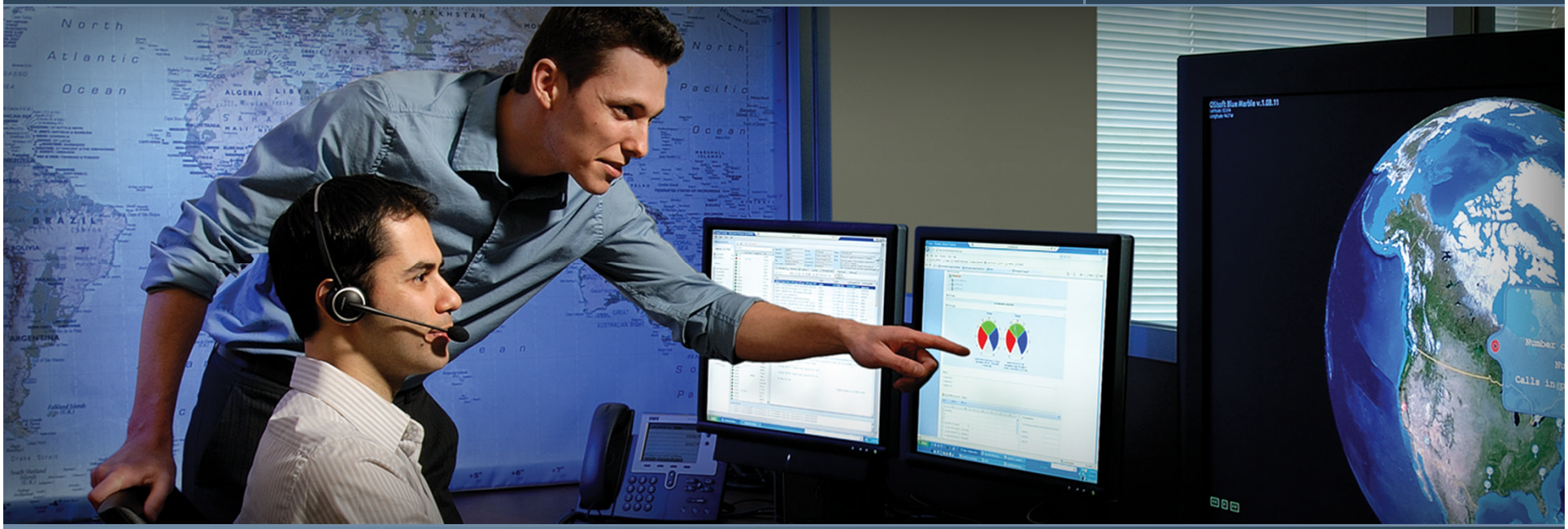
Regional Seminar Series

Cork, Ireland



Archiving Batch and Contextual Data from Manufacturing Execution Systems

Chris Nelson
Software Development Lead
OSIsoft, LLC

10/7/2010

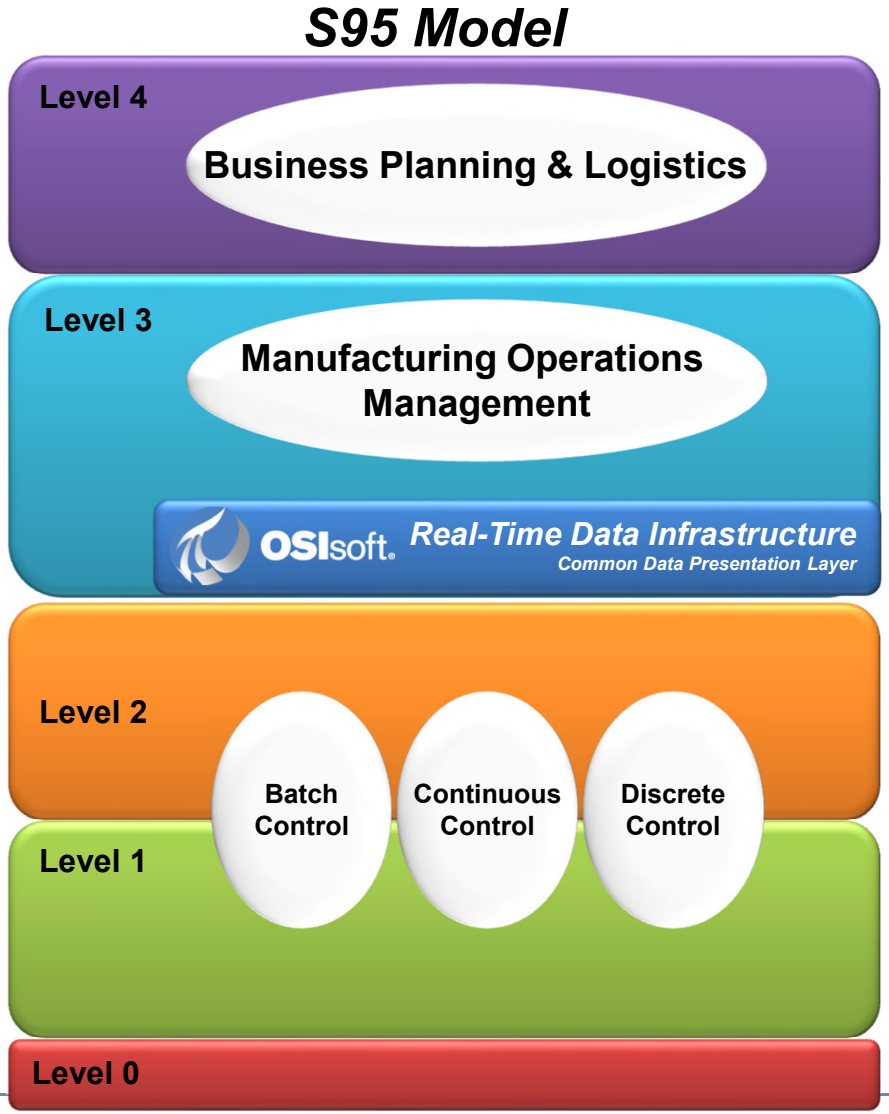
Empowering Business in Real Time.

