Operational Excellence at The Hershey Company

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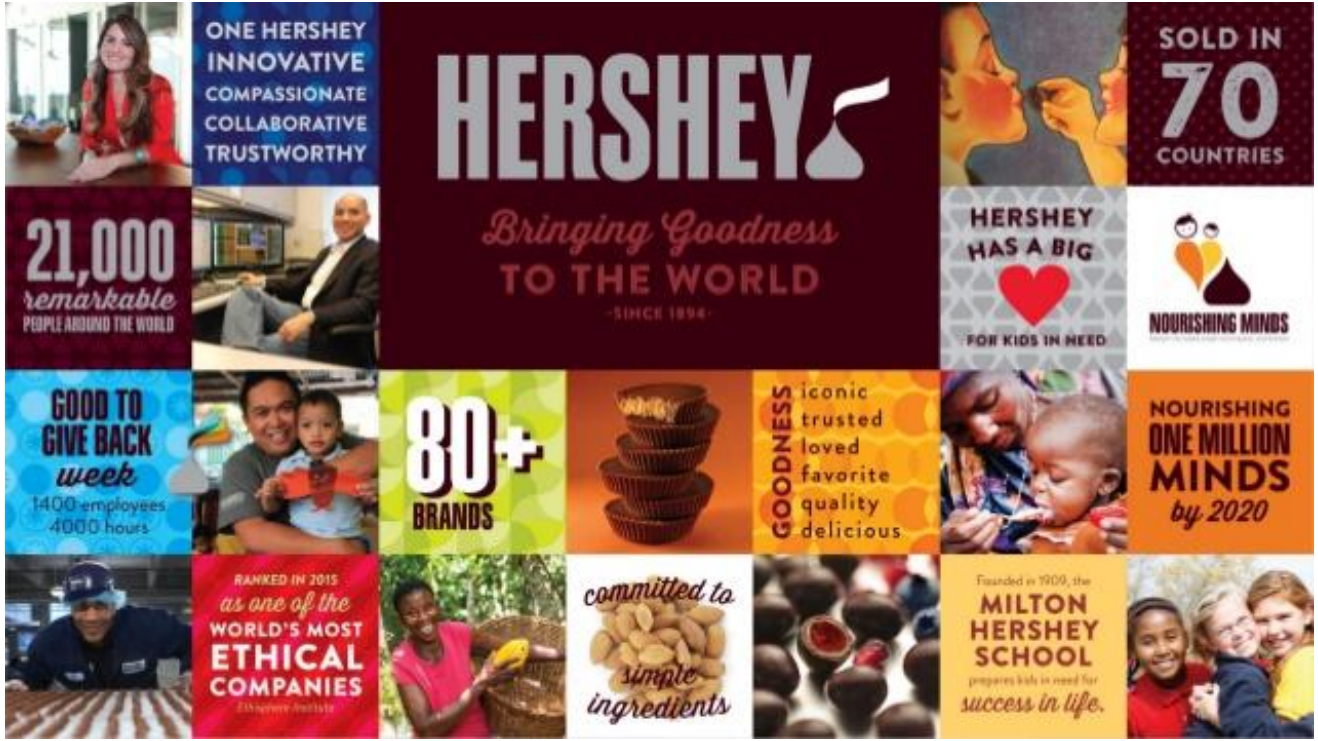
The Hershey Company



