler construction
- Master's degree in media informatics FSPO 2014 / core subject / practical and applied computer science
- Master's degree in media informatics FSPO 2014 / specialization / software engineering and compiler construction
- Master's degree in software engineering FSPO 2014 / core subject / software engineering

past events

WS 18/19

Contact

Prof. Dr. Matthias Tichy

Dates WS21 / 22

- The event will take place virtually via zoom in the winter semester 21/22.
- weekly **on Fridays from 10 a.m. to noon**
- To the event in the course catalog

Zum Moodle-Kurs

To class

III. TRANSFERENCIA/ACTIVIDAD PROFESIONAL

1. Calidad de la transferencia de los resultados

a. Patentes y productos con registro de propiedad intelectual

b. Transferencia de conocimiento al sector productivo

c. Contratos de transferencia o prestación de servicios profesionales con empresas, Administraciones públicas y otras instituciones suscritos al amparo del artículo 83 de la Ley orgánica 6/2001, de Universidades y Contratos Colaborativos.

Universitat Oberta de Catalunya

Barcelona, 21 de enero de 2021

MIREIA RIERA DURAN, con DNI 52592145T, como Directora del Área de Investigación e Innovación, y con suficiente capacidad de representación legal de la Fundació per a la Universitat Oberta de Catalunya,

CERTIFICA que:

LOLA BURGUEÑO CABALLERO con DNI 25346121Y ha participado en el proyecto “The beginnings of cognified MDE Platform” (número de referencia expediente CEA S32228), financiado por COMMISSARIAT A L’ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA LIST), con importe 50.000 euros, durante el período de ejecución comprendido entre el 01 de septiembre de 2018 y 31 de agosto de 2019.

Mireia Riera Duran - DNI 52592145T (AUT)

Firmado digitalmente por Mireia Riera Duran - DNI 52592145T (AUT)
Fecha: 2021.01.21 10:59:28 +01'00'

Mireia Riera Duran

CONVENTION DE L'EQUIPE DE RECHERCHE COMMUNE
ERC MODEL-IA Ref C30884
Avenant n°1 – Fiche Actions MDE Platform Ref. CEA : S32228

Le COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES,

Etablissement public à caractère scientifique, technique et industriel, inscrit au Registre du Commerce et des Sociétés sous le numéro B 775 685 019. dont le siège social est Bâtiment Le Ponant D. 25 rue Leblanc, 75015 PARIS

représenté par Monsieur Jean-Noel Patillon, Directeur du Laboratoire d'Intégration des Systèmes et des Technologies (LIST) par intérim.

ci-après dénommé « le CEA LIST».

Et,

La Fundació per a la Universitat Oberta de Catalunya,

Non-profit – Higher Education Institution, oficial registration n° 842, régie par la loi du Fondations, dont l'adresse est Av. Tibidabo, 39-43, 08035 Barcelona et dont le numéro de taxe (CIF) est G60667813

Représenté par Mrs. Mireia Riera Duran, Directrice du « UOC Research and Knowledge Transfer Support Office » ("UOC", Open University of Catalonia). Elle agit pour le compte de ce dernier en vertu de ses pouvoirs découlant de la procuration signée devant le notaire de Barcelone, M Francisco Armas Omedes, le 15 novembre 2012, sous le numéro 2 540 de son protocole.

Ci-après désignée par « UOC »,

ci-après collectivement désignés par "les Parties" et individuellement par "la Partie".

ATTENDU QUE :

Les Parties ont signé le 29/01/2018 la Convention Ref C30884 organisant leur collaboration au sein d'une équipe commune de recherche (« ERC MODEL-IA »).

Pour l'année 2018, les Parties ont convenu de la réalisation d'Action et de Projet dans le cadre de la Convention.

Il est donc convenu ce qui suit :

Article 1 : Objet

L'Avenant n° 1 a pour objet de définir les Projets et Actions à réaliser par les Parties pour l'année 2018 et les conditions de leur réalisation.

Article 2 : Projets et Actions.

Projet – The beginnings of cognified MDE Platform (ci-après le "Projet")

Context

Software development is in a permanent state of crisis. Improvements in programming tools, languages and methods have not been able to keep up with the increasing complexity, demands and trust we expect from all running software. This complexity will increase even further in the coming years to deal with challenges raised by the introduction of technology for IoT, BigData, and AI.

Content

As we discussed in Annexe 3 of the convention, the only way to overcome this situation consists in start adding some level of AI to the software development tools themselves. To benefit from the additional advantages of model-driven engineering, this AI integration must be done within the modelling tools themselves and not on the final code IDEs (as these so-called smart programming IDEs are aiming for). This is a very difficult process since it implies not only adding AI-based features to modelling IDEs but it also requires verifying that these AI components are efficient, trustable and to empirically validate that they are accepted by the human modellers (who may be reluctant to interact with AI-powered components) and that they actually improve the model-based software development process.
Due to the complexity of the process, we envision two projects dedicated to this topic. Here we detail the first one (for a duration of 12 months). We postpone the definition of the follow-up one (for an additional 12 months) until later on in order to be able to adapt to our own progress and to the technological changes in this fast-paced environment. This first project will consist of following tasks:
Task 1 - Survey of the main AI techniques and platforms available today to identify feasible integration opportunities for a smart modelling tool. This should include both recommendations on interesting smart features to add to the tool and on potential platforms and frameworks that could be adapted to provide such features
Task 2 - Development of a model recommender. As first AI technique to integrate, study of Ontology modelling languages (e.g., the one used in the CAESAR platform) and model repositories to be used as sources to suggest and recommend improvements to the current model the designer is creating. Suggestions could come from other models by the same organization or from external model repositories.
Task 3 - Specification of an uncertainty DSL and a model-review DSL to support the previous task. The uncertainty DSL would allow designers to mark parts of the model they are not sure about (and that, therefore, should be the primary focus of the model recommender). The model-review DSL would be used by the recommender to annotate the model with its recommendations (similar, in concept, as code-review tools) and let the designer choose whether to accept them or not. Both DSLs will be designed as UML extensions (UML profiles) and implemented into Papyrus.

Tasks distribution

The work related to all aforementioned tasks will be realized by Loli Burgueño, a post doc UOC under the supervision of both Sébastien Gérard and Jordi Cabot.

Deliverables

D1. Survey of AI techniques candidates and infrastructure to build a cognified model-based development environment integrated into the modeling tool Papryus. This document will include an exhaustive analysis of all major trends in AI now, together with the analysis of the potential benefits such techniques could bring to a modelling environment and the potential challenges of integrating them together and into Papyrus. Besides, the document will also suggest a technological infrastructure to be used as building block when performing those integrations.

D2. A proof-of-concept of a model recommender integrated into Papyrus. This deliverable will provide the description of the architecture of a model recommender with an emphasis on the process for identifying model improvements by comparing (and partially matching) the model with a previous catalogue of reference models or best practices. This deliverable includes the source code of a proof-of-concept implementation of such approach.

D3. An uncertain model recommender integrated into Papyrus. As an extension of the previous recommender, the uncertain model recommender will be able to "fill in the gaps" by providing useful suggestions to parts of the model that the designer is not sure how to complete. This deliverable includes the specification of an uncertainty DSL.

D4. A collaborative model recommender integrated into Papyrus. To improve the social acceptance of the model recommender. the recommender should behave as another modeler in the team. And as such, instead of automatically fixing the model, it should create suggestions/issues and attach them to the affected model elements as part of a "model-review" system, similar to the typical code-review tools. This deliverable includes the specification of this model-review DSL. This new facility shall reuse/extend, or replace, the exiting Papyrus facility for model review.

The proof of concepts developed in the above-mentioned deliverables shall be integrated in the Eclipse Papyrus modelling platform.

Planning

The project is expected to last one year (followed-up by a second project on this same topic for another year to be defined later on). Each task will last four months and the corresponding deliverable will be completed by the end of that period. Note that D3 and D4 are both linked to Task 3 and therefore will be part of the final deliverable for the project

Connaissances Antérieures

Pour le CEA LIST :

Papyrus - L'outil de modélisation UML/SysML Papyrus. Cet outil est open source sous licence EPL (Eclipse Public License). L'environnement est un projet Eclipse pour la modélisation et l'analyse de systèmes. Il comporte de nombreuses fonctionnalités notamment pour la définition de langages dédiés via une implantation par profils.

Diversity – La plateforme Diversity est une plateforme d'analyse formelle de modèles basée sur l'exécution symbolique.

AMOSE (All Media One Search Engine) – La plateforme logicielle AMOSE (All Media One Search Engine) est un moteur de recherche sémantique fondé sur l'outil d'analyse linguistique LIMA (LIST Multilingual Analyzer). Il offre des fonctionnalités innovantes pour la recherche de documents multimedia. La compréhension de la sémantique des termes dans leur contexte au sein de la requête et de l'index permet de générer des résultats plus pertinents. C'est un outil crosslingue : il permet de poser une requête dans une langue et recevoir des réponses dans une autre langue ; et ceci pour 10 langues, dont l'Arabe et le Chinois. Enfin, AMOSE propose une présentation dynamique des résultats sous la forme de classes de pertinences (regroupe les documents qui partagent un certain sous-ensemble des termes de la requête) ou de classes thématiques (regroupe les documents qui partagent une thématique commune).

LIMA – LIMA est un analyseur linguistique multilingue disponible en open-source à l'adresse suivante : https://github.com/aymara/lima/wiki.

Pour l'UOC :

EMFtoCSP (https://github.com/SOM-Research/EMFtoCSP).
EMFtoCSP est un outil basé sur Eclipse capable de vérifier les modèles EMF et les diagrammes de classes UML avec des contraintes OCL en utilisant une solveur CSP sous-jacent

Collaboro (https://som-research.github.io/collaboro/).
Collaboro est une approche visant à rendre les processus de développement du langage plus participatifs, ce qui signifie que les développeurs et les utilisateurs du langage peuvent collaborer ensemble pour le créer et le faire évoluer. Collaboro soutient à la fois la définition collaborative des syntaxes abstraites et concrètes pour un DSL en fournissant un environnement collaboratif.

JSON Discoverer (https://github.com/SOM-Research/jsonDiscoverer)
JSON discoverer permet de découvrir le schéma implicite des documents JSON et le représenter sous la forme d'un diagramme de classes (UML).

Propriété intellectuelle et exploitation

A défaut d'accord contraire décidé par le Comité Exécutif, les Parties s'accordent à ce que l'intégralité des droits de propriété intellectuelle générés dans le cadre de ce Projet appartienne à chacune des Parties à parts égales (50% CEA, 50% UOC).

Le Comité Exécutif se réunira en tant que de besoin, et en tout état de cause au moins à la fin du Projet, afin de déterminer les principes et conditions d'exploitation des Résultats du Projet. Il est d'ores et déjà entendu que, sauf accord contraire du Comité Exécutif, chaque Partenaire pourra exploiter librement les Résultats sans contrepartie financière à l'égard de l'autre Partie, et que toute licence exclusive concédée par une Partie sur les Résultats devra recueillir l'accord préalable et écrit de l'autre Partie.

Budget for both parties

CEA will pay to UOC 50.000 euros for the project. If a follow up is decided, CEA will pay another 50.000 euros to UOC for the second project that shall be also a one-year project

UOC will provide office space, computer equipment and will pay for the regular trips of the postdoc to CEA's offices (estimated cost 10.000 euros / year).

Both institutions will also contribute to the project through the participation of Jordi Cabot and Sébastien Gerard that will conjointly supervise the UOC post doc that will work on the deliverables described the previous section.

Article 3 : Entrée en vigueur ;

Le présent accord entre en vigueur au 01/09/2018 et jusqu'au 31/08/2019.

en 2 exemplaires originaux

Pour le CEA List

Date :

Jean-Noel Patillon
Directeur du LIST par Interim

Institut CEA LIST
[Institut Carnot TN@UPSaclay]
CEA Saclay - Nano-INNOV - Bât 861 - PC 142
F91191 GIF-sur-YVETTE CEDEX

Pour la Fundació per a la Universitat Oberta de Catalunya – UOC -
Mireia Riera Duran

Date :

Directrice du <<UOC Research and Knowledge Transfer Support office >>

Barcelona, 21 de enero de 2021

MIREIA RIERA DURAN, con DNI 52592145T, como Directora del Área de Investigación e Innovación, y con suficiente capacidad de representación legal de la Fundació per a la Universitat Oberta de Catalunya,

CERTIFICA que:

LOLA BURGUEÑO CABALLERO con DNI 25346121Y ha participado en el proyecto "The beginnings of cognified MDE Platform" (número de referencia expediente CEA S32228), financiado por COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA LIST), con importe 50.000 euros, durante el período de ejecución comprendido entre el 01 de septiembre de 2019 y 31 de agosto de 2020.

Mireia Riera Duran - DNI 52592145T (AUT)

Firmado digitalmente por Mireia Riera Duran - DNI 52592145T (AUT)
Fecha: 2021.01.21 11:00:24 +01'00'

Mireia Riera Duran

CONVENTION DE L'EQUIPE DE RECHERCHE COMMUNE
ERC MODEL-IA Ref C30884
Avenant n°1 – Fiche Actions MDE Platform Ref. CEA : S32228-1

Le COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES,

Établissement public à caractère scientifique, technique et industriel, inscrit au Registre du Commerce et des Sociétés sous le numéro B 775 685 019, dont le siège social est Bâtiment Le Ponant D, 25 rue Leblanc, 75015 PARIS

représenté par Monsieur Jean-Noel Patillon, Directeur du Laboratoire d'Intégration des Systèmes et des Technologies (LIST) par intérim.

ci-après dénommé « le CEA LIST»,

Et,

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Représenté par Mrs Mireia Riera Duran, Directrice du « UOC Research and Knowledge Transfer Support Office » ("UOC", Open University of Catalonia). Elle agit pour le compte de ce dernier en vertu de ses pouvoirs découlant de la procuration signée devant le notaire de Barcelone, M. Francisco Armas Omedes, le 15 novembre 2012, sous le numéro 2.540 de son protocole.

Ci-après désignée par « UOC »,

ci-après collectivement désignés par "les Parties" et individuellement par "la Partie".

ATTENDU QUE :

Les Parties ont signé le 29/01/2018 la Convention Ref C30884 organisant leur collaboration au sein d'une équipe commune de recherche (« ERC MODEL-IA »).

