ROAD 2 SoS
ROADMAPS FOR SYSTEM-OF-SYSTEMS ENGINEERING

Newsletter No. 4

Editoral

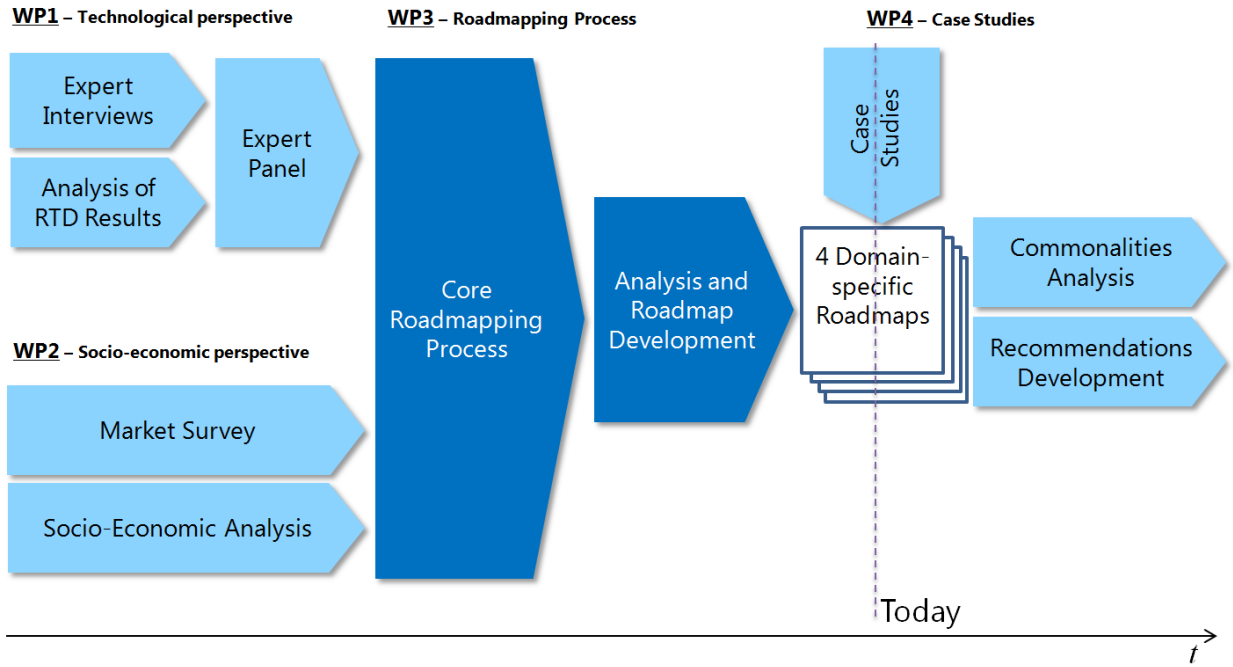
Dear Reader,

It is our pleasure to present to you the fourth issue of our Road2SoS newsletter. As you know, the main objective of the Road2SoS project is the development of research and engineering roadmaps in the field of System of Systems (SoS). In elaborating 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 expected 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.

We are now in the process of refining the developed roadmaps. Furthermore, the roadmaps are currently being analyzed for cross-cutting themes. These are aspects which can be observed in several application domains in a similar way and thus deserve special attention. Lastly, we are in the process of deriving final recommendations to the European Commission.

In the finalization process of the roadmaps, case studies are employed the first of which has just been conducted (please read further on page 3). Furthermore, to present the roadmaps to several target groups, a series of dissemination events is foreseen (please read further on page 2). In both types of events, we would appreciate your involvement.

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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Dissemination workshop series started

Road2SoS dissemination at the IfM Briefing Day, Cambridge, 21st May

Outputs from Road2SoS were presented at the Institute for Manufacturing's annual Briefing Day on 21st May. Speaking in front of an audience of over 100 industrial practitioners, Dr Simon Ford (picture on the right) introduced the concept of System of Systems to participants before going on to describe the roadmapping conducted within the multi-site industrial production domain in Road2SoS. Following the presentation, Simon Ford and Nicky Athanassopoulou fielded questions from interested companies who were positive about engaging with the project further through in-company case study workshops.

In the remaining months of the Road2SoS project, a further seven dissemination events are foreseen to present the developed SoS roadmaps in the domains of integrated multi-site industrial production, distributed energy generation and smart grids, multimodal traffic control, and emergency & crisis management to target audiences.