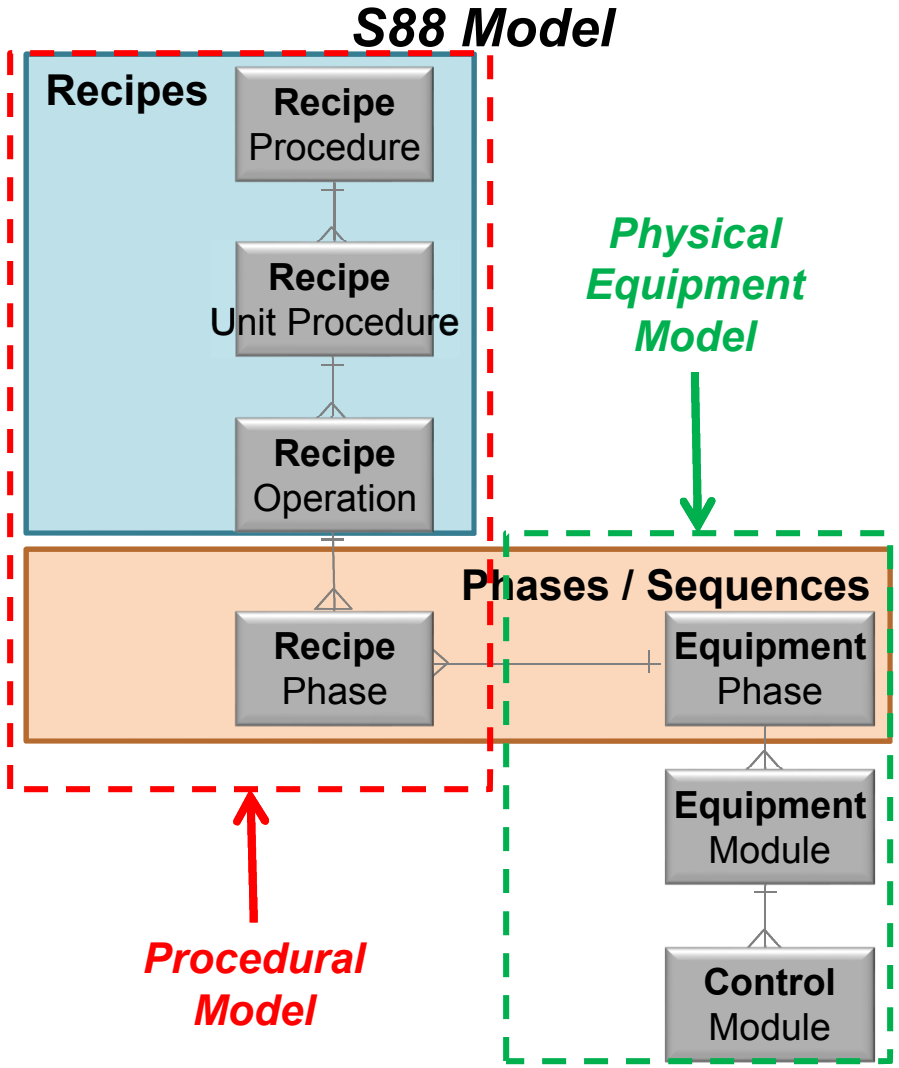
AGENDA

- The need for an infrastructure and sustainable architecture
- Batch Interface Framework Architecture
- Batch Interface Framework Features
- New Batch Interfaces & Roadmap
- Batch Interface Framework & Event Frames

The need for an infrastructure

Batch Concept through S95 & S88





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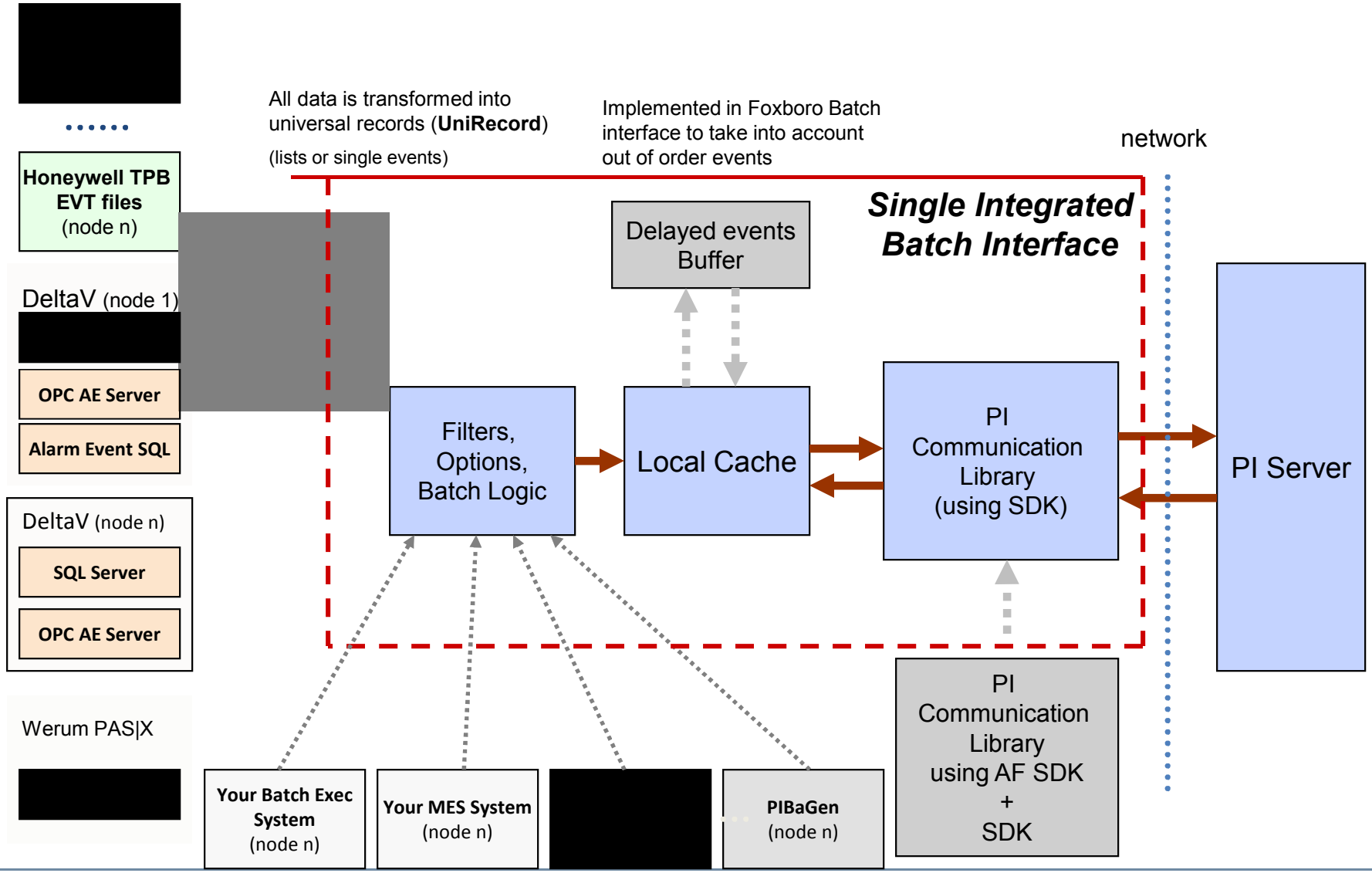
Increasing number of Data Sources