Pour l'année 2018, les Parties ont convenu de la réalisation d'Action et de Projet dans le cadre de la Convention, formalisée dans une fiche actions (Réf CEA S32228), dénommée « Avenant n°1 ».

Les Parties souhaitent désormais fixer les travaux dans le cadre de la Convention pour l'année 2019 par le présent Avenant n°1.

Il est donc convenu ce qui suit :

-

Article 1 : Objet

Le présent Avenant n° 1 a pour objet de définir les Projets et Actions à réaliser par les Parties pour la période du 01/09/2019 au 31/08/2020 et les conditions de leur réalisation.

Article 2 : Projets et Actions.

Projet – The beginnings of cognified MDE Platform (ci-après le "Projet")

Content

During the first year of this project starting in September 2018 and defined in the"Avenant1" (Ref CEA S32228-1) of the Convention, tasks 1,2 and 3 were satisfactorily completed. Tasks 4-6 below follow up on these achievements to consolidate the cognified MDE platform we are building in this project

Task 4 – Extension of the ML architecture for dealing with Model-to-Text transformations. We continue exploring the benefits (and disadvantages) of using ML neural networks as a replacement for model management operations by now focusing our attention to M2T. In particular, code-generation scenarios. The goal is not only to learn the code-generation rules (e.g. to go from UML class diagrams to Java code) but to learn them in a way that the network is able to mimic the programming style of the company. This way, the generated code will feel more familiar to the company's developers and therefore will be more likely to be adopted and used.

Deliverables:

- *D5. A ML architecture for learning code-generation rules. This deliverable will provide a technical report with the description of a ML architecture for M2T, emphasizing the changes and additions w.r.t. to the previous ML architecture developed for M2M. This deliverable includes de source code of a proof-of-concept implementation of such approach*

Task 5 – A model2vec proposal. Any application of ML on models requires first to encode the models into a fix vector representing them for learning purposes. Based on our previous experiences with ML for Model Transformations (and those of other colleagues in the same field), we will propose a more generic embedding of models that can simplify and speed up the adoption of ML in model-driven engineering.

Deliverables:

- *D6. The model2vec embedding proposal. This document will provide a technical report explaining how the embedding is done and the results of validating it over a set of input models. The code will be provided in a repository.*
- *D7. An implementation of such embedding specific to UML models and integrated in the Papyrus modelling environment.*

Task 6 – Extension and Validation of the Papyrus profile to represent uncertainty. The experiences with the ML for MTs architecture highlighted even more the need to define the uncertainty we have regarding the quality of the generated models. We will use this architecture as a case study to validate our current uncertainty profile. Additionally, we will experiment with a new method to propagate the uncertainty based on transferrable belief (in addition to the already existing approach which uses Bayesian probabilities) that may provide better results depending on the uncertainty scenario.

Deliverables:

- *D8. Extension and validation of the Papyrus profile for capturing uncertainty in the models generated by ML algorithms. This document will report the extension of the Papyrus profile and its new propagation algorithm based on transferable belief. The document will report on the validation results after applying the profile to our ML architecture.*
- *D9. New release of the Papyrus UML uncertainty profile based on the previous extensions*

Tasks distribution

The work related to all aforementioned tasks will be realized by Loli Burgueño, a post doc at UOC under the supervision of both Sébastien Gérard and Jordi Cabot.

Planning

Each task will last four months and the corresponding deliverable will be completed by the end of that period.

Connaissances Antérieures

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ensemble pour le créer et le faire évoluer. Collaboro soutient à la fois la définition collaborative des syntaxes abstraites et concrètes pour un DSL en fournissant un environnement collaboratif.

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JSON discoverer permet de découvrir le schéma implicite des documents JSON et la représenter sous la forme d'un diagramme de classes (UML).

Propriété intellectuelle et exploitation

A défaut d'accord contraire décidé par le Comité Exécutif, les Parties s'accordent à ce que l'intégralité des droits de propriété intellectuelle générés dans le cadre de ce Projet appartiendra à chacune des Parties à parts égales (50% CEA, 50% UOC), en application de l'article 12.3.1 de la Convention.

Le Comité Exécutif se réunira en tant que de besoin, et en tout état de cause au moins à la fin du Projet, afin de déterminer les principes et conditions d'exploitation des Résultats du Projet. Il est d'ores et déjà entendu que, sauf accord contraire du Comité Exécutif, chaque Partenaire pourra exploiter librement les Résultats sans contrepartie financière à l'égard de l'autre Partie, et que toute licence exclusive concédée par une Partie sur les Résultats devra recueillir l'accord préalable et écrit de l'autre Partie.

Budget for both parties

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UOC will provide office space, computer equipment and will pay for the regular trips of the postdoc to CEA's offices (estimated cost 10.000 euros / year).

Both institutions will also contribute to the project through the participation of Jordi Cabot and Sébastien Gerard that will conjointly supervise the UOC post doc that will work on the deliverables described in the previous section.

Article 3 : Entrée en vigueur ;

Le présent accord entre en vigueur au 01/09/2019 et jusqu'au 31/08/2020.

Fait en 2 exemplaires originaux .

Pour le CEA List

Date : 19/09/2019

Jean-Noël Patillon

Directeur du LIST par intérim

Jean-Noël PATILLON
Directeur de l'Institut CEA LIST
par intérim

list
cea tech
Institut CEA LIST
[Institut Carnot TN@UPSaclay]
CEA Saclay - Nano-INNOV - Bât. 861 - PC 142
F91191 GIF-sur-YVETTE CEDEX

Pour la Fundació per a la Universitat Oberta de Catalunya – UOC -
Mireia Riera Duran

Date : 21-10-19

Directrice du <<UOC Research and Knowledge Transfer Support office >>

d. Otros méritos relacionados con la calidad de la transferencia de resultados

2. Calidad y dedicación a actividades profesionales

a. Puestos ocupados y dedicación

UNIVERSIDAD DE MÁLAGA

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

INGENIERÍA INFORMÁTICA

MEMORIA DEL PRÁCTICUM

Realizado por

Dolores Burgueño Caballero

Tutor Académico

Dr. Juan Miguel Ortiz de Lazcano Lobato

Empresa

Hospital Universitario Virgen de la Victoria

Tutor en la Empresa

D. Joaquín Barranco

MÁLAGA, Diciembre 2010

ÍNDICE GENERAL

5. DOCUMENTACIÓN COMPLEMENTARIA (REFERENCIAS)

[1] Página web del Hospital Universitario Virgen de la Victoria
http://www.juntadeandalucia.es/servicioandaluzdesalud/huvv/opencms/opencms/es/index.html (Accedido en Diciembre de 2010)

[2] JasperReports for Java Developers (David R. Heffelfinger y Packt Publishing)

[3] The Definitive Guide to iReport (Giulio Toffoli)

[4] Wiki del hospital (accesible únicamente desde la red local).

[5] Guía OR – IR (formato PDF).

UNIVERSIDAD
DE MÁLAGA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

DON GABRIEL AGUILERA VENEGAS, SECRETARIO DE LA E.T.S. INGENIERÍA INFORMÁTICA

CERTIFICO:

Que en el expediente académico de la alumna de este Centro, DOÑA DOLORES BURGUEÑO CABALLERO, con D.N.I. número 25346121, correspondiente a la titulación de Ingeniero en Informática, que obra en poder de esta Secretaría, figuran los siguientes datos:

Relación de asignaturas cursadas y superadas en este Centro:

Denominación	Carácter	Ciclo	Curso	Créditos	Calificación	Convocatoria	Curso Ac.
Procesadores de lenguajes	TRONCAL	2º	4	9,00	APROBADO	1ª Ordinaria Junio	2009/2010
Inteligencia artificial e ingeniería del conocimiento	TRONCAL	2º	4	10,50	NOTABLE	1ª Ordinaria Junio	2009/2010
Ingeniería del software. Especificación	TRONCAL	2º	4	6,00	APROBADO	1ª Ordinaria Febrero	2009/2010
Arquitectura de computadores I	TRONCAL	2º	4	6,00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2009/2010
Arquitectura de redes	TRONCAL	2º	4	4,50	MATRICULA DE HONOR	1ª Ordinaria Febrero	2009/2010
Ingeniería de sistemas	OBLIGATORIA	2º	4	6,00	NOTABLE	1ª Ordinaria Febrero	2009/2010
Ingeniería del software. Diseño	TRONCAL	2º	4	6,00	NOTABLE	1ª Ordinaria Junio	2009/2010
Arquitectura de computadores II	TRONCAL	2º	4	4,50	APROBADO	1ª Ordinaria Junio	2009/2010
Comunicación de datos	TRONCAL	2º	4	6,00	APROBADO	1ª Ordinaria Junio	2010/2011
Ampliación de ingeniería del conocimiento	OBLIGATORIA	2º	5	9,00	NOTABLE	1ª Ordinaria Junio	2010/2011
Ingeniería del software. Proyectos	TRONCAL	2º	5	6,00	SOBRESALIENTE	1ª Ordinaria Junio	2010/2011
Practicum	TRONCAL	2º	5	9,00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2010/2011
Economía	OBLIGATORIA	2º	5	4,50	APROBADO	1ª Ordinaria Junio	2010/2011
Gestión de proyectos	TRONCAL	2º	5	6,00	NOTABLE	1ª Ordinaria Febrero	2010/2011
Auditoría informática	OPTATIVA	2º	–	6,00	NOTABLE	1ª Ordinaria Junio	2010/2011
Procesamiento de imágenes	OPTATIVA	2º	–	6,00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2010/2011
Programación declarativa avanzada	OPTATIVA	2º	–	6,00	SOBRESALIENTE	1ª Ordinaria Junio	2009/2010
Sistemas de información	OPTATIVA	2º	–	6,00	NOTABLE	1ª Ordinaria Febrero	2010/2011
Sistemas operativos distribuidos	OPTATIVA	2º	–	6,00	SOBRESALIENTE	1ª Ordinaria Febrero	2010/2011
Software de comunicaciones	OPTATIVA	2º	–	6,00	SOBRESALIENTE	1ª Ordinaria Junio	2009/2010
Tecnología de redes	OPTATIVA	2º	–	6,00	NOTABLE	1ª Ordinaria Junio	2010/2011
Minería de datos aplicada	LIBRE CONF.	Y.	–	3,00	NOTABLE	1ª Ordinaria Junio	2010/2011

Relación de asignaturas reconocidas por convalidación:

Denominación	Carácter	Créditos	Fecha resolución	Curso
La calculadora científica estándar	LIBRE CONF.	3,00	20-10-2010	2010/2011
Técnicas informáticas para el tratamiento de datos	LIBRE CONF.	3,00	20-10-2010	2010/2011

P.O.

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

../..

b. Evaluaciones positivas de su actividad

c. Otros méritos relacionados con la actividad profesional

IV. FORMACIÓN ACADÉMICA

1. Calidad de la formación predoctoral

a. Titulación universitaria

Juan Carlos I, Rey de España

y en su nombre

La Rectora de la Universidad de Málaga

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Doña Dolores Burgueño Caballero

nacida el día 30 de agosto de 1988 en Cuevas de San Marcos (Málaga), de nacionalidad española,

ha superado los estudios universitarios correspondientes organizados por la Escuela Técnica Superior de Ingeniería Informática, conforme a un plan de estudios homologado por el Consejo de Universidades, expide el presente título universitario oficial de

Ingeniera Técnica en Informática de Gestión

con validez en todo el territorio nacional, que faculta a la interesada para disfrutar los derechos que a este título otorgan las disposiciones vigentes.

Dado en Málaga, a 9 de julio de 2010

La interesada,	La Rectora,	El Jefe de la Sección,

1-BD-792581

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2010/163988	29012601	T000446

CLAVE ALFANUMÉRICA	Nº REGISTRO NAL. DE TÍTULOS	CÓDIGO DE CENTRO	REGISTRO UNIV. DE TÍTULOS	REG. EXP. UNIV.
1-BD-792581	2010/163988	29012601	T090448	300119070

Reverso del título universitario oficial de Ingeniero Técnico en Informática de Gestión, expedido el día 9 de julio de 2010 a favor de Doña Dolores [illegible] Caballero, que superó, en julio de 2010, los estudios conducentes al mencionado título, con la calificación final de SOBRESALIENTE, según el plan de estudios homologado por Acuerdo de 20 de mayo de 2003 ("B.O.E." [illegible]).

[illegible]

Juan Carlos I, Rey de España

y en su nombre

La Rectora de la Universidad de Málaga

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Doña Dolores Burgueño Caballero

nacida el día 30 de agosto de 1988 en Cuevas de San Marcos (Málaga), de nacionalidad española,

ha superado los estudios universitarios correspondientes organizados por la Escuela Técnica Superior de Ingeniería Informática, conforme a un plan de estudios homologado por el Consejo de Universidades, expide el presente título universitario oficial de

Ingeniera en Informática

con validez en todo el territorio nacional, que faculta a la interesada para disfrutar los derechos que a este título otorgan las disposiciones vigentes.

Dado en Málaga, a 23 de septiembre de 2011

La interesada, *La Rectora,* *El Jefe de la Sección,*

1-BE-100876

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2011/253648	29012601	7097203

CLAVE ALFANUMÉRICA	Nº REGISTRO NAL. DE TÍTULOS	CÓDIGO DE CENTRO	REGISTRO UNIV. DE TÍTULOS	
1-BE-306876	2011/253644	29012601	T097203	306020792

Reverso del título universitario oficial de Ingeniero en Informática, expedido el día 23 de septiembre de 2011 a favor de [illegible], que superó, en septiembre de 2011, los estudios conducentes al mencionado título, con la calificación final de SOBRESALIENTE, según el plan de estudios homologado por Acuerdo de 23 de mayo de 2001 ("B.O.E." 16-VII-2001).

Universidad
de Málaga

Nº UNIVERSITARIO DE TÍTULOS
CONTROL UNIVERSITY NUMBER

T097203

Este suplemento se ajusta al modelo elaborado por la Comisión Europea, el Consejo de Europa y la UNESCO/CEPES, y su propósito es ofrecer un volumen suficiente de datos independientes para mejorar la "transparencia" internacional y el adecuado reconocimiento académico y profesional de cualificaciones (Diplomas, Títulos, Certificados, etc.).

