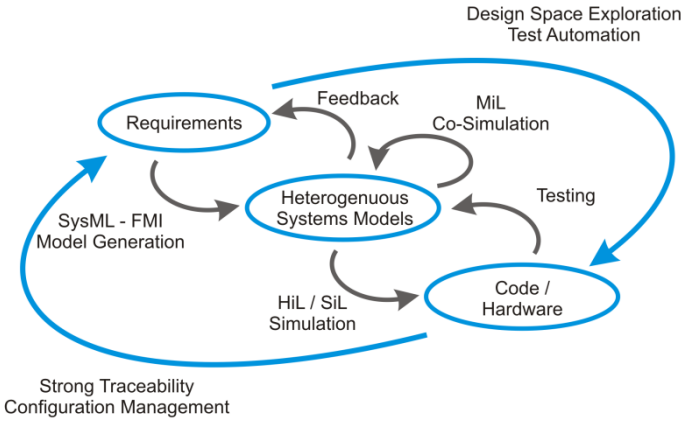
Integrated Tool Chain for Model-based Design of Cyber-Physical Systems

ABOUT INTO-CPS

The aim of the INTO-CPS project is to create an integrated "tool chain" for comprehensive Model-Based Design (MBD) of Cyber-Physical Systems (CPSs). The tool chain will support the multidisciplinary, collaborative modelling of CPSs from requirements through design, down to realisation in hardware and software. This will enable traceability at all stages of the development.

INTO-CPS will support the holistic modelling of CPSs, allowing system models to be built and analysed that would otherwise not be possible using stand-alone tools. We will integrate existing industry-strength tools with high Technology Readiness Levels (TRL 6–9) in their application domains based centrally around Functional Mockup Interface (FMI) compatible co-simulation. The project focuses on the pragmatic integration of these tools, making extensions in areas where a need has been recognised. The tool chain will be underpinned by well-founded semantic foundations that ensure that the results of analysis can be trusted.

The tool chain will provide powerful analysis techniques for CPSs, including connection to SysML; generation and static checking of FMI interfaces; model checking; Hardware-in-the-Loop (HiL) and Software-in-the-Loop (SiL) simulation, supported by code generation. The tool chain will allow for both Test Automation (TA) and Design Space Exploration (DSE) of CPSs. The INTO-CPS technologies will be accompanied by a comprehensive set of method guidelines that describe how to adopt the INTO-CPS approach, lowering entry barriers for CPS development.



Contract number:
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Project coordinator:
Aarhus University, DK

Contact person:
Prof. Peter Gorm Larsen
Department of Engineering
Aarhus University
Denmark
Finlandsgade 22
DK-8200 Aarhus
pgl@eng.au.dk

Project website:
http://into-cps.au.dk/

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8 million EURO

Project start date:
01-01-2015

Duration:
36 Months

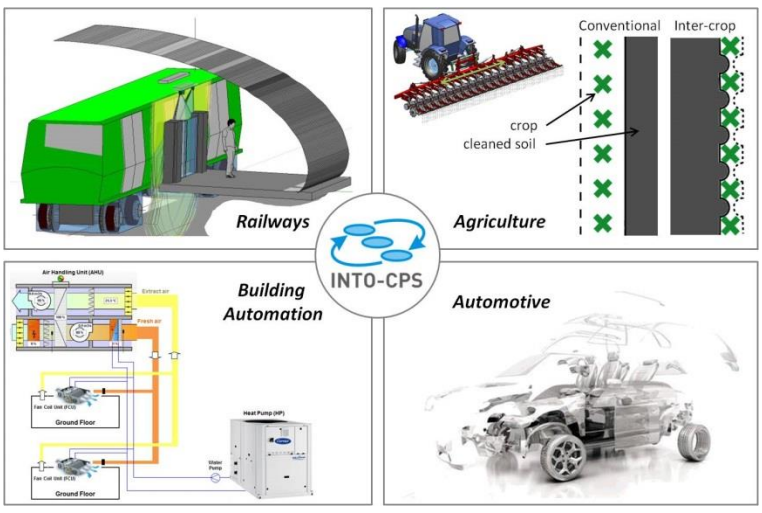
Programme:
H2020-ICT-2014-1

CASE STUDIES

To ensure that the INTO-CPS technology is applicable to as wide a number of value chains as possible, the four case studies have been selected from four distinct domains: railways, agriculture, building automation and automotive. Even if the target products of these case studies have been designed and developed previously, they are all different by nature with different technical objectives (operating metro doors without injuring people, ensuring an efficient seeding, running reliable air-cooling facilities, reducing energy consumption and emissions).

The focus in the execution of the case studies will be the evaluation of the INTO-CPS technology. The actual case studies that have been chosen and their innovative CPS angle:

- **Railways**: There is a drive to introduce automatic trains on existing metro infrastructure and a key part of this is the addition of screen doors on the existing metro platforms. This case study will develop a CPS with a controller for just such a system with safety-critical screen doors.
- **Agriculture**: This case study will develop a CPS to ensure a high-efficiency automated weed control system called an automated tilling system. This will be mounted on the rear of a semi/fully automated tractor.
- **Building Automation**: This case study will develop a CPS supporting Heating, Ventilation and Air-Conditioning (HVAC) in a building. Typically, such a system will aim to keep the building climate within a specified range by tuning and controlling heat and total air ventilation.
- **Automotive**: As fossil fuel reserves are running low, economical concepts such as all electric and hybrid cars will become major factors in future transport. This case study will develop a CPS supporting intelligent mobility assistance for electric and hybrid electric vehicles to help with their adoption by vehicle owners, thereby encouraging adoption of fuel saving strategies.



Project partners
Aarhus University (DK)
Newcastle University (UK)
University of York (UK)
Linköping University (SE)
Verified Systems International (DE)
Controllab Products (NL)
ClearSy (F)
TWT GmbH - Science & Innovation (DE)
Agro Intelligence (DK)
United Technologies (UK)
Softeam (F)

Key features

- Well-founded tool chain for multidisciplinary model-based design of CPS that covers the full development life cycle of CPS.
- Practical methods in the form of guidelines and patterns that support the tool chain.
- Demonstration of the effectiveness of the methods and tools in a variety of application domains in an industrial setting.