

# Cluster of EU FP7 Projects ON SYSTEMS OF SYSTEMS

Issue n°  
1

Newsletter • May 2014

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**Welcome**  
from Prof Sebastian Engell,  
Project Coordinator of CPSoS

**E**ngineering of Systems of Systems has been a priority topic in the last calls of the 7th Framework Programme for Research, Development and Demonstration of the European Union, as it was realized that the engineering of large distributed systems with partial autonomy of the components poses big challenges and is of crucial importance for the competitiveness of Europe and the quality of life of its citizens. In the last round, three focused research projects, AMADEOS, Local4Global and DYMASOS obtained funding, together with the Support Action CPSoS. The goal of CPSoS is to provide a roadmap for future research in Europe in the domain of cyber-physical systems of systems. As the individual projects can only address few topics within the broad range of important issues in the engineering of Systems of Systems, mechanisms for interactions between the projects were established. One of these is this Newsletter which is edited by CPSoS and informs on the activities of all four projects.

I hope you will find the information useful and check out more details. We will be happy to publish announcements of workshops, conferences etc. in the domain and appreciate your feedback (see contact details at the end of this Newsletter).



**Prof. Sebastian Engell,**  
Technische Universität Dortmund  
Project Coordinator of CPSoS

## Cooperation of the FP7 SoS Projects



The four recently approved EU projects on Systems of Systems interact in various ways. Representatives of the projects AMADEOS, Local4Global and DYMASOS contribute to the three Working Groups set up by the CPSoS Support Action.

Mutual participation in workshops and events as well as specific cluster meetings are planned. Further interactions will be organised around synthesis reports and strategic policy documents. Last but not least, this Newsletter is the first of four joint newsletters that will be published during the lifetime of CPSoS, containing contributions from and about the projects in the cluster.

The first joint meeting of the SoS projects will take place on July 8, 2014 in Sophia Antipolis, France in the framework of review meetings of all four projects.

### CPSoS - Public Events

Public Workshop on September 11-12, 2014 in Brussels (Belgium) organized by CPSoS Working Group 1 (*Systems of Systems in Transportation and Logistics*)

Public Workshop on October 1, 2014 in Zürich (Switzerland) organized by CPSoS Working Group 2 (*Physically Connected Systems of Systems*)

Public workshop on September 12, 2014 in Bertinoro (Italy) organized by CPSoS Working Group 3 (*Tools for Systems of Systems Engineering and Management*)



## Project overview

## AMADEOS

**AMADEOS** - *Architecture for Multi-criticality Agile Dependable Evolutionary Open System-of-Systems* - is a three year collaborative project, funded under the European Commission's FP7, which started on October 1st, 2013. The objective of AMADEOS is to bring time awareness and evolution into the design of Systems of Systems (SoS). To achieve this goal it will establish a sound conceptual model, a generic architectural framework and a design methodology including tools for prototyping, for the modelling, development and evolution of time-sensitive SoS with possibly emergent behaviours.

Special emphasis is put on evolution, emergence, dependability (e.g. safety, availability) and security, considering embedded devices and the computing cloud as the execution platform. The concept of evolution will be addressed from two complementary perspectives, considering both long-term evolution and unexpected short-term changes (e.g. failures) in the constituent systems. Instead of using traditional guarantees that were the target for more closed and static systems, AMADEOS will be based on the concept of guaranteed best adaptation under the given constraints, sometimes based on monitoring how the environment evolves, and taking mitigating actions. The viability of the framework will be validated on a



case study of a Cyber-physical System of Systems, a small smart grid application, where guaranteed responsiveness, evolution, dependability and security are essential requirements.

