The PI System – Enterprise Manufacturing Intelligence Infrastructure

Presented by
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Enterprise Manufacturing Intelligence (EMI)

“Manufacturing Intelligence (MI), also known as Enterprise Manufacturing Intelligence (EMI), software delivers real-time information about manufacturing processes to help businesses optimize the performance of these processes as well as manufacturing yields. MI software gathers and analyzes production data, provides role-based visualization, and helps manufacturers reduce waste. The software also enables the improvement of manufacturing processes, identification of best practices, and the ability to respond to exceptions and events.”

Source: Manufacturing Automation
EMI Definition Condensed

“Manufacturing Intelligence (MI), also known as Enterprise Manufacturing Intelligence (EMI), software delivers real-time information about manufacturing processes to help businesses optimize the performance of these processes as well as manufacturing yields. MI software gathers and analyzes production data, provides role-based visualization, and helps manufacturers reduce waste. The software also enables the improvement of manufacturing processes, identification of best practices, and the ability to respond to exceptions and events.”

Source: Manufacturing Automation

Manufacturing Intelligence:
- Delivers real-time information about manufacturing processes
- Gathers and analyzes production data
- Provides role-based visualization

Delivered Value:
- Optimize process performance and manufacturing yields
- Reduce waste
- Improve manufacturing processes
- Identification of best practices
- Respond to exceptions and events
Core Functions of EMI

• **Aggregation**: Making available data from many sources, most often databases.

• **Contextualization**: Providing a structure, or model, for the data that will help users find what they need. Usually a folder tree utilizing a hierarchy such as the ISA-95 standard.

• **Analysis**: Enabling users to analyze data across sources and especially across production sites. This often includes the ability for true ad hoc reporting.

• **Visualization**: Providing tools to create visual summaries of the data to alert decision makers and call attention to the most important information of the moment. The most common visualization tool is the dashboard.

• **Propagation**: Automating the transfer of data from the plant-floor up to enterprise-level systems such as SAP, or vice versa.

*Source: AMR Research*
Aggregation – Enterprise Challenges

Variable Process Control System Landscape

Typical DCS Vendors
- Vendor F
- Vendor G
- Vendor C

Typical PLC Vendors
- Vendor A
- Vendor B
- Vendor C
- Vendor D
- Vendor E

Typical Process Control System Landscape
- DCS
- PLC
- BMS

Level 0: Equipment
- Batch Control
- Continuous Control
- Discrete Control

Level 1
- Business Planning & Logistics
- Manufacturing Operations Management

Level 2
- Suppliers
- Distribution

Level 3: MES
- Quality Management
- Batch Management

Level 4: ERP
- Business Planning & Logistics

Making available data from many sources, most often databases.
Making available data from many sources, most often databases.

Aggregation – PI System Data Infrastructure

ISA S95

Level 4: ERP

Level 3: MES

Level 2

Batch Control
Continuous Control
Discrete Control

Level 1

SCADA/PLC/DCS

Level 0: Equipment

Data Access

Real-Time Data Infrastructure

Common Data Presentation Layer

Electronic Work Instructions

Event Frames & Batch

Electronic Work Instructions

Tag Data

Assets & Attributes

Downtime

Batch

Startup

Event Frames & Attributes

PI Server

PI AF

PI EF
Aggregation – Referenced Data Sources

• PI AF allows you to tie asset properties to your data
  – Static values, PI Tags from multiple PI Servers, static or linked Tables
  – Custom data references to other data sources
    • MES, other historians, LIMS, Maximo, etc.

• PI EF leverages PI AF functionality, but will add an EF / Batch Context
  – Reference LIMS data associated with a batch.
Providing a structure, or model, for the data that will help users find what they need.

Contextualization

- PI AF provides a **configurable and flexible data abstraction model** to help different users **easily find information** they need to make decisions.
<table>
<thead>
<tr>
<th>Summary: Where to Build the Meta Data Context?</th>
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<table>
<thead>
<tr>
<th>Context in Data Infrastructure Layer</th>
<th>Context in Application Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time Series Data</strong></td>
<td>Core competency of OSIsoft</td>
</tr>
<tr>
<td><strong>Relational Data</strong></td>
<td>Architecture supports relational data access</td>
</tr>
<tr>
<td><strong>Scalability / Big Data</strong></td>
<td>Scale to meet needs of EMI (many users, many composite applications)</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>Fast Horizontal Rollout Leading to Reduced Time to Value</td>
</tr>
<tr>
<td><strong>Interoperability</strong></td>
<td>Yes - Standards &amp; Custom</td>
</tr>
<tr>
<td><strong>Standardized …</strong></td>
<td>Behaviors (more valuable because you can count on the same answer independent of the client application)</td>
</tr>
<tr>
<td><strong>Solve Problems with …</strong></td>
<td>80% Products, 20% Partner / Custom</td>
</tr>
<tr>
<td><strong>Total Cost of Ownership</strong></td>
<td>Lower TCO</td>
</tr>
</tbody>
</table>
Enabling users to analyze data across sources and especially across production sites.

