Summary
The Future Factory Initiative (FFI) is a joint effort of SAP Research and external partner organizations. The FFI is active in the following three areas: Living Lab, Real-World Manufacturing Testbed and Center of Excellence.

Author: SAP Research
Company: SAP AG
Created on: 15 September 2007
The Future Factory Initiative

The Future Factory Initiative (FFI) is a joint effort of SAP Research and external partner organizations. The FFI is active in the following three areas:

**Living Lab**: The FFI Living Lab is a set of innovative demonstrators showing the potential of real-world integrated business processes in the manufacturing domain. Currently six demonstrators are available covering the whole product value chain including supply chain, warehouse, production, sales and maintenance processes. The FFI Living lab is hosted at the CEC Dresden and has been shown as “Future Factory” at various occasions including CeBIT 2007 and the “Symposium des Feldafinger Kreis 2007”. The next stop of the Future Factory tour will be DKOM 2007, Karlsruhe, Germany.

**Real-World Manufacturing Testbed**: Besides demonstrating the potential of real-world awareness the FFI also aims at gaining experience with the deployment and use of leading-edge software and hardware in a practical, real-world environment. Therefore, the FFI is in the process of setting up a real-world distributed manufacturing environment. The main production site will be the DFKI Smart Factory in Kaiserslautern. A supplier will be located in the model factory of the Fraunhofer IAO in Stuttgart. The backend enterprise software will be hosted at the SAP Research CEC Dresden.

**Center of Excellence**: Finally the FFI will also serve as a Center of Excellence for its members. The goal here is to exchange information and experiences as well as to define new challenging projects.

Towards Adaptive Manufacturing

Making manufacturing enterprises more adaptive is the primary motivation behind the new initiative. This becomes necessary due to the new challenges manufacturing enterprises are facing. Considering the continuously increasing pressure on production costs, the rapidly changing markets and customer-individual products the two key differentiators speed and flexibility are significantly gaining importance. Time-to-market for new products is decreasing, customers expect shorter order-to-delivery cycle times, and more and more products are created based on a make-to-order or even engineer-to-order approach, often with lot sizes as small as 1 while at the same time the complexity and variety of products increase. This forces manufacturers to be highly adaptive with regard to the product mix they support, the production processes they perform as well as the order volume they need to handle.

Supporting Future Manufacturing Operations

In a series of SAP-internal and collaborative projects, SAP Research and its partners look at different aspects of how to better support manufacturing operations in the future. A selection of these ideas is presented here.

Integrating & Visualizing in Real-time

Today, production orders generated in the ERP are often printed out on paper and passed on to the shop floor. Status information and production confirmations frequently are only returned at the end of the shift or even work week. This lack of integration hinders flexibility and reduces the ability of the enterprise to adapt to an ever changing situation. Current MES (Manufacturing Execution Systems) address this problem but lack a true integration with the ERP system. Often conflicting information exist in the master data held by the ERP and MES and processes are not synchronized. In an internal project SAP Research explores ways to bridge this gap with the vision of keeping the ERP synchronized with the reality on the shop floor in near real-time.
Core challenges are to reduce data redundancy and conflicting information while preserving the performance and reliability of plant-local production control systems.
SAP Research works on UI and portal techniques that can help to increase process visibility and allow the foreman, production supervisor, or plant manager to monitor production and quickly react to exceptional situations.
Considering the particular challenges of the manufacturing domain, the shop floor integration project focuses on the three dimensions performance, extensibility, and usability.

**Facilitating the Picking Process using RFID**

MICA (Multimodal Interaction in context-adaptive Systems) is a joint project between the Fraunhofer Gesellschaft and SAP Research. MICA explores new natural in- and output modalities for human computer interaction. Depending on the context and the environment the system should provide unobtrusive support for users in their tasks – ideally without being noticed by the user. The first MICA prototype realizes a warehouse-scenario where trained and untrained workers get hands-free support while picking goods. The MICA application automatically detects situations, where help is necessary and provides immediate, context aware support without disrupting the user while performing the task. MICA enables parallel picking of orders and detects errors in real time using RFID and WLAN location technology. Besides the reduction of picking errors MICA shortens the time necessary to locate a particular item in the warehouse. MICA also provides context aware user interaction, e.g. when the worker is away from the trolley where the display is mounted MICA switches to speech based interaction using the headset the worker is wearing.