Hershey Story – Do Well by Doing Good

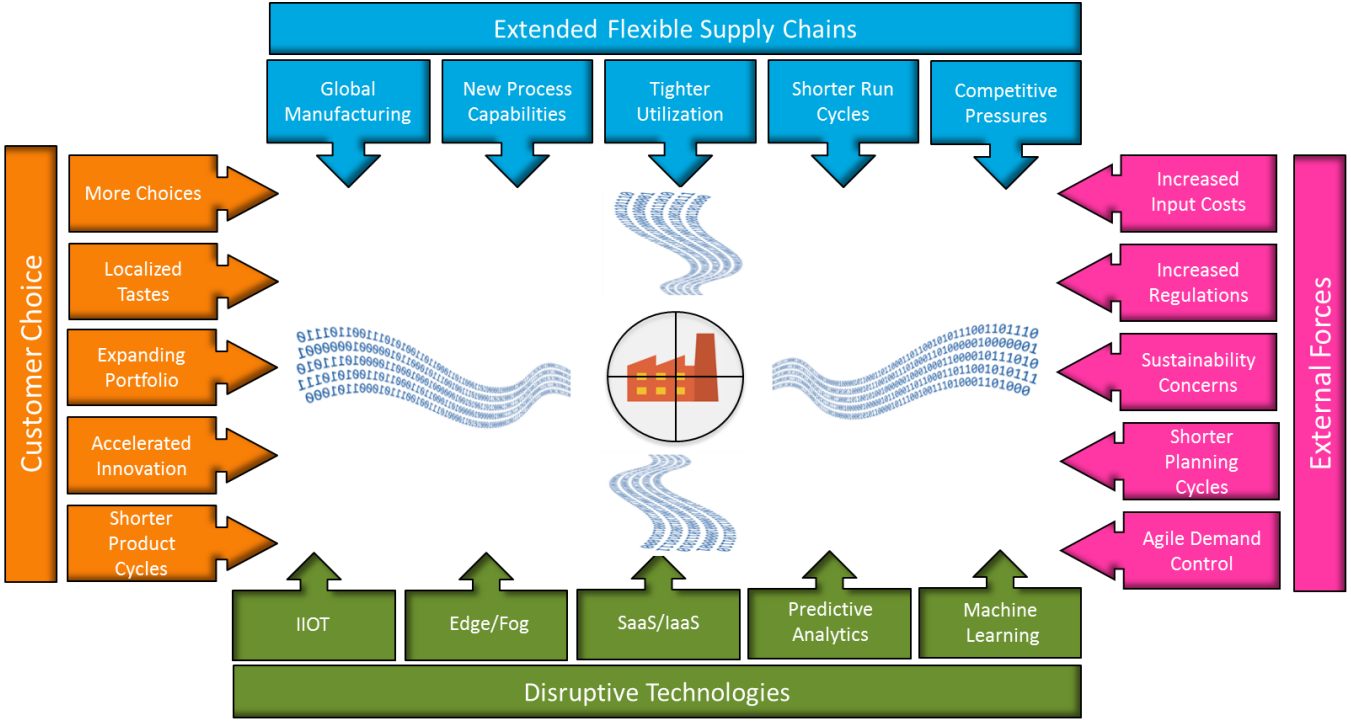
Year	Event
1894	Milton S. Hershey establishes the Hershey company.
1905	The Hershey Chocolate factory begins operations and the Hershey Trust Company is established.
1909	Mr. Hershey and his wife Catherine establish a boarding school for orphan boys.
1918	Milton establishes the Hershey Trust Fund to benefit children in need.
1935	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)
Today	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.

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

Supply Chain Visibility

Definition: Providing controlled access and transparency to accurate, timely and complete plans, event and data – transactions, content and relevant supply chain information. (Gartner, 2016)