- EVT Based Batch Execution Systems
- Diverging Implementations and Technologies
  - Emerson DeltaV moving toward relational database model
  - Rockwell FactoryTalk Batch adding columns to EVT File
  - Wonderware and Foxboro using a relational database model
- Standards are emerging
  - BatchML
  - B2MML
  - OPC Batch Specification
  - OPC UA
- Manufacturing Execution Systems
  - Proven their use and customers are widely deploying
  - Different technologies but similar to Batch Execution Systems
  - Driven by Recipe Context

Batch Interface Framework Architecture

Batch Interface Framework Architecture



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BIF Released Batch Interfaces (Jan 2010)

Supported Vendor Versions and Connectivity Methods

Emerson DeltaV Batch Interface (EMDVB)

- DeltaV v8.4: .EVT Files
- DeltaV v9.3: DeltaV Batch Historian or .EVT Files + SQL Alarm & Events Historian
- DeltaV v10.3: DeltaV OPC Alarm & Events Server + DeltaV Batch Historian + SQL Alarm & Events Historian or .EVT Files

Emerson Syncade Batch Interface (EMBCS)

- Syncade v4.0.1: Microsoft Message Queue / Web Service

Emerson DeltaV Syncade Batch Interface (EMDVBCS)

- Same as above (combination)

Rockwell FactoryTalk Batch Interface (PIFTBInt)

- RSBatch: .EVT Files
- FactoryTalk Batch: .EVT Files

ABB 800xA Batch Interface (ABB800xA)

- ABB 800xA: Oracle9i Release 2 Provider for OLEDB 9.2.0.7.0

WonderWare InBatch Batch Interface (WWInBatch)

- WW InBatch: SQL Server

GE iBatch Batch Interface (GEIB)

- iBatch: .EVT Files

Honeywell TotalPlant Batch Interface (HWTPB)

