SAP Manufacturing & Interoperability

Jürgen Wettengl
ASM Manufacturing, SAP AG
Agenda: SAP Manufacturing and Interoperability

What is the situation today?

What are the problems?

What are the objectives?

How can SAP help?

What are the benefits?
Kitchen

All In One
What is the situation today?

* Shop Floor Automation and Control Systems
What are the problems?

* Shop Floor Automation and Control Systems
Why use standards like ANSI/S95?
What are the objectives?

Cost Reduction per minimizing the number of interfaces, layers and data maintenance.

Standardize the interfaces based on ANSI/ISA-95 B2MML messages.

Logical integration between the ERP and the shop Floor systems to improve the data quality and the business processes.

Improved usability and exception based proactive business process monitoring to control the route of the message transportation.

Visualization and reporting of production relevant data from all involved levels from the shop floor to my SAP Business Suite.
Agenda: SAP Manufacturing and Interoperability

What is the situation today?

What are the problems?

What are the objectives?

How can SAP help?

What are the benefits?
How can SAP help?

Interoperability Scenarios – Best Practices

Proactive Solution Monitoring
Example ANSI/ISA-95 Production Schedule

**ERP**

1. Send Control Recipe

**xMII**

2. Receive Control Recipe
3. Mapping to S95 production schedule
4. Send S95 production schedule messages to MES system

**MES**

5. Receive, check and save S95 production schedule messages
6. Complete order data and save

Control Recipe Monitor
Example ANSI/ISA-95 Production Schedule

SAP ERP

Invoke XMII (E.g. Send Control Recipe)

xBII

B2MML Production Schedule

- Production Schedule Request
  - Product Segment
  - Material Produced Requirement
    - Production Parameter(Process Order Related)
  - Process Segment-Operation
    - Operation
      - Material Consumed Requirement
      - Material Consumed Requirement Property
  - Equipment Requirement
    - Equipment Property
  - Personnel Requirement
    - Phase
      - Material Consumed Requirement
      - Material Consumed Requirement Property
  - Production Parameter(Process Instruction for Phase)

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THE BEST-RUN BUSINESSES RUN SAP
Example ANSI/ISA-95 Production Schedule

SAP ERP

Invoke XMII (E.g. Send Control Recipe)

SAP xMII

Transform the Incoming request to a B2MML Standard XML Message

Send the B2MML Message to Shop floor application

B2MML Production Schedule

- Production Schedule Request
  - Product Segment
    - Material Produced Requirement
    - Production Parameter(Process Order Related)
  - Process Segment-Operation
    - Operation
      - Material Consumed Requirement
      - Material Consumed Requirement Property
    - Equipment Requirement
      - Equipment Property
    - Personnel Requirement
      - Phase
    - Material Consumed Requirement
      - Material Consumed Requirement Property
    - Equipment Requirement
      - Equipment Property
    - Personnel Requirement
      - Production Parameter(Process Instruction for Phase)
Example ANSI/ISA-95 Production Schedule

SAP ERP

Invoke XMII (E.g. Send Control Recipe)

SAP xMII

Transform the Incoming request to a B2MML Standard XML Message

Send the B2MML Message to Shop floor application

S95 Compliance Shopfloor Application

Receive the B2MML Standard XML Message
Example ANSI/ISA-95 Production Performance

1. Send S95 Production Performance

2. Receive S95 Production Performance

3. Mapping to ERP Process Messages

4. Send Process Messages to ERP

5. Receive, check and save Process Messages

Process Message Monitor

ERP

xMII

MES

RFC

XML
Example ANSI/ISA-95 Production Performance

B2MML Production Performance

Production Performance Schema
  - Control Recipe Status
  - Material Produced Actual
  - Material Produced Actual Property
  - Material Consumed Actual
  - PersonnelActual
  - EquipmentActual
  - EquipmentActualProperty

xMII

Process Message: PI_CRST
Process Message: PI_PROD
Process Message: PI_CONS
Process Message: PI_QMSMR
Process Message: PI_PMMMD

PP-PI-PCS

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Example ANSI/ISA-95 Production Performance

- **S95 Compliance Shop Floor Application**
  - Invoke XMII (E.g. Send S95 Production Performance)

- **xMII**

- **PP-PI-PCS**
  - Process Message: PI_CRST
  - Process Message: PI_PROD
  - Process Message: PI_CONS
  - Process Message: PI_QMSMR
  - Process Message: PI_PMMMD
Example ANSI/ISA-95 Production Performance

S95 Compliance Shop Floor Application

Invoke XMII (E.g. Send S95 Production Performance)