Real Time Enterprise

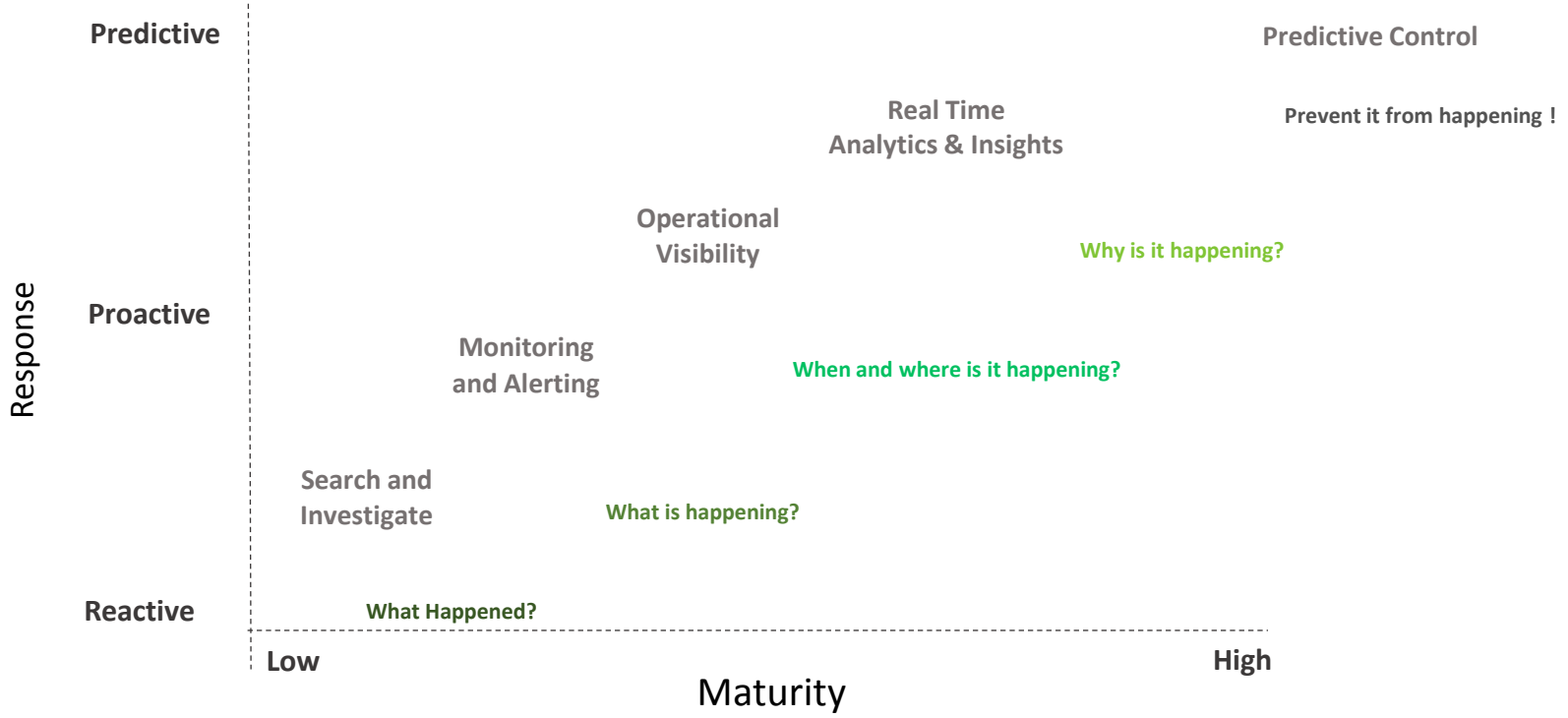
"The Real-Time Enterprise monitors, captures and analyzes root-cause and overt events that are critical to its success the instant those events occur to identify new opportunities, avoid mishaps and minimize delays in core business processes.

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



Transformation Stages

ASSESSMENT

Create the blueprint for a secure and collaborative operation.

SECURE & INTEGRATE

Securely integrate IT/OT networks and systems to modern information-enabled technologies.