- TPB: .EVT Files

Batch Interface Framework Features

Auto-Configure PI Tags

TagName	Server	Time	Value
BioPharma:TA001.AE.All	OSISOFT	2/19/2010 2:21:38 PM	ALARM|INSTRUMENT|MEDIA_PREP|CTRL_001|TA001|PI001_101|Media TANK PRESSURE|PVBAD_ALM|DISABLED|07-NGMP_WRN|OF|General I/O Failure|
BioPharma:TA001.AE.Process	OSISOFT	2/19/2010 2:1 PM	ALARM|PR [illegible] 009|BAG FILLER PRESSURE|LO_ALM|INACT/ACK|15-QLTY_CRT|LOW|Low Alarm Value 36.3883 Limit 2|
BioPharma:TA001.AE.Process_Alarm	OSISOFT	2/19/2010 2: PM	ALARM|PR [illegible] 009|BAG FILLER PRESSURE|LO_ALM|INACT/ACK|15-QLTY_CRT|LOW|Low Alarm Value 36.3883 Limit 2|
BioPharma:TA001.AE.Process_Alarm.NewAlarms	OSISOFT	2/19/2010 1:45:51 PM	ALARM|PROCESS|MEDIA_PREP|CTRL_001|TA001 001_HIST|TA001 PLC HIST|F_6751_ALM|ACT/UNACK|15-QLTY_CRT|CFN|Change From Normal Value %P1|
BioPharma:TA001.AE.Process_Event	OSISOFT	2/19/2010 2:08:00 PM	EVENT|PROCESS|MEDIA_PREP|CTRL_001|TA001|TI001_101|Media TANK TEMP|ACTIVE|4-INFO|TI001_101/AI1|Module Failure Active|
BioPharma:TA001.COOL.Owner Change.Owner Changed Detected:	OSISOFT	3/31/2010 10:21:37 AM	DELTAV BATCH
BioPharma:TA001.COOL.Recipe Value.R_COOL_SP	OSISOFT	3/31/2010 10:22:14 AM	25
BioPharma:TA001.COOL.Recipe Value.R_COOL_STRT_AMT	OSISOFT	3/31/2010 10:22:15 AM	0
BioPharma:TA001.COOL.Recipe Value.R_MAX_COOL_TM	OSISOFT	3/31/2010 10:22:18 AM	240
BioPharma:TA001.COOL.Recipe Value.R_MAX_TEMP	OSISOFT	2/2/2010 10:43:42 AM	30
BioPharma:TA001.COOL.Recipe Value.R_MIN_TEMP	OSISOFT	2/2/2010 10:43:43 AM	0
BioPharma:TA001.COOL.Recipe Value.R_TEMP_HIGH	OSISOFT	[illegible]	[illegible]
BioPharma:TA001.COOL.Recipe Value.R_TEMP_HIGH_HIGH	OSISOFT	[illegible]	[illegible]
BioPharma:TA001.COOL.Recipe Value.R_TEMP_LOW	OSISOFT	3/31/2010 10:22:22 AM	5
BioPharma:TA001.COOL.Recipe Value.R_TEMP_LOW_LOW	OSISOFT	3/31/2010 10:22:36 AM	4
BioPharma:TA001.COOL.Recipe Value.R_TEMP_MON	OSISOFT	3/31/2010 10:22:26 AM	FALSE
BioPharma:TA001.COOL.Recipe Value.R_WAIT_TEMP	OSISOFT	3/31/2010 10:22:27 AM	25
BioPharma:TA001.COOL.Report.L_COOL_TEMP	OSISOFT	3/31/2010 10:23:31 AM	27.4
BioPharma:TA001.Event.Active Step Change	OSISOFT	2/2/2010 10:54:40 AM	CIP_20100202_104137|BATCH_EXEC_20060228_002243739|PR_MP_CIP\UP_MP_CIP:1-1\OP_MP_BURST_WASH:2-1|Active Step Change command attempted|Activ
BioPharma:TA001.Event.Mode Change	OSISOFT	2/2/2010 11:19:37 AM	CIP_20100202_104137|BATCH_EXEC_20060228_002243739|PR_MP_CIP\UP_MP_CIP:1-1\OP_MP_NULL:1-1|Mode Changed:|Mode Change|P-AUTO||Factory 1|MEDI
BioPharma:TA001.Event.Mode Command	OSISOFT	2/2/2010 10:54:57 AM	CIP_20100202_104137|BATCH_EXEC_20060228_002243739|PR_MP_CIP\UP_MP_CIP:1-1\OP_MP_BURST_WASH:2-1|Mode Commanded:|Mode Command|AUTO-MI
BioPharma:TA001.Event.Multi.AllBatchEvents.Unit.Critical	OSISOFT	2/2/2010 11:19:29 AM	CIP_20100202_104137|BATCH_EXEC_20060228_002243739|PR_MP_CIP\UP_MP_CIP:1-1\\|State Changed:|State Change|HELD||Factory 1|MEDIA_PREP|TA001||
BioPharma:TA001.Event.Multi.Recipe_Report_OwnerChange_Prompt	OSISOFT	3/31/2010 10:29:11 AM	END_PROCESS.Recipe Value.R_DF_WT_TM: 15 sec
BioPharma:TA001.Event.Operator Prompt	OSISOFT	3/31/2010 10:20:55 AM	MP_20100331_094647|BATCH_EXEC_20060412_201412308|PR_MP_FORM\UP_MP_XFR:1-1\OP_MP_XFR:1-1\MP_MEDIA_TRANSFR:1-1|Make Connection to Drain
BioPharma:TA001.Event.Prompt Response	OSISOFT	[illegible]	[illegible]
BioPharma:TA001.Event.Recipe Value Change	OSISOFT	[illegible]	[illegible]
BioPharma:TA001.Event.State Change	OSISOFT	3/31/2010 10:33:07 AM	MP_20100331_094647|BATCH_EXEC_20060412_201412308|PR_MP_FORM\UP_MP_END:1-1\\|State Changed:|State Change|READY||Factory 1|MEDIA_PREP|TA001|
BioPharma:TA001.Event.State Change.ReportString	OSISOFT	3/31/2010 10:33:07 AM	Batch ID: MP_20100331_094647 | Recipe: PR_MP_FORM \ UP_MP_END:1-1 (TA001) \ \ | State Change: READY |
BioPharma:TA001.Event.State Command	OSISOFT	2/2/2010 10:54:41 AM	CIP_20100202_104137|BATCH_EXEC_20060228_002243739|PR_MP_CIP\UP_MP_CIP:1-1\OP_MP_BURST_WASH:2-1\CIP_USER_ROUTE:2-2|State Commanded:|St
BioPharma:TA001.Event.Step Activity	OSISOFT	3/31/2010 10:33:08 AM	MP_20100331_094647|BATCH_EXEC_20060412_201412308|PR_MP_FORM\UP_MP_END:1-1\\|Step Deactivated|Step Activity|Terminal Step||Factory 1|MEDIA_PREP|
BioPharma:TA001.Event.System Message	OSISOFT	3/31/2010 10:33:01 AM	MP_20100331_094647|BATCH_EXEC_20060412_201412308|PR_MP_FORM\UP_MP_END:1-1\\|Unit Procedure Finished|System Message|0||Factory 1|MEDIA_PREP|TA
BioPharma:TA001.PIEvent.Operation.Active	OSISOFT	3/31/2010 10:31:57 AM	OPERATION END: PR_MP_FORM\UP_MP_END:1-1\OP_MP_END:1-1
BioPharma:TA001.PIEvent.Phase.Active	OSISOFT	3/31/2010 10:31:39 AM	PHASE END: PR_MP_FORM\UP_MP_END:1-1\OP_MP_END:1-1\END_PROCESS:1-1
BioPharma:TA001.PIEvent.UnitBatch.Active	OSISOFT	3/31/2010 10:32:13 AM	0
BioPharma:TA001.PIEvent.UnitBatch.Active.Calc.ElapsedTime	OSISOFT	4/1/2010 1:02:12 PM	26. hrs, 29. min, 58. sec
BioPharma:TA001.PIEvent.UnitBatch.BatchID	OSISOFT	3/31/2010 10:32:13 AM	Inactive
BioPharma:TA001.PIEvent.UnitBatch.BatchID_UniqueID	OSISOFT	3/31/2010 10:24:31 AM	[illegible] 201412308|
BioPharma:TA001.PIEvent.UnitBatch.Procedure	OSISOFT	3/31/2010 10:32:13 AM	Inactive
BioPharma:TA001.PIEvent.UnitBatch.Product	OSISOFT	3/31/2010 10:32:13 AM	Inactive
BioPharma:TA001.PIEvent.UnitBatch.UniqueID	OSISOFT	3/31/2010 10:24:31 AM	BATCH_EXEC_20060412_201412308
BioPharma:TA001.PIEvent.UnitBatch.UnitName	OSISOFT	3/31/2010 10:24:31 AM	TA001