Se trata de ofrecer una descripción de la naturaleza, el nivel, el contexto, el contenido y el rango de los estudios realizados por el poseedor de la cualificación original a la que se añade este suplemento. Deben evitarse juicios de valor, posibles equivalencias o sugerencias de reconocimiento. Deben cumplimentarse las ocho secciones, y en caso contrario, explicar por qué no se ha hecho así.

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international "transparency" and fair academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.).

It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

1. Datos de la persona titulada
Information identifying the holder of the qualification

1.1. Apellidos / *Family name(s)*

BURGUEÑO CABALLERO

1.2. Nombre(s) / *Given name(s)*

DOLORES

1.3. Fecha de nacimiento / *Date of birth*

30 / 08 / 1988

1.4. Número de identificación / *Student identification number or code*

E MALAGA0125346121

2. Información sobre la titulación
Information identifying the qualification

2.1. Denominación de la titulación y título conferido (en idioma original)

Ingeniería en Informática

Ingeniera en Informática

2.1. Name of qualification and (if applicable) title conferred (in original language)

Ingeniería en Informática

Ingeniera en Informática

2.2. Principales campos de estudio de la titulación

Estructura de datos y de la información
Estructura y tecnología de computadores
Metodología, tecnología de la programación e ingeniería del software
Sistemas operativos
Teoría de autómatas y lenguajes formales. Procesadores de lenguaje
Arquitectura e ingeniería de computadores
Inteligencia artificial e ingeniería del conocimiento
Redes
Procesadores de lenguaje

2.2. Main field(s) of study for the qualification

Structure of data and information
Structure and technology of computers
Methodology, programming technology and software engineering
Operating systems
Theory of formal languages and automatons. Language processors
Architecture of computer systems and computer engineering
Artificial intelligence and knowledge engineering
Networks
Language processors

2.3. Nombre y naturaleza de la institución que ha conferido el título (en idioma original)

Universidad de Málaga
(Universidad Pública)

2.3. Name and status of awarding institution (in original language)

Universidad de Málaga
(Public University)

2.4. Nombre y naturaleza de la institución en la que se impartieron los estudios (en idioma original)

Escuela Técnica Superior de Ingeniería Informática
(Centro propio)

2.4. Name and status of institution administering studies (in original language)

Escuela Técnica Superior de Ingeniería Informática
(University center)

2.5. Lengua utilizada en docencia y exámenes

Castellano

2.5. Language of instruction / examination

Spanish

3. Información sobre el nivel de la titulación
Information on the level of the qualification

3.1. Nivel de la titulación

Enseñanza de primer y segundo ciclo conducente al título de Ingeniero en Informática

3.1. Level of qualification

Long cycle degree leading to an academic degree of Ingeniero en Informática

3.2. Duración oficial del programa

5 años. El tiempo presencial en clases teóricas y prácticas es de 3750 horas.

3.2. Official length of programme

5 years. The total time of taught classes and practical training is 3750 hours.

3.3. Requisitos de acceso

Bachillerato LOGSE + PAU, COU + Selectividad, Formación Profesional de grado superior, ciclos formativos de grado superior, primeros ciclos universitarios, pruebas de acceso para mayores de 25 años

3.3. Access requirement(s)

Bachillerato LOGSE (Upper Secondary School) + PAU (University Admission Exam), COU (University Oriented Programme) + Selectividad (university admission exam), advanced vocational training, upper-level training cycles, first university degree cycles, University Entrance Exam for students over 25 years old.

4. Información sobre el contenido y los resultados obtenidos
Information on the contents and results gained

4.1. Forma de estudio / *4.1. Mode of study*

Modo presencial / *Full time attendance*

4.2. Requisitos del programa / *4.2. Programme requirements*

El estudiante tiene que completar las horas del programa de estudios distribuidas de la siguiente forma:
169.5 créditos de asignaturas troncales (1695 horas)
99 créditos de asignaturas obligatorias (990 horas)
63 créditos de asignaturas optativas (630 horas)
37,5 créditos de asignaturas de libre elección (375 horas)
Proyecto fin de carrera (60 horas)

The program is distributed as follows:
169.5 credits of main subjects (1695 hours)
99 credits of obligatory subjects (990 hours)
63 credits of optional subjects (630 hours)
37,5 credits of subjects of free election (375 hours)
End of degree project (60 hours)

4.3. Datos del programa / *4.3. Programme details*

Acceso a segundo ciclo / *access to second cycle study programmes*

Asignaturas	Horas lectivas *Contact Hours*	Calificación *Grade*	Año académico *Academic Year*	Observaciones *Observations*	*Subjects*
Asignaturas troncales y obligatorias					***Core and compulsory subjects***
AMPLIACIÓN DE INGENIERÍA DEL CONOCIMIENTO	90.00	NOTABLE	2010-2011		*FURTHER KNOWLEDGE ENGINEERING*
ARQUITECTURA DE COMPUTADORES I	60.00	MATRICULA DE HONOR	2009-2010		*COMPUTER ARCHITECTURE I*
ARQUITECTURA DE COMPUTADORES II	45.00	APROBADO	2009-2010		*COMPUTER ARCHITECTURE II*
ARQUITECTURA DE REDES	45.00	MATRICULA DE HONOR	2009-2010		*NETWORK ARCHITECTURE*
COMUNICACIÓN DE DATOS	60.00	APROBADO	2010-2011		*DATA COMMUNICATION*
ECONOMÍA	45.00	APROBADO	2010-2011		*ECONOMICS*
GESTIÓN DE PROYECTOS	60.00	NOTABLE	2010-2011		*PROJECT MANAGEMENT*
INGENIERÍA DE SISTEMAS	60.00	NOTABLE	2009-2010		*SYSTEMS ENGINEERING*
INGENIERÍA DEL SOFTWARE. DISEÑO	60.00	NOTABLE	2009-2010		*SOFTWARE ENGINEERING (DESIGN)*
INGENIERÍA DEL SOFTWARE. ESPECIFICACIÓN	60.00	APROBADO	2009-2010		*SOFTWARE ENGINEERING (SPECIFICATION)*
INGENIERÍA DEL SOFTWARE. PROYECTOS	60.00	SOBRESALIENTE	2010-2011		*SOFTWARE ENGINEERING (PROJECTS)*
INTELIGENCIA ARTIFICIAL E INGENIERÍA DEL CONOCIMIENTO	105.00	NOTABLE	2009-2010		*ARTIFICIAL INTELLIGENCE AND KNOWLEDGE ENGINEERING*
PRACTICUM	90.00	MATRICULA DE HONOR	2010-2011		*PRACTICAL*
PROCESADORES DE LENGUAJES	90.00	APROBADO	2009-2010		*LANGUAGE PROCESSORS*
BÚSQUEDA AVANZADA DE RUTAS EN MAPAS DE CARRETERAS	60.00	MATRICULA DE HONOR	2010-2011	Proyecto Fin de Carrera / *Final project*	*ADVANCED PATH FINDING IN ROADS NETWORKS*
Asignaturas optativas					***Optional subjects***
AUDITORÍA INFORMÁTICA	60.00	NOTABLE	2010-2011		*COMPUTER AUDITING*
PROCESAMIENTO DE IMÁGENES	60.00	MATRICULA DE HONOR	2010-2011		*IMAGE PROCESSING*
PROGRAMACIÓN DECLARATIVA AVANZADA	60.00	SOBRESALIENTE	2009-2010		*ADVANCED DECLARATIVE PROGRAMMING*
SISTEMAS DE INFORMACIÓN	60.00	NOTABLE	2010-2011		*INFORMATION SYSTEMS*
SISTEMAS OPERATIVOS DISTRIBUIDOS	60.00	SOBRESALIENTE	2010-2011		*DISTRIBUTED OPERATIONAL SYSTEMS*
SOFTWARE DE COMUNICACIONES	60.00	SOBRESALIENTE	2009-2010		*COMMUNICATIONS SOFTWARE*
TECNOLOGÍA DE REDES	60.00	NOTABLE	2010-2011		*NETWORK TECHNOLOGY*
Créditos de libre elección					***Credits of free election***
CRÉDITOS CONVALIDADOS	30.00	CONVALIDADO	2010-2011	Convalidado / *Homologation*	*TRANSFERRED CREDITS*
CRÉDITOS CONVALIDADOS	30.00	CONVALIDADO	2010-2011	Convalidado / *Homologation*	*TRANSFERRED CREDITS*
MINERÍA DE DATOS APLICADA	30.00	NOTABLE	2010-2011		*APPLIED DATA MINING*

4.4. Sistema de calificación

La distribución de las calificaciones en el conjunto de las asignaturas conducentes a la obtención del título de Ingeniero en Informática en la Universidad de Málaga en los últimos dos años ha sido:
Aprobado 40,77% Notable 34,33% Sobresaliente 20,86% Matrícula de Honor 4,04%

En el sistema universitario español, las calificaciones están basadas en la puntuación absoluta sobre 10 puntos obtenida por el estudiante en cada asignatura, de acuerdo a la siguiente escala: Suspenso: 0-4,9; Aprobado: 5-6,9; Notable: 7-8,9; Sobresaliente: 9-10; Matrícula de Honor: implica haber obtenido Sobresaliente más una mención especial. Una asignatura se considera superada a partir de Aprobado (5).

4.5. Calificación global del titulado

2,35

Nota explicativa: la ponderación del expediente se calcula mediante el criterio siguiente: la suma de los créditos superados por el alumno multiplicados, cada uno de ellos, por el valor de la calificación que corresponda, a partir de la tabla de equivalencias que se especifica a continuación, y dividido por el número de créditos superados por el alumno.
Aprobado: 1 punto, Notable: 2 puntos, Sobresaliente: 3 puntos, Matrícula de Honor: 4 puntos. Convalidada: puntos correspondientes en función de la calificación obtenida en los estudios previamente cursados.

4.4. Grading scheme and, if available, grade distribution guidance

The grade distribution of subjects in the last two years at the Universidad de Málaga leading to an academic degree of Ingeniero en Informática has been:
Aprobado 40,77% Notable 34,33% Sobresaliente 20,86% Matrícula de Honor 4,04%

In the Spanish university system, each subject is graded on a scale from 0 to 10 points. Each numeric grade corresponds to a quality grade as follows: Suspenso: 0-4,9; Aprobado: 5-6,9; Notable: 7-8,9; Sobresaliente: 9-10; Matrícula de Honor: Means getting Sobresaliente plus a special mention. To pass a subject it is necessary to get at least 5 points.

4.5. Overall classification of the qualification (in original language)

2,35

Explanatory note: the grade point average is calculated with the following numerical criteria: Sum of the credits multiplied by the mark and divided by the total amount of credits.
Aprobado: 1 point, Notable: 2 points, Sobresaliente: 3 points, Matrícula de Honor: 4 points. Validated subject: points according to the mark obtained in previous studies.

5. Información sobre la función de la titulación
Information on the function of the qualification

5.1. Acceso a ulteriores estudios

El título de Ingeniero en Informática habilita el acceso al Doctorado y a otros estudios de postgrado.

5.1. Access to further study

The degree of Ingeniero en Informática gives access to doctoral courses and other postgraduate studies.

5.2. Cualificación profesional

Esta titulación capacita para desempeñar múltiples actividades en la industria de la informática y de los ordenadores: diseño, análisis y evaluación de sistemas informáticos en general, contemplando los distintos aspectos de gestión, organización y dirección de proyectos informáticos, de mantenimiento de equipos e infraestructuras, de inteligencia artificial, de paralelismo y de gestión masiva de la información; técnico de sistemas, de bases de datos y de comunicaciones en cualquier sector industrial y de servicios.
Puede desarrollar sus actividades tanto en la Administración y Organismos Públicos como en empresas privadas, así como en la docencia.

5.2. Professional status (if applicable)

This qualification enables the holder to carry out multiple activities in the IT and computer industries: design, analysis and assessment of IT systems in general, considering the different aspects of management, organisation and direction of IT projects, maintenance of equipment and infrastructure, artificial intelligence, parallelism and mass management of information; systems, database and communications technician for any sector of industry or services.
The holder may carry out activities for public administration and private companies, as well as in teaching.

6. Información adicional
Additional information

6.1. Información adicional

En los últimos años la Universidad de Málaga ha encontrado un hueco entre las mejores universidades de España. Sus señas de identidad son una completísima oferta de titulaciones, grandes medios humanos y técnicos al servicio de la institución y la colaboración de una provincia dinámica y en constante crecimiento.

Hoy las metas de la UMA son la internacionalización, seguir mejorando los estándares de calidad y fortalecer sus relaciones con el entorno económico y social. La utilización de las nuevas tecnologías y la innovación educativa son otra de las grandes señas de identidad de la Universidad de Málaga.

La UMA desarrolla un modelo educativo que promueve una enseñanza de calidad, competitiva, acreditada, orientada al empleo y convergente con el Espacio Europeo de Educación Superior. En los últimos años la UMA ha potenciado con decisión la internacionalización de las enseñanzas, la investigación y la movilidad de profesores y alumnos.

Para más información: www.uma.es

6.1. Additional information

In recent years, Malaga University has made itself a place among the best universities in Spain. A wide range of study programmes, excellent human and technical resources and the collaboration of a dynamic province in constant growth are its distinguishing characteristics.

The current goals of Malaga University include its internationalisation, improving quality standards and strengthening its links with the social and economic environment. The use of new technologies and educational innovation is another of the institution's main characteristics.

Malaga University is developing an educational model that promotes quality education that is competitive, proven, orientated towards employment and convergent with the European Space of Higher Education. Over the last decade, the university has made a consistent effort to internationalise its study programmes, its research activities and the mobility of its faculty members and students.

