Welcome to the fourth COMPASS newsletter.

This newsletter marks the end of the second year of COMPASS. We introduce the new COMPASS tool, provide a review of progress, recent meetings and workshops, and a look ahead to events in the final year of the project. These include the second COMPASS Interest Group workshop (January) and the Summer School (June).

**Symphony** is the new name for the COMPASS tool. The name is chosen both to indicate the lineage of the tool, from the VDM tool Overture to the co-simulation tool Crescendo, and to identify with the concept of a symphony as a coming together of diverse music from different instruments in an orchestrated “System of Systems”.

A screenshot from the new tool is shown below, illustrating the Symphony Explorer, CML editor, Outline and Problem views.

A tutorial video for the Symphony tool is available from the COMPASS website, along with several other videos illustrating debugging, theorem proving, the SysML to CML generator, Model checking, RT-Tester integration and Fault analysis.

The videos are available from [www.compass-research.eu/tool-videos.html](http://www.compass-research.eu/tool-videos.html)
Exploring the Challenge of Collaborative Modelling

One challenge for the SoS Engineering (SoSE) field is the individual ownership and development of constituent systems. With no centralized authority, decisions have to be agreed on collaboratively, between the individual owners/developers of the constituent systems.

This challenge affects the modelling of SoS, as the model may consist of a combination of multiple constituent system models. The various system integrators may not know the exact details of the other constituent systems. Constituent system owners/developers need to focus on the development and performance of their own models, but at the same time, there must be a functioning SoS that fulfills the common goal. The models therefore need to be developed collaboratively with the owners of the individual systems in order to establish the SoS.

To investigate the challenges of collaborative modelling, a study has been performed within the COMPASS project to acquire knowledge on the processes, challenges, advantages and disadvantages of collaborative modelling. The aim of the study was to help to show how the modelling of an SoS can be approached, how models can be developed collaboratively, and how models can evolve over time.

The study involves an SoS made up of different emergency services which need to cooperate in order to solve a given emergency. The various services provide and require different capabilities and types of information. A joint SoS model including each constituent service needed to be created, and the interactions and interfaces between the services/constituent systems needed to be defined.

Each university partner in the COMPASS project was assigned to act as one of the emergency services (owners of a constituent system). The study has evolved over the course of three months, where the collaborators have been working on solving both their individual service tasks and on establishing the relations and agreements between the constituent systems needed to establish the SoS model. During the course of the study, the misunderstandings, obstacles, clarifications and solutions that have appeared between the collaborators in developing the model have shown that it is both a challenging and stimulating task.

The outcomes of the study have shown that the development teams of the various constituent systems in an SoS need to work collaboratively on reaching a common agreement that ensures that a given SoS design is feasible and has the desired functionality. To accomplish this, there is a need to establish the some basic
organisational foundation with guidelines related to communication styles, decision-making and good practice on information sharing. In SoS engineering, communication is key, and having a common perception of the SoS is crucial in establishing effective communication. This common understanding can be accomplished by the use of a modelling framework, such as COMPASS.

As the study continues the focus will turn on using CML in collaborative modelling and on the tool support for incorporating aspects such as diverse owners and distributed development teams directly in the modelling framework.

**Project update: Industrial Partners**

The industrial partners are in the process of applying COMPASS technologies to their case studies. Significant results have been achieved in the field of SoS requirements engineering, SoS architectural level modelling and SoS model simulations.

In recent months there has been close collaboration between the technology developers and the case study owners, to ensure high applicability of the COMPASS technology. This co-operative development approach has improved the COMPASS tool chain maturity, and thereby the industrial deployability of COMPASS technology.

The formal methods and tools are going to be the focus for the next period for the industrial partners in COMPASS. The SysML and CML models developed in the previous phase will be extended for verification using the proof-obligation, theorem-proving and model-checker tools.

**INCOSE SoS Working Group**

This summer members of the COMPASS consortium have begun work with the International Council on Systems Engineering (INCOSE). In June 2013 COMPASS personnel travelled to Philadelphia, USA, to present the COMPASS approach to the INCOSE SoS Working Group (WG). Attendees were very interested in the preliminary findings and new techniques, and COMPASS staff will be continuing to collaborate with members of the SoS WG for the coming year.

As part of this work COMPASS is contributing towards the WG's development of an SoS framework. The framework will help to capture and disseminate information about SoS case studies and is expected to benefit engineers and researchers working in SoSE. This collaboration allows COMPASS to share some of the knowledge already gained through analysis of selected COMPASS case studies, alongside similar findings shared by a range of other expert participants in the same field, and will help to ensure that the framework fits the needs of a broad range of case studies. Working with INCOSE will allow COMPASS to access the high quality systems engineering and SoS engineering expertise available through INCOSE's Working Groups and its regular webinar events and symposiums. [www.incose.org](http://www.incose.org)

**Overture workshop**

The 11th Overture Workshop was held in Aarhus, Denmark on the 28-29th August 2013. These workshops bring together researchers interested in VDM, its community-based tool Overture, and related projects.
including COMPASS. This year's workshop involved 25 participants over the two days.

Presentation topics included the modelling of a smart grid SoS and bridging the gap between SoS and Cyber-Physical Systems (CPS) thinking. Topics relating to tools included the proof-obligation generator (POG) of the COMPASS tool, model-based testing in VDM, and improvements to Overture driven by the COMPASS project.

The workshop also hosted two invited speakers. Yves Ledru from Laboratoire d'Informatique de Grenoble (LIG) spoke of his experiences of translating SecureUML models to B and Z, a topic relevant to the link between SysML and CML in the COMPASS project. Joe Kiniry from the Technical University of Denmark (DTU) gave a personal view of open-source formal methods tools.

**COMPASS Interest Group Workshop**

The first COMPASS Interest Group workshop took place in Bristol, UK on 22 May 2013. Talks at he workshop introduced COMPASS, presented guidelines for requirements and architecture description, introduced the CML language and gave a demonstration of model-based testing. Five CIG member companies were represented (Roke Manor, Rolls Royce, Jaguar Land Rover, Altran and BAE SYSTEMS).

The next CIG workshop will be held on 15 January 2014 in Amsterdam. More details will be announced on the COMPASS website and via the twitter feed, @COMPASS_SoS.

**Upcoming events**

A workshop on *Engineering Dependable Systems of Systems (EDSoS)* will be held in Newcastle upon Tyne on 13 May 2014 in conjunction with the European Dependable Computing Conference (EDCC). The workshop will explore dependability issues in systems of systems. It aims to foster new relations between these two communities and to aid in the exchange of research ideas, results and experiences.

The call for papers is available on the website conferences.ncl.ac.uk/edsos2014, submissions are welcomed from both academia and industry.

The **COMPASS Summer School** will take place in Newcastle, UK from June 16 – 20. The summer school is aimed at PhD students and researchers in the field of System of Systems modelling, formal specification and proof. The programme will include tutorials on CML, exercises with the COMPASS tools, presentations about the case studies/challenge problems, and a common assignment for participants.

For more information, please contact Steve Riddle (Steve.Riddle@ncl.ac.uk).

**Social Networking**

You can now keep in touch with COMPASS via twitter (@COMPASS_SoS) for updates on project status, conferences and workshops.

The COMPASS Newsletter is edited by Steve Riddle. Thanks to Claus Ballegård Nielsen, Klaus Kristensen, Richard Payne, Ken Pierce, Claire Ingram and Joey Coleman for newsletter contributions.