SAP xMII

Transform the Incoming request to SAP Process Messages

Send the Process Messages to ERP

Process Message: PI_CRST
Process Message: PI_PROD
Process Message: PI_CONS
Process Message: PI_QMSMR
Process Message: PI_PMMD

PP-PI-PCS
Example ANSI/ISA-95 Production Performance

S95 Compliance Shop Floor Application

Invoke XMII (E.g. Send S95 Production Performance)

SAP xMII

Transform the Incoming request to SAP Process Messages

Send the B2MML Message to Shop floor application

SAP ERP

Receive, check and save process messages
Example A: Directly Integrate „Production Line“ using xMII

SAP ERP Manufacturing

Download Order

Upload Confirmation

SAP xMII Business Logic

„S95 enhanced“ Standard Mapping e.g. ANSI/ISA-95

Connector Framework

Buffering

SAP xMII: Business Content

- Business Logic for triggering messages and data checks (Logical Integration)
- Monitoring (Business View)
- Data Buffering (e.g. Orders per shift)

Shop Floor Automation and Control Systems (SFAC)

S95 Production Schedule

S95 Production Performance
Example A: Directly Integrate „Production Line“ using xMII

SAP ERP Manufacturing

- Download Order
- Upload Confirmation

SAP xMII Business Logic

- „S95 enhanced“ Standard Mapping e.g. ANSI/ISA-95
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SAP xMII: Business Content

- Business Logic for triggering messages and data checks (Logical Integration)
- Monitoring (Business View)
- Data Buffering (e.g. Orders per shift)
- Delivery and Support Shop Floor Connectors
- Transformation, Aggregation and Mapping
- Message Queuing and Logging
- Used for Synchronous and Asynchronous Message Transfer
- Visualization and Retry Capabilities

Shop Floor Automation and Control Systems (SFAC)
Example B: Integrate „Third Party MES System“ using xMII

SAP xMII: Business Content
- Business Logic for triggering messages and data checks (Logical Integration)
- Monitoring (Business View)
- Delivery and Support Shop Floor Connectors
- Transformation, Aggregation and Mapping
- Message Queuing and Logging
- Used for Synchronous and Asynchronous Message Transfer
- Visualization and Retry Capabilities
Example C: „Integrate Plant Systems“ using XI and xMII

SAP ERP Manufacturing
- Download Order
- Upload Confirmation

SAP XI

SAP XI: Technical Content
- Technical Monitoring of Messages
- Transformation and Mapping
- Message Queuing and Logging
- Retry Capabilities
- Higher Payload Size
- Processing Aggregated Data
- Mostly Used for Asynchronous Message Transfer

Subsystem 1
- Shop Floor
- Subsystem 2

ERP
- Synchronous
- Asynchronous

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Example C: “Integrate Plant Systems” using XI and xMII

SAP ERP Manufacturing

SAP XI: Technical Content
- Transformation and Mapping
- Technical Monitoring of Messages
- Message Queuing and Logging
- Retry Capabilities
- Higher Payload Size
- Processing Aggregated Data
- Mostly Used for Asynchronous Message Transfer

SAP xMII: Business Content
- Business Logic for triggering messages and data checks (Logical Integration)
- Monitoring (Business View)
- Data Buffering (e.g. Orders per shift)
- Delivery and Support Shop Floor Connectors
- Transformation, Aggregation and Mapping
- Message Queuing and Logging
- Used for Synchronous and Asynchronous Message Transfer
- Visualization and Retry Capabilities

Subsystem 1
- Subsystem 2
- SAP xMII

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**Interfaces in production?**

- **ERP**
- **MES**
- **Historian I**
- **Historian II**
- **LIMS**
- **Plant Maintenance**
- **‘Home-Grown’**

Correlation

Save

Analyze

ERP report

Bi report

3rd party data

Cut-and-paste to Excel

Calls to staff data jockey

40 hr/wk survival aid

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THE BEST-RUN BUSINESSES RUN SAP™
Integration of the production with SAP xMII

- ERP
- Data extraction
- Data in correlation
- Data analyses
- Historian I
- Historian II
- LIMS
- Plant Maintenance
- MES
- ‘Home-Grown’
SAP xMII functionality in comparison with MES systems

**ERP System**

Integration  SAP xMII  Intelligence

Data Connectors

- Non SAP System
- Excel
- SQL or Access

- Historian
- Custom Database
- Custom Database
- Custom Database
- Custom Database

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Correlation of Data from Different Sources

1. Look up customer SO from ERP & return ERP Production Order
2. Find Batch(es) created to satisfy Production Order
3. Get Historian and LIMS data for batches, run xMII Analytics
4. If SPC Alarm it is a Batch production problem – provide aggregate view of LOTS & CUSTOMERS
5. Email report to Product Manager, Disposition to SAP QM, Close record in QN System
How can SAP help?