**Project Coordinator:** Prof. Andrea Bondavalli,  
*Università degli Studi di Firenze, Italy*

### Partners:

- Technische Universität Wien, *Austria*
- Université Joseph Fourier Grenoble I, *France*
- ResilTech srl, *Italy*
- Thales Netherlands B.V., *Netherlands*
- European Network for Cyber Security, *Netherlands*

[Read more >](#)

## Project overview

## DYMASOS



**DYMASOS** - *Dynamic Management of Physically Coupled Systems of Systems* - will develop new management methods to better control and optimise the behaviour of large physically interconnected Systems of Systems, which are essential for the future well-being of the citizens of Europe.

The increasing complexity of large interconnected technical systems, such as electric power systems, air traffic, railway systems and large industrial production complexes, requires new ways to manage such systems of systems which consist of many interacting components that are managed locally and partly independently, according to different policies and priorities.

DYMASOS investigates three strategies to coordinate systems of systems: population control mechanisms, market-based coordination and dynamic forming of coalitions. It will develop a simulation platform for the testing of the strategies in detailed simulations of large scale systems. The applications are in the chemical industry and in electric grid management.

The developments will lead to increased energy and resource efficiency of industrial production and to stable electric power distribution systems with smaller carbon footprints and a more efficient use of renewables, fully in line with the "Smart Sustainable Growth" objective of the Horizon 2020 strategy of the European Commission.

The consortium consists of large industrial companies and research institutions, as well as several European SME's who will be instrumental in developing and marketing innovative solutions to cope with the challenges of the optimal distributed management of Systems of Systems.

**Project Coordinator:** Prof. Sebastian Engell,  
*Technische Universität Dortmund, Germany*

### Partners:

- BASF SE, *Germany*
- Hrvatska Elektroprivreda (HEP Group), *Croatia*
- INEOS Köln GmbH, *Germany*
- University of Seville, *Spain*
- University of Zagreb Faculty of Electrical Engineering and Computing, *Croatia*
- ETH Zürich, *Switzerland*
- RWTH Aachen, *Germany*
- inno TSD, *France*
- IDENER, *Spain*
- euTeXoo GmbH, *Germany*
- AYESA AT, *Spain*

[Read more >](#)



## Project overview

## Local4Global

The main objective of [Local4Global](#) - *Systems of Systems that act locally for optimizing globally* - is to develop, test and evaluate a new groundbreaking, generic and fully-functional methodology / system for controlling Technical Systems of Systems (TSoS) where – as in the case of «natural» systems such as biological systems, the human brain, animal herds (swarms), teams of interacting / cooperating humans and ecological systems – autonomous constituent systems reacting and interacting depend only on their local environment in order to optimize the emerging TSoS performance at the global level.

Local4Global's ambition is to deliver a fully functional system that can be embedded in everyday operations and will result in substantial savings and Quality-of-Service improvements, by minimizing infrastructure and installation effort. In other words, Local4Global's goal is to create an innovative product in plug-and-play "interfaceable" optimizing systems, similar to plug-and-play systems for communication operation where there is no need for an expensive infrastructure and, moreover, no need for a team of experienced engineers responsible for modelling, calibrating and tuning the system.



This system will be deployed and extensively tested and evaluated on two real-life TSoS Use Cases, a Traffic TSoS Use Case and a Building TSoS Use Case: the outcome of Local4Global is expected to be easily expandable to the majority of TSoS area. The self-learning and self-adjusting attributes of Local4Global combined with its minimum infrastructure requirements and the ability to provide information at the macroscopic level will also help in increasing operator's confidence and willingness to adopt Local4Global in future challenging real-life applications.

The Local4Global Kick-off Meeting was held in Aachen, Germany, in October 22nd-23rd, 2013. During the meeting, the partners discussed the preliminary ideas and set up the schedule for achieving the Local4Global's objectives. Schematically, the work flow of the project will pass through the following steps:

- TSoS modelling and analysis,
- TSoS software and modelling tools,
- The Local4Global System and Theoretical tools,
- Use Cases of the project,
- Evaluation of methods and tools,
- Dissemination and Exploitation plan for the project.

