

Integration of industrial IoT architectures for dynamic scheduling

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Abstract: Technology advancement in smart sensors, cloud computing, and decision support systems is pressuring the industry to adopt more flexible data-based solutions. One of the areas that can benefit from this progress is dynamic scheduling, which can improve production efficiency by tracking resource availability, job changes, and user commands. Challenges include setting triggers through the simultaneous integration of information from cloud-based enterprise databases and operational sources in the Industrial Internet of Things (IIoT). This paper proposes an integrated Information Technology - Operational Technology solution to support dynamic scheduling and rescheduling operations in a personalized production environment. It presents an implementation to a real-world application: an analytical quality control laboratory in the pharmaceutical industry. The resulting integration of intelligent sensors and business events in a fog computing architecture allows the generation of rescheduling triggers to specific online events. This paper focus on the definition of the online events affecting the operations and the cloud-fog-edge IIoT architecture used to support the implementation, and on the rescheduling triggers. The optimized reschedule of the use case shows that moving the computation closer to the cloud improves the CPU run time for larger instances. However, the combined CPU run time with the data exchange and querying introduces a non-negligible communication delay for smaller instances. In situations where fast scheduling solutions are required, fog computing near the edge is the best approach. On the other hand, for larger-size instances, moving the computation closer to the cloud is the recommended approach.

Keywords: Industrial IoT; Fog Computing; Cyber-Physical Production Systems; Dynamic Scheduling; Real-Time Rescheduling