SAP Manufacturing Integration and Intelligence
Turbo charge your SAP Applications with IBM Power

Compiled By

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SAP xMII Functional Overview

**xMII is a packaged composite application that delivers:**

**Manufacturing Intelligence:** Real-time six sigma analytics engine that aggregates and delivers unified visualization of events, alerts, KPIs and decision support to production personnel thru role-based dashboards.

**Manufacturing Integration:** A single standards compliant layer enabling SAP ERP connectivity into real-time plant floor apps. (MES, SFA, legacy apps.) to drive plant-to-enterprise business process interoperability.

MES – Manufacturing Execution Systems, EMI – Enterprise Manufacturing Intelligence, BW – Business Warehouse (from SAP)
SFAC – Shop Floor Automation & Control,
SAP xMII – Core Functions/Services

**Data Services**
- Bi-directional data access
- Metadata browsing
- XML-based data abstraction
- Connectors to external systems

**Business Logic Services**
- Logic
- Integration services
- Notification services
- Calculation and data transformation
- Content creation

**Visualization Services**
- Charts, grids, tickers, UI controls
- Dashboard components

**Analytic Services**
- SPC/SQC (Six Sigma) analyses
- Statistical and other mathematical analyses

**Web Services**
- All services exposed as web services
- Includes user-defined composite services
SAP xMII synchronizes manufacturing operations with the Enterprise

- Plan work orders
- Check resources
- Create mfg plan
- Scheduling
- Release work order
- Close order
- Shipping and logistics
- Production Order Details
- Material Details

- Real-time events/alerts
- Order status
- Charge rates
- Life of inventory
- Yields
- Completions and usage
- Start and stop times
- Quality and lab data
- Process history
- Best practice deviations
- Efficiency
- Downtime tracking
- Rework scrap rates
Manufacturing today has some key challenges...

Global Competitiveness is *HERE* placing tremendous pressure on cost, quality and responsiveness

- Manufacturing nodes are being pushed out to distant locations leading to a *loss of visibility and control*
- Business and financial impact of *production exceptions cannot be monitored* or controlled at the enterprise level
- Plants use *copies of master data* creating compliance and quality issues
- Production personnel *lack the decision support* information to meet their targets

Connecting the Factory to the Enterprise and enabling Production Personnel are critical to cost-effectively deliver on customer expectations
Disparate plant systems

A Typical manufacturing plant will have between 10 and 50 shop floor automation systems (SFA)

A multi-site manufacturer can have 100’s of SFA systems across its enterprise
Synchronizing Manufacturing and Enterprise business processes

How are we hitting our targets?
- Total Cost of Production and Variance
- Labor and Resource Productivity
- Order Fill Rates and Cycle Times
- Fixed and Variable Asset Utilization

What’s happening during every shift?
- Material availability and consumption
- Capacity availability and utilization
- Schedule changes
- Product Genealogy tracking and QM

What’s happening at each line?
- Cycle Times / Operating Efficiencies
- Machine Breakdowns / Unplanned Downtime
- Quality Index
- Predictive Maintenance requirements

SFAC - Shop Floor Automation and Control Systems
MES – Manufacturing Execution Systems
DCS – Distributed Control Systems
What capabilities do Manufacturers Need to be Adaptive?

To be adaptive, companies need capabilities for:

- **Manufacturing operations**: An integrated ERP solution for managing manufacturing with workflows that enable closed-loop operations.

- **Manufacturing integration**: A manufacturing integration platform to connect manufacturing processes with enterprise and supply chain processes.

- **Manufacturing intelligence**: Real-time actionable analytics and decision support for production personnel so they can determine performance goals.
Defining Manufacturing Synchronization and Manufacturing Excellence...

What is Manufacturing Synchronization?

- **Manufacturing Synchronization** – electronically linking enterprise business processes and master data with plant manufacturing processes to run from a “single version of the truth”

What is Manufacturing Excellence?