LIBERATE DATA

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

ANALYTICS

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

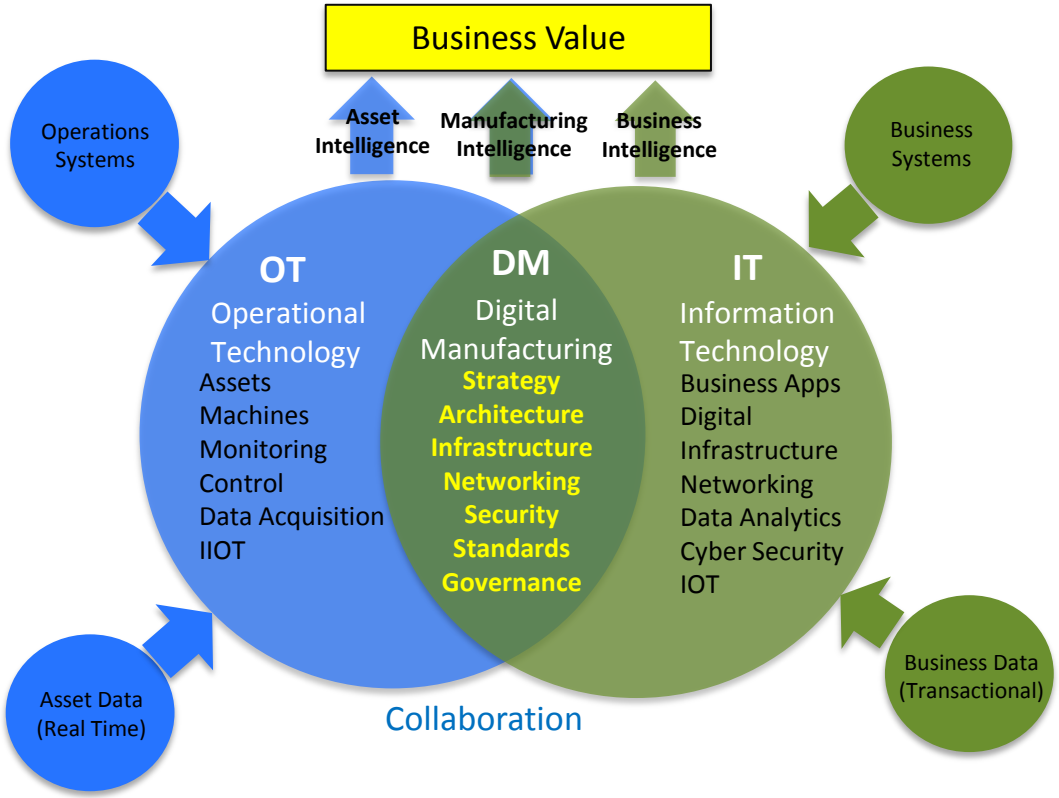
OPTIMIZE

Leverage predictive capabilities to respond faster to external events and changing market conditions.

IT/OT Convergence

Driving Collaboration @ all levels

1. Digital Manufacturing Strategic Council
2. Digital Manufacturing CoP
3. Digital Controls CoP



ISA-95 Domain Architecture

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

Overcoming Challenges – PI Infrastructure

- 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

Stakeholder	Scope	Time	Focus
Sr. VP Global Supply Chain	Entire Supply Chain	Year To Yr.	Total Cost to Deliver
VP Global Operations	All Operations	Quarter To Qtr.	Global Demand Delivery
VP Regional Operations	Regional Operations	Month To Mth.	Regional Demand Delivery
Plant Mangers	Plant Operations	Week To Wk.	Plant Delivery
BU Leaders	Unit Operations	Day To Day	Schedule Delivery
Quality Managers	Plant Quality	Day To Day	Quality & Regulatory
Supervisors	Shift Operations	Hour To Hr.	Shift Execution
Operators	Line Operation	Minute to Min.	Real Time Execution
Maintenance Tech	Equipment Operations	Second to Sec.	Asset Performance

Alignment with Objectives and Methods

Business Objectives	Plant Performance Objectives	Manufacturing Methods
Highest Quality, Lowest Cost (Brand Image)	Improve Quality Reduce Variability	6-Sigma
Highest Input Yield Lowest Cost	Eliminate Waste	Lean
Highest Margin	Optimize Production Costs Activity Based Accounting	Strategic Sourcing, Labor Planning, OEE, CIL, Predictive Maintenance.
Minimize Inventory Improved Customer Service	Produce to Schedule	E-Schedule, Dispatching, Job tracking, JIT, Kanban.
Schedule Agility and Expanded Product Mix, Lower Inventory	Change Over Optimization Time to First Quality Pack	SMED, JIT, 5S, Recipe Management, Planned Limits.
Expanded Consumer Base	Flexible Manufacturing Produce to Consumer Requirements	Product Lifecycle Management
Reduce Cost of Compliance Consumer Safety	100 % Regulatory Compliance (GAMP, HACCP)	E-Quality Task Mgmt. Quality, Food Safety, AIB Checks
Corporate Social Responsibility	Emissions, Waste, Energy Reduction Sustainable Resources/Materials	Utilities and Energy Optimization Sustainable Packaging, 0-Landfill
Sustainable Competitive Advantage	Organization Effectiveness	E-Task Management, Document Management, CBT

(Adapted from ARC Research)

Hershey Operational Intelligence Platforms

Manufacturing Intelligence

Asset Intelligence

Web Apps

SAP Manufacturing Integration & Intelligence

OSIsoft.

