Manufacturing Information Framework

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Agenda

- Manufacturing Environment Reality and Need
- IBM Manufacturing Case Study
- Reference Architecture
- Solution Summary
Today’s Manufacturing Reality

Requires integration to optimize performance

Source: SOA in Manufacturing Webinar, MESA, 2008
AMR Research, 2007

Production and Business Process Management

Requires integration to optimize performance
The Need For Flexibility

- **Technology Obsolescence** – many systems developed in 80’s, 90’s need replacement now
- **Outsourcing, joint ventures and other new business models**
- **Cost of making changes** demands flexibility/configurability of new functions – EDI expensive as are proprietary systems when integrating “out”
- **Need for incremental replacement of systems** and replication of function across geographies, plants
- **Emerging standards and technology** allow for new approaches
- **Desire for aggregated, real-time view of plant floor information** do support faster response to changes and problems
The Need For Flexibility

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- Outsourcing, joint ventures, new business models
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The Need For Flexibility

- Leverage Enterprise Services Bus to minimize integration costs and business constraints
- Implement changes incrementally based on priority
- Use Workflow Engine to support execution and change of processes external to applications

Integrate existing components

Manufacturing Services Bus

Device Service (RFID/PLC)

Workflow Engine

Tracking

Manufacturing Industry

Data Collection

Broadcast Services

Quality

Data Collection

Scheduling

B2B

Suppliers

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Business Requirements – Manufacturing Integration Platform

**Inability to:**
- Quickly adapt to production processes when needed to support changing product mix, outsourcing, etc
- Integrate across applications without changing the applications themselves
- Deploy production configuration across geographies with minimal changes
- Easily make line side changes to work station level processes
- Resolve problems in business transaction when it spans multiple applications (e.g. ERP, quality, MES)

**Results in additional costs:**
- Longer time to market
- Inflexible production systems that must be revamped at high cost to run new production models (with new processes)
- Difficulty in making timely sourcing decisions for subsets of manufacturing processes
- Need for expensive resources (programmers) to make process changes (process or integration)
- Longer downtime due to problems in system

**The Solution:**
- Websphere Sensor Event Server
- Webpshere Process Server, Websphere ESB
- IBM Software Services
- Manufacturing Integration Framework
Business Requirements – Track and Trace

**Inability to:**
- Track order location
- Determine part demand and consumption ratios
- Monitor and manage production orders and processes
- Monitor real time operational metrics and key performance indicators (KPIs)

**Resulting in:**
- Lost orders in process requiring manual intervention
- Inability to balance utilization of labor, machine, work cell, line, and plant assets
- Low inventory turns and large inventory of part safety stock
- Large consolidation centers
- Line stoppage due to incorrect parts and parts shortage
- Loss of manufacturing efficiency and effectiveness

**The Solution:**
- **InfoSphere Traceability Server**
- Cognos Reporting, DB2
- Webpshere Sensor Event Server, InfoSphere Information Integrator, WPS, WMB
- IBM Software Services
- Manufacturing Integration Framework
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Use Case – Asset Performance

Issues:
- Production assets are becoming continually more complex
- If assets on the production line fail, production is halted resulting in delays

Operational process:
- Sensors in the production equipment send alarm to engineer

Key questions:
- What is the normal failure rate on production assets, such as robot?
- What is causing certain production assets to break down more often?
- How can we prevent this failure from occurring again?
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IBM Manufacturing Reference Architecture

Manufacturing Integration Framework, links products to create Composite Solutions

COGNOS
Operational Dashboard

Business Visibility

Plant Visibility

Supplier Collaboration

Information Consumers

Usage Scenarios

Strategic Solution Platform

Sensing Technologies and External Integration

WebSphere Sensor Events Server

Capabilities:
- Factory model configuration
- Event management
- Process management
- Solution Logging
- Device Integration Services (RFID, PLC, etc)

Event Rules Processing

Products:
- WebSphere Process Server
- WebSphere Business Events/iLog
- DB/2
- WebSphere Business Modeller/Monitor

Adapters

Manufacturing Integration Framework, links products to create Composite Solutions

Barcode Scanners
RFID Readers
PLCs
Test Equipment
Robots
AGVs
Printers

ILOG
ILOG
Infosphere Traceability
Maximo
Lotus eForms
Infosphere Traceability
Adobe
WPG
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(1) Ensure Enterprise Process Flow Execution

