PADME – Process Automation for Discrete Manufacturing Excellence

Applicability Study of CPAS for Discrete Manufacturing Applications

Mohammad Ashjaei, Mälardalen University

As part of the PADME project, Mälardalen University started a study to investigate applicability of CPAS solutions for various types of manufacturing. In order to do so, a master thesis is defined. Three main activities have been done in the thesis as follows:

First, the solutions that are proposed by PADME are evaluated based on different components in the solutions. The evaluation is needed in order to compare and study the usability of solutions in different domains. Among the main components, communication between and within the infrastructure, performance, reliability, security and portability aspects are evaluated.

In the second activity, state of the art and state of the practice are reviewed to better understand the existing solutions for digitalization of discrete manufacturing. The main ongoing projects are RoboEarth[1], McCormick research[2], TEMBOO[3], and KUKA[4]. The comparison between the above ongoing projects and the solutions by PADME shows that most of the proposed architectures have similar components. The obvious similarity is the usage of ROS (Robot Operating System) which is flexible and easy to use, but open source. However, PADME solutions are not based on ROS. The study also shows that there are commercial off the shelf tools and devices which can build the architectures with reasonably good performance, while there are other aspects of that missing, e.g., security, adaptability, and privacy of data. In general, most of the proposed architectures have the same communication methods, such as OPC UA, while some are using TCP/IP communication. The advantage of OPC UA, which PADME solutions are using, is the unified communication protocol with security aspects integrated into it.

The third activity focuses on applicability study of PADME solutions on other manufacturing domains. Although the solutions are proposed in the context of ABB Robotics, within this study we have visited another manufacturing company, GKN Driveline, to investigate what are the limitations preventing the use of the PADME solution. Moreover, the study included giving hints and guidelines to how to adapt the solution to be able to use it in such a different domain. The study concludes that the PADME solution is modular and can be adapted for the other manufacturing domain, while it needs few changes. In particular, the PADME solution is based on ABB 800xA SCADA system, thus any other manufacturing company requires to adopt the system. Moreover, the equipment should be supplied by high-resolution sensors and the communication to outside via OPC UA.

To sum up, the PADME solutions have similarities to other proposed architectures. Note that some of the solutions are based on cloud computing paradigm, whereas the solutions proposed in PADME have ability of connection to cloud but not implemented in this phase. This is due to not fully advancement of cloud computing in the manufacturing domain. The next phase for PADME would be to investigate development of cloud computing to further use of the advantages of vast amount of computing resources. The details of the activities are in the attached thesis.

---

[1] http://roboearth.ethz.ch/
[2] http://ampl.mech.northwestern.edu/research/current-research/cps-oscm.html
[3] https://temboo.com/
[4] https://www.kuka.com/en-se/products/production-systems