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openETCS

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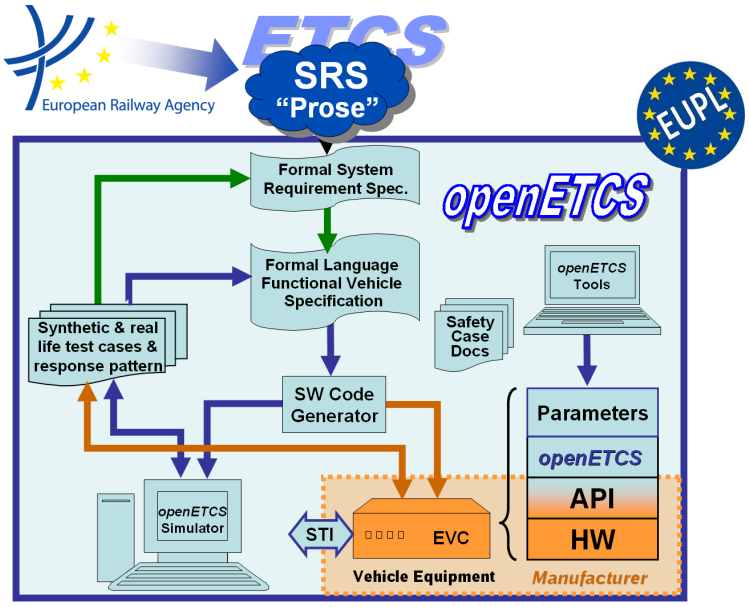
Work-Package 6: “Dissemination, Exploitation and Standardization”

Updated Dissemination Plan and Report

Updated Project Dissemination Plan and Report (D6.3)

Alexander Nitsch, Dr. Frank Golatowski, Dr. Stefan Rieger and Dr. Peter Mahlmann

September 2014



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Document approbation

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Prepared for openETCS@ITEA2 Project

Abstract: This document is the second version of the openETCS dissemination plan and report. It represents the project dissemination strategy and covers past and as well as planned dissemination activities. There will be an updated version to this document (D6.5).

Table of Contents

1 Introduction

This document is the second (updated) version of the openETCS dissemination plan and report. It represents the project dissemination strategy and covers past and as well as planned dissemination activities.

The document is structured as follows. Section 2 lists dissemination activities categorised by their type (conference, exhibition, journal, etc.). Details like date, publisher and/or venue as well as contributors and an abstract are provided. In Section 3 we list planned future dissemination opportunities and events. For each of those items we provide the planned contribution(s) and the relevance for the project.

Section 4 addresses additional dissemination activities not covered by the other sections.

2 Past Project Dissemination Activities

2.1 Exhibitions and Trade Shows

ITEA & ARTEMIS Co-summit 2012: Sharing a Vision for ICT Innovation

Date: 30-31/10/2012

Location: Paris, France

The ITEA & ARTEMIS Co-summit 2012 was used to introduce the openETCS project to a wide audience ranging from industry to academia, public authorities and press from all over Europe.

ITEA & ARTEMIS Co-summit 2013: Software innovation: boosting high-tech employment and industry

Date: 4-5/1/2013

Location: Stockholm, Sweden

The ITEA & ARTEMIS Co-summit 2013 was used to present the intermediate openETCS project results to a wide audience ranging from industry to academia, public authorities and press from all over Europe.

InnoTrans 2014

Date:	23-26/09/2014
Location:	Berlin, Germany

InnoTrans 2014, the world's largest trade fair for railways and public transit, addressing the entire railway industry has been used as a platform to disseminate the project and present project results. In particular, the following activities have been organised by project partners:

- A dedicated openETCS session in the "Speakers' Corner" at InnoTrans was set up, comprising three talks from project participants (NS, DB, TWT) and an invited talk of Ralph Müller, the head of Eclipse Europe. The goal was to spread the idea of openETCS and the concept of open source in safety-critical areas to a wider audience. The event lead to a variety of discussions and interesting contacts.
- The openETCS Mid-Term Workshop was organised in conjunction with InnoTrans as an event open to the public. The programme comprised presentations from project partners (ALL4TEC, Institut Mines-Télécom, Systerel, TU Braunschweig, TWT, Universität Rostock) covering a wide range of topics and results – from standardisation aspects to verification techniques and was very successful. We welcomed also project-external participants which led to interesting discussions.
- openETCS results were presented at the booths of consortium members. These were ERSA, showing their simulation technology used for the openETCS demonstrator, Fraunhofer FOKUS presenting verification techniques and results and Systerel.

2.2 Journal contributions

European Railway Review, Volume 18, Issue 3, 2012

Type:	Journal Article
Title:	openETCS: Applying 'Open Proofs' to European Train Control
Pages:	30–34
Author:	Klaus-Rüdiger Hase (DB)
Publisher:	Russell Publishing Ltd., Kent, UK
website:	`http://europeanrailwayreview.com/tag/openetcs`

European Railway Review is the leading bi-monthly technical journal for the European rail industry. Featuring articles and news about the latest technologies and developments, the magazine is essential reading for people involved in the railway business. Here, an overview article of the openETCS project, covering the technical background and the project goals, has been published by DB Netz AG.