- 1 wafer passes reader
- Workflow is started
- Event Processor
- Tracking
- Data Collection
- Broadcast
- WIP and order status updated
- Data sent to shop floor device
- Data Collection
- Scheduling
- B2B
- Maximo sent machine cycle counts
- Production Monitoring
- Production counters updated
- Asset Mgmt.
- Error Proofing
- Wafer Manufacturing Services Bus
- ERP parts back-flush
- JIT broadcast sent
- Suppliers
- Device Service (RFID/PLC)
Business Value of Process Composition

Solution integrates real-time, event driven factory floor with the supply chain to improve operational performance, asset utilization, and inventory management

- **Improve Flexibility and Adaptability**
  
  Greatly improved flexibility and responsiveness to business process and market changes

- **Enable Real Time Access to Business Performance**
  
  Improved information and collaboration to meet budget and cash flow challenges:
  
  - Respond quickly to process issues to improve quality and operational efficiency
  - Reduce in house or vendor managed inventory, scrap and production costs
  - Improve the ROI of existing supply chain systems

- **Create a Scalable, Integrated Business**
  
  Fast ROI through application of pre-built functionality with seamless configurable enterprise integration to existing information systems:
  
  - Reduce IT costs through lower TCO with improved capabilities to manage and absorb change
  - Utilize “off the shelf” services to eliminate development costs and reduce long-term maintenance costs.
  - Incorporate legacy components as services and extend their life and value
(2) Track and Trace Assets + Resources

Manufacturing Services Bus

Device Service (RFID/PLC)

Workflow Engine

Tracking

Data Collection

Broadcast

Quality

Scheduling

B2B

Information Management

Corp Systems

Suppliers

Asset Mgmt.

Error Proofing

Production Monitoring

Printers - Track Sheets and Bar-code labels (QMS and Quality processes)

 venda PLC - Data Concentrator
(For async devices - torque, etc.)

GSC/Test Gate
-plus other async devices

RF Terminals:
Data Collection, Inspection

Test Stands
(Perception, Etc.)

Data Collection
InfoSphere Traceability Server

With InfoSphere Traceability Server you can:

- Track the what, where, when and why of returnable containers and assets
- Gain visibility of container/asset movement across the total supply chain
  - Reduce container population by ~30%
  - Eliminate between 10 - 15% of safety stocks
- Easily build reports, alerts and additional applications to analyze data
(3) Plant Scheduling

Manufacturing Services Bus

- Workflow Engine
- Tracking
- Data Collection
- Broadcast
- Asset Mgmt.
- Error Proofing
- Production Monitoring
- Device Service (RFID/PLC)
- Quality

Suppliers

Customers

Manufacturing Industry Services

B2B

Manufacturing Services Bus

Plant Scheduling

- Printers - Work Sheets and Barcode Labels (Gilat and Zebra protocols)
- AS PC - Data Collector (For analog devices - torque, etc.)
- GPC Torque Guns (plus other analog devices)
- Existing Systems: AES, PVE
- RF Terminals - Data Collection, Inspection
- Test Stands (Palipan, Bauer)
- Data Collection
Integrated Planning and Scheduling

• Improves agility and visibility

• Reach operational efficiency while respecting min and max days of supply

• Analyze demand variation, inventory, min and max days of supply
Planning and Scheduling in One Tool
- Allows you to simultaneously develop schedules
- Many offer this as two separate tools

Ease of Use
- Drag and drop capability with pegging
- Inventory graphs
- Ability to see warnings and exceptions in real time

Strong Features to Support Multiple Industries
- Meant to handle batch production, tanks, sequence dependent set-ups, cleaning processes, shelf-life, and lot tracking
- Can also handle the discrete part of these industries

Advanced Optimization
- Scheduling applications grow complex very fast
- CPLEX (iLog Optimizer toolkit) and Constraint Programming
- Korea (BP – KS Tech) – build an RTS module on top of CPLEX and has development skills to do that. Sold to LG – close in Q2.