For more information: www.uma.es

7. Certificación del suplemento
Certification of the supplement

El Secretario General
General Secretary

Miguel Porras Fernández

Fecha / Date

23 / 09 / 2011

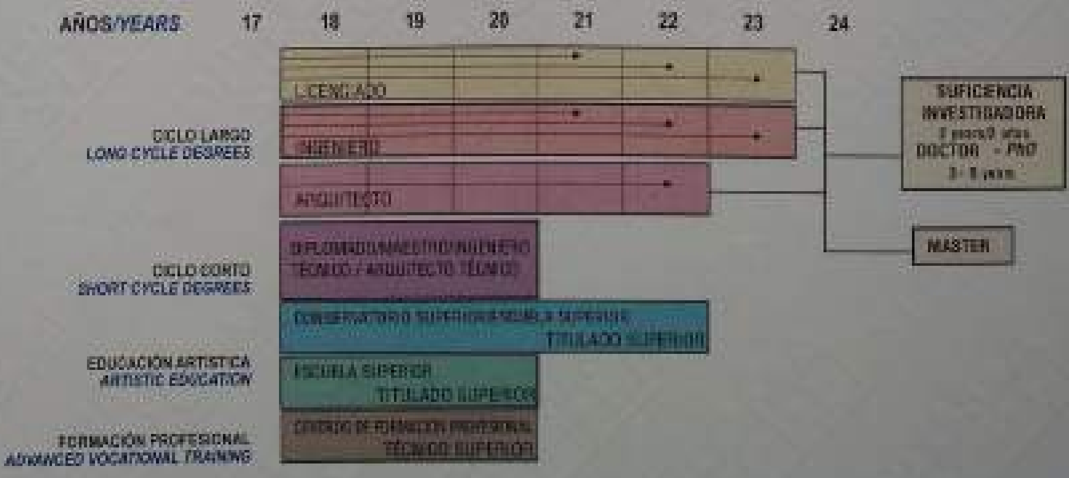
UNIVERSIDAD DE MÁLAGA

Sello oficial / *Official stamp or seal*

El Jefe de la Sección
Section Head

Luis Marcos Rivera

8. Información sobre el sistema nacional de enseñanza superior
Information on the Spanish higher education system



Signo, S. A.

UNIVERSIDAD
DE MÁLAGA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

DON GABRIEL AGUILERA VENEGAS, SECRETARIO DE LA E.T.S. INGENIERÍA INFORMÁTICA

CERTIFICO:

Que en el expediente académico de la alumna de este Centro, DOÑA DOLORES BURGUEÑO CABALLERO, con D.N.I. número 025346121 , correspondiente a la titulación de Ingeniero Técnico en Informática de Gestión, que obra en poder de esta Secretaría, figuran los siguientes datos:

Relación de asignaturas cursadas y superadas en este Centro:

Denominación	Carácter	Ciclo	Curso	Créditos	Calificación	Convocatoria	Curso Ac.
Elementos de programación	OBLIGATORIA	1º	1	7.50	APROBADO	2ª Ordinaria Septiembre	2006/2007
Técnicas de organización empresarial	TRONCAL	1º	1	6.00	NOTABLE	1ª Ordinaria Febrero	2006/2007
Matemática discreta	TRONCAL	1º	1	6.00	NOTABLE	1ª Ordinaria Febrero	2006/2007
Sistemas electrónicos digitales	OBLIGATORIA	1º	1	4.50	NOTABLE	Extraordinaria Diciembre	2007/2008
Física	OBLIGATORIA	1º	1	6.00	NOTABLE	1ª Ordinaria Febrero	2006/2007
Metodología de la programación	TRONCAL	1º	1	6.00	NOTABLE	1ª Ordinaria Junio	2006/2007
Cálculo para la computación	TRONCAL	1º	1	6.00	NOTABLE	1ª Ordinaria Junio	2006/2007
Estructuras algebraicas para la computación	TRONCAL	1º	1	6.00	NOTABLE	1ª Ordinaria Junio	2006/2007
Dispositivos electrónicos	OBLIGATORIA	1º	1	4.50	NOTABLE	1ª Ordinaria Junio	2006/2007
Laboratorio de programación	TRONCAL	1º	1	4.50	NOTABLE	1ª Ordinaria Junio	2006/2007
Estructura y tecnología de computadores	TRONCAL	1º	1	9.00	SOBRESALIENTE	1ª Ordinaria Junio	2006/2007
Teoría de autómatas y lenguajes formales	OBLIGATORIA	1º	2	9.00	NOTABLE	1ª Ordinaria Junio	2007/2008
Estructura de computadores	OBLIGATORIA	1º	2	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2007/2008
Tipos abstractos de datos	TRONCAL	1º	2	6.00	NOTABLE	1ª Ordinaria Febrero	2007/2008
Análisis y diseño de algoritmos	TRONCAL	1º	2	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2007/2008
Fundamentos de estadística para la computación	TRONCAL	1º	2	4.50	NOTABLE	1ª Ordinaria Febrero	2007/2008
Lógica computacional	OBLIGATORIA	1º	2	4.50	SOBRESALIENTE	1ª Ordinaria Febrero	2007/2008
Laboratorio de tecnología de objetos	OBLIGATORIA	1º	2	6.00	NOTABLE	1ª Ordinaria Junio	2007/2008
Diseño y utilización de bases de datos	OBLIGATORIA	1º	2	6.00	APROBADO	1ª Ordinaria Junio	2007/2008
Laboratorio de estadística computacional	TRONCAL	1º	2	4.50	NOTABLE	1ª Ordinaria Junio	2007/2008
Métodos numéricos	OBLIGATORIA	1º	2	4.50	NOTABLE	1ª Ordinaria Febrero	2007/2008
Ingeniería del software de gestión	TRONCAL	1º	3	12.00	NOTABLE	1ª Ordinaria Junio	2008/2009
Administración de bases de datos	TRONCAL	1º	3	6.00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2008/2009
Programación declarativa	OBLIGATORIA	1º	3	6.00	SOBRESALIENTE	1ª Ordinaria Febrero	2008/2009
Fundamentos de sistemas operativos	OBLIGATORIA	1º	3	6.00	NOTABLE	1ª Ordinaria Febrero	2008/2009
Técnicas de gestión empresarial	TRONCAL	1º	3	6.00	APROBADO	1ª Ordinaria Febrero	2008/2009
Informática distribuida	OBLIGATORIA	1º	3	4.50	SOBRESALIENTE	1ª Ordinaria Junio	2008/2009
Modelos computacionales	OBLIGATORIA	1º	3	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2008/2009

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

Denominación	Carácter	Ciclo	Curso	Créditos	Calificación	Convocatoria	Curso Ac.
Sistemas Operativos	TRONCAL	1º	3	6.00	MATRICULA DE HONOR	1ª Ordinaria Junio	2008/2009
Matemáticas financieras	OPTATIVA	1º	3	6.00	SOBRESALIENTE	1ª Ordinaria Febrero	2008/2009
Diseño de redes telemáticas	OPTATIVA	1º	3	6.00	APROBADO	1ª Ordinaria Febrero	2007/2008
Seguridad en redes telemáticas	OPTATIVA	1º	3	6.00	NOTABLE	1ª Ordinaria Junio	2007/2008
Introducción a la Antropología	LIBRE CONF.	T.	–	9.00	SOBRESALIENTE	1ª Ordinaria Junio	2008/2009
Técnicas informáticas para el tratamiento de datos geofísicos	LIBRE CONF.	T.	–	3.00	NOTABLE	1ª Ordinaria Junio	2007/2008
Diseño y construcción de placas de circuitos impresos	LIBRE CONF.	T.	–	3.00	NOTABLE	1ª Ordinaria Junio	2008/2009
Matemática recreativa	LIBRE CONF.	T.	–	3.00	NOTABLE	1ª Ordinaria Febrero	2008/2009
La calculadora científica estándar	LIBRE CONF.	T.	–	3.00	SOBRESALIENTE	1ª Ordinaria Febrero	2008/2009
Herramientas informáticas de cálculo matemático	LIBRE CONF.	T.	–	3.00	APROBADO	1ª Ordinaria Junio	2007/2008
Metaheurísticas en Bioinformática	LIBRE CONF.	T.	–	3.00	NOTABLE	1ª Ordinaria Junio	2007/2008

Relación de créditos reconocidos por equivalencia:

Descripción	Carácter	Créditos	Calificación	Ciclo	Curso	Fecha
Cursos: Asistencia a reuniones Semana Cultural 2008	LIBRE CONF.	1.00		T.	2007/2008	10-09-2008
Representación estudiantil: Dpto. Lenguajes y CC Computación (curso 2008-09)	LIBRE CONF.	0.50		T.	2008/2009	15-09-2009

Proyecto "fin de carrera":

FECHA DE INSCRIPCION DEL ANTEPROYECTO:	**5 de Mayo de 2009**
FECHA DE APROBACION DEL ANTEPROYECTO:	**25 de Junio de 2009**
TITULO DEL PROYECTO:	**WEB MULTIMEDIA DE DIVULGACIÓN CIENTÍFICA**
FECHA DE MATRICULACION DEL PROYECTO:	**15 de Junio de 2010**
FECHA DE DEFENSA DEL PROYECTO:	**8 de Julio de 2010**
CALIFICACION:	**MATRICULA DE HONOR**

Nota media del expediente: 2.32 (**)

(**) Calculada según los criterios del Acuerdo de 4 de abril de 2001, de la Comisión del Distrito Único Universitario de Andalucía, BOJA de 19 de mayo de 2001.

La alumna ha finalizado sus estudios en el curso académico 2009/2010 , teniendo abonados los derechos de expedición del título con fecha 09-07-2010.

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

Situación del cumplimiento de la carga lectiva exigida para la obtención del título:

	Troncales			Obligatorios			Optativos			Libre Configuración		
	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan
Primer ciclo	94.50	94.50		84.00	84.00		18.00	18.00		28.50	22.50	

Y para que así conste y surta los efectos oportunos, expido la presente, a petición del interesado para su uso personal, en Málaga a siete de octubre de dos mil once.

Comprobado y conforme.
EL JEFE DE SECRETARÍA

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

RAFAEL FLORES LUQUE

GABRIEL AGUILERA VENEGAS

UNIVERSIDAD
DE MÁLAGA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

DON GABRIEL AGUILERA VENEGAS, SECRETARIO DE LA E.T.S. INGENIERÍA INFORMÁTICA

CERTIFICO:

Que en el expediente académico de la alumna de este Centro, DOÑA DOLORES BURGUEÑO CABALLERO, con D.N.I. número 25346121, correspondiente a la titulación de Ingeniero en Informática, que obra en poder de esta Secretaría, figuran los siguientes datos:

Relación de asignaturas cursadas y superadas en este Centro:

Denominación	Carácter	Ciclo	Curso	Créditos	Calificación	Convocatoria	Curso Ac.
Procesadores de lenguajes	TRONCAL	2º	4	9.00	APROBADO	1ª Ordinaria Junio	2009/2010
Inteligencia artificial e ingeniería del conocimiento	TRONCAL	2º	4	10.50	NOTABLE	1ª Ordinaria Junio	2009/2010
Ingeniería del software. Especificación	TRONCAL	2º	4	6.00	APROBADO	1ª Ordinaria Febrero	2009/2010
Arquitectura de computadores I	TRONCAL	2º	4	6.00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2009/2010
Arquitectura de redes	TRONCAL	2º	4	4.50	MATRICULA DE HONOR	1ª Ordinaria Febrero	2009/2010
Ingeniería de sistemas	OBLIGATORIA	2º	4	6.00	NOTABLE	1ª Ordinaria Febrero	2009/2010
Ingeniería del software. Diseño	TRONCAL	2º	4	6.00	NOTABLE	1ª Ordinaria Junio	2009/2010
Arquitectura de computadores II	TRONCAL	2º	4	4.50	APROBADO	1ª Ordinaria Junio	2009/2010
Comunicación de datos	TRONCAL	2º	4	6.00	APROBADO	1ª Ordinaria Junio	2010/2011
Ampliación de ingeniería del conocimiento	OBLIGATORIA	2º	5	9.00	NOTABLE	1ª Ordinaria Junio	2010/2011
Ingeniería del software. Proyectos	TRONCAL	2º	5	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2010/2011
Practicum	TRONCAL	2º	5	9.00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2010/2011
Economía	OBLIGATORIA	2º	5	4.50	APROBADO	1ª Ordinaria Junio	2010/2011
Gestión de proyectos	TRONCAL	2º	5	6.00	NOTABLE	1ª Ordinaria Febrero	2010/2011
Auditoría informática	OPTATIVA	2º	–	6.00	NOTABLE	1ª Ordinaria Junio	2010/2011
Procesamiento de imágenes	OPTATIVA	2º	–	6.00	MATRICULA DE HONOR	1ª Ordinaria Febrero	2010/2011
Programación declarativa avanzada	OPTATIVA	2º	–	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2009/2010
Sistemas de información	OPTATIVA	2º	–	6.00	NOTABLE	1ª Ordinaria Febrero	2010/2011
Sistemas operativos distribuidos	OPTATIVA	2º	–	6.00	SOBRESALIENTE	1ª Ordinaria Febrero	2010/2011
Software de comunicaciones	OPTATIVA	2º	–	6.00	SOBRESALIENTE	1ª Ordinaria Junio	2009/2010
Tecnología de redes	OPTATIVA	2º	–	6.00	NOTABLE	1ª Ordinaria Junio	2010/2011
Minería de datos aplicada	LIBRE CONF.	T.	–	3.00	NOTABLE	1ª Ordinaria Junio	2010/2011

Relación de asignaturas reconocidas por convalidación:

Denominación	Carácter	Créditos	Fecha resolución	Curso
La calculadora científica estándar	LIBRE CONF.	3.00	20-10-2010	2010/2011
Técnicas informáticas para el tratamiento de datos	LIBRE CONF.	3.00	20-10-2010	2010/2011

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

CERTIFICACIÓN ACADÉMICA DE
DOÑA DOLORES BURGUEÑO CABALLERO

E.T.S. INGENIERÍA INFORMÁTICA

ANEXO: Relación de las asignaturas que han originado el reconocimiento de asignaturas y/o créditos, por convalidación:

Denominación		Calificación	Curso
Titulación:	INGENIERO TÉCNICO EN INFORMÁTICA DE GESTIÓN		
Organismo:	UNIVERSIDAD DE MÁLAGA.E.T.S.I.INFORMÁTICA		
	TÉCNICAS INFORMÁTICAS PARA EL TRATAMIENTO DE DATOS	NOTABLE	2007/2008
	LA CALCULADORA CIENTÍFICA ESTÁNDAR	SOBRESALIENTE	2008/2009

Proyecto "fin de carrera":

FECHA DE INSCRIPCION DEL ANTEPROYECTO:	**24 de Febrero de 2011**
FECHA DE APROBACION DEL ANTEPROYECTO:	**15 de Abril de 2011**
TITULO DEL PROYECTO:	**BÚSQUEDA AVANZADA DE RUTAS EN MAPAS DE CARRETERAS**
FECHA DE MATRICULACION DEL PROYECTO:	**19 de Septiembre de 2011**
FECHA DE DEFENSA DEL PROYECTO:	**23 de Septiembre de 2011**
CALIFICACION:	**MATRICULA DE HONOR**

Nota media del expediente: 2.35 (**)

(**) Calculada según los criterios del Acuerdo de 4 de abril de 2001, de la Comisión del Distrito Único Universitario de Andalucía, BOJA de 19 de mayo de 2001.