Science of Computer Programming, Volume 91, Part B, 2014

Type:	Journal Article
Title:	Dependability in Open Proof Software with Hardware Virtualization – The Railway Control Systems Perspective
Pages:	188–215
Author:	Johannes Feuser, Jan Peleska
Publisher:	Elsevier B.V., Amsterdam, Netherlands
website:	http://www.sciencedirect.com/science/article/pii/S0167642313002001

Using the openETCS initiative as a starting point, we describe how open software can be applied in combination with platform-specific, potentially closed-source extensions, in the development, verification, validation and certification of safety-critical railway control systems. To achieve certification credit for safety-critical system developments, evidence about numerous development, verification and validation artifacts has to be provided. Our focus is therefore on open models, and a model-driven development approach ensures that a large portion of the artifacts is automatically generated from the model. This strategy is illustrated by means of the ETCS standard, as far as applicable to the ETCS on-board computer managing train control and train protection. We show that a domain-specific language is suitable to cover all modeling aspects for this computer, starting from the ETCS standard itself and ending at supplier-specific adaptations extending the re-usable core model in concrete developments. In order to re-use certification credits once achieved for the re-usable core model, we suggest virtualization of run-time environments, so that suppliers can embed re-usable core components as binary code into their ETCS target platforms. A detailed analysis is provided, indicating how future changes in the standard and project-specific adaptations, extensions and restrictions, can be accounted for in a new ETCS development, while minimizing the re-certification effort. It is shown for all phases of the development life cycle how the peer-reviewing capacity of the openETCS community may contribute to the correctness of the phases' outputs, thereby increasing overall system dependability, with special emphasis on safety and security.

2.3 Conference papers and Talks

FORMS/FORMAT 2012

Type:	Conference Paper and Talk
Title:	Using ERTMSFormalSpecs to model ERTMS braking curves
Authors:	L. Ferier, S. Lukicheva and S. Pinte (ERTMS Solutions)
Date:	11-13/12/2012
Location:	Braunschweig, Germany
Website:	http://www.forms-format.de

The European Railway Traffic Management System (ERTMS) defines standards for interoperability between the on-board train protection systems (ETCS) and the railway infrastructure. Part of this specification describes the computation of train braking curves and the associated train reactions according to its speed. This document explains how ERTMSFormalSpecs has been used to model such braking curves and the associated advantages of traceability and understandability of using a domain-specific language as opposed to a more common specification-implementation process, where multiple stages of human interpretation and interaction increase the opportunities for errors.

SEFM 2012, 10th International Conference on Software Engineering and Formal Methods

Type:	Conference Paper and Talk
Title:	Frama-C: a Software Analysis Perspective
Author:	Pascal Cuoq, Florent Kirchner, Nikolay Kosmatov, Virgile Prevosto, Julien Signoles, and Boris Yakobowski
Date:	01-05/10/2012
Location:	Thessaloniki (Greece)
Website:	`http://sefm2012.city.academic.gr/`

Frama-C is a source code analysis platform that aims at conducting verification of industrial-size C programs. It provides its users with a collection of plug-ins that perform static analysis, deductive verification, and testing, for safety- and security-critical software. Collaborative verification across cooperating plug-ins is enabled by their integration on top of a shared kernel and datastructures, and their compliance to a common specification language. This foundational article presents a synthetic view of the platform, its main and composite analyses, and some of its industrial achievements.

24th IFIP International Conference on Testing Software and Systems (ICTSS)

Type:	Conference Paper and Talk
Title:	Off-line test case generation for timed symbolic model-based conformance testing
Author:	Christophe Gaston (CEA LIST)
Date:	19-21/11/2012
Location:	Aalborg (Denmark)
Website:	`http://ictss2012.aau.dk/`

Model-based conformance testing of reactive systems consists in taking benefit from the model for mechanizing both test data generation and verdicts computation. On-line test case generation allows one to apply adaptive on-the-fly analyzes to generate the next inputs to be sent and to decide if observed outputs meet intended behaviors. On the other hand, in off-line approaches, test suites are pre-computed from the model and stored under a format that can be later performed on test-beds. In this paper, we propose a two-passes off-line approach where: for the submission part, a test suite is a simple timed sequence of numerical input data and waiting delays, and then, the timed sequence of output data is post-processed on the model to deliver a verdict. As our models are Timed Output Input Symbolic Transition Systems, our off-line algorithms involve symbolic execution and constraint solving techniques.

FORMS/FORMATS 2014, 10th Symposium on Formal Methods

Type:	Conference paper and Talk
Title:	A Domain-specific Language for Railway Interlocking Systems
Author/Speaker:	Linh H. Vu, Anne E. Haxtausen, Jan Peleska
Date:	30/9-2/10/2014
Location:	Brunswick
Website:	http://www.forms-format.de/

This paper presents a domain-specific language (DSL) for describing route-based interlocking systems which are compatible with European Train Control System ETCS Level 2. The abstract syntax and static semantics of the language are formally defined using the RAISE Specification Language (RSL). Furthermore, the paper describes an interlocking table generator (ITG) that generates automatically a well-formed interlocking table from a well-formed railway network layout. Experiments with the DSL and ITG using the RAISE tools and the C++ implementation show that the use of the DSL and ITG can increase the productivity and significantly reduce errors in the specifications of railway interlocking systems.