Built to complement your existing systems
- Does not replace functionality in your ERP systems
How The Scheduler Interacts with PPO

- Data is downloaded to PPO on a periodic basis and schedules are generated

- Scheduler analyzes the schedule
  - Late jobs
  - Equipment utilization
  - Staffing

- Scheduler decides to make manual changes
  - Move around the times manually
  - Reassign resources
  - Decide what is firm and frozen
  - Re-run optimization, analyze, and commit schedule

- Event happens in the plant to cause a manual re-schedule
  - Machine breaks down
  - Quality problem with a batch
  - Demand changes
  - Scheduler decides what is frozen and re-runs to react to the event
## Key Benefits of ILOG PPO

### Process
- Improve
  - Operation efficiency/utilization
  - Service levels
  - Inventory levels
- Deliver executable plan
  - Finished & intermediate products
  - Cleaning & changeovers
- Planning and scheduling integrated

### Users
- Very good acceptance by users
- Easy to learn and easy to use
- Decision support system for planners with plan editing capabilities

### Organization
- Manufacturing and Supply Chain Planning can use the same tool
- Daily (or more frequent) planning: provides improved reactivity
- Detailed planning delivered to manufacturing
- Can schedules down to the minute while plan for the next few weeks/months

### Information System
- Full integration to existing ERP and SCM systems
- Modeling of both finished and semi-finished products
- Repeatable core-model
(4) Plant Asset Management

- Workflow Engine
- Tracking
- Data Collection
- Broadcast
- ILOG
- SAP
- B2B
- Manufacturing Industry Services
- Scheduling
- ERP
- Manufacturing Services Bus
- Device Service (RFID/PLC)
- Quality
- Error Proofing
- Production Monitoring
- Asset Mgmt
- ERP
- Scheduling
- Asset Mgmt
- Existing Systems: AME, PVE
- RF Terminals: Data Collection, Inspection
- Data Collection
- Test Stands: (Pneumatic, Bauer)
- Ethernet network
- Printers - Track Sheets and Bar-code Labels (QAS and Zebra protocols)
- AB PLC - Data Concentrator (For async devices - torque, etc.)
- GSC Torque Gage (plus other async devices)
MIF Asset Performance Management

Example: A production alert triggered by multiple error codes from device PLC.

MIF enables a predefined workflow process workflow to request maintenance service before the equipment fails completely.

A proactive response to avoid downtime.
(5) Performance Management Manufacturing Dashboards

How are we doing?
Why?
What should we be doing?

Workflow Engine
Tracking
Data Collection
Broadcast
Scheduling
ERP
B2B

Device Service (RFID/PLC)

Cognos
Asset Mgmt
maximo

Suppliers

Plant Data Warehouse
Manufacturing Services Bus

Customers

Manufacturing Industry Services

ERP

Scheduling

Production Monitoring

Error Proofing

maximo Asset Mgmt

Customer

Manufacturing Industry Services

Device Service (RFID/PLC)

maximo Asset Mgmt

How are we doing?

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Device Service (RFID/PLC)

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How are we doing?

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maximo Asset Mgmt

Device Service (RFID/PLC)
MIF & Maximo Value Proposition for Manufacturing Operations

- Full support of Asset Lifecycle Management
- Support asset configurations and complex asset hierarchies (Heavy Equipment, etc)

**Supporting Manufacturing Concepts as**
- Reliability Centered Maintenance (RCM)
- Total Productive Maintenance (TPM)
- Lean Manufacturing principles as well as Six Sigma

- Cost reduction in Maintenance & Service Operations
  - Track & trend critical asset information to increase visibility

- Risk & Compliance Management
  - SOX, ISO, ISA, ROHS, IEEE, WEEE, OSHA

- Capabilities for multi-site, multi-organization structures:
  - Global implementations and roll-out, running Maximo Asset Management on a single instance

- Many years proven experience in Manufacturing and “regulated” environments

- Alignment with overall Business Objectives
  - Supporting Services Management requirements
  - all Asset Classes
Delivering Insight For Operational Excellence

- Turn data into Information
  - Plant Data consolidation
  - Standardized reports
  - Threshold alarms
    - Green, Yellow, Red
  - Drill down capability

- Turn Information into Knowledge
  - Equipment utilization
  - Operator productivity
  - Downtime reports
  - Production volumes
  - Scrap and Yields
  - Defect reporting
  - Rework
  - Overtime Hours
  - Safety
Questions?

Thank You!