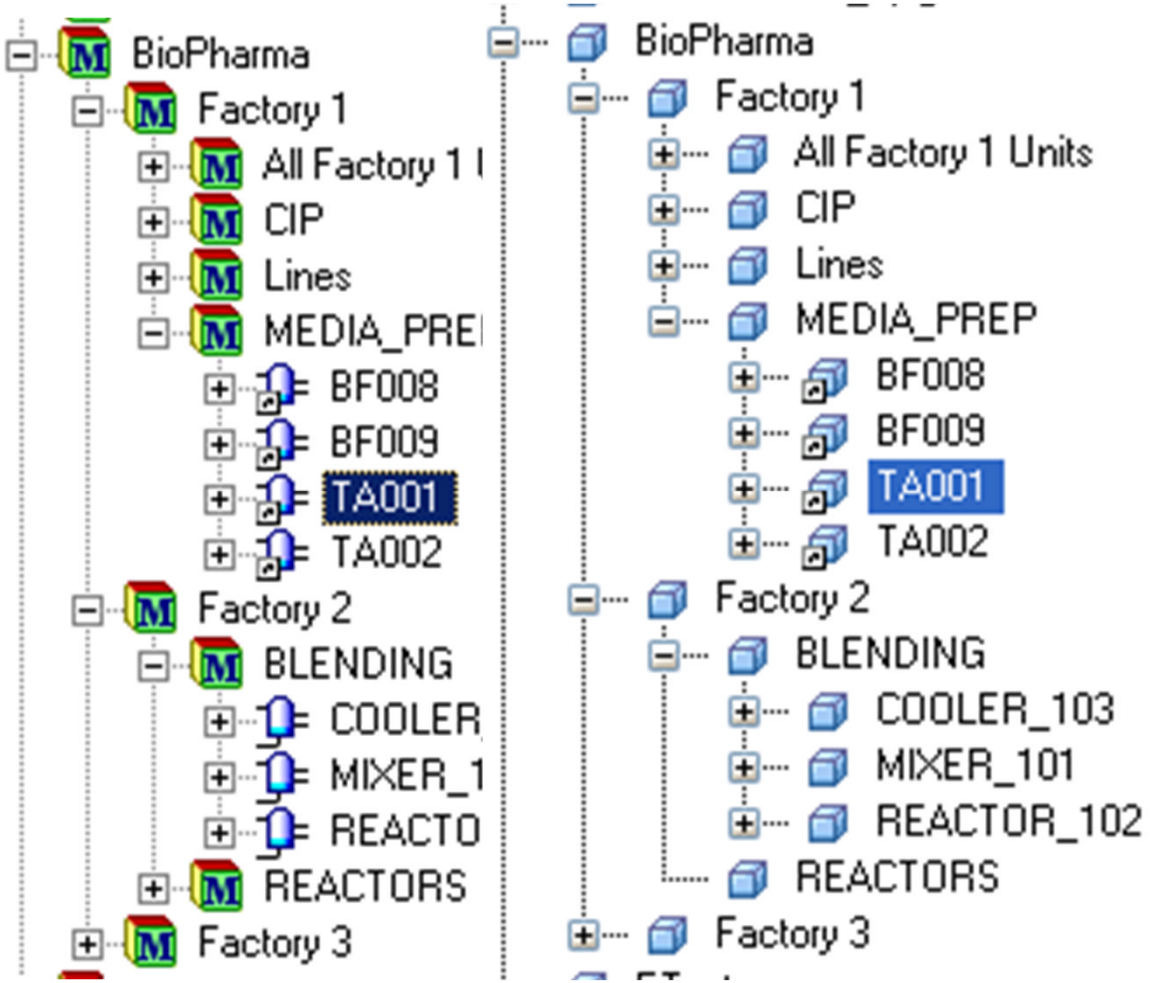
Alarm & Event Tags

Phase Recipe & Report Parameter Tags

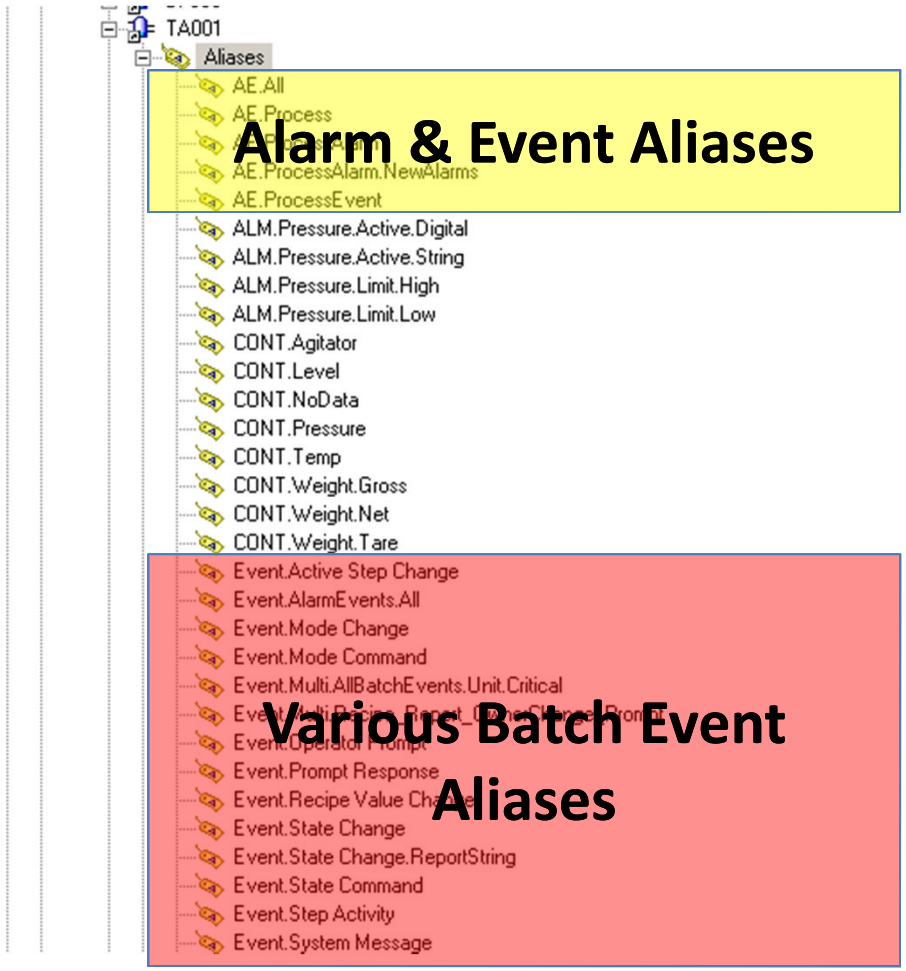
Various Batch Event Tags

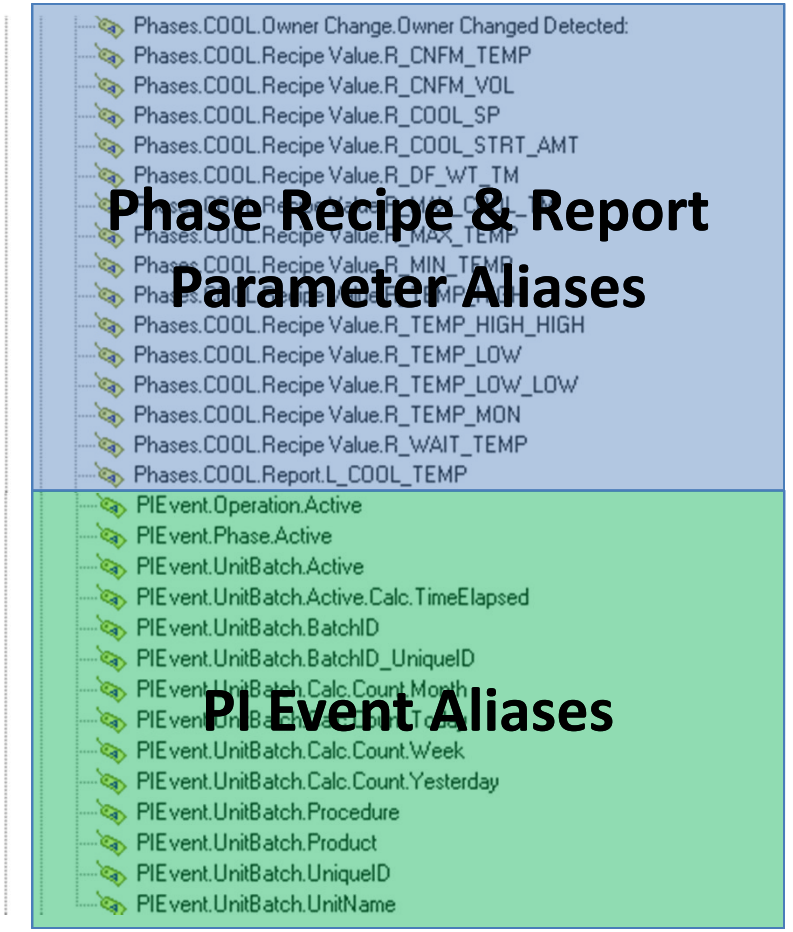
PI Event Tags

Auto-configure Assets



Auto-Configure Aliases





Empowering Business in Real Time.

Released new Batch Interfaces

Rockwell Automation

ABB

GE Intelligent Platforms

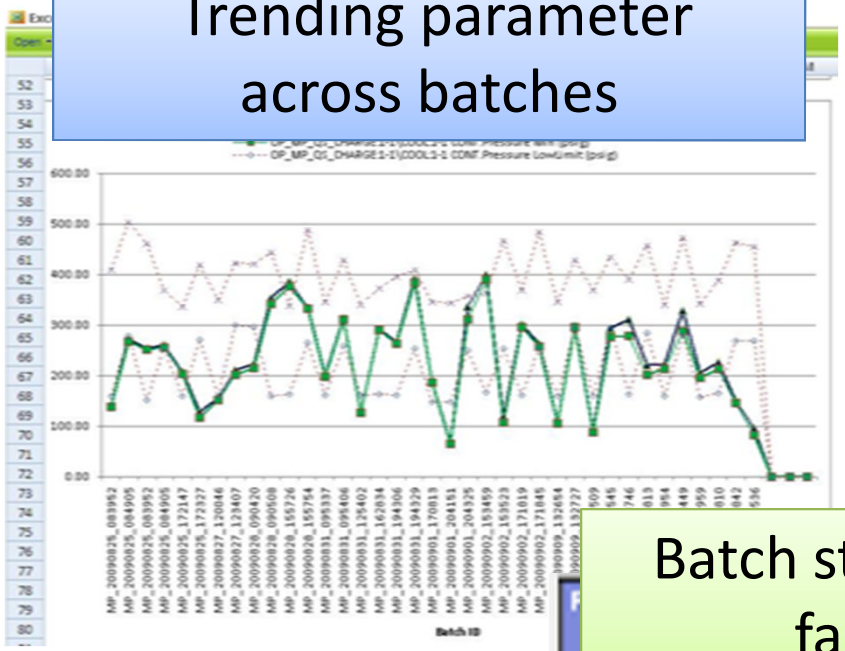
invensys Wonderware

Honeywell

SIEMENS

Tailor Data Collection for Reporting & Analysis

Trending parameter across batches



Single batch phase drill down

Time	StringValue
1.2632E+09	AGITATE.Recipe Value.R_AGIT_FINAL_ST: On
1.2632E+09	AGITATE.Recipe Value.R_AGIT_SPEED: 480 R
1.2632E+09	AGITATE.Recipe Value.R_AGIT_ACTIVATE: TR
1.2632E+09	AGITATE.Recipe Value.R_AGIT_MIX_TM: 5 mi
1.2632E+09	AGITATE.Recipe Value.R_DF_WT_TM: 15 sec
1.2632E+09	AGITATE.Recipe Value.R_AUTO_LVL: FALSE M
1.2632E+09	AGITATE.Recipe Value.R_AGIT_OFF_LVL: 60 k
1.2632E+09	AGITATE.Recipe Value.R_AGIT_ON_LVL: 80 kg