SPLC 2014, 18th Software Product Line Conference

Type:	Conference paper and Talk
Title:	A software product line approach for semantic specification of block libraries in dataflow languages
Author/Speaker:	A. Dieumegard, A. Toom, M. Pantel
Date:	15-19/9/2014
Location:	Florence, Italy
Website:	http://http://www.splc2014.net/

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SEFM 2013, 11th International Conference on Software Engineering and Formal Methods

Type:	Conference paper and Talk
Title:	Applied Bounded Model Checking for Interlocking System Designs
Author/Speaker:	Anne Elisabeth Haxthausen, Jan Peleska, Ralf Pinger
Date:	25-27/9/2013
Location:	Madrid, Spain
Website:	http://antares.sip.ucm.es/sefm2013/

In this paper the verification and validation of interlocking systems is investigated. Reviewing both geographical and route-related interlocking, the verification objectives can be structured from a perspective of computer science into (1) verification of static semantics, and (2) verification of behavioural (operational) semantics. The former checks that the plant model – that is, the software components reflecting the physical components of the interlocking system – has been set up in an adequate way. The latter investigates trains moving through the network, with the objective to uncover potential safety violations. From a formal methods perspective, these verification objectives can be approached by theorem proving, global, or bounded model checking. This paper explains the techniques for application of bounded model checking techniques, and discusses their advantages in comparison to the alternative approaches.

ICFEM 2014, 16th International Conference on Formal Engineering Methods

Type:	Conference paper and Talk
Title:	Complete Model-Based Equivalence Class Testing for the ETCS Ceiling Speed Monitor
Author/Speaker:	Cécile Braunstein, Anne E. Haxtausen, Wen-ling Huang, Felix Hübner, Jan Peleska, Uwe Schulze, Linh Vu Hong
Date:	3-7/11/2014
Location:	Luxembourg City, Luxembourg
Website:	http://icfem2014.uni.lu/

In this paper we present a new test model written in SysML and an associated blackbox test suite for the Ceiling Speed Monitor (CSM) of the European Train Control System (ETCS). The model is publicly available and intended to serve as a novel benchmark for inves- tigating new testing theories and comparing the capabilities of model- based test automation tools. The CSM application inputs velocity val- ues from a domain which could not be completely enumerated for test purposes with reasonable effort. We therefore apply a novel method for equivalence class testing that – despite the conceptually infinite cardi- nality of the input domains – is capable to produce finite test suites that are complete (i.e. sound and exhaustive) for a given fault model. In this paper, an overview of the model and the equivalence class testing strategy is given, and tool-based evaluation results are presented. For the technical details we refer to the published model and a technical report that is also available on the same website.

Rodin Workshop 2014, 5th Rodin User and Developer Workshop

Type:	Conference Paper and Talk
Title:	Event-B for Safety Analysis of Critical Systems
Author/Speaker:	Matthias Güdemann, Marielle Petit-Doche
Date:	2-3/6/2014
Location:	Toulouse, France
Website:	http://wiki.event-b.org/index.php/Rodin_Workshop_2014

The Event-B modeling approach is designed to reason about the correctness of systems in the early phases of the development process. We propose its application to support safety activities of a critical railway system and to strengthen the arguments for safety cases for certification bodies. We provide insights into our usage of Event-B for validation and verification of safety aspects using the analysis of a reference model of the European Train Control System (ETCS).

INDIN 2013, IEEE 11th International Conference on Industrial Informatics

Type:	Conference Paper and Talk
Title:	Formal Specification and Automated Verification of Railway Software with Frama-C
Author/Speaker:	Jens Gerlach, Virgile Prevosto, Jochen Burghardt, Kerstin Hartig, Kim Völlinger, Hans Pohl
Date:	29-31/7/2013
Location:	Bochum, Germany
Website:	`http://www.indin2013.org/n/`

This paper presents the use of the Frama-C toolkit for the formal verification of a model of train-controlling software against the requirements of the CENELEC norm EN 50128. We also compare our formal approach with traditional unit testing.

ERTSS 2014, Embedded Real Time Software and Systems

Type:	Conference paper and Talk
Title:	Formal specification of block libraries in dataflow languages
Author/Speaker:	Arnaud Dieumegard, Andres Toom, Marc Pantel
Date:	5-7/2/2014
Location:	Toulouse, France
Website:	`http://www.erts2014.org/`

Graphical dataflow-style modeling languages like Simulink and Scicos are widely used in the development of embedded control systems as high-level engineering languages. A signifcant part of their modeling power is captured in function block libraries. In this paper we present an on-going work on the model-based formalisation of such libraries, which intends to bridge the gaps between the different parts of the development process: high-level requirements, design, implementation and verification. Our approach is based on a specification domain specific language (DSL), which captures the variability of blocks through a software product line approach. We have defined translations to other languages like the WHY3 language for verification, different documentation formats, code generator configuration files, etc. These experiments have been carried out in the context of the GeneAuto embedded code generator project and are being extended and applied in its successor projects ProjectP and Hi-MoCo.

SEKE 2014, The 26th International Conference on Software Engineering and Knowledge Engineering

Type:	Conference paper and Talk
Title:	Formal Verification of Coordination Systems' Requirements - A Case Study on the European Train Control System
Author/Speaker:	Huu Nghia Nguyen, Ana Cavalli
Date:	1-3/7/2014
Location:	Hyatt Regency, Vancouver, Canada
Website:	`http://www.ksi.edu/seke/seke14.html`

Formal verification techniques of system requirements such as model-checking and theorem proving aims to show that the requirements satisfy some properties. Consequently, their success depends on the quality of the properties formulation. We propose an approach to verify requirements of coordination systems by generating automatically the properties to be verified from the requirements themselves. The requirement specifications of a system are provided at two different levels. The coordination specification gives a global overview of the system, in terms of the different roles participating to it, with their goals and needs and with their mutual dependencies and expectations. The process specification shows how a local participant of the system performs its activities. We exploit model checking techniques for verifying the process requirements against the properties generated by the coordination requirements. In addition to provide a theoretical framework, we show how to apply this methodology on the verification of the System Requirement Specification of the European Train Control System. It is complemented with a toolchain.