**Predicting and Handling Failures**

A major problem for manufacturing companies is the maintenance of their cost-intensive, production-critical assets, such as machines, tools, and equipment. These assets constantly suffer from aging and wear, which often lead to functional loss and breakdown of machines, and ultimately, complete standstill of production with costly consequences. One promising approach is to anticipate and address the problems before they occur. So far, several predictive solutions are already available for certain machines or equipment. In a joint project between SAP Research and the Dresden University of Technology, Germany, researchers are developing a comprehensive framework for predictive maintenance, which is able to integrate different diagnostic and prognostic models of equipment wear in a flexible way. The equipment models are not limited to traditional condition monitoring, but also include approaches considering other kinds of data, such as material properties and product quality.
In another joint research initiative with Fiat (Centro Ricerche FIAT, Italy), SAP Research has developed a decision support system for vehicle maintenance. In today’s maintenance practices, customers lack visibility into the costs associated with repairing a component vs. replacing it with a new one. Therefore, customers make wrong decisions, which have a negative financial impact for them. The developed decision support system integrates real product data captured using RFID and sensor technology and provides analysis functions to enable a Service Technician or Engineer to make accurate decisions to repair or replace/scrap a component. This yields optimal cost benefit for the customer and reduces the time and effort need for the actual maintenance process. The decision support is based on product KPI’s such as estimated repair cost, component reliability and replacement cost (buy). The approach can be applied to any repair/service based business, thereby exhibiting high cross-industry potential.

**Simplifying Production Scheduling**

A joint project of SAP Research and Ecole Polytechnique Montreal investigates the process of production scheduling (assigning production orders to resources) with the goal to design software that exactly matches the needs of production planners. In a recent study and series of interviews with planners Prof. Robert Pellerin and his team found that while most scheduling research and products are focused on highly sophisticated algorithms for building optimal production schedules, human planners or schedulers mostly do not use automated tools for schedule creation but rather need support for their highly manual and collaborative work of building the schedules (usually more than one) by hand, evaluating what-if scenarios,
and performing impact analyses. Planners often spend a large portion of their time on the shop floor assessing the progress of production. When making plans, they often knowingly violate constraints (such as capacity constraints) since they have more information than the system does. Current systems often do not allow constraint violations. Future scheduling systems should be designed to acknowledge these facts, become more flexible and return the control of the scheduling process to the planner.

**Authenticating Products**

(see also our “Internet of Things” initiative)

Protection of brands against illicit trading and counterfeiting requires processes and software that legitimate product vendors, distributors, consumers, and governmental organizations can utilize in their daily business. The project PROduct VErlification (PROVE) developed a system to provide these parties with the ability to distinguish between genuine goods and counterfeits, and to identify tampered, stolen, or diverted products at any stage of their life cycle.

The PROVE system also supports related backend production planning and data management processes to equip products with security features and authentication data.

PROVE can utilize multiple technologies secure against cloning, incl. printed copy detection patterns, secure holograms, or security featured RFID tags.

Verification procedures can target both unserialized product and serialized item level, and various packaging hierarchy levels such as boxes, pallets and more.

The prototype system is integrated with SAP enterprise software systems – such as the SAP Supply Chain Management (SAP SCM) application.

PROVE demos within the Future Factory show the system’s usage in three different Retail-related scenarios:
1. Frontstore product verification by consumer using her camera equipped mobile phone, 2. Detection of illicit parallel trading activities carried out by mobile expert investigator in the front/back store, 3. Secure goods receipt process at the retailer’s backstore via SAP portal.

**Managing Fleets and Transportation**

Another research project improves SAP solution support for logistic and transportation business processes. Research efforts included from-vehicle sensor integration and analysis, WAN delivery management services and in-vehicle audio delivery services.

