Operational Excellence at The Hershey Company

Russ Gregg
Digital Manufacturing Solutions Architect
IS Global Supply Chain Solutions
The Hershey Company
### Hershey Story – Do Well by Doing Good

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1894</td>
<td>Milton S. Hershey establishes the Hershey company.</td>
</tr>
<tr>
<td>1905</td>
<td>The Hershey Chocolate factory begins operations and the Hershey Trust Company is established.</td>
</tr>
<tr>
<td>1909</td>
<td>Mr. Hershey and his wife Catherine establish a boarding school for orphan boys.</td>
</tr>
<tr>
<td>1918</td>
<td>Milton establishes the Hershey Trust Fund to benefit children in need.</td>
</tr>
<tr>
<td>1935</td>
<td>Milton establishes the M.S. Hershey Foundation to provide educational and cultural enrichment for Derry Township residents and visitors. (Penn State Medical Center, The Hershey Story, Hershey Gardens, Hershey Theatre, and Hershey Community Archives)</td>
</tr>
<tr>
<td>Today</td>
<td>Manages the $12 billion trust to grow and maintain the Milton Hershey School which is a coed boarding school benefiting over 2,000 students from pre-K through High School.</td>
</tr>
</tbody>
</table>
Some Hershey Initiatives

- **Cocoa Sustainably**: [CocoaLink, Learn to Grow, CocaAction](#) are all part of meeting our 21st Century Cocoa Sustainability Goal of 100% certified and Sustainable supply by 2020. (2016 - Over 48,000 farmers and 60% sustainable sourcing) 50 Million Dollar Investment over next

- **Nourishing Minds**: Improving the lives of children by developing and supporting manufacturing of daily nutritional supplement. *(Reaching over 50,000 kids in Ghana each day.)*

- **Rise Against Hunger** – Annual event where over 700 employee volunteers pack meal packs to feed school children. *(Over 1 M meals packed in 4 years 285,120 meals in one afternoon)*

- **Packaging Sustainability** –Reduce 25 Million pounds of packaging by 2025. *(3.5 M lb. reduction through new innovative retail ready cases and over 9 M LB. reduction since 2014.)*

- **Simple Ingredients**: No artificial flavors, no preservatives no artificial sweeteners and natural colors. *(Milk Chocolate: Kisses, Nuggets, Bars and Simply 5-Syrup)*

- **Smart Labels**: Goes beyond the printed labels to provide scannable code for quick online access to detailed ingredient information and certifications. *(70% complete and 90% by 2018).*
Supply Chain Challenges

Key Capabilities
- Visibility
- Insights
- Speed
- Agility
- Efficiency
- Sustainability
- Scalability
Visibility

Results of an IBM survey of over 400 supply chain executives in over 25 countries and 29 industries.

“70% of the executives stated their **biggest challenge** was **visibility**. They **don’t have** the appropriate level of **insight** into what is happening within their operations on the ground-level or on the production floor **in real time**, and this lack of insight **hampers their ability** to make the **right decisions at the right time**.”

*IBM - Driving operational excellence with predictive analytics*
Real Time Enterprise

“The Real-Time Enterprise monitors, captures and analyzes root-cause and overt events that are critical to its success the instant those events occur to identify new opportunities, avoid mishaps and minimize delays in core business processes.

The Real-Time Enterprise will then exploit that information to progressively remove delays in the management and execution of its critical business processes.”

Gartner
Interest in Time Series Data is Growing
Operational Intelligence Maturity

- Predictive Control
- Prevent it from happening!
- Why is it happening?
- When and where is it happening?
- What is happening?
- What happened?

- Low Maturity
- High Maturity

- Predictive
  - Real Time Analytics & Insights
  - Operational Visibility
  - Monitoring and Alerting
  - Search and Investigate

- Reactive
  - Predictive Control
  - Monitoring and Alerting
  - Search and Investigate
  - What Happened?
Transformation Stages

1. **ASSESSMENT**
   - Create the blueprint for a secure and collaborative operation.

2. **SECURE & INTEGRATE**
   - Securely integrate IT/OT networks and systems to modern information-enabled technologies.

3. **LIBERATE DATA**
   - Define and organize operational data to deliver performance-critical information for better real-time decision making.

4. **ANALYTICS**
   - Transform data into operational information that can help lower cost, increase productivity and improve customer satisfaction.