INDIN 2013, IEEE 11th International Conference on Industrial Informatics

Type:	Conference paper and Talk
Title:	Graphical Modelling meets Formal Methods
Author/Speaker:	Stefan Gulan, Sven Johr, Roberto Kretschmer, Stefan Rieger, Michael Ditze
Date:	29-31/7/2013
Location:	Bochum, Germany
Website:	`http://www.indin2013.org/n/`

The graphical modelling languages UML and SysML, nowadays widely used in industry, integrate different modelling concepts and notations in one standardised framework. However, they lack a clearly defined, unambiguous semantics and thus their formal verification represents a challenge. On the other hand, current safety standards, including ISO 26262, demand such verification especially for safety-relevant systems. The literature proposes a plethora of different semantics and formalisms for UML/SysML. In this paper we compare and summarise existing work on the formalisation of behavioural UML and SysML models and their verification. Our goal is to foster a better understanding of the problems related to UML/SysML formalisation, and to aid people bridging the gap from high level graphical modelling to formal verification techniques.

ACATTA 2013, 1st IFAC Workshop on Advances in Control and Automation Theory for Transportation Applications

Type:	Conference paper and Talk
Title:	Integration of Petri Nets into STAMP/CAST on the example of Wenzhou 7.23 accident.
Author/Speaker:	Dirk Spiegel, René Sebastian Hosse, Jan Welte, Eckehard Schnieder
Date:	16-17/9/2013
Location:	Istanbul, Turkey
Website:	http://www.acatta13.itu.edu.tr/

This paper illustrates how formal models, in this case Petri nets, can be integrated into the promising STAMP approach. CENELEC 5012X recommend applying formal methods to demonstrate safety in the railway sector. STAMP does not include formal modeling and therefore seems inadequate for safety analysis in railway traffic. This drawback can be eliminated by hybridizing the approach with the ProFunD hazard analysis (DIN EN 62551) using Petri net models. Such a new method, called formalSTAMP that successfully integrates a formal model into STAMP is introduced in this paper. A sample accident analysis application on the Wenzhou 7.23 accident in China is performed and the results are presented in contrast to an original STAMP / CAST analysis by (Dong 2012).

FORMS/FORMAT 2012, 9th Symposium on Formal Methods

Type:	Conference paper and Talk
Title:	Model Based Development and Tests for openETCS Applications – A Comprehensive Tool Chain
Author/Speaker:	Johannes Feuser, Jan Peleska
Date:	12-13/12/2012
Location:	Brunswick, Germany
Website:	http://www.forms-format.de/2012/

This paper presents research results on model-based development and testing for the European Train Control System (ETCS). We focus on the tool chain developed by the authors, which supports the creation of graphical formal specifications of the ETCS System Requirement Specification, code generation, verification and validation.

ICSSEA 2013, 25th International Conference on Software and Systems Engineering and their Applications

Type:	Conference paper and Talk
Title:	Model-Based Testing and Test Case Generation in the Context of the Open ETCS Project
Author/Speaker:	Cyril Cornu, Christophe Gaston, Agnès Lanusse, Frédérique Vallée
Date:	4-6/11/2013
Location:	Paris, France
Website:	http://icssea.enst.fr/icssea13/

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4th International ABZ Conference

Type:	Conference paper and Talk
Title:	Model-Checking Real-Time Properties of an Aircraft Landing Gear System Using Fiacre
Author/Speaker:	Silvano Dal Zilio, Lukasz Fronc, Bernard Berthomieu
Date:	1-6/6/2014
Location:	Toulouse, France
Website:	`http://hal.archives-ouvertes.fr/hal-00967422`

We describe our experience with modeling the landing gear system of an aircraft using the formal specification language Fiacre. Our model takes into account the behavior and timing properties of both the physical parts and the control software of this system. We use this formal model to check safety and real-time properties on the system but also to find a safe bound on the maximal time needed for all gears to be down and locked (assuming the absence of failures). Our approach ultimately relies on the model-checking tool Tina, that provides state-space generation and model-checking algorithms for an extension of Time Petri Nets with data and priorities.

IPCT, The International Conference on Advances in Information Processing and Communication Technology

Type:	Conference paper and Talk
Title:	On Modeling and Testing Components of the European Train Control System
Author/Speaker:	César Andrés, Ana Cavalli, Nina Yevtushenko, João Santos, Rui Abreu
Date:	7-8/6/2014
Location:	Rome, Italy
Website:	`http://ipct.theired.org/`

This paper studies the abilities of the formal model of a Timed Extended Finite State Machine (TEFSM) to represent the safety properties of the European Train Control System (ETCS). The model is based on Finite State Machines augmented with continuous variables and time information, which allows representing the basic functioning of the units in this real-time system. In order to represent temporal requirements, timeouts are used for modeling some aspects of the (internal) critical behavior of the train control system. The model abilities to represent safety properties are evaluated using different testing scenarios for model implementations in IF, XML and JAVA languages. Tests are automatically generated using the tool TestGen-IF where corresponding safety properties are specified as test objectives. Based on the obtained experimental results the advantages and disadvantages of a developed model are briefly discussed.

