1.2.13 Using Workflows as Programming Abstraction for Wireless Sensor and Actor Network Applications

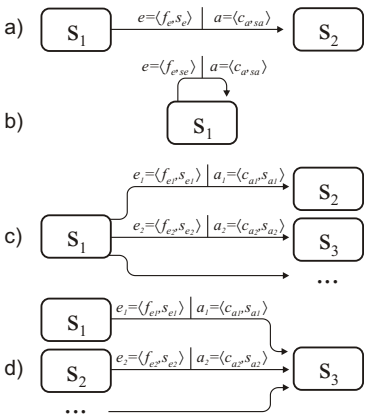
Keywords:
programming abstractions
workflow
event detection
in-network actuation

Pablo Guerrero
Technische Universität Darmstadt, Germany[a]
Webpage: `http://www.dvs.tu-darmstadt.de/staff/guerrero`
E-mail: `guerrero@dvs.tu-darmstadt.de`
Supported by the DFG Graduiertenkolleg 492, *"Enabling Technologies for Electronic Commerce"*.

[a] 64283 Darmstadt, Germany

As initial challenges of Wireless Sensor and Actor Networks (WSANs) are overcome, their application possibilities evolve. There is general consensus that the existing node-level programming languages do not provide adequate abstractions to implement user applications. Different middleware approaches have been proposed to alleviate the development effort. These *macroprogramming* languages, however, mainly focus on data extraction and not on in-network actuation.

In [1], we have proposed the usage of *workflows* as a means to define the logic that orchestrates the network activity. With this abstraction, the loop of event-sensing, decision and acting can be closed, leading to a reduced need for unnecessary, slow and error-prone human intervention in the process. In this way, the whole WSAN loop can be shifted to the network. Intuitively, this approach presents a number of benefits, namely: a) faster reaction to the event, as the decision is taken closer to the point of interest; b) enhanced reliability, due to the smaller chance of losing messages in the loop sequence; and c) energy savings (i.e. extended network lifetime) for the reduced amount of messages exchanged between event sources, sinks and actuation nodes.



These benefits, however, don't come for free. For this purpose, an infrastructure must be devised which senses and generates the data that causes the state transitions in such workflow and executes its associated actions. We have already identified a minimal set of operator to compose workflows (see figure) and provided a simple execution algorithm in [1]. Our focus is now placed in defining an in-network event detection mechanism exploiting the hierarchically structure of a scoped sensor network [2]. We believe that this abstraction is of practical relevance to the WSAN practitioners while still holding promise to an in-network operation.

[1] Pablo Guerrero, Daniel Jacobi, and Alejandro Buchmann. Workflow Support for Wireless Sensor and Actor Networks. In *4th International Workshop on Data Management for Sensor Networks*, Vienna, Austria, September 2007.

[2] Jan Steffan, Ludger Fiege, Mariano Cilia, and Alejandro Buchmann. Scoping in Wireless Sensor Networks. In Nitya Narasimhan and Paddy Nixon, editors, *2nd International Workshop on Middleware for Pervasive and Ad-Hoc Computing (MPAC'04)*, Toronto, Canada, October 2004. ACM.