La alumna ha finalizado sus estudios en el curso académico 2010/2011 , teniendo abonados los derechos de expedición del título con fecha 23-09-2011.

Situación del cumplimiento de la carga lectiva exigida para la obtención del título:

Primer ciclo: El interesado ha accedido directamente al segundo ciclo mediante un supuesto especial de incorporación al mismo previsto en el correspondiente plan de estudios. Consecuentemente la carga lectiva correspondiente al primer ciclo (96.00 troncales, 79.50 obligatorios, 27.00 optativos y 22.50 de libre configuración curricular) se considera superada por el interesado.

	Troncales			**Obligatorios**			**Optativos**			**Libre Configuración**		
	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan	Superados	Exigidos	Faltan
Segundo ciclo	73.50	73.50		19.50	19.50		36.00	36.00		15.00	15.00	

Y para que así conste y surta los efectos oportunos, expido la presente, a petición del interesado para su uso personal, en Málaga a siete de octubre de dos mil once.

Comprobado y conforme:
EL JEFE DE SECRETARÍA

P.O.

RAFAEL FLORES LUQUE

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA INFORMÁTICA

GABRIEL AGUILERA VENEGAS

b. Becas

Resolución de 28 de noviembre de 2012, de la Secretaría de Estado de Investigación, Desarrollo e Innovación, por la que se conceden ayudas predoctorales de formación de personal investigador en su convocatoria 2012.

Cumplidos los trámites establecidos en la Resolución de 30 de diciembre de 2011, (BOE de 3 de febrero de 2012), de la Secretaría de Estado de Investigación, Desarrollo e Innovación, por la que se aprueba la convocatoria correspondiente al año 2012 del procedimiento de concesión de ayudas del Programa Nacional de Formación de Recursos Humanos de Investigación, en el marco del Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica 2008-2011, he resuelto:

Primero.- Conceder las ayudas predoctorales de Formación de Personal Investigador (Ayudas FPI) que se relacionan en el Anexo I de la presente resolución.

De acuerdo con el artículo 17 de la resolución de convocatoria, estas ayudas tendrán una duración de 48 meses, a contar desde la fecha de incorporación del investigador a su Centro de Investigación, y se estructuran en dos periodos de 24 meses: el primero de beca, cuyos beneficiarios son los investigadores en formación, y el segundo de contrato en prácticas, cuyos beneficiarios son los Centros de I+D a los que se adscriben los mencionados investigadores.

En virtud al artículo 17.2 de la resolución de convocatoria, los periodos de disfrute de otras ayudas homologables por su análoga naturaleza, atendiendo al objeto, la cuantía, el proceso de selección u otros, según el criterio de la Comisión de Selección, podrán ser descontados del cómputo total de esta ayuda, inicialmente del periodo de beca, y si es necesario del de contrato.

Segundo.- Designar a los solicitantes que se relacionan en el Anexo II como candidatos en reserva para cubrir las posibles renuncias de los becarios, de acuerdo con lo establecido en el artículo 28 de la resolución de convocatoria.

Tercero.- Durante el período de beca la cuantía de las ayudas incluirá el importe de la beca y el coste de la cuota patronal a aportar a la Seguridad Social, que correspondan para cada año. La cuantía de las becas será de 1.142 euros mensuales brutos.

Durante el período de contrato, la ayuda anual para cada uno de los contratos que se formalicen al amparo de este subprograma será de 21.500 euros. La retribución mínima anual que deberán recibir el investigador en formación, y que figurará en su contrato, será de 16.422 euros brutos anuales. La ayuda indicada anteriormente se destinará necesariamente a cofinanciar el salario y la cuota empresarial de la Seguridad Social de los investigadores contratados.

El importe total de las ayudas a que se refiere esta Resolución asciende a 71.513.350,74 EUROS (SETENTA Y UN MILLONES QUINIENTOS TRECE MIL TRESCIENTOS CINCUENTA EUROS CON SETENTA Y CUATRO CENTIMOS) y su financiación se imputará a las aplicaciones presupuestarias 27.13.463B.784, 27.13.463B.731, 27.13.463B.754 , 27.13.463B.780, 27.13.463B.713 Y 27.13.463B.740 o equivalente del presupuesto de gastos del Ministerio de Economía y Competitividad para el año 2012 y ejercicios posteriores, de acuerdo con las disponibilidades presupuestarias.

Cuarto.- El personal investigador en formación se incorporará a su Centro de I+D en el primer día hábil de cualquiera de los cuatro meses siguientes al de la publicación de esta resolución en la página de la sede electrónica del Ministerio de Economía y Competitividad (https://sede.micinn.gob.es).

El personal investigador en formación remitirá a la Dirección General de Investigación Científica y Técnica, los documentos correspondientes a la incorporación, cuyos modelos se encontrarán disponibles en la página web http://www.mineco.es Adicionalmente, aquellos beneficiarios que reúnan los requisitos recogidos en el artículo 20 de la Resolución de 30 de diciembre de 2011, de la Secretaría de Estado de Investigación, Desarrollo e Innovación (BOE de 3 de febrero de 2012) posteriormente a la fecha de finalización del plazo de presentación de solicitudes, deberán además adjuntar copia del certificado de estudios y, en su caso, del título académico, de acuerdo a lo indicado en el artículo 23.6.b).1.º Esta documentación deberá ser enviada dentro de los diez días hábiles siguientes al de la fecha de incorporación. Se entenderá la no incorporación en este plazo como renuncia a la ayuda.

En casos excepcionales y debidamente justificados el órgano concedente, previa solicitud dentro del período de incorporación indicado en este apartado, podrá ampliar el plazo de incorporación. No obstante lo anterior, la fecha de cumplimiento de los requisitos recogidos en el artículo 20 no podrá ser aplazada y, en caso de aplazamiento de la incorporación, se deberá acreditar el cumplimiento de tales requisitos en el último día hábil primeramente establecido para la incorporación según lo indicado en el párrafo primero de este artículo.

Quinto.- Los investigadores en formación seleccionados y los Centros de I+D de adscripción deberán remitir todos los informes, formularios y demás documentos que, a los efectos del disfrute de la ayuda, le sean requeridos por la Dirección General de Investigación Científica y Técnica y las entidades que colaboran en su gestión.

Sexto.- La justificación de las ayudas por parte de los investigadores en formación y de los Centros de I+D de adscripción se realizará de acuerdo con lo establecido en el artículo 30 de la Ley General de Subvenciones y en los artículos 34 y 35 de la resolución de convocatoria, así como con las instrucciones que establezca la Dirección General de Investigación Científica y Técnica.

Contra la presente Resolución, que pone fin a la vía administrativa, se podrá interponer, potestativamente, recurso de reposición ante el órgano que la dictó, en el plazo de un mes, si la resolución fuera expresa, o de tres meses si no lo fuera, de acuerdo con lo dispuesto en los artículos 116 y 117 de la Ley 30/1992, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común.

Sin perjuicio de lo anterior, contra la resolución del procedimiento de concesión cabe interponer recurso contencioso-administrativo ante la Sala de lo Contencioso-Administrativo de la Audiencia Nacional, en el plazo de dos meses, si la resolución fuera expresa, o de seis meses si no lo fuera, de acuerdo con lo dispuesto en los artículos 11.1.a) y 46 de la Ley 29/1998, de 13 de julio, de la Jurisdicción Contencioso-Administrativa.

Madrid, 28 de noviembre de 2012. – La Secretaria de Estado de Investigación, Desarrollo e Innovación. (PD. Resolución de la Secretaría de Estado de Investigación, Desarrollo e Innovación de 19 de noviembre. BOE de 20 de noviembre de 2012), el Director General de Investigación Científica y Técnica.

ANEXO I
Ayudas FPI 2012 Concesiones

Nº	Apellidos y Nombre	NIF/NIE/ pasaporte	Referencia	Código Proyecto	Centro I+D	Duración concedida (meses y días)
121	Borrero Santiago, Ana Rocío	47506769Q	BES-2012-054950	CTM2011-28437-C02-02	UNIVERSIDAD DE CADIZ	48 meses
122	Borruel Abadía, Violeta	18058118J	BES-2012-061959	CGL2011-24408	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
123	Borzecka , Ewa	EA4250324	BES-2012-053617	BIO2011-26229	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
124	Bosque Chacón, Gabriel	48821604X	BES-2012-053772	DPI2011-28112-C04-01	UNIVERSIDAD POLITECNICA DE VALENCIA	48 meses
125	Bravo Segura, Iria	36176053C	BES-2012-052708	CTQ2011-28157	UNIVERSIDAD AUTONOMA DE MADRID	48 meses
126	Breschi , Alessandra	Y1751130Q	BES-2012-055848	BIO2011-26205	FUNDACIO PRIVADA CENTRE DE REGULACIO GENOMICA	48 meses
127	BROSET BLASCO, ESTHER	18450651M	BES-2012-052937	BIO2011-23555	UNIVERSIDAD DE ZARAGOZA	48 meses
128	Brzezicka , Katarzyna	Y2261597K	BES-2012-052835	CTQ2011-27874	ASOCIACIÓN CENTRO DE INVESTIGACION COOP. BIOMATERIALES	48 meses
129	Budde , Pablo	C4WF59KGV	BES-2012-054278	ECO2011-26308	CENTRO DE ESTUDIOS MONETARIOS Y FINANCIEROS	48 meses
130	Buendía Lucas, Julia	04618500P	BES-2012-054288	CTQ2011-22581	UNIVERSIDAD COMPLUTENSE DE MADRID	48 meses
131	Buj Gómez, Raquel	20469843G	BES-2012-055368	SAF2011-23638	FUNDACIÓ PRIVADA INSTITUT DE MEDICINA PREDICTIVA I PERSONALITZADA DE CÀNCER	48 meses
132	Burgos Simón, María Ángeles	15424360P	BES-2012-051868	CGL2011-23413	UNIVERSIDAD DE VALLADOLID	48 meses
133	Burgos Martín, Carmen Macarena	76136450X	BES-2012-053882	CTM2011-27891	UNIVERSIDAD DE CADIZ	48 meses
134	Burgos Pérez, Miguel Ángel	76632127Z	BES-2012-060333	MTM2011-27998	UNIVERSIDAD DE LA LAGUNA	48 meses
135	Burgueño Caballero, Dolores	25346121Y	BES-2012-057064	TIN2011-23795	UNIVERSIDAD DE MALAGA	48 meses
136	Bustamante Montoya, Mariana	25627682R	BES-2012-053274	BFU2011-22734	CONSORCI CSIC-IRTA-UAB CENTRE DE RECERCA EN AGRIGENOMICA (CRAG)	48 meses
137	Buzón Díaz, Vicente	30254348X	BES-2012-052714	FIS2011-24460	UNIVERSIDAD DE SEVILLA	48 meses
138	Byrom , Daniel	Y1461910K	BES-2012-052287	CTQ2011-23620	FUNDACIO PRIVADA INSTITUT DE RECERCA BIOMEDICA	48 meses
139	Caballero Cala, Verónica	05304268P	BES-2012-057895	EDU2011-26887	UNIVERSIDAD DE ALMERIA	48 meses
140	caballero casero, noelia	44353553P	BES-2012-052170	CTQ2011-23849	UNIVERSIDAD DE CORDOBA	48 meses
141	Caballero García, M. Blanca	02712028Y	BES-2012-053750	MAT2011-29194-C02-01	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
142	Caballo Ponce, Eloy	30238495G	BES-2012-052398	AGL2011-30343-C02-01	UNIVERSIDAD DE MALAGA	48 meses
143	Cabestrero Aranda, Óscar	70252257E	BES-2012-054282	CGL2011-26781	UNIVERSIDAD COMPLUTENSE DE MADRID	48 meses
144	Cabras , Paolo	Y0150640G	BES-2012-054499	DPI2011-22471	UNIVERSITAT POLITECNICA DE CATALUNYA	48 meses
145	Caetano Cordeiro, Ana Sara	Y2052862B	BES-2012-057183	SAF2011-30337-C02-01	UNIVERSIDADE DE SANTIAGO DE COMPOSTELA	48 meses
146	Cahill Marrón, Emma Luisa	72071617J	BES-2012-054529	HAR2011-25138	UNIVERSIDAD DE CANTABRIA	48 meses
147	Cairó Calzada, Montserrat	46707317K	BES-2012-052771	SAF2011-23636	UNIVERSIDAD DE BARCELONA	48 meses
148	Cal Delgado, Laura	44075452T	BES-2012-055414	AGL2011-23581	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
149	Calatayud Subias, Juan Antonio	47913515F	BES-2012-055074	BFU2011-23662	FUNDACIO PRIVADA INSTITUT DE RECERCA BIOMEDICA	48 meses
150	CALDERÓN PÉREZ, AINGERU	48569420K	BES-2012-052021	BFU2011-28716	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
151	CALLE NAVARRO, MIKEL	18056420V	BES-2012-056723	CGL2011-29176	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
152	Calvo Beguería, Laura	72985926A	BES-2012-059174	AGL2011-24524	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
153	Calvo Gallego, Elisa	77811648A	BES-2012-053555	TEC2011-24319	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
154	Calvo Gallego, José Luis	77811647W	BES-2012-053526	DPI2011-28080	UNIVERSIDAD DE SEVILLA	48 meses
155	Campillo Sánchez, Pablo	48507646W	BES-2012-052984	TIN2011-28335-C02-01	UNIVERSIDAD COMPLUTENSE DE MADRID	48 meses
156	Camponogara , Douglas	CX496111	BES-2012-055769	TEC2011-23612	UNIVERSIDAD DE CANTABRIA	48 meses
157	Cancela Vallespín, Ana	75788436D	BES-2012-061847	PSI2011-26212	UNIVERSIDAD AUTONOMA DE MADRID	48 meses
158	Cando Guañuna, Deysi Prisila	03203779V	BES-2012-053420	AGL2011-24693	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
159	Cano Ruiz, Esther	71150837S	BES-2012-054860	FEM2011-26210	UNIVERSIDADE DA CORUÑA	48 meses
160	Cano Lozano, Jose Carlos	26247684S	BES-2012-053785	DPI2011-28356-C03-03	UNIVERSIDAD DE JAEN	48 meses
161	Cappucci , Paola	Y1076333Q	BES-2012-058951	PSI2011-22416	UNIVERSIDAD DE GRANADA	48 meses
162	Carballo Palos, Arkaitz	44627987Y	BES-2012-060870	AGL2011-30352-C02-01	UNIVERSIDAD PUBLICA DE NAVARRA	48 meses
163	Carda Diéguez, Miguel	53382011T	BES-2012-052361	AGL2011-29639	UNIVERSIDAD DE VALENCIA	48 meses
164	CARDENAS MILAN, MARIA DEL MAR	53081817W	BES-2012-060193	TRA2011-28900	FUNDACIÓN INSTITUTO DE HIDRÁULICA AMBIENTAL DE CANTABRIA	48 meses
165	Caridi , Flavia	Y1235547R	BES-2012-053799	BIO2011-24351	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
166	CARMONA RODRIGUEZ, LORENA	76442299M	BES-2012-057086	SAF2011-24453	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
167	Caro Campos, Luis Alberto	05320149L	BES-2012-055023	TEC2011-25995	UNIVERSIDAD AUTONOMA DE MADRID	48 meses
168	Caro Martín, Carmen Rocío	14623020B	BES-2012-052748	BFU2011-29286	UNIVERSIDAD PABLO DE OLAVIDE, DE SEVILLA	48 meses
169	CARPENA GARCIA, NURIA	74246799Q	BES-2012-057568	BIO2011-30503-C02-01	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
170	Carpio , Azahara	30979784A	BES-2012-054479	CTQ2011-23790	UNIVERSIDAD DE CORDOBA	48 meses
171	Carrasco García, Irene María	74884113T	BES-2012-055918	CTQ2011-24433	UNIVERSIDAD DE MALAGA	48 meses
172	Carreño Yugueros, David	53559592K	BES-2012-054972	AGL2011-23700	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
173	CARRERA OLIVARES, CARLOS	52887487E	BES-2012-058978	CGL2011-27349	UNIVERSIDAD DE CADIZ	48 meses
174	CARRIÓ SEGUÍ, ÀNGELA	53219030C	BES-2012-056241	BIO2011-24848	UNIVERSIDAD DE VALENCIA	48 meses
175	Carrión García, Alicia	23277910R	BES-2012-051960	TEC2011-23403	UNIVERSIDAD POLITECNICA DE VALENCIA	48 meses
176	Carvalho Vicente Paredes, Ricardo Filipe	11225447	BES-2012-053265	CGL2011-25894	UNIVERSIDAD COMPLUTENSE DE MADRID	48 meses
177	Casado Merino, Cintia	53435716T	BES-2012-056661	CTM2011-29143-C03-01	UNIVERSIDAD REY JUAN CARLOS	48 meses
178	Casado Ruiz, Yolanda	12781795M	BES-2012-055279	CSO2011-29970	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
179	Casal López, Estefanía	33542163K	BES-2012-059612	AYA2011-30147-C03-01	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses
180	Casals Montserrat, Blai	47916282Z	BES-2012-059023	MAT2011-29269-C03-01	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	48 meses