ERTSS 2014, Embedded Real Time Software and Systems

Type:	Conference paper and Talk
Title:	Probabilistic failure analysis in model Validation and Verification
Author/Speaker:	Ning Ge, Marc Pantel, Xavier Crégut
Date:	5-7/2/2014
Location:	Toulouse, France
Website:	http://www.erts2014.org/

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ERTSS 2014, Embedded Real Time Software and Systems

Type:	Conference paper and Talk
Title:	Rail, Space, Security: Three Case Studies for SPARK 2014
Author/Speaker:	Claire Dross, Pavlos Efstathopoulos, David Lesens, David Mentré, Yannick Moy
Date:	5-7/2/2014
Location:	Toulouse, France
Website:	http://www.erts2014.org/

SPARK is a subset of the Ada programming language targeted at safety- and security-critical applications. SPARK 2014 is a major evolution of the SPARK language and toolset, that integrates formal program verification into existing development processes, in order to decrease the cost of software verication, subject to certification constraints. We present industrial case studies in three different certification domains that show the benefits of using formal verification with SPARK 2014.

PNSE 2013, International Workshop on Petri Nets and Software Engineering

Type:	Conference paper and Talk
Title:	Real-Time Property Specific Reduction for Time Petri Net
Author/Speaker:	Ning Ge, Marc Pantel
Date:	23-24/6/2014
Location:	Tunis, Tunisia
Website:	http://www.informatik.uni-hamburg.de/TGI/events/pnse14/

This paper presents a real-time property specific reduction approach for Time Petri Net (TPN). It divides TPN models into sub-nets of smaller size, and constructs an abstraction of reducible ones, which exhibits the same property specific behavior, but has less transitions and states. This directly reduces the amount of computation needed to generate the whole state space. This method adapts well to the verification of real-time properties in asynchronous systems. It should be possible to apply similar methods to other families of properties.

WCRR2013, 10th World Congress on Railway Research

Type:	Conference paper and Talk
Title:	Survey of formal model-based development of safety-critical software for railway applications
Author/Speaker:	Jan Welte, Hansjörg Manz, Eckehard Schnieder
Date:	25-28/11/2013
Location:	Sydney, Australia
Website:	`http://www.wcrr2013.org/`

The OpenETCS project has the goal to develop an integrated approach for development and implementation of software of European Train Control System (ETCS) on-board units. Thereby, the OpenETCS concept is based on the use of methods and tools which support the formal specification and verification of requirements in an overall model-based development process. To provide transparency and allow compatibility over the life cycle of the train system "Open Standards" shall be utilized on all levels. This paper presents an overview on existing methods used in the railway sector and other comparable industries for software development including verification and validation. Therefore a number of interviews with experts from different organisations and various fields of expertise have been conducted to learn about their approaches and experience. In addition the possibility of integrating "Open Standards" in the existing development process has been discussed. Based on these interviews requirements have been derived, which have to be addressed during the further work of the OpenETCS project.

Formats 2014, 12th International Conference on Formal Modeling and Analysis of Timed Systems

Type:	Conference paper and Talk
Title:	Time Petri Nets with Dynamic Firing Dates: Semantics and Applications
Author/Speaker:	Silvano Dal Zilio, Lukasz Fronc, François Vernadat
Date:	8-10/9/2014
Location:	Florence, Italy
Website:	`http://formats2014.unifi.it/`

We define an extension of time Petri nets such that the time at which a transition can fire, also called its firing date, may be dynamically updated. Our extension provides two mechanisms for updating the timing constraints of a net. First, we propose to change the static time interval of a transition each time it is newly enabled; in this case the new time interval is given as a function of the current marking. Next, we allow to update the firing date of a transition when it is persistent, that is when a concurrent transition fires. We show how to carry the widely used state class abstraction to this new kind of time Petri nets and define a class of nets for which the abstraction is exact. We show the usefulness of our approach with two applications: first for scheduling preemptive task, as a poor man's substitute for stopwatch, then to model hybrid systems with non trivial continuous behavior.

IPCT, The International Conference on Advances in Information Processing and Communication Technology

Type:	Conference paper and Talk
Title:	Verifying and testing ETCS Train Implementations based on IF specifications
Author/Speaker:	Natalia Kushik, Denisa Ianculescu, Ana Cavalli, Mounir Lallali
Date:	7-8/6/2014
Location:	Rome, Italy
Website:	`http://ipct.theired.org/`

This paper presents test generation scenarios for a train implementation based on the requirements for European Train Control System (ETCS). The formal model used for the test derivation is the model of a Timed Extended Finite State Machine (TEFSM) given in the IF language. This language allows to capture some important properties such as safety properties that should be checked for train implementations represented as corresponding test objectives. The tool TestGen-IF is then used for automatic generation of test cases.

INFORMATIK 2014, Workshop: Technologien zur Analyse und Steuerung komplexer cyber-physischer Systeme (CPSData)

Type:	Conference paper and Talk
Title:	Ein abstraktes SystemC-Modell zur Analyse und Leistungsabschätzung des europäischen Zugsicherungssystems ETCS
Author/Speaker:	Benjamin Beichler, Alexander Nitsch, Frank Golatowski, Christian Haubelt
Date:	22-26/9/2014
Location:	Stuttgart, Germany
Website:	`http://www.informatik2014.de/workshops14.html`

In diesem Beitrag wird ein SystemC-Modell der Geschwindigkeits- und Abstandsüberwachung aus dem European Train Control System (ETCS) vorgestellt. Dieses Modell dient als Ausgangspunkt für die frühzeitige Abschätzung der Leistungsfähigkeit des Systems und die in der Berechnung entstehenden Datenmengen. Hierfür wurde eine neuartige Methode entwickelt, welche es bei minimalen Anpassungen am Anwendungsmodell erlaubt, schnell unterschiedliche Entwurfsalternativen zu explorieren. Dabei werden SystemC-Prozesse in Abhängigkeit von Scheduling-Entscheidungen gestartet, deren Kommunikationsverhalten aufgezeichnet und anschließend Ausführungs- und Kommunikationszeiten simuliert.