SAP

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

MOM

- Multi Platform
- Multi Vendor
- Custom Solutions

SCADA

- Multiple Vendors
- Multiple Platforms
- Multiple Versions

Controls

- Multiple Vendors
- Multiple Platforms
- Multiple Vintages

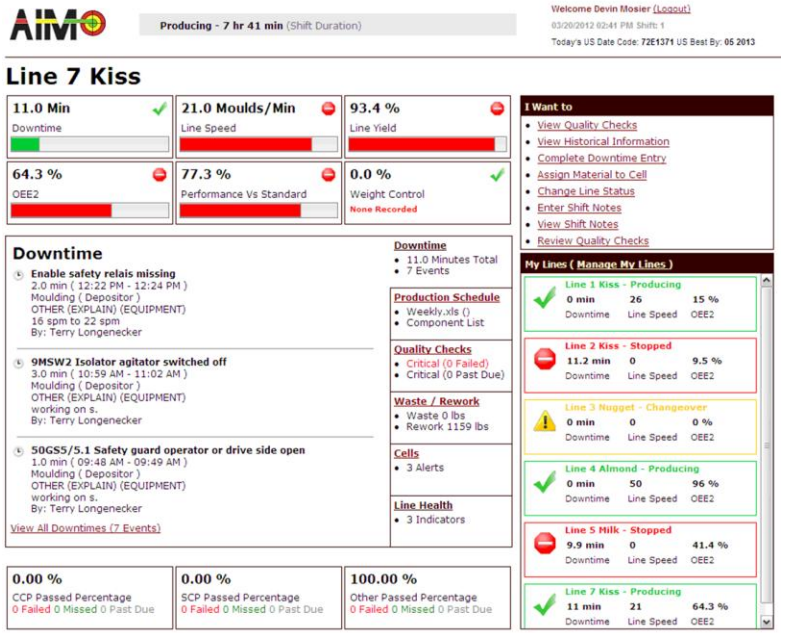
Devices

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

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

Business Performance	Product Margin & Cost			
Plant Performance	Cost Variance $	% Utilization	% Efficiency	% Schedule Conformance
Line Performance	% Yield vs STD	OEE %	% Efficiency	% Downtime
Machine Performance Inputs	In Count	Line Speed	Prod. Mode	DT Reasons
	Out Count	Producing State	Reject Count	Net Weight

