

COMPREHENSIVE MODELLING FOR ADVANCED SYSTEMS OF SYSTEMS

Welcome to the First COMPASS Newsletter

COMPASS is an international research project in Europe and Brazil, which began in October 2011 and runs for three years. This is the first project newsletter, which describes the project background and progress to date. We'll also introduce one of the nine project partners in more detail, in the first of a *Meet the Partners* feature series.

Want to know more?

To join our mailing list, or find out more about the COMPASS Interest Group (CIG), please see our website:

www.compass-research.eu



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In this issue:

An Introduction to COMPASS	1
The First Six Months	2
Upcoming Conferences and Workshops	3
Meet the Partners: Bang & Olufsen	3
The COMPASS Interest Group	4

An Introduction to COMPASS

The **COMPASS** project partners conduct research into modelling languages and tool support for Systems-of-Systems (SoS). A SoS is a composition of constituent, self-contained systems which cooperate to achieve a common goal. Examples include the integration of healthcare services to cooperate and deal with an emergency situation, or the assembly of home entertainment and automation components such as TV, music players, radio and DVD player, which together form a "home entertainment" SoS.

SoS design is hampered by the complexity and independence of the constituent systems. COMPASS will extend the capability of architectural modelling for SoS by integrating formal techniques to deliver improved analytical power, providing a coherent and consistent set of resources to enable true model-based SoS engineering. These resources will consist of:

- **Methods:** Well-founded modelling, analysis, simulation, and test automation techniques based on architectural models with formal semantics. Established notations such as **SysML**, **VDM** and **Circus** will be used as a basis for **CML** (COMPASS Modelling Language), a new, purpose-built formal modelling language in which SoS architectures and contracts can be expressed.
- **Tools:** An open-source tools platform with prototype plug-ins for model construction and analysis, allowing users to operate with the established architectural modelling language SysML, or at the CML level, or both.
- **Process:** a set of guidelines that help organisations to realise industry best practice and state-of-the-art approaches to developing SoSs along with a set of competencies that are required to realise them.

To evaluate these outputs, we use case studies provided by industrial partners Insiel and Bang & Olufsen. For each case study, a SoS development problem is first addressed

using current best practice, and then using SysML + CML for comparison. More detail on these case studies will follow in further newsletters.

The First Six Months

COMPASS kicked off with a two-week **Convergence Workshop** in Longhirst Hall, near Newcastle upon Tyne, UK. This marked the beginning of the first of three Convergence Phases in the project, which ensure all partners have an understanding of the concepts, methods and tools being developed. The workshop included training in the so-called "Baseline technologies" **VDM**, **CSP**, and **SysML** to enable work on modelling the industrial case studies to commence.

2012 commenced with a workshop on **Systems of Systems Requirements** at Aarhus, Denmark (home of AU), and workshops on the two **Case Studies** at Aarhus (Bang & Olufsen) and Trieste (Insiel). Both workshops provided an introduction to the case study topics: from B&O, a Video/Audio/Home Automation Ecosystem, and from Insiel an Accident Response system. Work has begun on modelling these case studies using the baseline technologies.

In April in York, UK, project members were brought up to date with the **UTP** (Unifying Theories of Programming) and version 0 of **CML**, with workshops on **SoS Architectures**, **Fault Modelling** and the **RT-tester** tool for test automation.

Upcoming Conferences and Workshops

COMPASS will be represented at a number of events in 2012, including:

SoS Safety - Safety in Systems of Systems, a Safety-Critical Systems Club Seminar on June 21, London. The seminar explores the safety implications of SoS, arising from emergent behaviour and dynamic collaboration between autonomous systems.

www.safety-club.org.uk

INCOSE Symposium, July 9-12, Rome. COMPASS will participate in a panel session on *Identifying the Top Challenges for International Research in Systems of Systems Engineering*.

www.incose.org/symp2012

IEEE SoSE Conference, July 16-19, Genoa. A COMPASS invited session on *Contract-based Modelling and Analysis Technologies for Systems of Systems* will include six papers from COMPASS partners. A plenary session on *European Research in SoSE* will include COMPASS along with the three other European projects in SoS: DANSE, ROAD2SOS and T-Area-SoS.

www.sose2012.eu

FM 2012 (International Symposium on Formal Methods), August 27-31, Paris. The symposium will include the 10th **Overture** workshop and the co-located 4th International Symposium on Unifying Theories of Programming (UTP 2012), both of which will feature developments from COMPASS.

fm2012.cnam.fr

TCPS (Workshop on Trustworthy Cyber-Physical Systems), in conjunction with **CONCUR 2012**, September 3, 2012, Newcastle. The workshop aims to help develop a community of interest in the science and engineering of trustworthy cyber-physical systems, complex systems which integrate networked computing elements with electrical or mechanical components.

conferences.ncl.ac.uk/concur-2012

Meet the Partners: Bang & Olufsen

This section of the newsletter will be used to introduce the project partners, presenting a brief biography and the role played by the partner in the project. In this first newsletter, we introduce Bang & Olufsen (B&O).



B&O has been developing audio products since its foundation in

1925. It is famous world-wide for its luxury high-fidelity audio and video products. In the last couple of years B&O has also been supplying high-end sound systems for Aston Martin, Mercedes Benz and BMW.

B&O have been active in various research communities and every year hosts the B&O Summer School, where students from around the world participate in workshops with a focus on innovation. B&O have for the last five years been focusing on the audio/video experiences of many products working together, and this has led to work in distributed embedded systems.

Lasse Lorenzen is B&O's primary researcher on the COMPASS project, working on the project for the Audio-Video System Engineering R&D division. Previous to this he was the technical lead on the software platform for the latest audio product released by B&O, the BeoSound 5 Encore. Before joining B&O R&D, Lasse was working for Systematic Software Engineering on military communications software. Lasse finished his MSc on distributed real-time systems in 2009 from Aarhus University, in particular working on co-simulation between mechanical systems and software systems.



In COMPASS, B&O is looking to expand its knowledge on audio-video systems with the new emerging paradigm of Systems of Systems. B&O are working with the COMPASS project in order to be on the forefront on Systems of Systems, which is certain to play a vital role in future Audio-Video systems.

www.bang-olufsen.com

The COMPASS Interest Group

While the COMPASS project consortium will undertake the innovation and prototyping work in the project, another essential part of the project is guidance, advice and evaluation from interested external organisations. We call this the **COMPASS Interest Group (CIG)**.

The CIG has the opportunity to provide SoS Challenge Problems from their domain. These problems will help to develop and evaluate the methods and tools of COMPASS, with the results presented at CIG meetings.

CIG members currently include Roke Manor Research Ltd, Noki, GridManager, West Consulting BV, Rockwell Collins, UNU-IIST Center for Electronic Governance, 3SL, Embraer and Terma.

A strong initial set of challenge problems has been proposed by CIG members, covering a wide range of application domains. The set is currently being reviewed by project partners.

For further details and information on joining the COMPASS Interest Group, contact Steve Riddle (Steve.Riddle@ncl.ac.uk, +44 191 222 5156) or see the project website, www.compass-research.eu

Next Issue

The next issue of the COMPASS Newsletter will be published in October/November 2012.