2.4 Project-Organised Workshops

Ensuring Safety of Industrial Critical Systems (ESICS) at IEEE INDIN 2013

Type:	Workshop / Special Session
Date:	29-31/7/2013
Location:	Bochum, Germany
Website:	`http://www.indin2013.org/`

At the IEEE INDIN 2013 conference in July a Special Session "Ensuring Safety in Industrial Critical Systems" has been set up by partners from the openETCS project and the ARTEMIS project VeTeSS. In addition to talks from partners of the two projects there was also significant participation by external parties (such as the CERN). The event has proven a great opportunity to disseminate early project results and discuss safety-related aspects among experts from different industrial domains.

2.5 Book chapter

Railway Safety, Reliability, and Security: Technologies and Systems Engineering

Type:	Book chapter
Title:	The Model-Driven openETCS Paradigm for Secure, Safe and Certifiable Train Control Systems
Author/Speaker:	Jan Peleska, Johannes Feuser, Anne Elisabeth Haxthausen
Date:	5/2012
Website:	`http://www.igi-global.com/chapter/model-driven-openetcs-paradigm-secure/66666`

A novel approach to managing development, verification, and validation artifacts for the European Train Control System as open, publicly available items is analyzed and discussed with respect to its implications on system safety, security, and certifiability. After introducing this so-called model-driven openETCS approach, a threat analysis is performed, identifying both safety and security hazards that may be common to all model-based development paradigms for safety-critical railway control systems, or specific to the openETCS approach. In the subsequent sections state-of-the-art methods suitable to counter these threats are reviewed, and novel promising research results are described. These research results comprise domain-specific modeling, model-based code generation in combination with automated object code verification and explicit utilization of virtual machines to ensure containment of security hazards.

2.6 Project-internal publications

OpenETCS WP4 Contribution

Type:	Technical report
Title:	A SysML Test Model and Test Suite for the ETCS Ceiling Speed Monitor
Author/Speaker:	Jan Peleska, Cecile Braunstein, Uwe Schulze, Felix Hübner, Wenling Huang, Anne E. Haxthausen, Linh Vu Hong
Date:	11/5/2014
Location:	Bremen/Hamburg, Germany
Website:	`http://www.informatik.uni-bremen.de/agbs/testingbenchmarks/openETCS/ceiling-speed-monitoring/testing_the_etcs_csm.pdf`

2.7 Talks

4th annual Signalling and Train and Control Conference

Type:	Talk
Title:	Infrastructure manager case study: Ensuring systems integration and developing functionality with openETCS
Speaker:	Klaus-Rüdiger Hase (DB)
Date:	19-21/03/2013
Location:	Vienna, Austria
Website:	`http://globaltransportforum.com/signalling-and-train-control/`

The 4th annual Signalling and Train Control show in Vienna is one of the definitive events for rail signalling, telecom and traffic management experts. With over 50 leading speakers and 300 attendees, the congress allows for the sharing of best practice strategies and unparalleled business development opportunities. At the symposium openETCS project leader Klaus-Rüdiger Hase presented the openETCS approach to developing functionality and system integration.

12th International SIGNAL+DRAHT-Congress 2012

Type:	Talk
Title:	openETCS: Von der Idee zur Praxis
Speaker:	Klaus-Rüdiger Hase (DB)
Date:	08-09/11/2012
Location:	Fulda, Germany

The openETCS project has been presented at the congress, which took place under the motto "How will signaling technology evolve over the next ten to fifteen years?". The focus was predominantly on the development of the railway networks as well as on the expected changes in the areas of automatic train control, route protection, level crossing protection and control technology. Therefore, this congress was an ideal platform to present the project to a large audience of highly distinguished experts.

APTA/UIC High-Speed Congress 2012

Type:	Talk
Title:	openETCS: Applying Open Proof's to the European Train Control System
Speaker:	Klaus-Rüdiger Hase (DB)
Date:	10-13/07/2012
Location:	Philadelphia, PA, USA

The Congress focuses on highspeed railway traffic. Here, the openETCS project has been presented a large audience of highly distinguished experts and has especially been presented to the non-european audience.

41th Symposium "Moderne Schienenfahrzeuge"

Type:	Talk
Title:	Open ETCS: Ein internationales ITEA2-Projekt begleitet den Wandel
Speaker:	Klaus-Rüdiger Hase (DB)
Date:	7-10/4/2013
Location:	Graz, Austria

The symposium focuses on highspeed railway traffic, railway transport vehicles, rail fraight transport, vehicle components, and interaction of wheel and track. The platform of the symposium will be used to present the openETCS approach to a large audience of distinguished experts in railway business.

iFM 2013: 10th International Conference on integrated Formal Methods

Type:	Talk
Title:	Tutorial: Specification and Proof of Programs with Frama-C
Speaker:	Virgile Prevosto
Date:	10-14/6/2013
Location:	Turku, Finland

Despite the spectacular progress made by the developers of formal verification tools, their usage remains basically reserved for the most critical software. More and more engineers and researchers today are interested in such tools in order to integrate them into their everyday work. This half-day tutorial proposes a practical introduction during which the participants will write C program specifications, observe the proof results, analyze proof failures and fix them. Participants will be taught how to write a specification for a C program, in the form of function contracts, and easily prove it with an automatic tool in FRAMA-C, a freely available software verification toolset. Those who will have FRAMA-C and JESSIE installed (e.g. from ready-to-install packages frama-c, why, alt-ergo under Linux) will also run automatic proof of programs on their computer. Program specifications will be written in the specification language ACSL similar to other specification languages like JML that some participants may know. ACSL-syntax is intentionally close to C and can be easily learned on-the-fly.