### Project Coordinator:

Prof. Elias Kosmatopoulos  
Centre for Research and Technology  
Hellas, Greece

### Partners:

- ETH Zürich, Switzerland
- RWTH Aachen University, Germany
- IK4 TEKNIKER, Spain
- TRANSVER GmbH, Germany
- Technical University of Crete, Greece
- Technische Universität München, Germany

[Read more >](#)

## Project overview

## CPSoS

The concept of Systems of Systems has emerged as an active domain of research in recent years at the interface of various disciplines, such as computer science, systems and control, systems engineering, and is of crucial importance for the societal challenges facing the world.



[CPSoS](#) – *Towards a European Roadmap on Research and Innovation in Engineering and Management of Cyber-physical Systems of Systems* – is a 30-month Support Action supported by the European Commission under the FP7 programme. Its main goal is to provide a European Research and Innovation agenda on cyber-physical SoS.

CPSoS provides a forum and an exchange platform for Systems of Systems-related communities and ongoing projects, focusing on the challenges posed by the engineering and the operation of technical systems in which computing and communication systems interact with large complex physical systems. Its approach is simultaneously integrative, aiming at bringing together knowledge from different communities, and applications driven.

**Project Coordinator:** Prof. Sebastian Engell, Technische Universität Dortmund, Germany

### Partners:

- Haydn Consulting Ltd, United Kingdom
- Technische Universiteit Eindhoven, Netherlands
- inno TSD, France

## CPSoS Working Groups

Three interacting [Working Groups](#), consisting of top-level specialists who represent different application domains, vendors and end users, have been set up, and will support the project in its work, providing input, feedback and recommendations.

**Working Group 1:** Systems of Systems in Transportation and Logistics

**Working Group 2** Physically Connected Systems of Systems (*i.e. Systems of Systems in Electrical Power Grids, Industrial Systems, Distribution Networks, Smart Buildings*)

**Working Group 3** Tools for Systems of Systems Engineering and Management

[Read more >](#)



## Project news and activities

### CPSoS Working Groups Kick off Meeting

The CPSoS Working Groups met on January 31, 2014 at Düsseldorf Airport for a joint full-day meeting of plenary and group discussions. An input paper “Cyber Physical Systems of Systems – Definition, relevance and research needs” was presented by the coordinator, and discussions were organised around the following main topics:

- Prototypical cases of cyber-physical systems of systems
- Main difficulties encountered in the engineering, realization and operation of these systems
- Obstacles to the use of advanced management methods and engineering tools
- Specific demands and challenges for advanced engineering methods and tools for CPSoS,
- Important open research questions for CPSoS in the next five years.



The discussions of the 27 top-level experts provided useful input for the further elaboration of the scope document, confirming its main ideas. Numerous examples for cyber-physical systems of systems were presented and discussed, and the three Working Groups provided prioritized lists of future topics for research and development in the area of CPSoS. These will be further elaborated in the Working Groups and discussed with domain experts. A first draft of a strategy document will be ready by the end of June 2014.

[Read the WG meeting report here >](#)

### Local4Global

#### Building Use Case TSoS

The working group for this use case consists of CErTH, ETHZ, IK4 and the task leader RWTH.

As a starting point, a verification phase will take place in order to make sure that all interfaces are in place and work properly and then the implementation will start. During the implementation phase, the following set of experiments will be conducted:

- Operation with the resident controller being active.
- Operation with the Local4Global system being active.

The alternation between the two systems over a long period of time will allow the evaluation process to gather sufficient data for both systems and for comparative fault / incident / weather /demand conditions, something that will allow a comprehensive and fair evaluation of the Local4Global overall system (in comparison with the resident systems).

The basic goal for the Use Case is to create a self-learning system that will result in a better control strategy, in order to minimize the cost of energy that the building is using, in respect with internal conditions and comfort of the users.



