Modelling Framework for In-Node Processing in Industrial Sensor and Actuator Networks

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Abstract: Architecting efficient systems with on-board sensing capabilities with a growing number of sensing devices is a challenging task, in particular because of the range of the technological field, as well as the diversity and complexity of requirements. We present a novel modeling framework, which can describe different implementation strategies for computation of data locally. In this framework, we first describe the systems in Architecture Analysis and Design Language (AADL), following which the described system is exported to XML which is then given input to java based software program. This program automatically generates different implementation options, illustrates different parameters such as processing energy, communication energy, latency and design complexity. To show a proof-of-concept, we have modelled a real-life system in a modelling framework, which shows that the framework can be of use in automated design space and architecture exploration for in-node processing.

Modelling framework

For design space exploration, we employ a framework (Fig. 1) which investigates the in-node processing for IWSAN. AADL captures the system's functionality (Fig. 2), which is then exported to XML. The design framework is read in a Java software program. During the modelling process we implement different strategies for computation of data locally, exploring the parameters that are involved in communication and processing of the system. The above study helps us select energy efficient and high performance architecture for in-node processing. For proof of concept, an efficient model can be implemented in AADL, and in AADL we are able to estimate different parameters such as power, latency and data rate. The selected architecture of the system will then be tested on a hardware platform like FPGA.
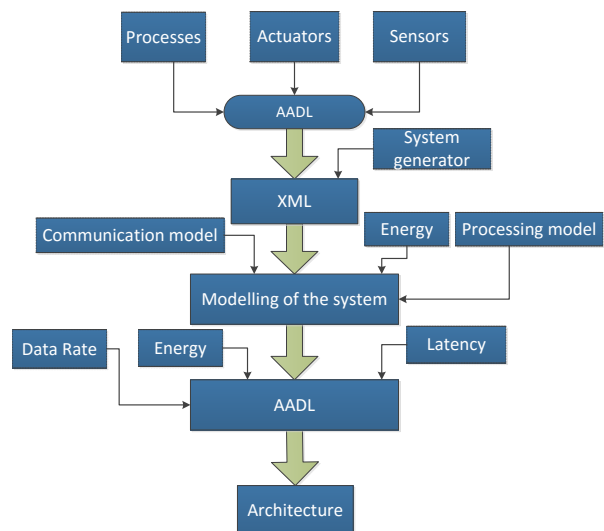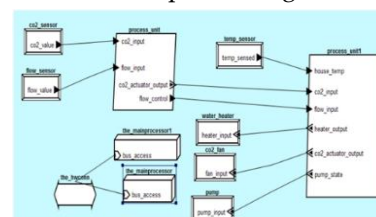

Figure 1: Framework for quantitative design space exploration of in-node processing in IWSAN.

Figure 2: AADL implementation