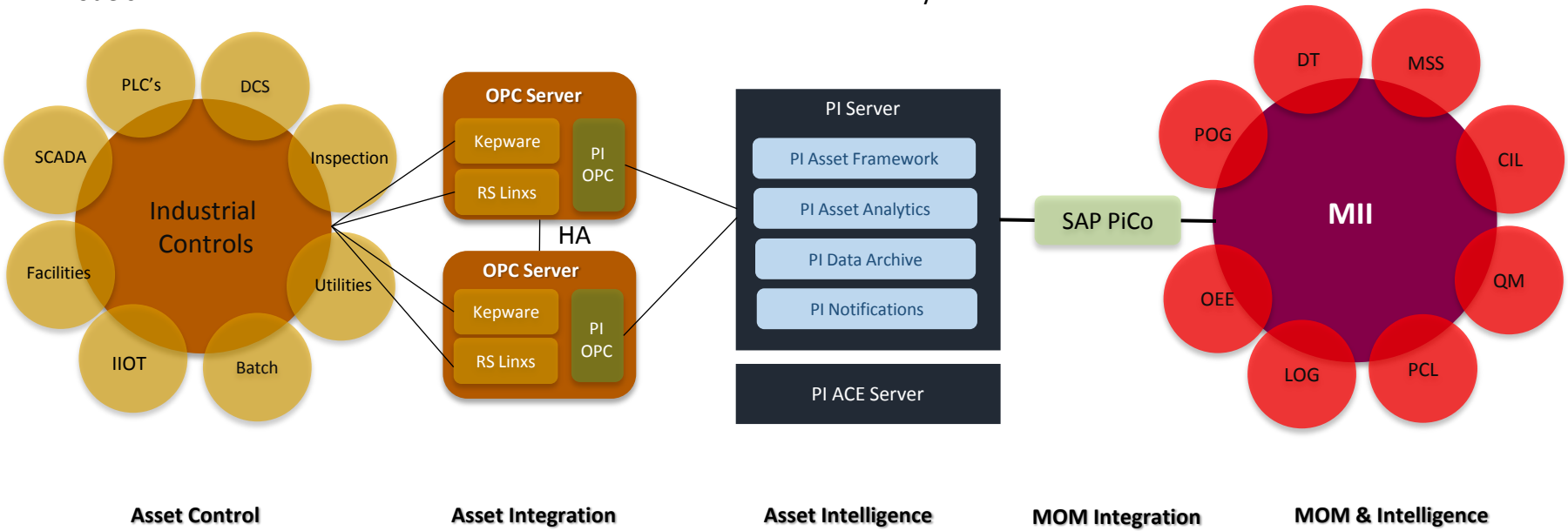
Solution Architecture

- Multiple Vendors
- Multiple Models
- Varied Implementation Models

- Unified Interface
- Data Buffering
- Open Standards

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

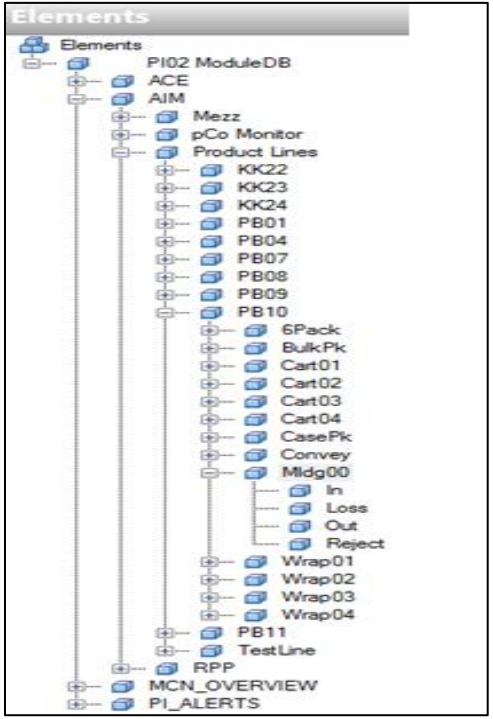
- MOM Platforms
- MOM Apps
- MOM Integration



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

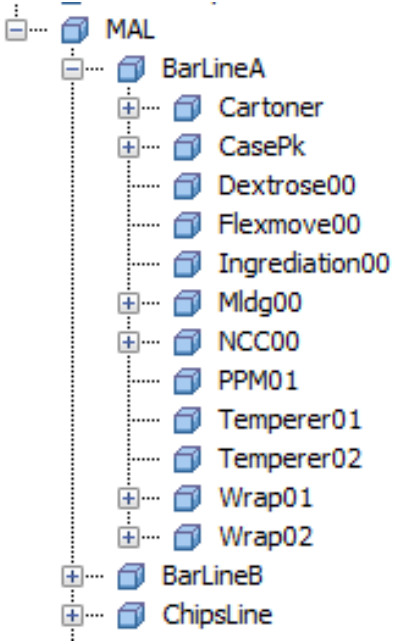


Logical Data Structures

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 underlaying 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.