## Project news and activities

### AMADEOS publications

*“Why Global Time is Needed in Dependable SoS”*

Hermann Kopetz

Presented at Engineering Dependable Systems of Systems (EDSoS) 2014 on May 13th, 2014

### Upcoming AMADEOS presentations

[The 23rd Annual NIST-ATIS Synchronization Workshop](#)

*“Systems of Systems Need a Global Time”*

Hermann Kopetz

Invited Keynote Presentation on June 12, 2014

[17th IEEE Computer Society symposium \(ISORC\)](#)

*“A Conceptual Model for the Information Transfer in System of System”*

Hermann Kopetz

Presentation on June 10, 2014

### DYMASOS publications

*“Coalitional model predictive control of an irrigation canal”*

F. Fele, J.M. Maestre, M. Hashemy, D. Muñoz & E.F. Camacho  
Journal of Process Control 24 (2014) pp. 314–325

*“Distributed Model Predictive Control: an Overview of Features and Research Opportunities”*

R.R. Negenborn & J.M. Maestre

Presented at IEEE International Conference on Networking, Sensing and Control, April 7-9, 2014

### Upcoming DYMASOS presentations

[13th European Control Conference \(ECC14\)](#)

*“Constraints on the Shapley Value for a Coalitional Control System”*

J. Muros, J.M. Maestre, E. Algaba, T. Álamo & E.F. Camacho

Presentation on June 26, 2014

[The 19th World Congress of the IFAC](#)

*“An Iterative Design Method to Constraint coalitional control networks by the shapley Value”*

F.J. Muros, J.M. Maestre, E. Algaba, T. Álamo & E.F. Camacho

Presentation on August 25, 2014

## Events

### organised by the Cluster Projects

#### Call for Contributions:

**Workshop on Tools and Methods for Cyber-Physical Systems of Systems**

[CPSoS Working Group 3](#) is organising a public workshop on September 12, 2014 in Bertinoro, Italy, at the occasion of [IFM2014](#) with the aim to discuss the state-of-the-art and future challenges in the engineering of Cyber-physical Systems of Systems. The workshop will consist of three types of presentations: invited presentations, presentations by CPSoS Working Group members and submitted presentations.

A call for contributions has been launched; deadline for the abstract submission is May 31, 2014

Find the complete information here >

#### Save the dates:

**September 11-12, 2014 (Brussels, Belgium)**

[CPSoS Working Group 1](#) (Systems of Systems in Transportation and Logistics) plans to organise a public workshop in conjunction with the [Automotive World Megatrends Europe 2014](#) Conference .

**October 1, 2014 (Zurich, Switzerland)**

[CPSoS Working Group 2](#) (Physically Connected Systems of Systems) will organise a public workshop in cooperation with DYMASOS. The event shall take place at ETH Zürich.

More details will be published on the CPSoS web site soon >

#### CPSoS Web-Questionnaire

Please help us expand our database and spend a few minutes to fill in the [CPSoS-Questionnaire](#)



## Other Systems of Systems Related Events

### **17<sup>th</sup> IEEE Computer Society symposium (ISORC)**

*June 8-12, 2014 – Reno, Nevada, USA*

This is the 17th IEEE Computer Society symposium dealing with the rapidly expanding field of object / component / service-oriented real-time distributed computing (ORC) technology. The principal theme of ISORC is the use of the object, component, and service-oriented computing paradigms - which has prevailed in many non-real-time applications in the past decade - in a wide variety of real-time applications. In the ISORC series, this paradigm emphasizes its spirit of openness where diverse views and new approaches to challenging issues can be freely discussed.

### **The 23<sup>rd</sup> Annual NIST-ATIS Synchronization Workshop**

*June 9-12, 2014 - San José, California*

The NIST-ATIS Workshop on Synchronization in Telecommunication Systems (WSTS) is the premier North American event focused on state-of-the-art clock synchronization issues. With a steering group of 25 leading international experts, the workshop provides in-depth coverage of industry-critical issues while maintaining product and company neutrality. The NIST-ATIS workshop highlights both developing sync requirements and deployment strategies for new sync systems and standards.