- **Manufacturing Excellence** – reliably produce to target with year-to-year cost reductions/quality improvement

Synchronizing Manufacturing with the Enterprise and enabling Manufacturing Excellence are mission critical for competitiveness
xMII Illustrative Scenario

1. Production schedule is sent from SAP ERP to xMII, transmitted to the MES system and displayed on Mfg. Dashboard

2. After batch execution, xMII aggregates production performance data and automatically updates SAP ERP inventory

3. Based on SFA sensor data and Six Sigma control analysis, xMII detects quality problem, generates alert and quarantines batch in SAP ERP

4. Production quality alert appears in Plant Manager’s Dashboard and he drills down into alert to performs a rapid root cause analysis of the problem via xMII

5. Plant Manager initiates corrective action to fix the quality problem and resolve exception before it becomes customer issue
The xMII Fit

SAP xMII stands for **Manufacturing Integration and Intelligence**

xMII is a **toolkit** that includes data connectors, query templates, display templates, business logic transactions and plug-in’s for FrontPage and Dreamweaver to build a web-based user interface with xMII components.

These tools allow our customers to **Integrate** the data from their shop floor with their corporate data and view it in a standard web browser to make **Intelligent** business decisions based on real-time production data.

Because xMII is a composite application and **not** a standard SAP solution, each implementation is unique. Although there are ‘templates’ for commonly used integration functionality with SAP ERP, there is **nothing ‘out of the box’**. Each shop floor integration will involve different hardware systems, even among different plants within the same enterprise.
Top 3 Variables for Implementation

Single Plant vs. Global Implementation
Implementation in a single plant vs. a global implementation can greatly impact resource requirements, cost and implementation timeline. It may be beneficial to consider a single plant implementation as a first phase if cost and timeline are an area of concern.

ERP Integration, Shop Floor Integration or BOTH
ERP and Shop Floor integration requires connections to many disparate data sources. This data needs to be combined, aggregated and sent to ERP to manage production on a corporate level. The number of integration points can greatly affect resource requirements and project timelines.

KPI and Dashboard Complexity
KPI and Dashboard complexity can vary greatly depending on business requirements. A KPI can be a simple average calculation or a complex calculation used to aggregate data for Six Sigma analysis. Dashboards can also vary from a simple one page overview to role based dashboards with multiple drill downs into detail information.
Small Project
- Simple standard KPI and dashboard implementation
- 1 xMII resource
- 4 – 6 weeks implementation

Medium Project
- ERP and shop floor integration to automate the production process
- 2 – 3 xMII resources
- 2 – 6 month implementation

Large Project
- ERP, shop floor integration and complex KPI’s in several levels of dashboards
- 3 – 5 xMII resources
- 6 – 12 month implementation
SAP xMII projects need to be staffed differently than other SAP implementations.

- The uniqueness of SAP xMII requires resources to fulfill both Functional and Technical roles
- There is no distinction between an xMII Functional resource and an xMII Technical resource
- A qualified xMII resource will be able to fulfill both roles

Currently Available SAP Consulting Resources

- 2 NCC xMII Practice Principals
- 13 SAP Regional US Consultants (3 currently engaged in xMII projects)
- 1 SAP Canada Consultant
- 1 SAP Latin America Consultant
The role of xMII

SAP xMII allows for the creation of views that correlate data from various plant floor data sources to ERP data – enabling drill down to real time information.

Universal Connectivity to the data, functionality and processes is available for all existing and future plant floor systems.

SAP xMII allows SAP solutions to access to real time plant floor information with a library of adapters.

SAP xMII is data source neutral, and can be implemented without other SAP components (competitive ERP environments) at a plant site. This will enable us to expand the Netweaver platform into non-SAP accounts.

Business Logic Transactions are used to create automated events, KPIs and alerts that can be viewed with any web browser.

Authoring business processes with xMII enables our customers to create a Plant to Enterprise Business Process Alignment.
XI vs. xMII

XI is the central integration broker for SAP and is integral to SAP’s manufacturing integration strategy.

SAP xMII is an application for manufacturing integration which fully leverages XI as a platform.

XI provides the message routing, queuing, store and forward services required in manufacturing integration for integration to ERP Business Systems.

For Shop Floor Integration, xMII offers an extensive library of connectors for the broad variety of plant floor systems. These connectors exchange data with virtually any plant floor level system or application.

SAP xMII connectors utilize vendor specific APIs, communication standards (e.g. OPC) and data access methods to connect to plant floor systems. These connectors require no modification to the existing plant floor systems, allowing for quick data integration without the need to invest in additional middleware.
XI and xMII

SAP xMII is an application for manufacturing integration which fully leverages the XI platform. XI provides the message routing, queuing, store and forward services required in manufacturing integration to integrate to ERP Business Systems.

