Mashing Up Manufacturing
Thanks to Java SOAs...

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4000
Agenda

Motivation

Architecture & Prototype

Wrap Up
Motivation

> The manufacturing industry is facing a number of challenges:
  – Mass customization, last-minute changes
  – Cross-organizations processes
  – ... in a very heterogeneous world.

> Need for increased flexibility and agility in the manufacturing process:
  – Enable dynamic reconfiguration and composition
  – Enable shop-floor events to be integrated to top-floor enterprise applications (e.g. ERP, etc.)
Trends in Manufacturing

Agile Manufacturing + Smart Objects + Service Oriented Architectures = Future Manufacturing
SOA- Ready Device Integration in Enterprise Systems

> The aim is to develop a cross-layer infrastructure composed of web service enabled devices (SOA-ready) strongly coupled with enterprise applications.
> Mashing-up manufacturing.
> The project brings together leading competitors in the automation area.
> SAP’s contribution is in the enterprise integration.
Video
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Device Layer: Device Profile for Web Services

> Based on DPWS:
  - Open standard for providing (Big) Web Services at device level.
  - Minimal set of standards.
  - Small footprint.
  - Similarities with UPnP but based on WS standards.
  - DPWS = WS + Discovery + Service Description + Security and focus on Eventing.

> Goal: Embedding DPWS in devices and even « in silicon »:
  - Schneider Electric, ABB, ARM

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Devices Profile for Web Services (DPWS) protocol stack
DPWS: continuing

> Initial open standard:
  - Standardization driven by several actors (Microsoft, Intel, Lexmark, etc.)

> The DPWS stack is implemented in Windows Vista

> Various implementations:
  - [http://ws4d.e-technik.uni-rostock.de/](http://ws4d.e-technik.uni-rostock.de/), opensource, C, Java, Java ME driven by University of Rostock, Dortmund and MATERNA.
  - Forge on: [https://forge soa4d.org/](https://forge soa4d.org/)
Using DPWS in the SOCRADIES Prototype

Robotic Gripper (Model)

Programmable Logic Controller (PLC)

SunSPOTs = Wireless Sensor Nodes
SAP Manufacturing Integration and Intelligence

> SAP MII is a visualization and composition software tailored to manufacturing:
  - Reads datasources (DB, MES, etc.).

> In the current version of the SOCRADES middleware it is extended and used as a:
  - As UI to visualize shop-floor data.
  - As a mashup editor.
Using MII in the SOCRADES Prototype

Business Rule Engine

If(OverheatingAlert) then
  stopProduction()
  triggerMaintenance()
  rescheduleProduction()
  informAccountManager()
ENTERPRISE APPLICATIONS

SAP MII

**Visualization Services**
- Applets
- Display Controls
- Displays
- GUI Widgets

**SAP Connectivity**
- SAP Transaction Access

**SAP Protocols**

**Web Services**

**Business Logic Services**
- Business Process Monitoring
- Alert

**Web Services**

**Legacy Connector**

**Data Services**

**SOCRADES MIDDLEWARE APP SERVICES**
- Invoker
- Asynchronous Buffer
- Eventing
- Notification Broker
- (Event) Pull Point

**Cross-layer Service Catalogue**

**Composed Services Runtime**

**DPWS Back-end Services**

**Web Services**

**Business Process Monitoring**

**Service Discovery**

**Service Mapper**

**Service Repository**

**Gateway**

**OPC UA over DPWS**

**Web Services**

**SAP MII**

**HTML-GUI Applets**

**SAP Protocols**

**Web Services**

**Shop floor standard**

**Hardware Vendor Implementation**

**Proprietary Protocol**

**OPC UA over DPWS**

**OPC UA over DPWS**

**DEVICE LAYER**
The SOCRADES Middleware

> The SOCRADES middleware is the bridging technology:
  - Connects the shop-floor to the top-floor and vice-versa.
  - Supports dynamic environments.
**Brokered Access to Devices & Discovery**

> Brokered Access to Devices:
>  - Creates an *intermediate* party in the communication.
>  - Asynchronous invocations and deferred invocations.

> Service Discovery and Monitor
>  - Enables *dynamic* environments.
>  - **Dynamic** and *static* information about devices « available » in the system.

> Service Lifecycle Management
>  - Maps service types to devices.
>  - Enables service *injection.*
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Wrap-up and Future Work

> SOCRADES is a Webservice based Service Oriented Architecture:
>   – Which supports the connectivity of Smart Devices (i.e. machines on shop-floor) to high-level backend systems (e.g. ERP).

> Approach motivated by:
>   – Emerging importance of Enterprise Service Oriented Architecture
>   – Emerging importance of Smart Objects
>   – Changes towards agile manufacturing.

> Our contributions are in:
>   – Proposing a concrete architecture realizing the requirements.
>   – A first (minimal) implementation of the SOCRADES architecture.

> We are currently working on a full implementation of the middleware components (expected by September 2008).