5. **OPTIMIZE**
   - Leverage predictive capabilities to respond faster to external events and changing market conditions.
Driving Collaboration @ all levels

1. Digital Manufacturing Strategic Council
2. Digital Manufacturing CoP
3. Digital Controls CoP
# ISA-95 Domain Architecture

<table>
<thead>
<tr>
<th>STD</th>
<th>LEVEL</th>
<th>TIME</th>
<th>PROCESS</th>
<th>MISSION</th>
<th>GOV.</th>
<th>PLATFORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERP Saas</td>
<td>5</td>
<td>Years Months Weeks</td>
<td>Business Process Management</td>
<td>Integrated planning, design of Business Processes used to execute and monitor BPM activities including Strategy, Finance, Marketing, HR, Sales, R&amp;D, Legal, and Customer Service.</td>
<td></td>
<td>SAP S4 HANNA</td>
</tr>
<tr>
<td>APICS SCOR</td>
<td>4</td>
<td>Months Weeks Days</td>
<td>Supply Chain Management</td>
<td>Integrated planning, design of Supply Chain processes used to execute and monitor SCM activities including Planning, Sourcing, Making, Delivering and Returning materials and products.</td>
<td>IT</td>
<td>SAP MII</td>
</tr>
<tr>
<td>ISA 95 MESA</td>
<td>3</td>
<td>Shifts Hours Minutes</td>
<td>Manufacturing Operations Management</td>
<td>Integrated planning, design and management of Manufacturing Operations Management (MOM) processes used to execute and monitor MOM activities including plant Production, Quality, Inventory and Maintenance.</td>
<td>DM</td>
<td>OSIsoft</td>
</tr>
<tr>
<td>ISA 88</td>
<td>2</td>
<td>Minutes Seconds</td>
<td>Supervisory Control and Data Acquisition Management</td>
<td>Integrated planning, engineering and management of Supervisory Control and Data Acquisition (SCADA) systems used to manage, control and monitor industrial control systems.</td>
<td></td>
<td>Kepware</td>
</tr>
<tr>
<td>ISA SME</td>
<td>0</td>
<td>Real Time</td>
<td>Batch Process, Continuous Process, Discrete Process</td>
<td>Integrated design, engineering and operation of production processes through the accurate and timely measurement, manipulation and control of physical equipment and production processes.</td>
<td>OT</td>
<td>Various SCADA, DCS and Controls</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Material Batching, Material Processing, Production &amp; Packaging</td>
<td>Integrated design, engineering, deployment and commissioning of physical machines and production processes to manufacture products to meet forecasted consumer demand.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Overcoming Challenges – PI Infrastructure

<table>
<thead>
<tr>
<th>Integrate</th>
<th>Manage</th>
<th>Architect</th>
<th>Analyze</th>
<th>Deliver</th>
</tr>
</thead>
</table>
| • Legacy Controls  
  • Multiple Vendors, Models  
  • Multiple Logic Models  
  • Variable Process Types  
  • IIOT | • Single Data Source  
  • Low Touch Points  
  • High Availability  
  • Security | • Configurable  
  • Scalable  
  • Flexible  
  • Expandable  
  • Proven | • Streaming Data  
  • High Fidelity  
  • Event Capture  
  • Data Structure  
  • Meta Data  
  • Data Aggregation  
  • Data Analytics  
  • BI Integration | • Open Standards  
  • Multiple Data Delivery Methods  
  • Visibility Tools  
  • Ease of Use |

### Integrate
- PI Interfaces 400 +  
- PI Connectors  
- PI Developer Tech.  
- PI Manual Logger

### Manage
- IT Monitoring  
- High Availability  
- User & Role Based Security  
- Trust Tables  
- Audit Trail  
- Data Services

### Architect
- PI Data Archives  
- PI Interfaces  
- PI HA  
- Flexible deployment  
- 1,000,000 + points.

### Analyze
- AF Data Analytics  
- AF Element Templates  
- AF Event Frames  
- Real Time  
- Event Management  
- Data Aggregation  
- Reusable

### Deliver
- PI Vision  
- PI Process Book  
- PI DataLink  
- PI Batch View  
- PI OLEDB  
- PI ODBC  
- PI SDK
# Manufacturing Insight Consumers