Juan Teodomiro López Navarrete, Vicerrector de Investigación y Transferencia de la Universidad de Málaga

INFORMA: Que según los datos que constan en este Vicerrectorado, **Dª. Dolores Burgueño Caballero** con D.N.I. 25346121 Y ha participado en las siguientes actividades y/o proyectos:

- Ha estado contratada con la categoría de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de enero hasta el 30 de septiembre de 2017, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría de Técnico Superior (A) a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de octubre de 2017 hasta el 28 de febrero de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría de Técnico Superior (A) a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2014-52034-R, desde el 1 de marzo hasta el 30 de septiembre de 2018, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha sido Personal Investigadora en Formación (FPI) de referencia BES-2012-057064 financiado por el MINECO, con cargo al Proyecto TIN2011-23795, desde el 2 de enero de 2013 hasta el 31 de diciembre de 2016, cuyo investigador principal fue Manuel Díaz Rodríguez.

- Ha estado contratada con la categoría de Titulado Superior a tiempo completo (40 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 16 de noviembre de 2011 hasta el 31 de marzo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

- Ha estado contratada con la categoría de Titulado Superior a tiempo parcial (20 horas) con cargo a proyectos, grupos, convenios o contratos de investigación de referencia TIN2008-03107, desde el 1 de abril hasta el 31 de mayo de 2012, cuyo investigador principal fue Antonio Vallecillo Moreno.

Y para que conste donde proceda a los efectos oportunos en Málaga a 27 de noviembre de 2019

MINISTERIO
DE CIENCIA
E INNOVACIÓN

RESOLUCIÓN DE LA PRESIDENCIA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN, POR LA QUE SE CONCEDEN SUBVENCIONES PARA LA CONTRATACIÓN LABORAL DE DOCTORES POR CENTROS DE INVESTIGACIÓN Y DESARROLLO AYUDAS JUAN DE LA CIERVA-INCORPORACIÓN, CONVOCATORIA 2018.

Por Orden ECC/1402/2013, de 22 de julio, se aprobaron las bases reguladoras para la concesión de ayudas en el marco del Programa Estatal de Promoción del Talento y su Empleabilidad del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016. Esta orden de bases, de conformidad con lo dispuesto en el Acuerdo del Consejo de Ministros, en su reunión de 29 de diciembre de 2017, por el que se aprobó el Plan Estatal de Investigación Científica y Técnica e Innovación 2017-2020, se mantiene vigente, en tanto no se aprueben nuevas bases reguladoras, y las referencias realizadas al Plan Estatal de Investigación Científica y Técnica y de Innovación para el período 2013-2016 se entenderán efectuadas al nuevo Plan Estatal respecto de aquellos programas y subprogramas que mantengan su continuidad en él.

Por Resolución de 20 de diciembre de 2018, de la Presidencia de la Agencia Estatal de Investigación se aprobó la convocatoria, correspondiente al año 2018, de diversas actuaciones contempladas en el Subprograma Estatal de Formación y en el Subprograma Estatal de Incorporación, del Programa Estatal de Promoción del Talento y su Empleabilidad, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020, entre las que se encuentran las Ayudas Juan de la Cierva-incorporación.

Por resolución de 27 de noviembre de 2019 de la Presidencia de la Agencia Estatal de Investigación, modificada por resolución de 11 de diciembre de 2019, se concedieron subvenciones para la contratación laboral de personal en posesión del grado de doctor, por centros de investigación y desarrollo, en el marco de las Ayudas Juan de la Cierva- incorporación, convocatoria 2018, al tiempo que se designaron solicitudes de reserva que se relacionaban en el Anexo II de la resolución de acuerdo con lo establecido en el artículo 13.3 de la resolución de convocatoria.

Con posterioridad a la publicación de la resolución de concesión, algunas entidades beneficiarias han comunicado las renuncias que se relacionan en el Anexo II de esta resolución, por lo que, de acuerdo con lo dispuesto en el artículo 13 de la resolución de convocatoria y en el artículo 63.3 del Reglamento de la Ley 38/2003, de 17 de noviembre, General de Subvenciones, aprobado por Real decreto 887/2006, de 21 de julio, la Agencia Estatal de Investigación, ha declarado la pérdida del derecho al cobro de dichas subvenciones concedidas por un importe de 2.232.000,00 euros.

Asimismo, y conforme a los artículos citados en el párrafo anterior, con fecha 5 de febrero de 2020, se publicó en la sede electrónica del Ministerio de Ciencia e Innovación la propuesta de resolución provisional de solicitudes de reserva a las que se propone la concesión de una ayuda, habiendo manifestado la aceptación de dicha propuesta las solicitudes que se relacionan en el Anexo I de esta resolución.

Por Resolución de la Presidencia de la Agencia Estatal de Investigación, publicada en la sede electrónica del Ministerio de Ciencia e Innovación, se ha acordado dejar sin efectos la suspensión de los términos y la interrupción de los plazos administrativos, establecida en la disposición adicional tercera del Real Decreto 463/2020, de 14 de marzo, por el que se declara el estado de alarma para la gestión de la situación de crisis sanitaria ocasionada por el COVID-19, del procedimiento de concesión de estas ayudas y continuar su tramitación en la forma ordinaria.

Por todo ello, cumplidos los requisitos establecidos en la Orden de bases y en la resolución de convocatoria, esta Agencia Estatal de Investigación,

RESUELVE:

1.- Conceder las subvenciones, a los organismos beneficiarios que se citan en el Anexo I de la resolución, para financiar contratos Juan de la Cierva-incorporación, por un importe total de 1.581.000,00 euros. Su financiación se imputará a las aplicaciones presupuestarias del presupuesto de gastos de la Agencia Estatal de Investigación que se indican a continuación o las que correspondan en ejercicios posteriores, según el siguiente desglose:

Torrelaguna 58 bis
28027 Madrid

APLICACIÓN PRESUPUESTARIA	2020	2021	2022	TOTAL
28.303.000X.731	35.000,00	29.000,00	29.000,00	93.000,00
28.303.463B.740	35.000,00	29.000,00	29.000,00	93.000,00
28.303.463B.750	490.000,00	406.000,00	406.000,00	1.302.000,00
28.303.463B.780	35.000,00	29.000,00	29.000,00	93.000,00
TOTAL	595.000,00	493.000,00	493.000,00	1.581.000,00

2.- Desestimar la concesión de subvenciones al resto de solicitudes presentadas.

3.- Las condiciones de ejecución son las previstas en la normativa indicada, pudiéndose, en su caso, dictar instrucciones específicas.

4.- Los Centros de I+D dispondrán de un plazo de 20 días hábiles a contar desde el día siguiente al de la publicación de la resolución de concesión en la sede electrónica del Ministerio de Ciencia e Innovación para formalizar los contratos con las personas seleccionadas y presentarlos al órgano concedente, de conformidad con el artículo 80 de la Resolución de convocatoria.

Contra esta resolución, que pone fin a la vía administrativa, se podrá interponer potestativamente recurso de reposición ante el órgano que la dictó en el plazo de un mes desde el día hábil siguiente a la fecha de finalización de la declaración del estado de alarma, de acuerdo con lo dispuesto en la disposición adicional octava del Real Decreto-ley 11/2020, de 31 de marzo, por el que se adoptan medidas urgentes complementarias en el ámbito social y económico para hacer frente al COVID-19.

Alternativamente, podrá recurrirse en vía contencioso administrativa ante la Sala de lo Contencioso-Administrativo de la Audiencia Nacional, de conformidad con los artículos 11.1.a) y 46 de la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso-Administrativa en el plazo de dos meses a contar desde el día siguiente a la publicación de la resolución. En caso de presentar recurso de reposición no se podrá interponer el contencioso administrativo hasta que se haya resuelto expresamente el de reposición o se haya producido la desestimación presunta.

LA PRESIDENCIA DE LA AGENCIA ESTATAL DE INVESTIGACIÓN
P.D. (Resolución de 27 de julio de 2018, BOE nº 184, de 31 de julio)
EL DIRECTOR DE LA AGENCIA ESTATAL DE INVESTIGACIÓN

Enrique Playán Jubillar

Torrelaguna 58 bis
28027 Madrid

MINISTERIO DE CIENCIA E INNOVACIÓN

ANEXO I
SUBVENCIONES CONCEDIDAS EN LA ACTUACIÓN JUAN DE LA CIERVA-INCORPORACIÓN

Organismo	Nif	Partida Presupuestaria	Referencia	Nombre y Apellidos	1ª anualidad	2ª anualidad	3ª anualidad	Total
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Q2818002D	28-303-000X-731	IJC2018-035386-I	LARA DEL CAMPO MILAN	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-000X-731**			**35.000,00**	**29.000,00**	**29.000,00**	**93.000,00**
UNIVERSIDAD NACIONAL DE EDUCACION A DISTANCIA	Q2818016D	28-303-463B-740	IJC2018-038147-I	IRENE VILLARROEL FERNANDEZ	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-463B-740**			**35.000,00**	**29.000,00**	**29.000,00**	**93.000,00**
FUNDACION INSTITUTO DE INVESTIGACIÓN SANITARIA DE SANTIAGO DE COMPOSTELA	G15796683	28-303-463B-750	IJC2018-036875-I	JORGE BARBAZAN GARCIA	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD AUTONOMA DE BARCELONA	Q0818002H	28-303-463B-750	IJC2018-035423-I	ANTONINA LEVATINO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD AUTONOMA DE MADRID	Q2818013A	28-303-463B-750	IJC2018-035187-I	SANDRA RAYEGO MATEOS	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD CARLOS III DE MADRID	Q2818029G	28-303-463B-750	IJC2018-038347-I	LIZE DE COSTER	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD COMPLUTENSE DE MADRID	Q2818014I	28-303-463B-750	IJC2018-038164-I	GABRIEL SANCHEZ SANTOLINO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-037818-I	CLAUDIA JEANNETTE PEÑALOZA SALAZAR	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE GRANADA	Q1818002F	28-303-463B-750	IJC2018-035946-I	MIGUEL ANGEL FERNANDEZ RODRIGUEZ	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE MURCIA	Q3018001B	28-303-463B-750	IJC2018-036969-I	MARIA ISABEL ARCE SANCHEZ	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE OVIEDO	Q3318001I	28-303-463B-750	IJC2018-035696-I	DANIEL RODRIGUEZ PRADO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE SEVILLA	Q4118001I	28-303-463B-750	IJC2018-037863-I	DIEGO ARAUJO DE SOUZA	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE VIGO	Q8650002B	28-303-463B-750	IJC2018-035132-I	SABELA MELCHOR COUTO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE ZARAGOZA	Q5018001G	28-303-463B-750	IJC2018-037830-I	MONICA BUENO FERNANDEZ	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	Q4818001B	28-303-463B-750	IJC2018-035072-I	MAGDALENA NATALIA WOJTAS	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSITAT POLITECNICA DE CATALUNYA	Q0818003F	28-303-463B-750	IJC2018-035334-I	ILARIO BONACINA	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-463B-750**			**490.000,00**	**406.000,00**	**406.000,00**	**1.302.000,00**
FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA	G60667813	28-303-463B-780	IJC2018-035304-I	LOLA BURGUEÑO CABALLERO	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-463B-780**			**35.000,00**	**29.000,00**	**29.000,00**	**93.000,00**
		Total General:			**595.000,00**	**493.000,00**	**493.000,00**	**1.581.000,00**