**Analysis**

Inventory – Region Level

Rollup PI System Data Reference
Providing tools to create visual summaries of the data to alert decision makers and call attention to the most important information of the moment.

Visualization – PI WebParts & Microsoft SharePoint

PI WebParts 2010 for Microsoft SharePoint 2010 or 2007
Providence tools to create visual summaries of the data to alert decision makers and call attention to the most important information of the moment.

Visualization – PI WebParts & Microsoft SharePoint

Cycle Time
Over Selected Operation / Phase

CONT.Level Summary Calcs
Over Selected Operation / Phase
Automating the transfer of data from the plant-floor up to enterprise-level systems such as SAP & Maximo, or vice versa.
Core Functions of EMI – Satisfied by the PI System

- Aggregation
- Contextualization
- Analysis
- Visualization
- Propagation
How is the PI System different?

- **True Enterprise View & Management**
  - PI AF Element Templates
  - PI EF Templates
  - PI AF Unit of Measure
  - Enterprise Deployment Options

- **Infrastructure Approach to EMI**
  - Reactive vs. Proactive

Core Functions of EMI

- Aggregation
- Contextualization
- Analysis
- Visualization
- Propagation
Enterprise Management – PI AF Element Templates

- Standardize across your enterprise – common asset model
- Maintain many elements with your template and grow your PI AF database as an analysis tool over time
- Leverage templates in analytics/calculations, notifications, reports, visualization, and integration with other systems.
Enterprise Management – EF Templates

- Standardize on Event Frame templates across the Enterprise for a variety of use cases:
  - Shift Analysis
  - Startup / Shutdown
  - Downtime & Overall Equipment Effectiveness (OEE)
  - Excursions
  - Alarms & Events
  - Batch
Enterprise Management – PI AF Unit of Measure

- Automatic conversion of UOMs of the same class
- Enables cross site comparison
- UOMs are extensible (define your own through code)
Deploy PI AF with the Enterprise in Mind

- PI AF supports referencing data across multiple PI Servers & systems
- PI AF supports both central (Enterprise) and local (Site) deployments with several synchronization options
  - AF HA (Replication)
  - AF XML Export/Import
  - AF Builder Export/Import
  - AF Data Access Custom App
  - More options in the future

Think Globally, Implement Locally

AF XML Export/Import

Enterprise Level

Automatic Manual

WAN

XML

Site Level

Site A

Site B

Site C

R/W

R/W

R/W
Infrastructure Approach to EMI

- Why did it take so long to notice?
- What did it take for the customer to find this trend and identify this problem?
- With tens of thousands of tags in a typical PI System, how many other opportunities are going unnoticed?

Fuel flow spikes discovered costing $93,000 / year

Reactive or Proactive?
Infrastructure Approach to EMI

Web Service

Root Cause

PI Notifications

Reactive or Proactive?
Infrastructure Approach to EMI

How many solutions are implemented at a single site but the ‘best practice’ is never formalized and replicated to other sites?

Process Knowledge, Transparent Accountability
Articulated, Defined, & Standardized
Scalable Across Enterprise
Reduced Information Management Infrastructure

• The “E” in EMI is Enterprise
  – How many Manufacturing Intelligence applications enable you to spread your ‘intelligence’ across the Enterprise?
• The PI System enables you to scale the EMI Infrastructure across the Enterprise.
  – Replication of solutions/applications/analytics/displays/reports/BI
  – Rollup and Enterprise views
  – Ease of accessibility to information for ALL users
• Reduced …
  – Cost of Ownership & Maintenance
  – Cost of Curiosity that enables Value Discovery across the Enterprise
Conclusions

• Value from Manufacturing Intelligence (and BI) requires Real-Time Insight
• The PI System fulfills all the required functions of Enterprise Manufacturing Intelligence

“If application vendors succeed in delivering real-time transactional insight with reduced information management infrastructure, it would be a game changer.”

The PI System:
• Delivers real-time information about manufacturing processes
• Gathers and analyzes production data
• Provides role-based visualization
• Reduces the information management infrastructure for EMI

Delivered Value:
• Optimize process performance and manufacturing yields
• Reduce waste
• Improve manufacturing processes
• Identification of best practices
• Respond to exceptions and events
• Game changer!!!
Thank you