Plant/Line/Cell

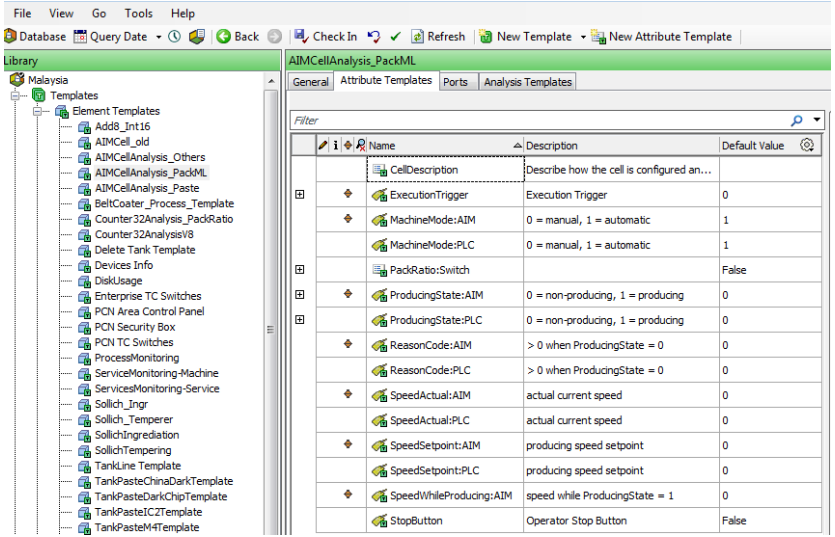


Reusable Data & Event Object Templates

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

AIM Cell Analysis PackML Template



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

MIdg00

General | Child Elements | Attributes | Ports | Analyses | Version

Filter

Name	Value	Time Stamp	Description	Value Type	Data Reference	Settin
Template: AIMCellAnalysis_PackML						
CellDescription		1/1/1970 12:00:00 AM	Describe how the cell is configured and operates	String	<None>	
ExecutionTrigger	0	10/19/2017 4:59:30 PM	Execution Trigger	Int32	PI Point	\\MALI
MachineMode:AIM	0	10/19/2017 4:59:30 PM	0 = manual, 1 = automatic	Int32	PI Point	\\MALI
MachineMode:PLC	0	10/19/2017 4:49:46.922 PM	0 = manual, 1 = automatic	Int32	PI Point	\\MALI
PackRatio:Switch	False	1/1/1970 12:00:00 AM		Boolean	<None>	
ProducingState:AIM	1	10/19/2017 4:59:30 PM	0 = non-producing, 1 = producing	Int32	PI Point	\\MALI
ProducingState:PLC	6	10/19/2017 4:46:39.036 PM	0 = non-producing, 1 = producing	Int32	PI Point	\\MALI
ReasonCode:AIM	0	10/19/2017 4:59:30 PM	> 0 when ProducingState = 0	Int32	PI Point	\\MALI
ReasonCode:PLC	0	10/19/2017 4:45:19.038 PM	> 0 when ProducingState = 0	Int32	PI Point	\\MALI
SpeedActual:AIM	12	10/19/2017 4:59:30 PM	actual current speed	Double	PI Point	\\MALI
SpeedActual:PLC	12	10/19/2017 4:46:39.036 PM	actual current speed	Double	PI Point	\\MALI
SpeedSetpoint:AIM	12	10/19/2017 4:59:30 PM	producing speed setpoint	Double	PI Point	\\MALI
SpeedSetpoint:PLC	12	10/19/2017 4:46:39.036 PM	producing speed setpoint	Double	PI Point	\\MALI
SpeedWhileProducing:AIM	12	10/19/2017 4:59:30 PM	speed while ProducingState = 1	Double	PI Point	\\MALI
StopButton	False	5/25/2016 10:14:46.633 PM	Operator Stop Button	Boolean	PI Point	\\MALI
Template: <None>						
ReasonCodeDesc	NULL	10/19/2017 4:45:19.038 PM		BarAMIdg00...	PI Point	\\MALI