The advantage of using the XI interface is the guaranteed delivery that comes with an enterprise messaging system.

In addition, new services specifically designed for manufacturing business processes will be delivered via the XI platform. The first of these services will be the realization of S95 interfaces.

SAP xMII + XI delivers the complete Manufacturing Integration Solution which connects to plant floor and enterprise systems.

XI is the central integration broker to connect to business systems and an integral part of manufacturing integration strategy with SAP xMII.
Do I need XI if I have xMII?

However, there are some advantages to an integrated solution using both products.

- All the manufacturing intelligence capabilities of xMII are available without an XI server in your production landscape.
- For ERP to plant integration, the supported direction is to use XI for message routing and delivery, and use xMII to create the message content to and from manufacturing systems. Direct connection can be made to ERP via JCo or the SAP Business Connector. If you do not use XI, you will need to build additional error checking and retry logic into your final solution.
- JCO provides a direct connectivity to ERP for synchronous messaging.
- WAS (SOAP Interface) has a limitation which requires some Z wrapper to do COMMITs, if the commit is not executed in the RFC or BAPI.
- XI provides the message routing, queuing, store and forward services as well as being the integration platform for Business Systems (e.g. ERP, SCM, CRM, etc).
- xMII does not provide the service mapping and message queue capabilities that XI provides. The set of adaptors that can be found in XI do not overlap with the xMII set of connectors.
Customer Implementation Overviews

Chevron
- Presented by Ray Tallud, Senior Consultant, Midwest
  - Project Objectives and Key Challenges
  - Illustrative Scenario – Goods Receipt

Solae
- Presented by Ranga Manthena, NCC Practice Principal, xMII
  - Project Objectives and Key Challenges
  - Implementation Best Practices and Project Scope
  - Major KPI’s Implemented
  - Solae KPI Dashboards

Altivity
- Presented by Reynaldo Ruiz, Senior Technical Consultant, Northeast
  - Overall Scope
  - Sample Screen
  - Connection Layout
  - Resources
Chevron xMII Implementation

OBJECTIVES

- Reduce organizational change to the largest user population using web based screens providing real time actionable information to the shop floor.

- Applying an enterprise template of xMII at all plants will help spread best practices, while maintaining local flexibility.

- Ongoing savings for systems and support costs using a common system globally

- Synchronization of shop floor to enterprise system.

KEY CHALLENGES

- Multiple plants with different legacy systems

- xMII implementation running parallel to an R/3 implementation

- Disparate shop floor systems in all the plants.
Illustrative Scenario – Goods Receipt

1. Truck arrives at Gate. Operator calls up a list of open Purchase Orders scheduled to arrive. Event is posted.

2. Truck is 1st weighed. Event is posted. Truck is send to be unloaded.

3. Opening gauge is taken. Unload is completed. Closing gauge is taken. G/R into tank. Event is posted.

4. Truck is weighed empty. Determine final receipt quantity. Event is posted.

5. Truck leaves the plant. Event is posted.
Solae xMII Implementation
Optimizing Operational Performance

Objective

- Deliver Standard Work utilizing KPI methodology to manage overall operational performance
- Enable continuous process improvement
- Establish higher asset utilization
- Deliver visibility into manufacturing operations

Key Challenges

- Development of global key performance indicators (KPIs) to streamline production and delivery
- Ensure visibility into disparate data sources, easy access to information, and ability to build analytics to support processes
- Optimize operational performance and improve yields
- Enhance decision making, boost product delivery performance, and ensure manufacturing excellence throughout supply chain
- Achieve a “single version of truth” enterprise-wide
Implementation Best Practices and Project Scope

Implementation Best Practices

- Rapid global implementation with a common framework
- Early and continuous user participation
- In-house skill building
- Tight collaboration among corporate IT, manufacturing, and business units
- Reusable components and use of balanced scorecards

Project Scope

- Implementation Period: 3 Months
- Dash Boards: 4 (Quality, Cost, Plant Manager, Supervisor)
- KPIs: # 50
- Resources: 2 SAP Consulting and 3 Solae Internal Resources
Major KPIs Implemented