Trip data is collected by a flexible repository format used as a source system for BI analysis, allowing flexible drill-downs on a range of sensor and location-based data, as well as trip visualization via a service interface to dashboard composites integrated with GIS visualization components.

It is a 2-way communications component - conceptually building on an ‘active’ database, integrating business constraints and logic extensions, as well as mapping features. It brings additional features such as location-based delivery, token message release, and delivery tracking and receipt that allows SAP solutions to integrate physical objects augmented with IT capabilities (here: vehicles). Easy extensibility includes examples like Toll Collection capabilities.

**Community Involvement**

SAP Research is continuously looking for feedback as well as opportunities for co-innovation. If you are interested in discussing manufacturing-related R&D, please contact Manfred Pauli at manfred.j.pauli@sap.com
Copyright

© Copyright 2007 SAP AG. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or for any purpose without the express permission of SAP AG. The information contained herein may be changed without prior notice.

Some software products marketed by SAP AG and its distributors contain proprietary software components of other software vendors.

Microsoft, Windows, Outlook, and PowerPoint are registered trademarks of Microsoft Corporation.

IBM, DB2, DB2 Universal Database, OS/2, Parallel Sysplex, MVS/ESA, AIX, S/390, AS/400, OS/390, OS/400, iSeries, pSeries, xSeries, zSeries, z/OS, AFP, Intelligent Miner, WebSphere, Netfinity, Tivoli, Informix, i5/OS, POWER, POWER5, OpenPower and PowerPC are trademarks or registered trademarks of IBM Corporation.

Adobe, the Adobe logo, Acrobat, PostScript, and Reader are either trademarks or registered trademarks of Adobe Systems Incorporated in the United States and/or other countries.

Oracle is a registered trademark of Oracle Corporation.

UNIX, X/Open, OSF/1, and Motif are registered trademarks of the Open Group.

Citrix, ICA, Program Neighborhood, MetaFrame, WinFrame, VideoFrame, and MultiWin are trademarks or registered trademarks of Citrix Systems, Inc.

HTML, XML, XHTML and W3C are trademarks or registered trademarks of W3C®, World Wide Web Consortium, Massachusetts Institute of Technology.

Java is a registered trademark of Sun Microsystems, Inc.

JavaScript is a registered trademark of Sun Microsystems, Inc., used under license for technology invented and implemented by Netscape.

MaxDB is a trademark of MySQL AB, Sweden.

SAP, R/3, mySAP, mySAP.com, xApps, xApp, SAP NetWeaver, and other SAP products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of SAP AG in Germany and in several other countries all over the world. All other product and service names mentioned are the trademarks of their respective companies. Data contained in this document serves informational purposes only. National product specifications may vary.

These materials are subject to change without notice. These materials are provided by SAP AG and its affiliated companies ("SAP Group") for informational purposes only, without representation or warranty of any kind, and SAP Group shall not be liable for errors or omissions with respect to the materials. The only warranties for SAP Group products and services are those that are set forth in the express warranty statements accompanying such products and services, if any. Nothing herein should be construed as constituting an additional warranty.

These materials are provided “as is” without a warranty of any kind, either express or implied, including but not limited to, the implied warranties of merchantability, fitness for a particular purpose, or non-infringement.

SAP shall not be liable for damages of any kind including without limitation direct, special, indirect, or consequential damages that may result from the use of these materials.

SAP does not warrant the accuracy or completeness of the information, text, graphics, links or other items contained within these materials. SAP has no control over the information that you may access through the use of hot links contained in these materials and does not endorse your use of third party web pages nor provide any warranty whatsoever relating to third party web pages.

Any software coding and/or code lines/strings ("Code") included in this documentation are only examples and are not intended to be used in a productive system environment. The Code is only intended better explain and visualize the syntax and phrasing rules of certain coding. SAP does not warrant the correctness and completeness of the Code given herein, and SAP shall not be liable for errors or damages caused by the usage of the Code, except if such damages were caused by SAP intentionally or grossly negligent.