Further dissemination workshops

- 20th June, Universidad Complutense de Madrid (UCM), Madrid
- 21st June, Prodigy Consultores, Palma
- 3rd July, Fraunhofer-Institut für Produktionstechnik und Automatisierung (IPA), Stuttgart
- 24th October, Laboratoire d'électronique des technologies de l'information (CEA), Belfort

If you are interested in dissemination activities of the project, please feel free to contact us for further information:

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Case Studies

To test the validity of the four developed domain-specific SoS roadmaps, case studies are conducted to reflect each roadmap in the context of concrete organizational settings, to confirm the content of the roadmaps, to complement the roadmaps where necessary, and to test that the roadmaps are indeed general enough to accommodate specific cases. While it has been the purpose of earlier roadmapping workshops to capture a multitude of experts' perspectives in order to develop a valid, general roadmap, it is the purpose of such case studies to capture and examine the specific perspective of e.g. an SME, an infrastructure provider, etc. on SoS in a specific setting.

Beside the important functions the case studies fulfill in the roadmap finalization process in Road2SoS, it is expected that the case studies bring tangible benefits to the participating organizations. Among the expected benefits are early access to Road2SoS roadmaps, insight into trends and anticipated SoS-related technological developments, and the opportunity for the organization to decide on a future SoS-related strategy and to derive SoS-related innovation opportunities.

25th June 2013, Road2SoS case study at the European Institute for Energy Research (http://www.eifer.uni-karlsruhe.de/) in Karlsruhe, Germany

If a case study workshop seems interesting to you and your organization, please contact us for further information:

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Interview with Dr. Irene Lopez de Vallejo - ARTEMIS Industry

by Dolores Ordóñez (Prodigy Consultores)

What is your perception about the importance of Embedded Systems/ System of Systems within the European policies?
Taking into account that ES are the neural backbone of our current society and a key technology area in our future, my understanding is that without a clear commitment from the European Commission on keeping this area alive, our current advantage in relation to other geographical areas around the World will be lost.

Being part of ARTEMIS, could you give us some information about the Embedded Systems/SoS in Horizon2020? Are specific calls foreseen?
The merge of ARTEMIS JTI with ENIAC JTI and the ETP EPoSS in a new JTI in Horizon 2020 is highly advanced. This is a move to create new synergies, jointly mobilise resources that are now working in relative isolation and create new opportunities in the – technically – multidisciplinary field of Cyber Physical Systems. The first call is expected to open by the beginning of 2014, so be ready to witness a new mechanism that will fabricate conditions for innovation in this area, from Europe to the World.

Road2SoS is producing the roadmaps in four domains: integrated multi-site industrial production, distributed energy generation and smart grids, multi-modal traffic control, and emergency and crisis management. What do you think about this division?
It is a valid one, reflecting areas where European industry is strong, has capabilities and also respond to specific European societal challenges. I would add, as per ARTEMIS SRA, Health CHECK SRA KEY TECHNOLOGY AREAS http://www.artemis-ia.eu/about_artemisia

After analysing Embedded Systems/ SoS in the four mentioned domains, Smart Cities seems to be one of the most important application fields, what do you think?
It is indeed one of the most important for, in urban environments, all the technology domains find a complex and much needed real setting where to develop and provide solutions. Areas of high concentration of population present specific challenges of security, coordination, energy management, traffic control, social networks and structures where Embedded Systems are essential to solve.

What will be your recommendation to promote Embedded Systems/SoS?
A clear political commitment, both from the European Commission and the Member States, coupled with Large and Small and Medium Size companies' pledge to invest in this area. Without forgetting a reinforcement of adequate educational strategies, specific innovation actions focused on the wider societal implications of the technologies falling into the new JTI framework, plus a clear internationalisation strategy to link with other, similar and complementary initiatives, around the world. An example of this activity is the Working Group on developing a Global Web of Clusters jointly lead by ARTEMIS and ITEA2, an initiative that will conduct precisely the last type of activity.

Dr. Lopez de Vallejo, thank you very much for the interview.

Dr. Irene Lopez de Vallejo is a member of the Presidium of ARTEMIS Industry Association: http://www.artemis-ia.eu/member/presidium/list. She represents Research and Technology Organisations (RTOs), within the highest decision making body of the ETP representing the European Embedded Systems community. Irene has a multidisciplinary background with a clear commitment on building international research partnerships and an interest for a wide range of social implications of the latest wave of cyber physical systems. (http://www.linkedin.com/pub/dir/Irene/Lopez+de+vallejo)

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New paper from Road2SoS partners published