MINISTERIO DE CIENCIA E INNOVACIÓN

ANEXO II
RELACIÓN DE RENUNCIAS EN LA ACTUACIÓN JUAN DE LA CIERVA-INCORPORACIÓN

Organismo	Nif	Partida Presupuestaria	Referencia	Nombre y Apellidos	1ª anualidad	2ª anualidad	3ª anualidad	Total
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Q2818002D	28-303-000X-731	IJC2018-035271-I	LAURA MOLINA BUENO	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-000X-731**			**35.000,00**	**29.000,00**	**29.000,00**	**93.000,00**
CONSORCI INSTITUT D INVESTIGACIONS BIOMEDIQUES AUGUST PI I SUNYER	Q5856414G	28-303-463B-750	IJC2018-035209-I	PATRICIA GARCIA CAÑADILLA	35.000,00	29.000,00	29.000,00	93.000,00
CONSORCI INSTITUT D INVESTIGACIONS BIOMEDIQUES AUGUST PI I SUNYER	Q5856414G	28-303-463B-750	IJC2018-036142-I	CRISTINA LOPEZ GONZALEZ	35.000,00	29.000,00	29.000,00	93.000,00
CONSORCI INSTITUT D INVESTIGACIONS BIOMEDIQUES AUGUST PI I SUNYER	Q5856414G	28-303-463B-750	IJC2018-037780-I	ALBA MAIQUES DIAZ	35.000,00	29.000,00	29.000,00	93.000,00
FUNDACIO INSTITUT D INVESTIGACIO BIOMEDICA DE BELLVITGE (IDIBELL)	G58863317	28-303-463B-750	IJC2018-037216-I	EDGARD VERDURA PERALTA	35.000,00	29.000,00	29.000,00	93.000,00
FUNDACION IMDEA NANOCIENCIA	G84909068	28-303-463B-750	IJC2018-037201-I	JOSE IGNACIO URGEL TENDERO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD AUTONOMA DE BARCELONA	Q0818002H	28-303-463B-750	IJC2018-035070-I	MIGUEL HERNANDEZ CABRONERO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD AUTONOMA DE BARCELONA	Q0818002H	28-303-463B-750	IJC2018-037255-I	ELENA PAGLIARINI	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD AUTONOMA DE MADRID	Q2818013A	28-303-463B-750	IJC2018-036216-I	DAVID GONZALEZ ALVARO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD COMPLUTENSE DE MADRID	Q2818014I	28-303-463B-750	IJC2018-035379-I	FERNANDO HUESO GONZALEZ	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD COMPLUTENSE DE MADRID	Q2818014I	28-303-463B-750	IJC2018-036035-I	JOSE LUIS BESADA PORTAS	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-035066-I	MARGOT STROHMINGER	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-035639-I	MARINA MITJANS NIUBO	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-036205-I	TANIA PEREIRA	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-037374-I	MARC RECASENS FUSTE	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-037977-I	FILIPPO FERRARI FERRARI	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE BARCELONA	Q0818001J	28-303-463B-750	IJC2018-038175-I	MARIA JOSE MASANET JORDA	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE CANTABRIA	Q3918001C	28-303-463B-750	IJC2018-035186-I	ANA CASANUEVA VICENTE	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE GRANADA	Q1818002F	28-303-463B-750	IJC2018-035344-I	MATTIA BRAMINI	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE GRANADA	Q1818002F	28-303-463B-750	IJC2018-037095-I	CELIA RODRIGUEZ PEREZ	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE SALAMANCA	Q3718001E	28-303-463B-750	IJC2018-038334-I	ANTONIO MIGUEL CARAVACA AGUIRRE	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DE SEVILLA	Q4118001I	28-303-463B-750	IJC2018-035631-I	JOSE ANGEL GALINDO DUARTE	35.000,00	29.000,00	29.000,00	93.000,00
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	Q4818001B	28-303-463B-750	IJC2018-037329-I	SUDDHASATTWA BRAHMA	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-463B-750**			**770.000,00**	**638.000,00**	**638.000,00**	**2.046.000,00**
FUNDACIO PRIVADA INSTITUT D'INVESTIGACIO ONCOLOGICA DE VALL-HEBRON (VHIO)	G64384969	28-303-463B-780	IJC2018-035223-I	JARA PALOMERO GORRINDO	35.000,00	29.000,00	29.000,00	93.000,00
	Total	**28-303-463B-780**			**35.000,00**	**29.000,00**	**29.000,00**	**93.000,00**
		Total General:			**840.000,00**	**696.000,00**	**696.000,00**	**2.232.000,00**

MINISTERIO
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CONTRATO DE TRABAJO TEMPORAL

DATOS DE LA EMPRESA

CIF/NIF/NIE

D./DÑA.	NIF./NIE	EN CONCEPTO (1)
NOMBRE O RAZÓN SOCIAL DE LA EMPRESA	DOMICILIO SOCIAL	
PAIS	MUNICIPIO	C. POSTAL

DATOS DE LA CUENTA DE COTIZACIÓN

RÉGIMEN	COD. PROV.	NÚMERO	DIG. CONTR.	ACTIVIDAD ECONÓMICA

DATOS DEL CENTRO DE TRABAJO

PAIS	MUNICIPIO

DATOS DEL/DE LA TRABAJADOR/A

D./DÑA.		NIF./NIE (2)	FECHA DE NACIMIENTO
Nº AFILIACIÓN S.S.	NIVEL FORMATIVO	NACIONALIDAD	
MUNICIPIO DEL DOMICILIO		PAIS DOMICILIO	

con la asistencia legal, en su caso, de D./Dña. ....
con N.I.F/N.I.E. ...., en calidad de (2) ....
.

DECLARAN

Que reúnen los requisitos exigidos para la celebración del presente contrato y, en su consecuencia, acuerdan formalizarlo con arreglo a las siguientes:

.

CLÁUSULAS

PRIMERA: El/la trabajador/a prestará sus servicios como (3) ...., incluido en el grupo profesional de... ., para la realización de las funciones (4)..de acuerdo con el sistema de clasificación profesional vigente en la empresa.
En el centro de trabajo ubicado en (calle, nº y .localidad)..
....

☐ A DISTANCIA, en el domicilio ubicado en (calle, nº y localidad)...

SEGUNDA:: La jornada de trabajo será:(5)

☐ **A tiempo completo**: la jornada de trabajo será de .... horas semanales, prestadas de ...., a ...., con los descansos establecidos legal o convencionalmente.

☐ **A tiempo parcial**: la jornada de trabajo ordinaria será de ...., horas ☐ al día, ☐ a la semana, ☐ al mes, ☐ al año,siendo esta jornada inferior a (6) ....
La distribución del tiempo de trabajo será de ....

TERCERA: La duración del presente contrato se extenderá desde ...., hasta .... Se establece un período de prueba de (7) ....
Cuando el convenio colectivo permita una duración mayor a la establecida legalmente, señálelo con una X: ☐

CUARTA: El/la trabajador/a percibirá una retribución total de ....euros brutos(8).......................................que se distribuyen en los siguientes conceptos salariales (9)...

QUINTA: La duración de las vacaciones anuales será de (10)..

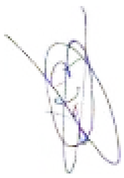
SEXTA: A la finalización del contrato de obra o servicio, eventual por circunstancias de la producción y temporal de fomento de empleo para personas con discapacidad, el/la trabajador/a tendrá derecho a recibir una indemnización de acuerdo con la D. Transitoria 13ª del Estatuto de los Trabajadores, o con la Disposición Adicional primera de la ley 43/2006.

SÉPTIMA: El presente contrato se regulará por lo dispuesto en la legislación vigente que resulte de aplicación y particularmente,por el artículo 15 del Estatuto de los Trabajadores , aprobado por R.D. Legislativo 1/1995, de 24 de marzo, (BOE de 29 de marzo), Real Decreto 2.720/1998 de 18 de diciembre (BOE. de 8 de enero) , Disposición Adicional Primera de la Ley 43/2006, y en su caso por el Convenio Colectivo de ....

OCTAVA: El contenido del presente contrato se comunicará al Servicio Público de Empleo de .... , en el plazo de los 10 días siguientes a su concertación .

NOVENA:ESTE CONTRATO PODRÁ SER COFINANCIADO POR EL FONDO SOCIAL EUROPEO.

DÉCIMA : PROTECCIÓN DE DATOS : Los datos consignados en el presente modelo tendrán la protección derivada de la Ley Organica 15/1998 de 13 de dicembre (B.O.E. de 14 de diciembre)



(1) Director/a, Gerente, etc.
(2) Padre, madre, tutor/a o persona o institución que le tenga a su cargo.
(3) Indicar profesión.
(4) Señalar el grupo profesional y la categoría o nivel profesional que corresponda, según el sistema de clasificación profesional vigente en la empresa.
(5) Marque con una X lo que corresponda.
(6) indique las horas, si es inferior a la de un trabajador a tiempo completo comparable a la del convenio colectivo o a la máxima legal.
(7) Respetando lo establecido en el art. 14.1 del Texto refundido de la Ley del Estatuto de los Trabajadores, aprobado por R D. Legislativo 1/1995, de 24 de marzo (BOE de 29 de marzo).
(8) Diarios, semanales, o mensuales.
(9) Salario base y complementos salariales.
(10) Mínimo: 30 días naturales.

Que el contrato temporal que se celebra (marque la casilla que corresponda), se realiza con las siguientes cláusulas específicas:

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- ☐ EVENTUAL POR CIRCUNSTANCIAS DE LA PRODUCCIÓN. (pág.5)
- ☐ INTERINIDAD. (pág.6)
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ha superado en abril de 2016, los estudios
conducentes al título universitario oficial de

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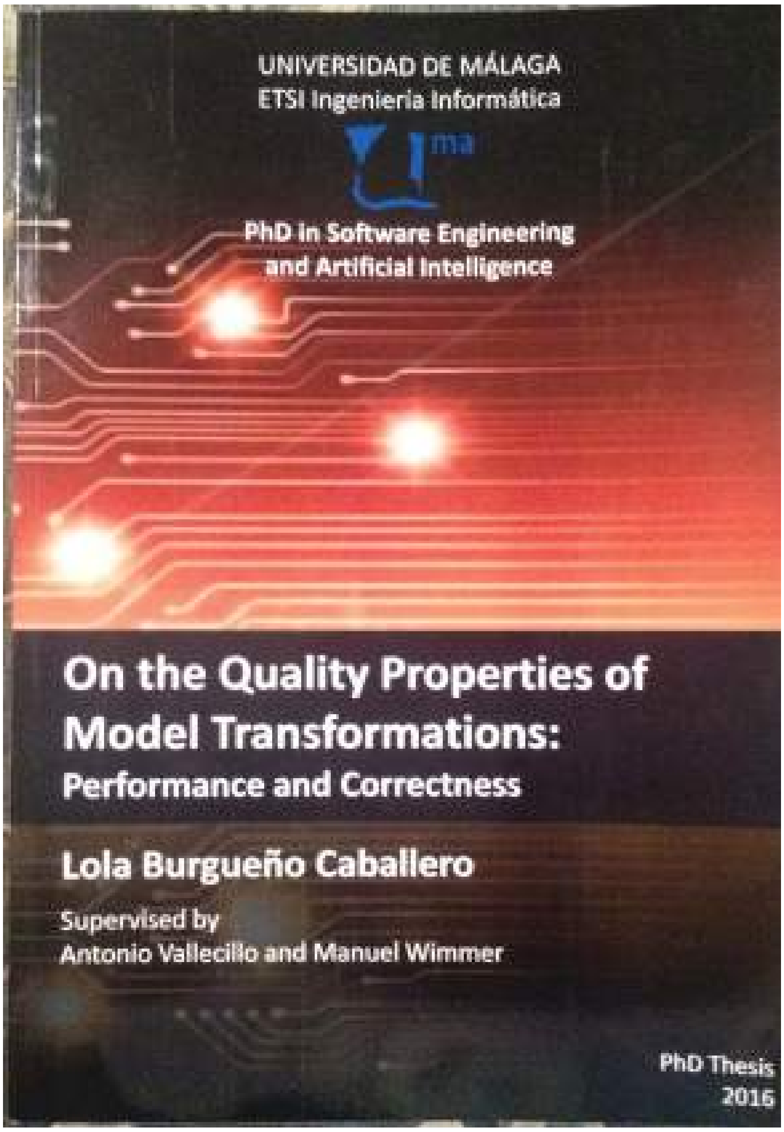
UNIVERSIDAD DE MÁLAGA
ETSI Ingeniería Informática
ma
PhD in Software Engineering
and Artificial Intelligence
On the Quality Properties of
Model Transformations:
Performance and Correctness
Lola Burgueño Caballero
Supervised by
Antonio Vallecillo and Manuel Wimmer
PhD Thesis
2016

El Dr. Antonio Vallecillo Moreno, Catedrático de Universidad del Departamento de Lenguajes y Ciencias de la Computación de la E.T.S. de Ingeniería Informática de la Universidad de Málaga, y el Dr. Manuel Wimmer, profesor perteneciente al Business Informatics Group en la Universidad Tecnológica de Viena,

Certifican que Dña. Dolores Burgueño Caballero, Ingeniera Informática, ha realizado en el Departamento de Lenguajes y Ciencias de la Computación de la Universidad de Málaga, bajo su dirección, el trabajo de investigación correspondiente a su Tesis Doctoral titulada:

On the Quality Properties of
Model Transformations:
Performance and Correctness

Revisado el presente trabajo, estimamos que puede ser presentado al tribunal que ha de juzgarlo, y autorizamos la presentación de esta Tesis Doctoral en la Universidad de Málaga.