Interoperability Scenarios – Best Practises

Proactive Solution Monitoring
What are the problems?

SAP ERP Manufacturing

Send Production Order

Upload Confirmation

SAP xMII Business Logic

„S95 enhanced“ Standard Mapping
e.g. ANSI/ISA-95

Connector Framework

MES System

S95 Production Schedule

Buffering

S95 Production Performance
What are the problems?

SAP ERP Manufacturing

SAP xMII Business Logic
"S95 enhanced" Standard Mapping e.g. ANSI/ISA-95

Connector Framework

M5 System

Send Production Order
Upload Confirmation

S95 Production Schedule
S95 Production Performance
Buffering

MES System
What are the requirements?

ERP

1. Send Production Order

xMII

2. Receive Order
3. Mapping to S95 production schedule
4. Send S95 production schedule messages to MES System

MES

5. Receive, check and save S95 production schedule messages
6. Complete order data and save

Proactive Monitoring
What are the requirements?

ERP
1. Send Production Order

xMII
2. Receive Order
3. Mapping to S95 production schedule
4. Send S95 production schedule messages to MES System

MES
5. Receive, check and save S95 production schedule messages
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Proactive Monitoring
What are the requirements?

**ERP**
1. Send Production Order

**xMII**
2. Receive Order
3. Mapping to S95 production schedule
4. Send S95 production schedule messages to Wonderware

**MES**
5. Receive, check and save S95 production schedule messages
6. Complete order data and save

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What are the requirements?

1. **Allow supervision of configurable manufacturing processes** from ERP to Shop floor (or Shop Floor to EP) including message exchange and message processing in the affected systems.

2. **Trigger alerts** for processes which either show errors or show ‘hanging’ steps. Alerts should be visible in a dashboard.

3. **Allow follow-up action** on individual processes either as drill down or corrective action.

4. **Support high data volumes** of process messages to be usable in shop floor scenarios.

5. **Must be easy** to configure and easy to use.

6. **Should run on existing mySAP ERP** or on separate SAP instance.
Customer Prototype:

SAP Solution Manager

System Monitoring
Business Process Monitoring
Service Level Reporting

ERP

Process Monitoring Package

1 Send Control Recipe

System Monitoring

2 Receive Recipe

Mapping to S95 production schedule

3

WEB Service

4 Send S95 production schedule messages to the MES-system

MES

System Monitoring

5 Receive, check and save S95 production schedule messages

6 Complete order data and save

Status & Info Reporting
Customer Prototype:

**ERP**
- Process Monitoring Package
- RFC

**System Monitoring**
1. Send Control Recipe

**xMII**
- Receive Recipe
- Mapping to S95 production schedule
- Send S95 production schedule messages to the MES-system

**System Monitoring**
2. Receive Recipe
3. Mapping to S95 production schedule
4. Send S95 production schedule messages to the MES-system

**MES**
- System Monitoring
- Receive, check and save S95 production schedule messages
- Complete order data and save

**SAP Solution Manager**
- System Monitoring
- Business Process Monitoring
- Service Level Reporting

**Status & Info Reporting**
**Customer Prototype:**

**SAP Solution Manager**
- System Monitoring
- Business Process Monitoring
- Service Level Reporting

**ERP**
- Process Monitoring Package
- RFC

**xMII**
- System Monitoring
- WEB Service
- Receive Recipe
- Mapping to S95 production schedule
- Send S95 production schedule messages to the MES-system

**MES**
- System Monitoring
- Receive, check and save S95 production schedule messages
- Complete order data and save

**Status & Info Reporting**
### Change View "Process definitions": Overview

<table>
<thead>
<tr>
<th>Plant</th>
<th>Monitoring Object</th>
<th>Step</th>
<th>System</th>
<th>Status</th>
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</table>
### Process Monitoring

**Plant:** 1100  
**Start Date range:** Von 15.06.2006 01:39:49 bis 18.08.2005 19:38:33  
**Processes read:** 51  
**Processes shown:** 51

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<tr>
<th>Process Type</th>
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</table>

#### Erp system
1. Received 18.06.2006 19:39:33  
   Control recipe 100000000000003913 for Process order 000070002780 send

#### xMII system
2. Received 18.06.2006 19:39:41  
   Control recipe 100000000000003913 received by xMII
3. Processed 18.06.2006 19:39:50  
   Control recipe 100000000000003913 processed and mapped
4. Sent 18.06.2006 19:39:58  
   Mapped Control recipe 100000000000003913 send to execution system
5. Wonderware sys. Received 18.06.2006 19:40:03  
   Control recipe 100000000000003913 received for execution

#### Erp system
6. Received 18.06.2006 19:39:33  
   Control recipe 100000000000003912 for Process order 000070002779 send