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Scope</th>
<th>Time</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. VP Global Supply Chain</td>
<td>Entire Supply Chain</td>
<td>Year To Yr.</td>
<td>Total Cost to Deliver</td>
</tr>
<tr>
<td>VP Global Operations</td>
<td>All Operations</td>
<td>Quarter To Qtr.</td>
<td>Global Demand Delivery</td>
</tr>
<tr>
<td>VP Regional Operations</td>
<td>Regional Operations</td>
<td>Month To Mth.</td>
<td>Regional Demand Delivery</td>
</tr>
<tr>
<td>Plant Managers</td>
<td>Plant Operations</td>
<td>Week To Wk.</td>
<td>Plant Delivery</td>
</tr>
<tr>
<td>BU Leaders</td>
<td>Unit Operations</td>
<td>Day To Day</td>
<td>Schedule Delivery</td>
</tr>
<tr>
<td>Quality Managers</td>
<td>Plant Quality</td>
<td>Day To Day</td>
<td>Quality &amp; Regulatory</td>
</tr>
<tr>
<td>Supervisors</td>
<td>Shift Operations</td>
<td>Hour To Hr.</td>
<td>Shift Execution</td>
</tr>
<tr>
<td>Operators</td>
<td>Line Operation</td>
<td>Minute to Min.</td>
<td>Real Time Execution</td>
</tr>
<tr>
<td>Maintenance Tech</td>
<td>Equipment Operations</td>
<td>Second to Sec.</td>
<td>Asset Performance</td>
</tr>
</tbody>
</table>
# Alignment with Objectives and Methods

## Business Objectives
- Highest Quality, Lowest Cost (Brand Image)
- Highest Input Yield, Lowest Cost
- Highest Margin
- Minimize Inventory, Improved Customer Service
- Schedule Agility and Expanded Product Mix, Lower Inventory
- Expanded Consumer Base
- Reduce Cost of Compliance, Consumer Safety
- Corporate Social Responsibility
- Sustainable Competitive Advantage

## Plant Performance Objectives
- Improve Quality
- Reduce Variability
- Eliminate Waste
- Optimize Production Costs
- Activity Based Accounting
- Produce to Schedule
- Change Over Optimization
- Time to First Quality Pack
- Flexible Manufacturing
- Produce to Consumer Requirements
- 100% Regulatory Compliance (GAMP, HACCP)
- Emissions, Waste, Energy Reduction
- Sustainable Resources/Materials
- Organization Effectiveness

## Manufacturing Methods
- 6-Sigma
- Lean
- Strategic Sourcing, Labor Planning, OEE, CIL, Predictive Maintenance
- E-Schedule, Dispatching, Job tracking, JIT, Kanban
- SMED, JIT, SS, Recipe Management, Planned Limits
- Product Lifecycle Management
- E-Quality Task Mgmt.
- Quality, Food Safety, AIB Checks
- Utilities and Energy Optimization
- Sustainable Packaging, 0-Landfill
- E-Task Management, Document Management, CBT

(Adapted from ARC Research)
Hershey Operational Intelligence Platforms

Manufacturing Intelligence

- PM-Plant Maintenance
- PP-Production Planning
- WM-Warehouse Mgmt.
- MM- Material Mgmt.

Web Apps

Asset Intelligence

- Multiple Vendors
- Multiple Platforms
- Multiple Versions

SAP Manufacturing Integration & Intelligence

OSIsoft

MOM

- Multi Platform
- Multi Vendor
- Custom Solutions

SCADA

- Multiple Vendors
- Multiple Platforms
- Multiple Vintages

Controls

- Instrumentation
- Metal Detectors
- X-Ray
- Scales
- Vision Systems

Devices
Integration Challenges

Obstacles

• Variability in control data configuration and coding models.
• Wide span of both legacy control systems and newer technologies.
• Inconsistent data definitions and scaling that require data transformations.
• Minimizing risk of over tasking the legacy control systems.
• Needed to open up connectivity while retaining security.
• Application layer requires a uniform data model to simplify integration of MOM platforms and SAP MII applications.
# Agree on Key Outcomes and KPI’s

