Coupling ERP systems with shop-floor web service enabled devices

Oliver Baecker[2], Dominique Guinard[2], Stamatis Karnouskos[1], Moritz Koehler[2], Domnic Savio[1], Luciana Moreira Sá de Souza[1], Patrik Spiess[1] and Vlad Trifa[2]

[1] SAP Research, Vincenz-Priessnitz-Strasse 1, D-76131, Karlsruhe, Germany
[2] SAP Research Switzerland, Kreuzplatz 20, Zürich CH-8008, Switzerland
{oliver.baecker, dominique.guinard, stamatis.karnouskos, mo.koehler, domnic.savio, luciana.moreira.sa.de.souza, patrik.spiess, mihai.vlad.trifa}@sap.com

Abstract. We are moving towards the Internet of Things where millions of networked such devices are interconnected, and provide their functionality as a service and seamlessly integrate in modern enterprise environments. The demo presented shows how web service-enabled devices and their services can be dynamically discovered, and integrated in business applications.

Keywords: Devices profile for web services (DPWS), ERP, SunSPOT, SAP xMII, Enterprise Applications, Web Services

1 Demonstration

Future manufacturing environments are expected to be populated with heterogeneous networked devices that can offer their functionality as a service and also consume other services, creating effectively mash-up factories. Today most of them hold proprietary communication interfaces, however with the increasing computing capabilities that will be available, their (even proprietary) functionality can be wrapped and integrated in modern service oriented environments. This will offer a tighter cooperation between shop-floor and enterprise layer, eventually drastically limiting integration gaps and error-proneness of shop-floor data due to media breaks. As we demonstrate the increased information granularity allows for more flexible and accurate enterprise services, increasing proactiveness and performance of the enterprise.

Figure 1 - Enterprise View of the shop-floor

Our prototype demonstrates the DPWS-based integration of shop-floor devices amongst each other and with enterprise systems. The combination of independent device-level DPWS services enables the composition of higher-level services and offers this functionality to top-floor applications (depicted in Figure 1). Our prototype consists of two DPWS devices on the shop-floor, which are integrated via the SAP xMII solution to SAP enterprise systems that allow controlling the devices from the top-floor. These two devices are:

- A DPWS-enabled robotic clamp which offers the services e.g. getInfo, start, stop, failure etc
- A SunSPOT wireless sensor node that is attached to the robot clamp and senses the environmental conditions of the clamp like the current temperature.
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Figure 2 – Integration of Enterprise, Middleware and Device layers

As depicted in Figure 2, the described atomic services offered by the two devices are combined in a manufacturing process running on the middleware layer, which in turn interfaces with xMII that enables the modeling of business rules at run time. The middleware layer offers a mid-level business view on the services provided by shop-floor devices. Within xMII the application logic is modeled as business rules and corresponding service invocations to enterprise systems are triggered. Finally the manager can be informed via a dynamic web interface integrated with GoogleMaps about the status of all factories and their potential problems. In parallel, via the

connection to the ERP system, combined data showing the effect of errors in the shop floor on the customer orders is depicted in real-time.

Figure 3 – The demonstrator testbed

Figure 3 depicts our demonstrator testbed. One can clearly see the two visual interfaces in the two monitors i.e. xMII on the left and dynamic web based GUI on the right. The robotic clamp, the alarm, as well as the Programmable Logic Controler (PLC) are connected via IP over Ethernet to eachother. The SunSPOT sensor is connected wirelessly via IEEE 802.15.4 with a base station attached to the USB port of the computer.

The main goal of our demonstration is to show:

- DPWS-based integration
- High level composite services
- Enterprise control via web services
- Business process monitoring
- Cross-layer alerts
- Enterprise visualization
- Automatic workflow for alert resolution
- Timely information dissemination and visibility
- Better customer relationship management

This demo has been implemented as part of the ongoing work within the European Commission IST FP6 project SOCRADES (www.socrades.eu). Further info on the architecture, motivation and rationale behind this demo can be found in [1].

References

1. Luciana Moreira Sa de Souza, Patrik Spiess, Moritz Koehler, Dominique Guinard, Stamatis Karnouskos, and Domnic Savio, "SOCRADES: A Web Service based Shop Floor Integration Infrastructure" , Internet of Things 2008 Conference, March 26-28, 2008, Zurich, Switzerland.