Flexible Real Time Data Analytics

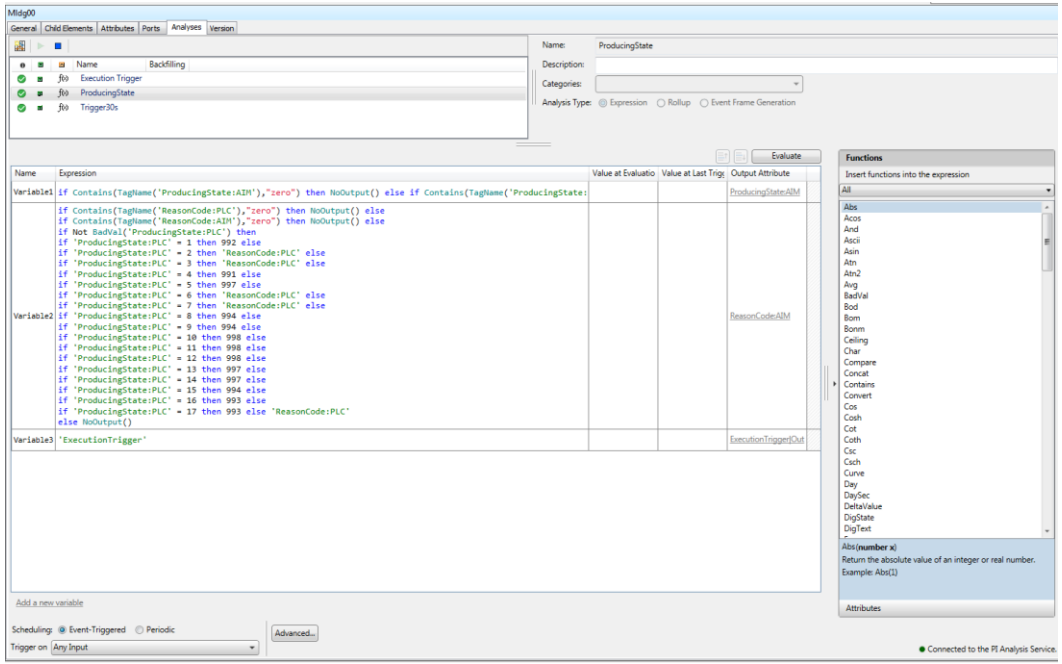
PI AF Analysis

- 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

Moulding Cell – Producing State Analysis

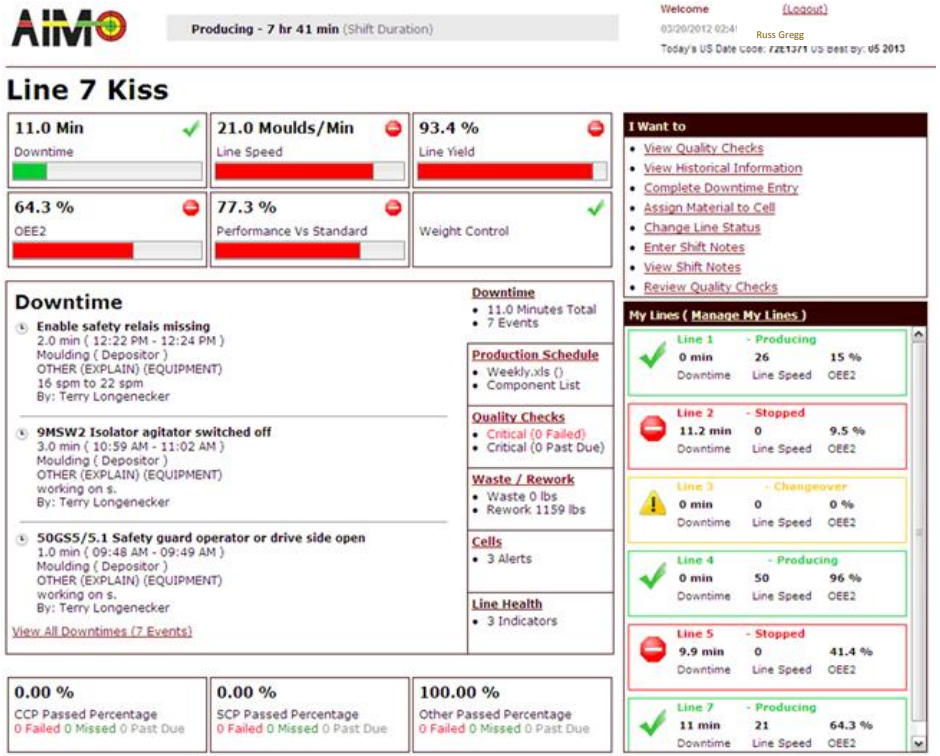


Reusable MOM Application Framework

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

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado

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