

Project DEPLOY Grant Agreement 214158  
*“Industrial deployment of advanced system engineering methods for high  
productivity and dependability”*



**DEPLOY Deliverable D50**

**D14.13 Collaboration Report**

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## Contents

Executive summary .....	3
1 Introduction.....	5
2 Achievements .....	6
2.1 Formal Methods for Service Oriented Architecture.....	6
2.2 Other Collaborations .....	9

## **Executive summary**

This document presents achievements obtained during the fourth year of the project, for establishing links and organizing co-operation activities with other ICT projects under the WP2007/2008 Strategic Objective IST-2007.1.2 « Service and Software Architectures, Infrastructure and Engineering », regarding objectives defined in [D3].

This document completes the previous reports [D13], [D26] and [D36] covering achievements obtained during the first three years of the project.

An important aspect was the collaboration with the ADVANCE project, which started in October 2012 and which will ensure the continuing evolution and support of the Rodin platform.



# 1 Introduction

This document presents achievements obtained during the fourth year of the project, for establishing links and organizing co-operation activities with other ICT projects in the WP2007/2008 Objective Service and Software Architectures, Infrastructure and Engineering.

The co-operation has aimed at exploiting synergies between the projects and increasing the impact of the ICT initiative. The consortium members have been committed to provide contributions to the following activities, if applicable:

- [A1] Exploitation of synergies / technical concertation: participation to workshops, contribution to some of the working groups.
- [A2] Joint exchange, dissemination and training activities.
- [A3] Production of dissemination material that can be used for communication with the general public.
- [A4] Co-ordination of standardisation efforts.
- [A5] Contribution to repositories of reference implementations.

This deliverable only covers the specific activities for collaboration with other projects (Task T14.3). The other project WPs cover the project activities in some of the above areas (e.g., dissemination, standardisation).

The specific plan for collaboration, including the specific working group set up during this project was detailed in Deliverable D3 Collaboration Plan<sup>1</sup>, released at month 6. The present document reports on the activities done during the fourth year, completing the previous reports covering the first three years of the project.

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<sup>1</sup> Reachable at <http://www.deploy-project.eu/pdf/d14.9-collaborationplan-1.0.pdf>

## 2 Achievements

### 2.1 Formal Methods for Service Oriented Architecture

Following the SSAI FP7 Call 1 projects meeting that took place in March 2008 in Brussels, we have identified a common thematic, namely “Formal methods for Service Oriented Architecture”, bridging over DEPLOY main focus (formal methods) and “Internet Technology” mainstream that most FP7 Call 1 projects adhere to.

A Discussion Group (FM4SOA) was created, with the objective of determining how formal methods would contribute to the specification, design, development and deployment of service oriented architectures, based on potential or real error risks analysis. This analysis would rely on experience gained through non-formal developments, as well as the reasons why some SSAI FP7 Call 1 projects are making explicit use of formal methods or plan to develop a formal framework (project ALIVE for example). “Negative” testimony or feelings (justified or not) explaining why formalities are not welcome in SOA were also expected to contribute to the analysis.

Log in / create account

deploy 7

Go Search

Main Page Current events Category Recent changes Help

### Formal Methods for SOA and Internet of the Future

Article Discussion View source History

**Contents** [hide]

- 1 Introduction
- 2 Objectives
- 3 Discussions
- 4 Participants and contributors
- 5 Events
- 6 Links and resources
  - 6.1 Interesting Papers

### Introduction

This site is dedicated to a Group Discussion entitled Formal Methods for [Service Oriented Architecture](#) and Internet of the Future. It gathers expertise on Internet Technology and Formal Methods from FP7 Call1 projects of Objective 1.2 "Services and Software Architectures, Infrastructure and Engineering". It contributes to the cooperation activities between the projects, aiming at increasing the impact of the ICT initiative.