Batch status across plants / factories / units

```
Tag[1].Name=[UNIT]([PHASEMODULE]):[DESCRIPT]-[EVENT]
Tag[1].Value=[PVAL]
```

SP_CHARGE_MATERIAL

SP_CHARGE_AMOUNT

ACT_CHARGE_AMOUNT

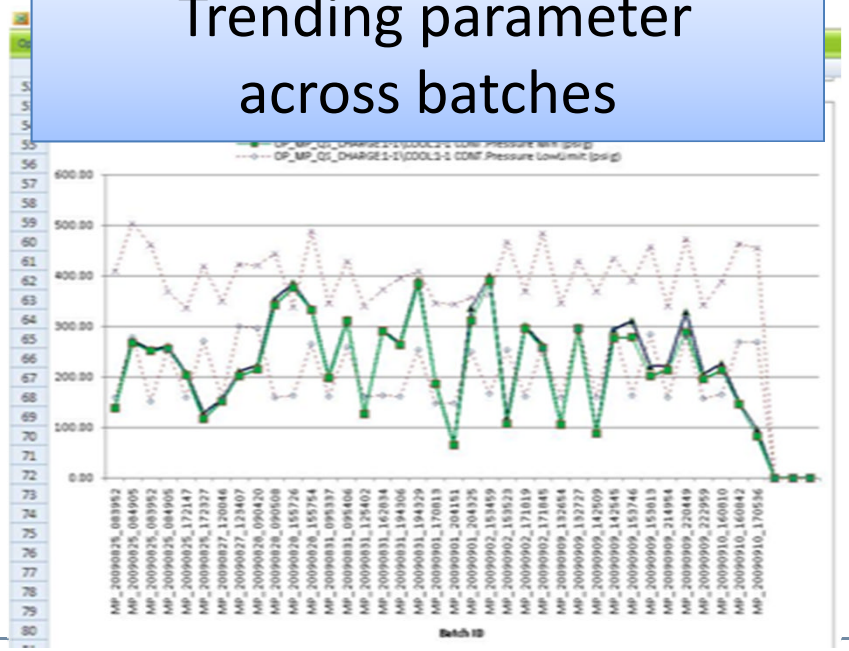
TAG TEMPLATE 1
Multiple Events into Multiple Tags

```
RE1560(CHARGE_DIW):SP_CHARGE_MATERIAL-Recipe Value
 03/03/2010 14:24:01.000    PW100
```

```
RE1560(CHARGE_DIW):SP_CHARGE_AMOUNT-Recipe Value
 03/03/2010 14:24:01.000    2480
```

```
RE1560(CHARGE_DIW):ACT_CHARGE_AMOUNT-Report
 03/03/2010 14:24:03.000    2414.5
```

Trending parameter across batches



```
Tag[2].Name=[UNIT].Event.Multi.Recipe_Report
Tag[2].Value=[PHASEMODULE].[EVENT].[DESCRIPT]: [PVAL] [EU]
```

SP_CHARGE_MATERIAL

SP_CHARGE_AMOUNT

ACT_CHARGE_AMOUNT

TAG TEMPLATE 2
Multiple Events into Single Tag

```
RE1560.Event.Multi.Recipe_Report
 03/03/2010 14:24:01.000   CHARGE_DIW.Recipe Value.SP_CHARGE_MATERIAL: PW100
 03/03/2010 14:24:01.000   CHARGE_DIW.Recipe Value.SP_CHARGE_AMOUNT: 2480 kg
 03/03/2010 14:24:03.000   CHARGE_DIW.Report.ACT_CHARGE_AMOUNT: 2414.5 kg
```

Single batch phase drill down

Time	StringValue
1.2632E+09	AGITATE.Recipe Value.R_AGIT_FINAL_ST: On
1.2632E+09	AGITATE.Recipe Value.R_AGIT_SPEED: 480 R
1.2632E+09	AGITATE.Recipe Value.R_AGIT_ACTIVATE: TR
1.2632E+09	AGITATE.Recipe Value.R_AGIT_MIX_TM: 5 mi
1.2632E+09	AGITATE.Recipe Value.R_DF_WT_TM: 15 sec
1.2632E+09	AGITATE.Recipe Value.R_AUTO_LVL: FALSE M
1.2632E+09	AGITATE.Recipe Value.R_AGIT_OFF_LVL: 60 k
1.2632E+09	AGITATE.Recipe Value.R_AGIT_ON_LVL: 80 kg

```
Tag[3].Name=[UNIT].PIEvent.UnitBatch.BatchID
Tag[3].Value=[BATCHID]
```

Unit Procedure Start

Unit Procedure End

TAG TEMPLATE 3
PI Event Tags - Start

TAG TEMPLATE 4
PI Event Tags - End

```
RE1560.PIEvent.UnitBatch.BatchID
 03/03/2010 14:30:30.000    MP_20100415_01
 03/03/2010 16:17:10.000    Inactive
```

```
Tag[4].Name=[UNIT].PIEvent.UnitBatch.BatchID
Tag[4].Value=Inactive
```

Batch status across plants / factories / units

Available Data from BES/MES

Emerson DeltaV Batch Historian Placeholders

- TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT or PARAMETER, PVAL or VALUE, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID

Emerson DeltaV Alarms & Events Placeholders

- TIME, EVENT, CATEGORY, NODE, AREA, PROCESSCELL, UNIT, MODULE, MODULEDESC, ATTRIBUTE, STATE, LEVEL, DESC1, DESC2

Emerson Syncade Placeholders

- TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, PARAMETER, VALUE, USER, AREA, PROCESSCELL, UNIT, UNIQUEID,SET,HIGH,LOW