<table>
<thead>
<tr>
<th>Business Performance</th>
<th>Product Margin &amp; Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Performance</td>
<td>Cost Variance $</td>
</tr>
<tr>
<td></td>
<td>% Utilization</td>
</tr>
<tr>
<td></td>
<td>% Efficiency</td>
</tr>
<tr>
<td></td>
<td>% Schedule Conformance</td>
</tr>
<tr>
<td>Line Performance</td>
<td>% Yield vs STD</td>
</tr>
<tr>
<td></td>
<td>OEE %</td>
</tr>
<tr>
<td></td>
<td>% Efficiency</td>
</tr>
<tr>
<td></td>
<td>% Downtime</td>
</tr>
<tr>
<td>Machine Performance</td>
<td>In Count</td>
</tr>
<tr>
<td>Inputs</td>
<td>Line Speed</td>
</tr>
<tr>
<td></td>
<td>Prod. Mode</td>
</tr>
<tr>
<td></td>
<td>DT Reasons</td>
</tr>
<tr>
<td></td>
<td>Out Count</td>
</tr>
<tr>
<td></td>
<td>Producing State</td>
</tr>
<tr>
<td></td>
<td>Reject Count</td>
</tr>
<tr>
<td></td>
<td>Net Weight</td>
</tr>
</tbody>
</table>
Solution Architecture

- Multiple Vendors
- Multiple Models
- Varied Implementation Models

- Unified Interface
- Data Buffering
- Open Standards

- Unified Data Storage
- Unified Asset Model
- Event Management
- Real Time Analytics

- MOM Platforms
- MOM Apps
- MOM Integration

**Industrial Controls**

**Asset Control**
- PLC’s
- DCS
- SCADA
- Facilities
- Utilities
- Batch
- IIOT
- Batch

**Asset Integration**
- OPC Server
  - Kepware
  - RS Linxs
  - PI OPC

**Asset Intelligence**
- PI Server
  - PI Asset Framework
  - PI Asset Analytics
  - PI Data Archive
  - PI Notifications
  - PI ACE Server

**MOM Integration**
- SAP PiCo

**MOM & Intelligence**
- DT
- MSS
- POG
- CIL
- QM
- OEE
- LOG
- PCL

**MII**

- MOM Platforms
- MOM Apps
- MOM Integration
Modular & Flexible Data Services Design

PI AF (Asset Framework)

- Provides flexible hierarchical object structures with *reusable* templates.
- Enables the *standardization* of applications and reporting.
- Supports *real-time*, relational and calculated data elements.
- Supports integrated *event* and *schedule* based *calculations* and rules.
- *Easy to modify and expand* as new requirements arise.
- Easy to create *notifications*.
- Supports *open integration* with a full SDK.
- Ability to *create and track events* with PI Event Frames
Logical Data Structures

PI AF Element Structure

- Multiple PI AF hierarchies can be created to provide views of the same data from different users or use case perspectives.
- PI AF makes it easy to see how the underlying data, analysis and events fit into the higher level structures.
- It provides an easy way for users to navigate the PI System to find data in the context of the user.
- PI SDK and AF SDK allow programmatic manipulation of PI and PI AF data and objects for custom developed solutions.
- PI DataLink, PI ProcessBook, Web Parts and PI Vision leverage PI AF in their native UI’s.
Reusable Data & Event Object Templates

PI AF Templates

- Allow the creation of reusable data models.
- Templates enforce standardization.
- Templates support Parent/Child relationships through Derived Templates or Reference Templates.
- Changes in templates are inherited by each object instance of an element.
- Templates simplify administration, maintenance and changes.
- Templates are recommended for all elements, notifications and event frames. Support a
Flexible Data Elements

PI AF Elements

- Elements define the data objects for a specific asset or object.
- Attributes are defined for all required data.
- Attributes have a data reference setting that can be relative to tags, other elements and/or data sources.

Moulding Cell Element
Flexible Real Time Data Analytics

PI AF Analysis

• Manage process logic
• Manage data quality
• Filter data
• Manage data logic/rules
• Aggregate data
• Perform calculations
• Look up values in AF Tables

Solution

• Create Producing State logic
• Assign Reason Codes
• Create trigger tag validation logic
Reusable MOM Application Framework

With PI AF we are able to create uniform data models, perform required data transformations and easily support edits and additions as the plant production equipment evolves.

Result Is Operational Awareness

- Real Time Visibility
- Data Context
- Actionable Insights
- Measured Performance
Delivering Business Value

• Visibility
  • “Without visibility you are just wondering in the dark.”

• Measuring Performance
  • “You cannot improve what you can not measure.”

• Unified Architecture
  • “Unity brings harmony.”

• Improvement Methods
  • Support Lean & Six Sigma Operational Excellence Methodologies and Goals
    • DMAIC - Define, Measure, Analyze, Improve & Control
Thank You

Danke

Merci

Gracias

Спасибо

Obrigado

감사합니다

谢谢

ありがとうございます
Contact Information

Russ Gregg
Digital Manufacturing Architect
IS Global Technology Development & Operations
rgregg@hersheys.com