Málaga, abril de 2015

Fdo. Antonio Vallecillo	Fdo. Manuel Wimmer
Catedrático de Universidad	Associate Professor
Dpto. Leng. y Ciencias de la Computación	Business Informatics Group
Universidad de Málaga	Vienna University of Technology

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This thesis has been supported by the fellowship BES-2012-057064 granted by the Programme for the Training of Researchers of the Ministry of Economy and Competitiveness of Spain and the Spanish research projects TIN2011-23795 and TIN2014-52034-R.

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Abstract

The increasing complexity of software due to continuous technological advances has motivated the use of models in the software development process. Initially, models were mainly used as drafts to help developers understand their programs. Later they were used extensively and a new discipline called Model-Driven Engineering (MDE) was born. In the MDE paradigm, aside from the models themselves, model transformations (MT) are garnering interest as they allow the analysis and manipulation of models. Therefore, the performance, scalability and correctness of model transformations have become critical issues and thus they deserve a thorough study. Existing model transformation engines are principally based on sequential and in-memory execution strategies, and hence their capabilities to transform very large models in parallel and in distributed environments are limited. Current tools and languages are not able to cope with models that are not located in a single machine and, even worse, most of them require the model to be in a single file. Moreover, once a model transformation has been written and executed—either sequentially or in parallel—it is necessary to rely on methods, mechanisms, and tools for checking its correctness.

In this dissertation, our contribution is twofold. Firstly, we introduce a novel execution platform that permits the parallel execution of both out-place and in-place model transformations, regardless of whether the models fit into a single machine memory or not. This platform can be used as a target for high-level transformation language compilers, so that existing model transformations do not need to be rewritten in another language but only have to be executed more efficiently. Another advantage is that a developer who is familiar with an existing model transformation language does not need to learn a new one.

In addition to performance, the correctness of model transformations is an essential aspect that needs to be addressed if MTs are going to be used in realistic industrial settings. Due to the fact that the most popular model transformation languages are rule-based, i.e., the transformations written in those languages comprise rules that define how the model elements are transformed, the second contribution of this thesis is a static approach for locating faulty rules in model transformations. Current approaches able to fully prove correctness—such as model checking techniques—require an unacceptable amount of time and memory. Our approach cannot fully prove correctness but can be very useful for identifying bugs at an early development stage, quickly and cost effectively.

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d. Otros títulos

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RESUMEN:

Página 1 de 1

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Málaga, a [illegible] de noviembre de 2019

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Página 1 de 1

EL SECRETARIO

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Premio Nacional
SISTEDES
a la Mejor Tesis
Doctoral

Sistedes

Accésit al Premio Nacional a la mejor *Tesis Doctoral*

"On the Quality Properties of Model Transformations: Performance and Correctness"

realizada por

Dª. Lola Burgueño Caballero

Sevilla, Septiembre 2018

Fdo: Antonio Vallecillo Moreno
Presidente de SISTEDES

f. Otros méritos asociados a la formación académica

Asistencia a cursos de formación

- 4th Summer school on domain specific modelling - theory and practice (2013)
- Multi-paradigm modeling for cyber-physical systems (MPM4CPS) training school (2015)
- Una panoramica de la mineria de procesos: de la practica a los retos algoritmicos (2018)
- La computacion autonoma desde la perspectiva de los modelos en tiempo de ejecucion (2018)
- Curso fundamentos RGPD (2019)
- Formació Transversal en Compliance (2020)
- Matemáticas con perspectiva de género (2020)
- Eines d'etreball i organització personal (2020)
- Conversational AI (Chatbots) and NLP using Javascript (2020)
- Curso Ciberseguridad (2021)

USC
UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

CAMPUS VIDA

CiTIUS
Centro Singular de Investigación en Tecnoloxías da Información

September 6, 2013

This is to certify that **Loli Burgueño** has attended the **4th Summer School on Domain Specific Modelling – Theory and Practice**, held from September 2-6, 2013 at the Research Centre on Information Technologies and the School of Engineering of the University of Santiago de Compostela, involving 36,5h of educational activities.

For more information about DSM-TP please refer to www.dsm-tp.org

Vasco Amaral

Prof. Vasco Amaral
Chair – Program Committee DSM-TP
Centre on Computer Science and Information Technologies
Department of Computer Science
Faculty of Sciences and Technology
University Nova of Lisboa

Prof. Alberto J. Bugarín Diz
Chair - Organizing Committee DSM-TP
Research Centre on Information Technologies
Dept. of Electronics and Computer Science
School of Engineering
University of Santiago de Compostela

DSM TP 2013
Theory and Practice

4th International Summer School
on Domain Specific Modeling

Santiago de Compostela
2 - 6 September

CTIT

UNIVERSITY OF TWENTE.

Cyber Physical Systems

Multi-Paradigm Modeling

Certificate

This is to certify that

Loli Burgueño

has successfully attended and contributed to the

Young MPM4CPS-Researchers Activity

of which the meeting was on December 17 and 18, 2015

worth 3 ECTS

Organiser and Chair of WG 2

Dr. Jan F. Broenink

COST

EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

Robert Clarisó Viladrosa, profesor agregado en los Estudios de Informática, Multimedia y Telecomunicación de la Universitat Oberta de Catalunya, con DNI 40993303N

CERTIFICA

Que el investigador/a

Dolores Burgueño Caballero

ha asistido al curso "Una panorámica de la minería de procesos: de la práctica a los retos algorítmicos", organizado por la Red de Excelencia MDE en Ingeniería del Software Dirigida por Modelos (TIN2016-81836-REDT) que ha tenido lugar en Barcelona, en el 5 de febrero de 2018.

Y para que conste a los efectos oportunos, firmo el presente certificado a 5 de febrero de 2018.

Dr. Robert Clarisó Viladrosa
Coordinador de la Red MDE
UNIVERSITAT OBERTA DE CATALUNYA

Robert Clarisó Viladrosa, profesor agregado en los Estudios de Informática, Multimedia y Telecomunicación de la Universitat Oberta de Catalunya, con DNI 40993303N

CERTIFICA

Que el investigador/a

Dolores Burgueño Caballero

ha asistido al curso "La computación autónoma desde la perspectiva de los Modelos en tiempo de Ejecución", organizado por la Red de Excelencia MDE en Ingeniería del Software Dirigida por Modelos (TIN2016-81836-REDT) que ha tenido lugar en Barcelona, en el 6 de febrero de 2018.

Y para que conste a los efectos oportunos, firmo el presente certificado a 5 de febrero de 2018.

Dr. Robert Clarisó Viladrosa
Coordinador de la Red MDE
UNIVERSITAT OBERTA DE CATALUNYA

Universitat Oberta de Catalunya

CERTIFICADO DE APROVECHAMIENTO

Se hace constar que

LOLA BURGUENO CABALLERO

Ha completado el curso

CURSO DE FUNDAMENTOS RGPD - UOC - OSRT Y IN3

entre las fechas 5/02/2019 y 31/12/2019

Director del Curso

ZQKNYqp5CM

Universitat Oberta de Catalunya

DIPLOMA ACREDITATIU

TOTH
FORMACION EN COMPLIANCE

El/la treballador/a

Lola Burgueño Caballero

que presta serveis a la **Universitat Oberta de Catalunya**
ha superat la **Formació Transversal en Compliance**,
impartida des del dia 7 de Setembre fins el dia 18 d'Octubre de 2020,
en modalitat online, amb una carrèga horària de dues hores.

Data **02/10/2020**

Jimena Alguacil
TOTH Compliance

Codi de Diploma **EC25371/3858**

PROGRAMA

- Codi de Conducta
- Política de compliance penal
- Política sobre conflictes d'interessos
- Procediment de diligència deguda
- Política de compres i proveïdors
- Política comercial
- Política d'ús dels mitjans tecnològics
- Política de propietat intel·lectual i industrial
- Política de regals
- Política de qualitat
- Política de tresorería
- Política fiscal
- Manual per a la prevenció del blanqueig de capitals
- Normativa pressupostària
- Política de confidencialitat
- Política de gestió documental
- Normativa de règim disciplinari
- Reglament del Canal de Consultes i Denúncies

PILAR SAFONT JORDÀ, EN CALIDAD DE VICERRECTORA DE PROMOCIÓN LINGÜÍSTICA E IGUALDAD DE LA UNIVERSITAT JAUME I DE CASTELLÓ

CERTIFICA QUE:

LOLA BURGUEÑO CABALLERO

con número de identificación DNI/NIE 25346121Y, ha participado satisfactoriamente como asistente en la Jornada virtual de Coeducación Matemática. Rompiendo Estereotipos, celebrada del 2 al 10 de noviembre de 2020, a través del aula virtual de la Universitat Jaume I: http://www.coeducamates.uji.es/m. La Jornada ha sido organizada por la Universitat Jaume I, a través del Grupo de Innovación Educativa NTESTAD del Departamento de Matemáticas, con el apoyo del Vicerrectorado de Promoción Lingüística e Igualdad y la Escuela Superior de Tecnología y Ciencias Experimentales de la Universitat Jaume I de Castellón. La participación supone 8 horas de actividad formativa. El programa completo de la Jornada está disponible en http://www.coeducamates.uji.es.

Y, para que así conste, firmo el presente certificado.

Pilar Safont Jordà
Vicerrectora de Promoción Lingüística e Igualdad

Castellón de la Plana, 28 de noviembre de 2020.

Código de validación nrURlLuhmi

Certificate of Completion

*This is to certify that **Lola Burgueño** successfully completed 9.5 total hours of **Conversational AI (Chatbots) and NLP using Javascript** online course on Dec. 22, 2020*

Jesús Seijas

Jesús Seijas, Instructor

&

Udemy

Certificate no: UC-66a80ced-e0f9-4def-ad32-641ce9667f90
Certificate url: ude.my/UC-66a80ced-e0f9-4def-ad32-641ce9667f90
Version 3

#BeAble

CERTIFICAT D'APROFITAMENT
CURS DE FORMACIÓ INTERNA

Lola Burgueño Caballero, amb NIF 25346121Y, que presta els seus serveis a la FUNDACIÓ PER A LA UNIVERSITAT OBERTA DE CATALUNYA, amb CIF G-60667813, ha participat en l'acció formativa **Eines d'Etreball i organització personal**, que ha tingut lloc els diez 11, 18 i 25 de noviembre de 2020, amb una durada de 6h.

José Miguel de la Dehesa
Director de l'Àrea de Persones

Barcelona, a 16 de febrer de 2021

La Universitat Oberta de Catalunya atorga el present CERTIFICAT pel curs de

Formación en ciberseguridad

a

Lola Burgueño Caballero

com a acreditació per haver superat satisfactòriament el curs en da9 de febrero de 2021

amb una durada de 8 hores i qualificació APTE

Barcelona, 9 de febrero de 2021

El Director de l'Àrea de Persones
Jose Miguel de la Dehesa

Universitat
Oberta
de Catalunya

2. Calidad de la formación posdoctoral

a. Becas posdoctorales

b. Otros méritos asociados a la calidad de la formación

3. Otros méritos asociados a la formación

Concesión de beca FPU Concesión de una beca para la Formación de Profesorado Universitario (FPU) del Ministerio de Educación Cultura y Deporte en 2012. No disfrutada por haber aceptado una beca FPI.

Convocatoria de becas y ayudas para la formación de doctores del programa nacional de formación de profesorado universitario

Formulario de resolución

Datos solicitante

Nombre, Apellidos	DOLORES, BURGUEÑO CABALLERO
Documento identificativo	NIF: 25346121Y
Número de solicitud	FPU12/05501

Solicitud propuesta

Por Resolución de 25 de abril de 2012, de la Secretaría General de Estado de Educación, Formación Profesional y Universidades (BOE de 10 de mayo), modificada por Resolución de 18 de mayo (BOE 22 de mayo) y por Resolución de 31 de octubre (BOE 12 de noviembre), se convocaron las ayudas para becas y contratos del Programa Nacional de Formación de Recursos Humanos de Investigación del ejercicio 2012, en el marco del Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica 2008-2011.
De conformidad con el artículo 33.5 de la convocatoria, examinada la propuesta elevada por la Comisión de Selección, la Secretaria de Estado de Educación, Formación Profesional y concluidos los plazos señalados en los apartados 1 y 4 del mencionado artículo, ha resuelto la publicación de los beneficiarios de las ayudas para becas de Formación de Profesorado Universitario, incluyendo las reservadas para estudiantes con discapacidad y de los extranjeros no comunitarios. Por ello ha resuelto :

Concederle la ayuda para becas y contratos del Programa Nacional de Formación de Recursos Humanos de Investigación del ejercicio 2012.

La Resolución de Secretaria de Estado de Educación, Formación Profesional y Universidades se publicará en el «Boletín Oficial del Estado» y en la página web del Ministerio de Educación, Cultura y Deporte (www.mecd.gob.es). Esta resolución agota la vía administrativa y contra ella podrá interponerse en el plazo de un mes recurso potestativo de reposición, de acuerdo con lo previsto en los artículos 116 y 117, de la Ley 30/1992, de 26 de noviembre de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común. Asimismo, podrá interponerse recurso contencioso-administrativo ante la sala correspondiente de la Audiencia Nacional, conforme al artículo conforme al artículo 11.1 de la Ley 29/1998, de 13 de julio, reguladora de la Jurisdicción Contencioso-administrativa y el artículo 66 de la Ley Orgánica 6/1985, de 1 de julio, del Poder Judicial.
Contra la presente Orden cabe interponer recurso potestativo de reposición en el plazo de un mes. Asimismo, podrá interponerse recurso contencioso-administrativo ante la Sala de lo Contencioso-Administrativo de la Audiencia Nacional, en el plazo de dos meses a contar desde el día siguiente a la fecha de su publicación. Dicho recurso no podrá ser interpuesto hasta que el anterior recurso potestativo de resolución sea resuelto expresamente o se haya producido la desestimación presunta.

Madrid, 28 de diciembre de 2012. - La Secretaria de Estado de Educación, Formación Profesional y Universidades. Monserrat Gomendio Kindelan

V. EXPERIENCIA EN GESTIÓN Y ADMINISTRACIÓN EDUCATIVA

1. Desempeño de cargos unipersonales en las universidades u organismos públicos de investigación durante al menos un año

2. Desempeño de puestos en el entorno educativo, científico o tecnológico dentro de la Administración General del Estado o de las Comunidades Autónomas durante, al menos, un año

3. Otros méritos relacionados con la experiencia en gestión y administración