#### xMII system
2. Received 18.06.2006 16:39:44  
   Control recipe 100000000000003912 received by xMII
3. Processed 18.06.2006 16:39:48  
   Control recipe 100000000000003912 processed and mapped
4. Sent 18.06.2006 16:39:56  
   Mapped Control recipe 100000000000003912 send to execution system
5. Wonderware sys. Received 18.06.2006 16:40:01  
   Control recipe 100000000000003912 received for execution
# Central Alert Handling

## Alert Dashboard in xMII:

### Alert Inbox of Dr. Stephan Boecker

<table>
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<th>Category</th>
<th>Description</th>
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<tr>
<td>Monitoring error</td>
<td>Control receipt (1000000000000003871) delayed</td>
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<tr>
<td>Monitoring error</td>
<td>Control receipt (1000000000000003870) delayed</td>
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</table>

Error in Process Control receipt, Instance 1000000000000003872: Process using 5196 minutes

### Alert Dashboard

### Alert Inbox of Dr. Stephan Boecker

<table>
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<tr>
<td>Monitoring error</td>
<td>Control receipt (1000000000000003870) delayed</td>
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</tbody>
</table>

Row 1 of 3

Check details > Process Monitor
Agenda: SAP Manufacturing and Interoperability

- What is the situation today?
- What are the problems?
- What are the objectives?
- How can SAP help?

What are the benefits?
Value to Customers

**Cost Reduction** per minimizing the number of interfaces, layers and data maintenance.

**Standardize** the interfaces based on ANSI/ISA-95 B2MML messages.

Improved usability and **proactive** solution monitoring.

**Visualization** and reporting of production relevant data from **all involved levels** from the shop floor to my SAP Business Suite.
**Summary**

**Interoperability** is the ability of production applications and manufacturing business applications to share information and exchange services with each other based on **standards**.

Depending on the required scenarios and the size of the company SAP XMII alone or complementary used together with SAP XI can help to improve the interoperability.

A **proactive** solution monitoring can help to monitor the systems and to control the route of the message transport.
Example ANSI/ISA-95 Production Schedule
Material List

| Item | Material | Material Description          | Lo | Requirement quantity | U | It | R | Stor | Batch | Co. | Bac | End | Ph | It | B | F | Ac | Plant | Opr.
|------|----------|--------------------------------|----|-----------------------|---|----|---|------|-------|-----|-----|-----|----|----|---|---|----|-------|------
| 0010 | A1-1200  | Concentrate tree orange 334   |    | 88,000                | K1 | L  | X | 0001 | 66000000417 |     |     |     |    |    |   |   |    | 1100  | 002C |
| 0020 | A1-160   | Water                         |    | 23                    | L  | N  | X |      |       |     |     |     |    |    |   |   |    | 1100  | 002C |
|      |          |                               |    |                       |    |    |   |      |       |     |     |     |    |    |   |   |    |       |      |
|      |          |                               |    |                       |    |    |   |      |       |     |     |     |    |    |   |   |    |       |      |
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Entry 1 of 2
Create Process Order: Operation Overview

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### Create Process Order: Process Instruction

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#### PI Characteristics

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### Control Recipe Monitor: Overview

**Plant:** 1100  
**Process order:** 000070004502  
**Status:** Created, Sent, Processed, Terminated, Discarded  
**Selected control recipes:** 1

<table>
<thead>
<tr>
<th>Enco</th>
<th>Control recipe</th>
<th>Process order</th>
<th>C.</th>
<th>Destination Address</th>
<th>Status</th>
<th>Test</th>
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### Change Process Order: Header - General Data

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#### General data

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<td>Delivered Qty</td>
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<td>Note</td>
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<td>Float before proc</td>
<td>2 Workdays</td>
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<tr>
<td>Float after product</td>
<td>1 Workdays</td>
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<tr>
<td>Release period</td>
<td>5 Workdays</td>
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Process Monitoring Cockpit – Drill Down in xMII

![Process Monitoring Cockpit – Drill Down in xMII](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>Creation Date</th>
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<tbody>
<tr>
<td>Dr:\Light hammer\jco\Output\WWEI_ENABLED_CONTROL_RECIPE_DOWNLOAD_2008091211217.xml</td>
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Central Alert Handling

Alert Dashboard in xMII:

Alert Inbox of Dr. Stephan Boecker

<table>
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<tr>
<th>Category</th>
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<td>Control receipt (100000000000003872) delayed</td>
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<tr>
<td>Monitoring error</td>
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<tr>
<td>Monitoring error</td>
<td>Control receipt (100000000000003870) delayed</td>
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Error in Process Control receipt, Instance 100000000000003872: Process using 5196 minutes