Symposium Test4Rail

Type:	Talk
Title:	Early Verification of Concepts on the Example of openETCS
Speaker:	Marc Behrens
Date:	29-30/10/2013
Location:	Brunswick, Germany

The concept of early verification is one key factor in shortening the development cycle by parallelizing development and verification. With its integrated model based approach and proof of transformation tests within openETCS tests are shifted to model level transforming the general V- Model to a Y-Model. The symposium focused on new approaches to verification of safety critical software in the railway sector. The concept of early verification has been presented to an audience of highly distinguished international experts.

3 Planned Future Dissemination Activities

3.1 Exhibitions and Trade Shows

ITEA & ARTEMIS Co-summit 2015

Date:	10-11/3/2015
Location:	Berlin, Germany

The ITEA & ARTEMIS Co-summit will be used as platform to present the project, report about the current status of the openETCS project and present intermediate results. It is a great opportunity for exchanging ideas with the community and to disseminate and advertise the project as the event covers participants from industry, academia, public authorities and press from all over Europe.

Embedded World Exhibition & Conference

Frequency:	annual
Next Event:	February 2015 (Nuremberg, Germany)
Website:	`http://www.embedded-world.eu/`

The annual EmbeddedWorld Exhibition & Conference is the world largest trade exhibition in the area of embedded systems. It is planned to present openETCS partner results at the exhibition as well as at the conference.

3.2 Conferences and Workshops

41th Symposium "Moderne Schienenfahrzeuge"

Type:	Talk
Title:	Open ETCS: Ein internationales ITEA2-Projekt begleitet den Wandel
Speaker:	Klaus-Rüdiger Hase (DB)
Date:	7-10/04/2013
Location:	Graz, Austria
Website:	`http://www.schienenfahrzeugtagung.at/`

The symposium focuses on highspeed railway traffic, railway transport vehicles, rail fraight transport, vehicle components, and interaction of wheel and track. The platform of the symposium will be used to present the openETCS approach to a large audience of distinguished experts in railway business.

SIGNAL+DRAHT-Congress

Frequency:	annual
Website:	`http://www.eurailpress.de/events/eurailpress-events.html`

A talk about the openETCS project has already been given at the 12th international SIGNAL+DRAHT congress in 2012 (see Section 2). A follow up talk is planned for 2014 or 2015 in order to present the results of the project.

IEEE Vehicular Technology Conference

Frequency:	bi-annual
Next Events:	May 2015 (Glasgow, Scotland)
Website:	`http://www.ieeevtc.org/vtc2015spring`

This semi-annual flagship conference of the IEEE Vehicular Technology Society will bring together individuals from academia, government, and industry to discuss and exchange ideals in the fields of wireless, mobile, and vehicular technology. The conference will feature world-class plenary speakers, tutorials, and technical as well as application sessions.

IFIP International Conference on Testing Software and Systems (ICTSS)

Frequency:	annual

The well-established ICTSS series of international conferences addresses the conceptual, theoretic, and practical challenges of testing software systems, including communication protocols, services, distributed platforms, middleware, embedded systems, and security infrastructures.

European Safety and Reliability Conference (ESREL)

Frequency: annual

Safety, reliability and risk management become more and more important in an always more challenging and competitive environment, in every industry and human activity: multidisciplinary approaches to safety and reliability engineering and risk management become more and more necessary and attractive.
This annual conference will provide a forum for presentation and discussion of scientific works covering theories and methods in the field of risk, safety and reliability, and their application to a wide range of industrial, civil and social sectors and problem areas. ESREL 2011 will also be an opportunity for researchers and practitioners, academics and engineers to meet, exchange ideas and gain insight from each other.

Nasa Formal Methods Symposium (NFM)

Frequency: annual

Next Event: April 2015 (Pasadena, USA)

Website: `http://nasaformalmethods.org/`

The NASA Formal Methods Symposium is a forum for theoreticians and practitioners from academia, industry, and government, with the goals of identifying challenges and providing solutions to achieving assurance in mission- and safety-critical systems.

Integrated Formal Methods (iFM)

Frequency: annual

Website: `http://ifm2014.cs.unibo.it/`

The iFM conference series seeks to further research into hybrid approaches to formal modeling and analysis; i.e., the combination of (formal and semi-formal) methods for system development, regarding modeling and analysis, and covering all aspects from language design through verification and analysis techniques to tools and their integration into software engineering practice.

FORMS/FORMAT 2015

Frequency: bi-annual

Website: `http://www.forms-format.de`

The symposium FORMS/FORMAT offers scientists facing formal techniques, practitioners and managers, developers and consultants of automotive and railway industries as well as traffic system operators with interest in formal methods an accepted platform for the exchange of scientific experience and the transfer of practical description means, methods and tools for complex automation systems. With its focus on formal methods and transportation it provides an ideal forum to present openETCS and its results.