### **IEEE 9<sup>th</sup> International System of Systems Engineering Conference**

*June 9-13, 2014 - Adelaide, Australia*

The 9th International System of Systems Engineering Conference, with its sponsors, will present state-of-the-art in System of Systems research and practices through its strong program. The conference program will include numerous keynote speakers in the field, plenary panel sessions in addition to high quality research papers. The conference theme is "SoSE: Managing Complex Systems".

### **13<sup>th</sup> European Control Conference (ECC14)**

*June 24-27, 2014 – Strasbourg, France*

The conference aims to bring together academics and industry professionals from the field of systems and control, and to promote scientific cooperation and exchanges within the European Union and between Europe and other parts of the World. Scientific co-sponsorship of the event is provided by the IEEE Control Systems Society (CSS), and the event is held in cooperation with the International Federation of Automatic Control (IFAC).

### **ICSEng 2014 - 23<sup>rd</sup> International Conference On Systems Engineering**

*August 19-21, 2014 - Las Vegas, USA*

This event is organized on triennial basis. It covers the general area of Systems Engineering with particular emphasis being placed on applications of system approaches in aerospace, control, intelligent and expert systems, information and communication, computer networks, and industrial automation and robotics, etc.

### **The 19<sup>th</sup> World Congress of the IFAC**

*August 24-29, 2014 - Cape Town, South Africa*

One of the most prestigious events for automatic control community, the 19th World Congress of the International Federation of Automatic Control (IFAC), will be held in Cape Town, South Africa from 24th to 29th August 2014. IFAC has been holding triennial World Congresses since the 1960 Moscow congress and these congresses offer the most up-to-date and complete view of control techniques, with the widest coverage of theoretical and application fields. The theme for the Cape Town congress is "Promoting automatic control for the benefit of humankind", as encapsulated by the vision and mission of IFAC. The event is expected to welcome more than 2500 scientists and industrial control practitioners.



## **8<sup>th</sup> IEEE Multi-Conference on Systems & Control**

**IEEE MSC 2014**

**October 8-10, 2014 - Nice-Antibes, France**

The 2014 IEEE Multi-Conference on Systems and Control to be held at the Antibes Congress Centre, Antibes, France, during October 8th to 10th, 2014 includes two international conferences sponsored and promoted by the IEEE Control Systems Society:

- The IEEE Conference on Control Applications (CCA)
- The IEEE International Symposium on Intelligent Control (ISIC)

MSC 2014 will feature several kinds of presentations including contributed and invited papers, special and tutorial sessions, and pre-conference workshop covering a broad range of topics relevant to control applications and methods.

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## **IEEE 53<sup>rd</sup> Annual Conference on Decision and Control (CDC)**

**December 15-17, 2014 - Los Angeles, CA, USA**

The CDC is recognized as the premier scientific and engineering conference dedicated to the advancement of the theory and practice of systems and control. The CDC annually brings together an international community of researchers and practitioners in the field of automatic control to discuss new research results, perspectives on future developments, and innovative applications relevant to decision making, automatic control, and related areas.

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## **14<sup>th</sup> European Control Conference (ECC15)**

**June 15-17, 2015 – Linz, Austria**

The aim of the conference is to bring together academics and industry professionals from the field of systems and control and provide them with a view on the control-related challenges arising today from academia and industry. The conference currently welcomes the submissions of contributed papers and proposals for pre-conference workshops, invited and tutorial sessions, and panel sessions on topics of industrial interests.

**PLEASE PROVIDE YOUR FEEDBACK!**

**Do you have information to share?  
A SoS related event to promote?  
Questions? Suggestions?**

Contact: [d.marron@inno-group.com](mailto:d.marron@inno-group.com)

**or the project coordinators:**

AMADEOS – [Andrea Bondavalli](#)

DYMASOS – [Sebastian Engell](#)

Local4Global – [Elias Kosmatopoulos](#)

CPSoS – [Sebastian Engell](#)

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