**Categories implemented:** Costing, Safety, Quality and Delivery

**Costing:**
- Production Volume vs. Plant
- Value of Raw Material Inventory
- Fixed Cost vs. Plan
- Variable Cost vs. BOM
- Combustibles vs. BOM
- Purchased Stream vs. BOM
- Packaging Rate

**Safety:**
- Incidents
- Recordable Rate

**Quality:**
- Revaluation Dollars: Revaluation $ - dollar changes in inventory due to product reclassifications
- Grade B Inventory
- First past First Quality Yield
- Product Tests

**Delivery:**
- On Time In Full
- Confirmed volume vs. Schedule
Solae KPI Dash Boards

Quality

- Grade A Production
- Grade A D Level
- Grade B % of Total Inventory
- Production vs. Daily
- Production vs. Weekly
- Production vs. Monthly

Cost

- Production Budget
- Research Consumption
- Note of Change

Tests for MSP

- Component
- Sample Date
- Frequency
- ODOR 08/23/2007 04:00:04 4.00
- POB_HIR 08/23/2007 16:00:12 4.00
- SEDIMENT 08/23/2007 04:00:04 4.00

SPC Chart

- Production Volume
Altivity xMII Implementation

Overall Scope

Data Collection

- Throughput, Downtime and Waste data to be collected from critical machines in the 9 plants with 7 lines/plant and 3 machines/lines.
- Manufacturing data (e.g. Machine Speed, Counter Reading, etc.) will be automatically collected from sensors/vorne pair combination on each machines.
- Certain types of data (e.g. product lost in Quality Checks, Downtime Causes, etc.) will be entered manually by the operator into an application screen.

Dashboard

- Corporate Dashboard - 3 KPI with drill down capability
- Plant Manager Dashboard - 12 screens, 3 KPI each
- Operator Dashboard – for data entry, 4 screens
- Master Data Maintenance – since no ERP is connected
Sample Screen

Corporate Throughput, Downtime and Waste Dashboard

<table>
<thead>
<tr>
<th>Plant</th>
<th>Throughput % of Target</th>
<th>Downtime % of Target</th>
<th>Waste % of Target</th>
<th>Status of Corrective Action Plan</th>
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<tr>
<td>Arcadia</td>
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## Resources Projected

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<td>12</td>
<td>1</td>
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<tr>
<td>Basis / DBA</td>
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</table>
SAP xMII 12.0 – What’s new?

NetWeaverization of SAP xMII
- SAP Web Application Server (Web AS) / J2EE Architecture
- NetWeaver Database backend
- WebAS Datasources for JDBC connection pools

Enhanced Integration and Intelligence Functionality
- Expanded JCO / JRA and XI capabilities including session support, caching
- Local queuing / monitoring services
- Unified security model including SAP single-sign-on
- Core manufacturing services and scenarios
- DataSource v/s IDBC connection – with full functional pooling – J2EE pooling

New Developer Functionality
- Workbench
  - Single editor for transactions, templates, animated objects, reference documents and user content.
  - Passwords encrypted (wherever passwords are stored)
  - Drag and Drop capabilities
  - Dreamweaver and FrontPage plugins supported.
- Project Management
  - Import and Export transactions, templates, and WebPages into Projects.
- Dynamic mapping for xml queries and transforms
- JRE 1.5 support
- Full Accessibility – No applets on admin / config side
Composites / Templates developed by SAP xMII Field Services Team

- xMII SAP Function Best Practice templates:
  - Pre-configured xMII transactions for a specific business or data scenario.
  - Content includes xMII intellectual property gained over years of use.
  - Content is specifically oriented to using the SAP functions in the shop floor operations environment.

- Access to the best practice processes are immediately web service enabled.

- A collection of “building block” transactions that expose many of the basic functions through xMII

- “2nd & 3rd” level transactions using the building blocks for more advanced or industry specific processes.

- Higher level transactions can then be used as the basis for sophisticated composite applications.

- The current categories for the building block transactions are:
  - Materials Data, Material Movements, Batches, Production Orders, Process Orders, Plant Maintenance Notifications, Plant Maintenance Work Orders, Quality, Planned Orders, Repetitive Manufacturing, IDOCs

- Templates are delivered via SAP Developer Network (SDN)

- The collection of xMII transactions will continuously evolve with all content posted and maintained on SDN.
New SAP xMII 12.0 Developer Functionality

Integrated Workbench
- Single editor for transactions, templates, animated objects, reference documents and user content.
- Passwords encrypted (wherever passwords are stored)
- Drag and drop capabilities
- Dreamweaver and FrontPage plugins supported.

