Distribution of Components in Event-Driven Sensor Networks

Bc. Miroslav Hájek

Faculty of Informatics and Information Technologies
Slovak University of Technology in Bratislava

October 6, 2022

Project objective

The sensors are widely used in enviroment monitoring be it in scientific instruments, factories, logistics or inside modern households. Their purpose is not only to capture the perceived conditions, but also to process them into meaningful events and sustain themselves in remote locations. These events are supposed to be delivered wherever they are needed which is provided by appropriate messaging pattern in the network. In the majority of control systems actuators act upon the events, messages are logged and visualized for the further analysis.

The architecture of these networks and tasks of hardware devices within them have to be devised in such a way as to the best utilization of resources on the each step in the chain. Nodes are varied in their core responsibilities and in their computing power, but not every component of the system is fixed in place. Depending on the circumstances and the specific application it is better to distribute the components towards the edge of the network or in other cases more centralized approach is in order.

We will focus on the microscopic and on the macroscopic overview of the chosen intranet intelligent building control subsystem and its decomposition onto the distributed infrastructure of the sensor-actuator network. The subsystem to be disected will be either energy efficient lighting or HVAC.

The major event-driven messaging architectures (e.g. bus, broker, n-layers) and deployment of components there in will be compared in accordance with the layout of components divided amongst nodes (e.g. sensor, actuator, gateway, monitoring, storage, operator station). The expected results should contain basic primer on designing simple control system based on the sensor network. The comparison will consist of various views in UML of the prominent messaging architectural styles and allotment of the components onto the nodes.

References

1. CRISTEA, Valentin; POP, Florin; DOBRE, Ciprian; COSTAN, Alexandru. Distributed Architectures for Event-Based Systems. In: *Reasoning in Event-Based Distributed Systems* [online]. Berlin, Heidelberg: Springer, 2011, pp. 11–45 [visited on 2022-09-23]. Studies in Computational Intelligence. ISBN 978-3-642-19724-6. Available from DOI: 10.1007/978-3-642-19724-6_2.
2. ZHOU, Guangming. Architecture research of distributed intelligent computer system. In: *2013 2nd International Symposium on Instrumentation and Measurement, Sensor Network and Automation (IMSNA)*. 2013, pp. 591–594. Available from DOI: 10.1109/IMSNA.2013.6743346.
3. WEN, John T.; MISHRA, Sandipan (eds.). *Intelligent Building Control Systems* [online]. Cham: Springer International Publishing, 2018 [visited on 2022-10-03]. Advances in Industrial Control. ISBN 978-3-319-68461-1 978-3-319-68462-8. Available from DOI: 10.1007/978-3-319-68462-8.
4. TRAGOS, Elias Z.; FOTI, Magda; SURLIGAS, Manolis; LAMBROPOULOS, George; POURNARAS, Stelios; PAPADAKIS, Stefanos; ANGELAKIS, Vangelis. An IoT based intelligent building management system for ambient assisted living. In: *2015 IEEE International Conference on Communication Workshop (ICCW)*. 2015, pp. 246–252. Available from DOI: 10.1109/ICCW.2015.7247186. ISSN: 2164-7038.
5. VERMA, Anurag; PRAKASH, Surya; SRIVASTAVA, Vishal; KUMAR, Anuj; MUKHOPADHYAY, Subhas Chandra. Sensing, Controlling, and IoT Infrastructure in Smart Building: A Review. *IEEE Sensors Journal*. 2019, vol. 19, no. 20, pp. 9036–9046. ISSN 1558-1748. Available from DOI: 10.1109/JSEN.2019.2922409.
6. KHANNA, Anirudh; ARORA, Shivam; CHHABRA, Anshuman; BHARDWAJ, Kartik Krishna; SHARMA, Deepak Kumar. IoT Architecture for Preventive Energy Conservation of Smart Buildings. In: *Energy Conservation for IoT Devices : Concepts, Paradigms and Solutions* [online]. Springer, 2019, pp. 179–208 [visited on 2022-10-03]. ISBN 978-981-13-7399-2. Available from DOI: 10.1007/978-981-13-7399-2_8.
7. FARIAS, Claudio; PIRMEZ, Luci; DELICATO, Flávia C.; SOARES, Henrique; SANTOS, Igor L. dos; CARMO, Luiz F.R.C. A Control and Decision System for Smart Buildings. In: *2013 IEEE 10th International Conference on Ubiquitous Intelligence and Computing and 2013 IEEE 10th International Conference on Autonomic and Trusted Computing*. 2013, pp. 254–261. Available from DOI: 10.1109/UIC-ATC.2013.108.