

Editorial

Dear Reader,

It is our pleasure to present to you the second issue of our Road2SoS newsletter. Since the project started in October 2011, a lot has happened and exciting activities lie yet ahead of us. As you know, the ultimate objective of the Road2SoS project is the development of research and engineering roadmaps in the field of Systems of Systems (SoS). In the elaboration of these roadmaps, we are following a bottom-up approach – enquiring in four promising application domains which research needs and technological challenges exist to successfully implement SoS approaches in each of these domains. Also, we are looking

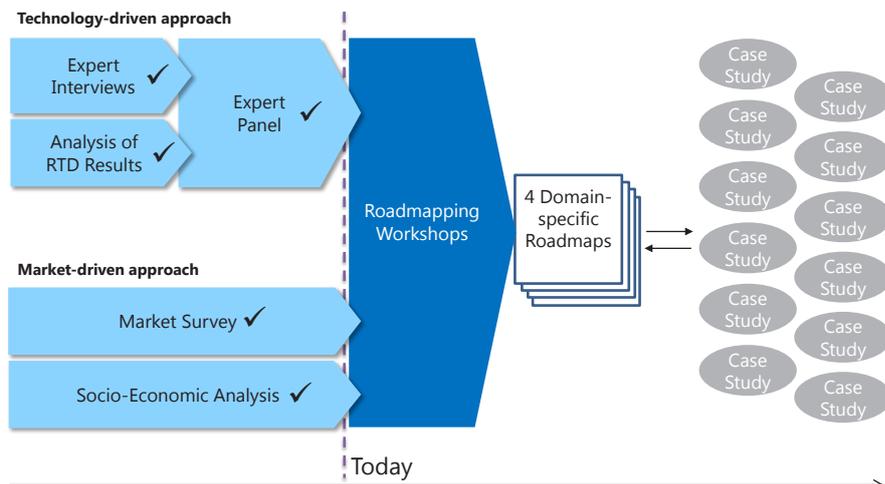
to identify economic, social, political or legal barriers that may exist and we are asking what the SoS development in these domains is driven by. Today, in each domain, a clear vision exists of what a mature, full-blown SoS implementation could look like in the future and the numerous benefits it is thought to bring to the domain. The roadmaps, we believe, are going to show the way to get there by outlining RTD and innovation strategies for Europe in the field of Systems of Systems.

In the development of the roadmaps, we crucially depend both on the judgement of our domain-specific experts within the consortium and also on expert knowledge, opinions, and

assessments from a variety of sources from outside the consortium. Indeed, over the course of the past 10 months we have built up a body of information that enables us now to embark on the actual roadmapping process which you can expect us to report on in the next newsletter.

In this newsletter we would like to report on some of the most fruitful events of the past months within the Road2SoS project. Also, we would like to draw your attention to some interesting Systems of Systems related events which you can find on the last pages of this newsletter.

Yours sincerely  
The Road2SoS Consortium



Data sources and sequence of work to be carried out within Road2SoS on the way to complete roadmaps and case studies

Development of strategic research and engineering roadmaps in Systems of Systems Engineering and related case studies

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## Getting to know the Neighbors - T-Area-SoS

In appreciation for the System of Systems concept, its promising applications and expected benefits to European companies, the European economy and society Road2SoS has been co-financed as a Coordination and Support Action (CSA) in the 7th Framework Programme. But we are not alone – there is other SoS life out there! Based on the same appreciation of the System of Systems concept, the **T-Area-SoS** project has set out to create a strategic research agenda (SRA) for the field of Systems of Systems engineering. With a consortium comprising partners from the UK and US, the project provides a unique transatlantic perspective.

In order to expand our project's view on Systems-of-Systems, Fraunhofer IPA, a Road2SoS project partner, participated at an expert workshop of the T-Area-SoS project held in April in

Brussels which aimed at common EU-US SoS roadmapping in areas like IT, manufacturing, and defense. The information exchange has been fruitful from both perspectives, since T-Area-SoS, by trend, follows a top-down approach from systems engineering to application in several examined application domains while Road2SoS applies a bottom-up approach, deriving from the point of view of application domains the research needs, technological challenges, barriers, drivers, and benefits regarding SoS in the domains.

For the future, collaboration among the project teams are expected to generate benefit for both sides.

Website of the T-Area-SoS project:

<http://www.t-area-sos.eu>



## IEEE International Conference on Systems of Systems Engineering



The IEEE recently held its 7th Internal Conference on System of Systems Engineering in Genoa, Italy, bringing together over 100 academic and industry experts. Simon Ford of IfM-ECS represented Road2SoS at the conference. He gave a plenary talk on Road2SoS alongside the three other SoSE projects currently funded by

the EU, T-Area-SoS, COMPASS and DANSE, and presented a paper on the work undertaken within the multi-site manufacturing domain. The conference was an excellent opportunity to share our work with this community, to consolidate existing relationships with the other EU projects, and to forge new connections. Road2SoS

anticipates contributing to next year's conference, which will be held in Maui, Hawaii, and will see the dissemination of the final roadmaps.

Conference website:

<http://www.sose2012.eu>

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## Road2SoS Expert Panel at KIT, Karlsruhe

In Road2SoS, the first months have been under the general theme of data collection. To critically examine the picture obtained thus far in each of the examined domains, an Expert Panel has been held in May at the Karlsruhe Institute of Technology (KIT) in Germany.