Project Management
- Import and Export functionality for entire Projects
- Manage all transactions, templates, and WebPages in Project folder structure
- Potential Import and Export of projects from previous versions of xMII (Project folder structure on older platform required for clean import or export)

Dynamic mapping for xml queries and transforms
- New flexibility allows for easy portability across servers (e.g. server:\\..\)

JRE 1.5 support

Full Accessibility – No applets on admin / config side
The Frontpage and DreamWeaver plugins have been updated with a “Publish Assistant” to get and put content into the SAP xMII content management structure.
SAP xMII 12.0 NetWeaverization

Central Alert Monitoring System

Web Application Server (J2EE)

Web AS Datasource For JDBC

User Management Engine
Benefits

**Web AS J2EE (SPS10 or higher)**
- Scalability (Web Dispatcher Needed for HTTP load balance)
- High Availability
- Database backend for all configuration, templates and transaction files

**User Management Engine (UME)**
- Provides a centralized user management front-end for user administration
- UME can be configured to read and write user-related data from and to multiple datasources:
  - System database of the J2EE Engine
- Supports Kerberos and SAP SSO
Benefits

WebAS Datasources for JDBC (an alternative to IDBC)
- Provides central control of JDBC connectivity
- Improves system performance due to connection pooling and reusing
- Can manage transaction isolation levels for the JDBC connection
- Ability to Monitor Datasource connections

Central Alert Monitoring System
- Integrated with monitoring architecture within NetWeaver - Central Monitoring
- Solution Manager Diagnostics – Remote diagnostics and troubleshooting
**NetWeaver WebAS J2EE Architecture**

- **Java Central Instance (Java-CI)**
  - Java Dispatcher
  - Server Processes
  - Software Deployment Manager (SDM)

- **Java Central Services Instance (Java-SCS)**
  - Enqueue Server
  - Message Server

- **Database Instance**
  - Java Schema
Installation options – Central System

Central Installation

- All Instances run on one host
  - Central Java Instance
  - Central Services Instance
  - Database Instance
- Simplest installation option for installing Web AS Java
Distributed System

- Mandatory Instances installed on separate hosts:
  - Central Instance on Host A
  - Central Services instance on Host B
  - Database instance on Host B
  - **Optional** Dialog Instances on additional hosts,

**Note:** If additional dialog instances are used, a load balancer is needed for load balancing request
High Availability System

- Single Point of Failure (SPOF):
  - Central Services Instance
    - Enqueue Server
    - Message Server
  - Database Instance
- Install SPOF in switch over software
  - Enables automatic fail-over capability
  - Minimize downtime
- Two Nodes Minimum for High Availability
Chevron’s Proposed xMII Landscape

- Sandbox for prototyping and pathfinding
- 3 Tier System Landscape for deployment
- High Availability for Production System with two hosts
High Availability configuration for Production System

- Install Java Central Services instance in switchover group
- Install and add SAP Web Dispatcher to Java Central Services instance switch over group
- Install Database instance in switchover group
- Install Central Instance and Dialog Instance on each MSCS host (no fail-over)
- Install Enqueue Replication Servers on each host for replication of lock table
Where do I get more information?

**Discussion Board on Field Services Portal**
- Ask and respond to questions – this can be emailed to MS outlook

**Document Library on Field Services Portal**
- You can look up lessons learned, project plans and consulting documents used by other consultants

**SDN – SAP Developer Network**
- Exchange questions, answers, solutions, etc in this worldwide community of developers

**RKT Documents**
- Learning and training documentation exists in RKT
- [SAP Support Portal – Technology Consultant](#)

**SAP Education**
- SAP Education site allows you to register courses using the Online Training Catalog or find the courses using curriculum paths.

**xMII Community and Focus Group**
- Monthly xMII Community Calls
- Community page on Field Services Portal including Document Library and Discussion Boards

**What's New in xMII 12.0 Kit**
- [SAP xMII Integrating the Shop Floor and The Top Floor](#)
Thank you!

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