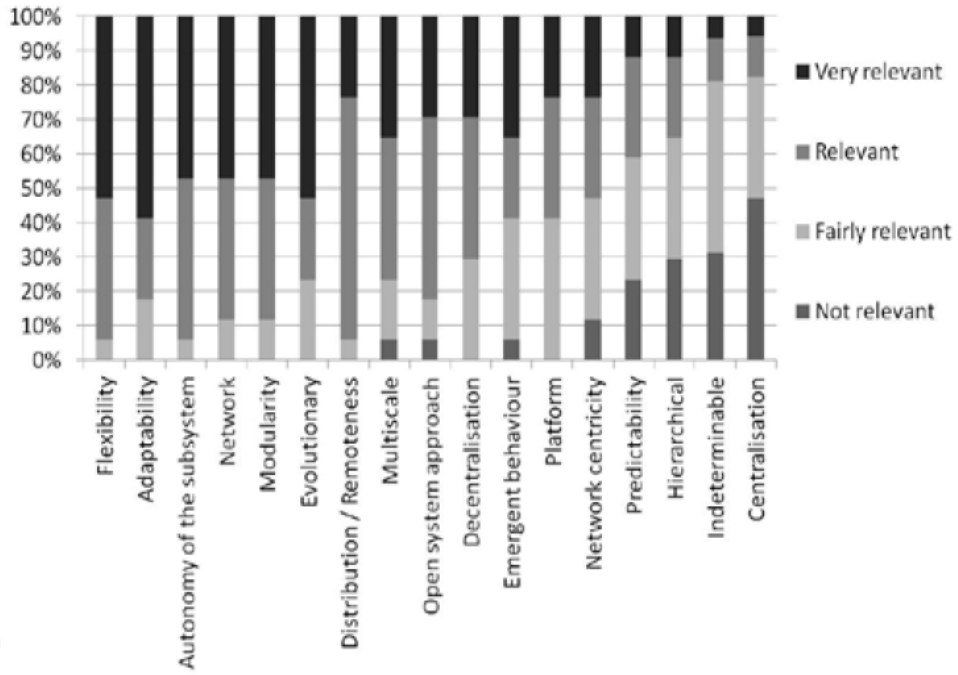
In the proceedings of IEEE 7th International Conference on System of Systems Engineering (SoSE 2012) Simon Ford (University of Cambrige), Ursula Rauschecker (Fraunhofer IPA) and Nikoletta Athanassopoulou (IfM-ECS) presented their paper "System-of-system Approaches and Challenges for Multi-Site Manufacturing".

In the multi-site manufacturing domain, systems-of-systems (SoS) are rarely called so. However, there exist a number of collaborative manufacturing paradigms which closely relate to system-of-system principles. These include distributed manufacturing, dispersed network manufacturing, virtual enterprises and cloud manufacturing/ manufacturing-as-a-service. The paper provides an overview of these terms and paradigms, exploring their characteristics, overlaps and differences. These manufacturing paradigms are then considered in relation to five key system-of-systems characteristics: autonomy, belonging, connectivity, diversity and emergence. Data collected from two surveys of academic and industry experts is presented and discussed, with key challenges and barriers to multi-site manufacturing SoS identified.

A common feature from these new [manufacturing] paradigms is the temporary nature of the collaborative manufacturing effort. Manufacturers self-organise into collaborative networks in response to customers' needs, dissolving once these needs have been satisfied. This principle behaviour ir highly equivalent to SoS characteristics.

To pool their capabilities in order to provide the necessary production capacity that a larger customer required, the membership of the network may change over time. The degree of autonomy possessed by each member leads to the emergence of collective behaviour that goes beyond the control of any single firm.

The figure shows the responses to the concepts and principles of SoS relevant to multi-site manufacturing. The most relevant concepts and principles are shows on the left of the figure, with the six most relevant judged to be: (1) flexibility, (2) adaptability, (3) autonomy of the subsystems, (4) network, (5) modularity, and (6) evolutionary.



"Main principles and concepts in multi-site manufacturing SoS *(Survey 1, n=17)*"

You can find the whole paper in the IEEE database under the following link: http://tinyurl.com/ohfk3v2

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Upcoming events

International Conference on Intelligent Networking and Collaborative Systems (INCoS)
Xi'an, China

September 9-11, 2013

For more information on the event please refer to: http://voyager.ce.fit.ac.jp/conf/incos/2013/

IEEE 11th International Symposium on Intelligent Systems and Informatics (SISY 2013)
Subotica, Serbia

September 24-26, 2013

For more information on the event please refer to: http://conf.uni-obuda.hu/sisy2013/

IREP Symposium - Bulk Power System Dynamics and Control - IX Optimization, Security and Control of the Emerging Power Grid (IREP)
Rethymnon, Crete, Greece

September 25-30, 2013

For more information on the event please refer to: http://irep2013.gr/

5th International Conference on Changeable, Agile, Reconfigurable and Virtual Production (CARV2013)
Munich, Germany

October 6-9, 2013

For more information on the event please refer to: http://www.carv-production.com/

ICT 2013 - Create, Connect, Grow (ICT 2013)
Vilnius, Lithuania

November 6-8, 2013

For more information on the event please refer to: https://ec.europa.eu/digital-agenda/en/ict-2013

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