International Conference on Software Engineering and Formal Methods (SEFM)

Frequency: annual

Website: `http://sefm2014.inria.fr/`

The SEFM conference series aims to advance the state of the art and usage of formal methods in the industry, being a great hub for discussion on formal methods and software engineering.

IEEE International Conference on Software Testing (ICST)

Frequency: annual

Website: http://www.icst.lu/

ICST is a conference series that specialises in Software Testing and Verification & Validation. Topics discussed range from Verification & Validation, testing, model checking, among others.

International Conference on Model Driven Engineering Languages & Systems (MODELS)

Frequency: annual

Next Event: September/October 2015 (Ottawa, Canada)

Website: http://www.modelsconference.org/

The International Conference on Model Driven Engineering Languages & Systems (Models) is the premier conference series for model-based software and system engineering. The conference covers all aspects of modeling, from languages and methods to tools and applications.

IEEE International Conference on Software Engineering (ICSE)

Frequency: annual

Next Event: April 2015 (Nanjing, Jiangsu, China)

Website: http://icse2015.org/

The International Conference on Software Engineering (ICSE) is the premier software engineering conference, providing a forum for researchers, practitioners and educators to present and discuss the most recent innovations, trends, experiences and concerns in the field of software engineering.

IEEE/ACM International Conference on Automated Software Engineering (ASE)

Frequency: annual

Next Event: Nov. 2015 (Lincoln, Nebraska, USA)

Website: http://ase-conferences.org/

The ASE conference series is a great forum for automatic software engineering, with main research topics on techniques and tools for the automation of testing, analysing and maintenance of software systems.

ACM Symposium on Applied Computing (SAC)

Frequency: annual

Next Event: April 2015 (Salamanca, Spain)

Website: http://www.acm.org/conferences/sac/sac2015/

Over the past years, the ACM Symposium on Applied Computing (SAC), the primary SIGAPP Annual Conference, has become a primary forum for applied computer scientists, computer engineers, software engineers, and application developers from around the world to interact and present their work.

International Conference on Software Engineering and Knowledge Engineering (SEKE)

Frequency:	annual
Next Event:	November 2015 (Istanbul, Turkey)
Website:	http://www.waset.org/conference/2015/11/istanbul/ICSEKE

Specializing in software engineering, the SEKE conference series provides a great forum for discussion around this topic.

EclipseCon Europe

Frequency:	annual
Next Event:	Oct. 2014 (Ludwigsburg, Germany)
Website:	http://www.eclipsecon.org

EclipseCon is one of the largest open source conferences of the world. Several consortia such as POLARSYS, the Automotive Group and the OPEES group are presenting their results and are looking for potential collaboration partners.

3.3 Journals and Magazines

Journal of Statistical Software

Website:	http://www.jstatsoft.org/

Specializing in statistical software and algorithms, it provides a medium to publish about different techniques used for the validation & verification of embedded systems.

SIGNAL+DRAHT

Website:	http://www.eurailpress.de/verlag/zeitschriften/signal-draht/profil.html

A talk about the openETCS project has already been given at the 12th international SIGNAL+DRAHT congress in 2012 (see 2). For 2014 or 2015 it is planned to publish an article about the project results in the accompanying SIGNAL+DRAHT magazine.

International Railway Journal (IRJ)

Website:	http://www.railjournal.com

The journal was launched in 1960 and is the world's first globally-distributed magazine for the railway industry. It is written for senior managers and engineers of the world's railways and transit systems, ministers of transport, manufacturers, railway planners, and consultants. Concerning openETCS, it is planned to publish an article about the simulator which will be developed for the purpose of demonstration in the project.

ZEV Rail

Website:	http://www.zevrail.de

ZEV Rail is the accompanying journal to the "Moderne Schienenfahrzeuge" symposium. An article with the title "OpenETCS: Ein internationales ITEA2-Projekt begleitet den Wandel" is currently under submission.

3.4 openETCS-Specific Events

IEEE INDIN 2015

Type:	Workshop / Special Session
Date:	22-25/7/2015
Location:	Cambridge, UK

The ESICS workshop at INDIN 2013 was a success and thus it is planned to organise another workshop for INDIN 2015. It will again focus on critical systems, safety and security.

openETCS Conference/Final Workshop 2015

Date: 2015

At the end of the project in 2015 a second conference is planned to present the final results, possible follow-up activities and exploitation perspectives.

4 Further Activities

4.1 openETCS Website

The project's public website is available at `http://www.openetcs.org`. In addition to a brief overview over the project, its goals and the participating partners, it provides links to the openETCS working platform GitHub [2], enabling easy access to deliverables, software, meeting minutes, etc. Moreover, a calendar with upcoming events gives people not yet involved but interested in the project an overview of ongoing activities and thus the possibility to participate in these events. The website also offers downloads for the openETCS tool.

4.2 Github

Throughout the project the GitHub platform [2] is used for management and publication of project results. Most of the project repositories are public and thus are accessible to the outside world, making it possible for everyone to view the state of the project and its results. In addition, the platform enables anybody to contribute content to the project. GitHub is based on the open source Git tool [1] and provides a wide variety of functions, including versioning, team collaboration support, public and private repositories and a wiki. In addition to the main project repositories wikis are a useful tool for communicating project state and results to the outside world.

References

[1] The Git Tool: `http://git-scm.com/`.

[2] The GitHub Platform: `http://github.com/`.