Participants were key experts from European academia and industry from each of the four application domains: Distributed Energy Generation and Smart Grids, Integrated Multi-site Industrial Production, Emergency and Crisis Management, and Multi-modal Traffic Control. Jointly with domain experts from the Road2SoS consortium, the to-date findings in each domain were examined, validated, supplemented, and prioritized. Beside the discussion of domain-specific findings, a strong focus has been put on the identification of commonalities across the several application domains. While many of the SoS-relevant aspects have been found to be highly domain-specific, a broad strand of commonalities across domains has also been identified. Commonalities exist regarding technological challenges, research needs, drivers, enablers, and barriers which hold for several or even all domains.

Choosing to carry out the expert panel with the structure of a road-



Discussion among (from left to right) Jean Noël Patillon (CEA LIST), Philippe Liatard (CEA-Leti), and Friedemann Wenzel (KIT) about the preliminary roadmap for System of Systems in the domain of multi-modal traffic control, Picture: Meike Reimann

mapping workshop yielded not only validated and enhanced findings but – due to the consideration of the temporal dimension – an actual early version of a roadmap in each of the four domains. As an anchor point at the far end of the roadmaps, visions have been elaborated in each domain. These are scenarios of wholistic and large-scale SoS applications in the domains where the benefits of SoS are very clear and of many sorts. These visions are an important means in order

to more clearly see the road that may lead there.

Participants considered the discussion inspiring and were delighted to have awakened to the fact that they were actually sharing common cross domain challenges captured by a SoS perspective.

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Annual INCOSE International Symposium 2012



From July 9-12 the International Council on Systems Engineering (INCOSE, [www.incose.org](http://www.incose.org)) held its annual international symposium in Rome, Italy. In the context of the symposium, Prof. Michael Henshaw of the University of Loughborough, UK held a panel session with the goal to review, discuss, and extend a set of research priorities in the field of System of Systems Engineering identified in the EU co-financed T-Area-SoS project. As one of the contributors to the panel, Christian Albrecht of Steinbeis-Europa-Zentrum in Germany presented the research challenges and practical problems which exist from the application oriented perspective the Road2SoS project is investigating.

Across the four application domains investigated in Road2SoS, there appear to exist some important commonly relevant challenges, not limited to the field of systems of systems engineering. Firstly, there is the general challenge of integrating heterogeneous systems which have not necessarily been built to be interconnected. These systems may further be of different generations, posing the challenge of integrating new systems with legacy systems. Developing standards, protocols and interfaces suitable for such a scenario is not an easy task. Another issue relevant in all of our application domains is the handling of Big Data. While it is precisely the advantage of a System of Systems scenario to be able to draw information from a multitude of sources, the available and potentially relevant data easily exceeds the computing power required to analyze it. New concepts



Panel organizer Michael Henshaw (T-Area-SoS project) with the panelists (from left to right) Michael Winokur (DANSE project), Christian Albrecht (Road2SoS project), Alkis Konstantellos (DG Connect of the EC), John Fitzgerald (COMPASS project), Mo Jamshidi (T-Area-SoS project), and Armando Colombo (IMC-AESOP project), Picture: Vishal Barot

of dealing with large amounts of data are therefore required. Yet another topic relevant in all application domains is that of emergent behavior. While emergence may yield new functionality it is somewhat undesired from an engineering point of view because it means that the system of systems does behave in an initially unintended way. In this regard, the question becomes: Can we predict emergent behavior of a given system? Related to this is the question of whether and how we can model a System of Systems suitably so to be able to study its behavior realistically. Further input to the panel was provided by representatives of further EU co-financed projects in the System of Systems field. A voting involving the panel audience served to rank the

identified research challenges according to priority. Results of the voting are available in the contribution of Michael Henshaw to the current issue of the INCOSE insight magazine. The INCOSE International Symposium, being an international conference for system engineers, was an important event to achieve visibility for the field of Systems of Systems Engineering - the importance of which was nicely outlined by Dr. Alkis Konstantellos who presented the European Commission's efforts in this new field. Next year's INCOSE International Conference is going to take place in Philadelphia, PA (USA).

Website of INCOSE:

[www.incose.org](http://www.incose.org)

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## Upcoming events

### **Roadmapping Workshop on Systems of Systems in the domain of Multi-site Industrial Production**

Brussels, Belgium

September 13, 2012

Registration procedure is closed.

### **Roadmapping Workshop on Systems of Systems in the domain of Multimodal Traffic Control**

Paris, France

September 25, 2012

For more information on the event and to register, please contact Dr Meike Reimann (reimann@steinbeis-europa.de).

### **Roadmapping Workshop on Systems of Systems in the domain of Distributed Energy Generation and Smart Grids**

Paris, France

September 26, 2012

For more information on the event and to register, please contact Dr Meike Reimann (reimann@steinbeis-europa.de).

### **Roadmapping Workshop on Systems of Systems in the domain of Emergency and Crisis Management**

Madrid, Spain

October 25-26, 2012

For more information on the event and to register, please contact Dr Meike Reimann (reimann@steinbeis-europa.de).

### **EPoSS General Assembly, Annual Forum & Engagement Day 2012**

Paris, France

September 26-28, 2012

For more information on the event please refer to: <http://www.smart-systems-integration.org/public/news-events/events/eposs-annual-forum-2012>

### **ARTEMIS-Austria Conference - Future Embedded Systems Solving Societal Challenges**

Vienna, Austria

September 20-21, 2012

For more information on the event please refer to: <http://www.artemis-austria.net/index.php?id=19>

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**ARTEMIS Co-Summit 2012 - Sharing a Vision for  
ICT Innovation**  
Paris, France

October 30-31, 2012

For more information on the event please refer to:  
[http://www.artemis-ia.eu/cosummit2012\\_home](http://www.artemis-ia.eu/cosummit2012_home)

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