About the Project

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The Internet-of-things (IoT) has the potential to improve our lives dramatically. The backbone of industry automation, smarter homes, higher energy efficiency, better health care, assistance of elderly people and more flexibility in working environments are only some areas that can be imagined today and realized tomorrow. The tremendous impact of IoT on our work environments and our private life is a key reason to consider IoT research and developments as important pillars in the European Horizon 2020 and the German Industry 4.0 strategy as its importance and economic impact is expected to grow dramatically for the next decade.

IoT devices with sensors and actuators need electronics to connect that world of "things" with the digital world of the Internet. Yet software runs the IoT electronic hardware. Since IoT devices need to be smart, cheap and capable to run with extremely small amounts of energy – known as ultra-thin IoT nodes – IoT software must also be ultra-thin with extremely small memory footprints and ultra-low energy support. At the same time, software must provide smart functions including real-time computing capabilities, connectivity, security, safety, and remote update mechanisms. These constraints put a high pressure on IoT software development. Due to the very limited resources provided by IoT nodes, today's commonly used design approach to trade-off development time with software efficiency is not competitive any longer. Therefore, an industry-wide effort is needed to provide measures for fast and efficient IoT software development.

The main goal of the COMPACT project is to provide novel solutions for the application-specific and customer-oriented realization of ultra-small IoT nodes with focus on software generation for IoT nodes with ultra-small memory footprints and ultra-low power consumption. This will have an impact for all companies along the IoT value chain, starting from the semiconductor companies providing the IoT hardware platform including low-level software pieces, over middleware providers for operating systems and communication stacks, and tool developers ending at product makers that finally build the IoT applications and the IoT operators.

To obtain this goal, COMPACT will create important technological innovations to automate the software development and configuration flow for ultra-constrained IoT nodes. As such, it can be seen as carefully developed software construction robots that will be developed in this project. The automation methodology follows the OMG notion of model-driven architecture (MDA) and applies it to the development of IoT node software. Due to the main principles of MDA, COMPACT will follow a scalable approach using carefully designed meta-models and generators for auto generating the required software as its key concept. In detail, the MDA-based flow and tool chain will be enabled by

1. the new IoT Platform Modelling Language (IoT-PML) that captures both the IoT node hardware, software stack, functional and non-functional requirements, as well as node configurability and IoT scenarios. Its main focus is to drive software generators for ultra-thin IoT software that consists only of what is required for smart functionality and nothing else. Additional efforts to bring the IoT-PML into standardization will make sure that the results are quickly transferred into industrial practise and widely accepted.
2. highly efficient analysis and optimization methods that will help to evaluate the generated code and its non-functional properties such as memory footprint, safety, security, timing, and power.
3. a reference IoT tooling framework with advanced features such as requirement management and human readable interfaces to the IoT-PML
4. the application of the COMPACT methodology by various use cases and demonstrators from the IoT domain.

The benefits are obvious: The approach proposed by the COMPACT project will make the development of IoT software, and thus of IoT devices, much shorter and more efficient. It will support products being just in time on the market at a highly competitive price with increased reliability and stability. The meta-model based approach and the carefully designed IoT-PML both support the interchange of models along the complete IoT value chain. This will strengthen the competitiveness of European industries impacted by IoT, like industry automations, automotive industry, energy infrastructure industry, and health care industry. A higher IoT product variability and safety as well as security through continuously updated software are further benefits enabled.

The chances to realize this potential are excellent due to the European cooperation between different actors along the IoT value chain and due to the MDA based approach which has been proven as highly efficient in many applications and which is successfully used by all project partners in other areas.

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