Rockwell FactoryTalk Batch Placeholders

- TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT, PVAL, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID, MATERIALNAME, MATERIALID, LOTNAME, LABEL, CONTAINER

ABB 800xA PlaceHolders

- TIME, UNIQUEID, BATCHID, UNIT, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, PARAMETER, VALUE

Wonderware InBatch PlaceHolders

- TIME, UNIQUEID, BATCHID, PROCEDURE, UNIT, UNITPROCEDURE, OPERATION, PHASE, PARAMETER, VALUE, TARGETVALUE, OLDVALUE, DESCRIPT , EU, USERID

GE iBatch Placeholders

- TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT, PVAL, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID

Honeywell TotalPlant Batch Placeholders

- TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT, PVAL, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID, MATERIALNAME, MATERIALID, LOTNAME, LABEL, CONTAINER

Tag Templates Functionality

Tag Templates can contain placeholders which are vendor / system specific

Placeholders are replaced at runtime with actual values from the source system

DELTAV

TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT or PARAMETER, PVAL or VALUE, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID

Rockwell Automation

TIME, BATCHID, PROCEDURE, UNITPROCEDURE, OPERATION, PHASE, DESCRIPT, EVENT, PVAL, EU, AREA, PROCESSCELL, UNIT, PHASEMODULE, USERID or USER, UNIQUEID, MATERIALNAME, MATERIALID, LOTNAME, LABEL, CONTAINER

New Batch Interfaces

- Common Code Library
- More Robust
- New Caching Mechanism
- New Batch Merging Functionality
- New Tag Templates Functionality

Batch Interface Roadmap - Releases

- Werum PAS-X Batch Interface (End 2010)
- Standards based Batch Interface (BatchML, B2MML)

Batch Interface Framework Roadmap : Event Frames

- Swap out PI Communication Layer: write to EF database instead of PI Batch Database
- Enable auto-configuration of AF Database instead of Module Database
- Enhance tag template functionality to write to AF/EF attributes
- EF available as Community Technology Preview (CTP) on OSIsoft vCampus

Batch Interface Framework: Event Frames

- Details and or screenshot(s) of the demo

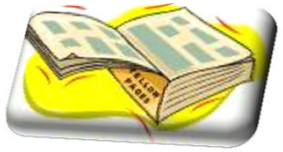
A refresher of PI AF: If time permits

Foundation by any other name

Code Name
- Foundation

Product
- PI AF 2.0

Goal
- Data Directory



The value of AF: structure

- PI is extremely good at:
  - History of data collected data from almost anywhere
  - Massive scalability, Highly available
  - Ease of use & Rapid deployment
- PI is focused on a points database
- Meta-data: a **structure** for the data
  - PI supplies data
  - AF supplies structure and access to more data

Why add structure?

- Structure is ***your*** knowledge applied to ***your*** points
- Structure helps you:
  - Store your domain expertise
  - Build applications
  - Build displays
  - Answer new questions

AF shapes your data

AF is designed to store structure:

– Defining types of assets	→ Templates
– Associating points with assets	→ Elements
– Extra information about points	→ Attributes
– Physical/logical asset structure	→ Hierarchy
– Assets connectivity	→ Models
– Transactions	→ Transfers

Domain knowledge - performance

Model different types of equipment

- Heat exchangers
- Reduction furnaces
- Power Meters
- Trucks
- Buildings
- Wells
- IT devices
- Tanks

Domain knowledge - calculations

Apply engineering/business rules

- Heat, mass transfer
- Chemical principals
- Electrical calculations
- Material movements
- Energy consumption
- Production and forecast
- Load, availability
- Inventories

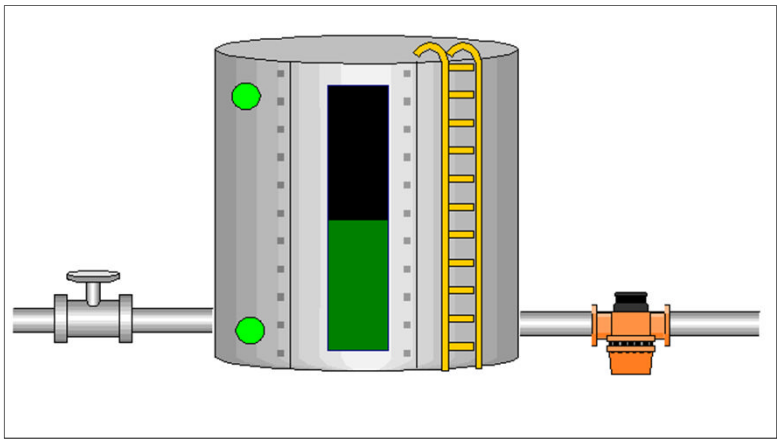
Domain knowledge - limits

Assets performance

- Determine if the equipment is operating effectively
  - Heat exchanger fouling
  - Efficiency
  - Power factor
  - Demand/Supply
- Detect and act on abnormal conditions with PI Notifications
  - Alarming rules

Domain knowledge - Tank R21

- How to totalize flow rates in/out of Tank R21
- Limits for notification on Tank R21
- Alarm states on Tank R21
- Strapping table
- Capacity of Tank R21
- Production line for Tank R21
- Downstream units of Tank R21
- Responsible person for production line



Applications – from OSI

- PI Notifications
  - Store Analysis and Notifications
  - Contacts
  - Use Element Attributes
- Assets connectors
- Event frames

AF speeds up visualization

- Many displays are centered on equipment
  - Unit detail, Line diagram
  - Process Overview
  - Area displays
- Knowledge of the equipment helps
  - Finding relevant points
  - Creating unit relativity
  - Custom object symbols

Answer new questions

- Adding your structure is done once
  - Organize points from multiple PI systems
  - Adding consistent naming
  - Adding static configured data
  - Adding data from other systems
- This structure benefits all PI users forever
  - Searches across PI systems
  - Search for information related to the business
  - Ability to view and use additional information

Thank you

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