Figure 1: FM4SOA Working Group wiki

This FM4SOA Working Group has been initially planned to be a subgroup of the Service Engineering Collaboration Working Group. The purpose was that it contributes to larger, service engineering oriented objectives. It emerged into a separate Working Group as it addresses specific thematics.

A wiki<sup>2</sup> has been set up (see Figure 1: FM4SOA Working Group wiki). It presents the Discussion Group objectives, lists the projects potentially interested in participating to the exchanges. It hosts all contributions from the Working Group members that could be discussions, statements, case studies, etc. Everyone has been invited to register and to contribute to this wiki, which has been updated regularly.

**Mailing list.** In order to ease the communication among the FM4SOA collaboration Working Group, a dedicated mailing list has been set up. This mailing list is based on JSCLIST facilities, used by DEPLOY for internal and external communication.

**Collaboration meeting.** DEPLOY has organized and sponsored the Internet of Services Collaboration meeting<sup>3</sup> in Brussels on September 28-29 2011. Its objective was to raise the impact of the results of individual projects through networking, sharing experiences and participation to collaboration activities. All representatives of the FP6 and FP7 projects in the area of Software & Services, Grid and Software and Service Architectures and Infrastructures were invited to participate.

At that occasion, a meeting of the Working Group on Formal Methods and SOA was organized by DEPLOY, with a general theme: Combining Formal Verification with Graphical Modelling Languages. Indeed, many projects implement graphical modelling and visualization tools, which makes a collaboration in this area most promising. In particular, these tool implementations use Eclipse and the Eclipse Modeling Framework (EMF) which is also an important cornerstone of many Rodin plugins.

Precise objectives of the meeting were:

- Exchange experience around using formal verification and graphical modelling,
- Find new applications of tools & techniques developed within the participating EU projects,
- Find new challenging case studies and future directions of research. The agenda of the meeting was:
- Presentation: iUML: Combining UML and Formal Models (Colin Snook, University of Southampton)
- Presentation Graphical Visualisation of Formal Models (Michael Leuschel, University of Düsseldorf)

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<sup>3</sup> [http://ec.europa.eu/information\\_society/events/ssai/ios2011/index\\_en.htm](http://ec.europa.eu/information_society/events/ssai/ios2011/index_en.htm)

- Presentation(s) on using EMF for developing tools for Graphical or Formal modelling languages (Alexei Iliasov, University of Newcastle)
- Technical Discussion on UML, EMF and formal models: experiences, challenges, and outlook
- Technical Discussion on graphical visualisation of formal models: experiences, challenges and outlook.

The presentations are available on the meeting's site<sup>4</sup>. Some interesting discussions took place during the meeting; in particular exchanges with Fastfix and Advance triggered follow-up discussions (see also next section below). The idea was proposed to set up a working group on formal methods across different units in the future.

It is expected that the FM4SOA WG will continue to exist after DEPLOY ends. We have seen enough evidence to state that rigorous specification, modelling and verification are playing an important role in many ongoing EC projects on SOA and the Internet of the Future. We believe their importance will grow when new application domains (e.g. safety-critical) will start using these technologies on a much wider scale.

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<sup>4</sup> [http://ec.europa.eu/information\\_society/events/cf/ios11/item-display.cfm?id=6939](http://ec.europa.eu/information_society/events/cf/ios11/item-display.cfm?id=6939)

## 2.2 Other Collaborations

DEPLOY collaborated bilaterally with a number of EU projects by exchanging experiences, artefacts, and visions about topics of overlapping interest, as listed below:

- The FP7 Call 5 project FITTEST, aka "Future Internet Testing"<sup>5</sup> develops an integrated environment for the automated and continuous testing of Future Internet Applications.. Since model-based testing is of special interest for them, DEPLOY participated in a common workshop on model-based testing in London, UK, in May 2011. Alin Stefanescu from UniPit presented the model-based testing work in DEPLOY and the deployment at SAP.
- The project SPRERS, aka "Strengthening the Participation of Romania at European R&D in Software Services"<sup>6</sup>, funded by EC via FP7 (CSA), has been a further collaboration partner. The collaboration has been concretized by a participation in a workshop in Timisoara, Romania, in December 2010. Alin Stefanescu from UniPit gave a tutorial on DEPLOY on model-based testing for service-oriented systems in the SAP deployment of WP4.
- The ARTEMIS JU project RECOMP7 is developing methodologies for component-based design of safety-critical real-time systems using Event-B and targeting and developing trusted multi core platforms. The project is very much industrially involved. Collaboration with this project took place mainly through AAU being a participant both in DEPLOY and RECOMP.
- The FP7 IP COMPASS on Comprehensive Modelling for Advanced Systems of Systems<sup>8</sup> (2011-2014) researches model-based techniques for developing and maintaining Systems of Systems (SoS). Collaboration with that project has taken place through the Newcastle team which was involved both in DEPLOY and - as coordinator - in all main strands of work in COMPASS including developing a modelling framework for SoS architecture and fault modelling and safety analysis for SoS.
- The 3-year FP7 DESTTECS STREP on Design Support and Tooling for Embedded Control Software<sup>9</sup> aims to develop methods and tools that that combine continuous time system models with discrete event controller models through co-simulation. The Newcastle team was involved in modelling faults and fault tolerance mechanisms that cross the boundaries between models, leveraging experiences from DEPLOY.

Finally, the project ADVANCE<sup>10</sup>, an FP7 Information and Communication Technologies Project.

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<sup>5</sup> <http://www.pros.upv.es/fittest/>

<sup>6</sup> <http://sprers.eu/>

<sup>7</sup> <http://atc.ugr.es/recomp/>

<sup>8</sup> <http://www.compass-research.eu/>

<sup>9</sup> <http://www.destecs.org/>

<sup>10</sup> <http://www.advance-ict.eu>

is of vital importance for DEPLOY, as it ensures the continuation of the Rodin platform. Intensive collaboration has taken place to ensure a smooth handover of the Rodin technology. The overall objective of ADVANCE is the development of a unified tool-based framework for automated formal verification and simulation-based validation of cyber-physical systems. Unification is being achieved through the use of a common formal modelling language supported by methods and tools for simulation and formal verification. An integrated tool environment will provide support for construction, verification and simulation of models. Fortunately ADVANCE does not need to start from scratch in order to achieve our objectives. ADVANCE will use the Event-B formal modelling language as the basis for the common modelling language and will build on the existing open-source Rodin toolset for Event-B. The industrial experience gained in DEPLOY with the Event-B modelling formalism demonstrates that it provides a solid basis for ADVANCE. The open architecture of Rodin has allowed a number of plug-in tools to be developed including plug-ins for model-checking, animation, model composition and code generation which have direct relevance to the ADVANCE project. Building on the firm foundation that the DEPLOY project has provided, ADVANCE will further strengthen and augment the Rodin platform with novel approaches to multi-simulation and testing.

Five partners make up the ADVANCE consortium: Alstom Transport, Systerel, Critical Software, the University of Düsseldorf and the University of Southampton. The focus of ADVANCE is to develop and deliver methodology and tools that fit well together in a rigorous and integrated process that will be validated with two industrial case studies, Dynamic Trusted Railway Interlocking and Smart Energy Grids. Interlocking is the component of the signalling system that sets and locks the routes for trains on request of the traffic operator and that commands the lights of the wayside signals according to the state of the routes. Alstom Transport is developing with the ADVANCE methods and - tools a new component, called an Interlocking Dynamic Controller (IDC), which dynamically checks the safety of the configurations computed by the interlocking at run-time. Until recently, energy efficiency has been about individual devices making local savings without taking into account demand on the grid and the price of electricity. Critical Software will model and verify the distributed monitoring and control of a smart energy grid together with communication between consumer devices, electricity suppliers and grid operators. The University of Southampton is the ADVANCE project coordinator.