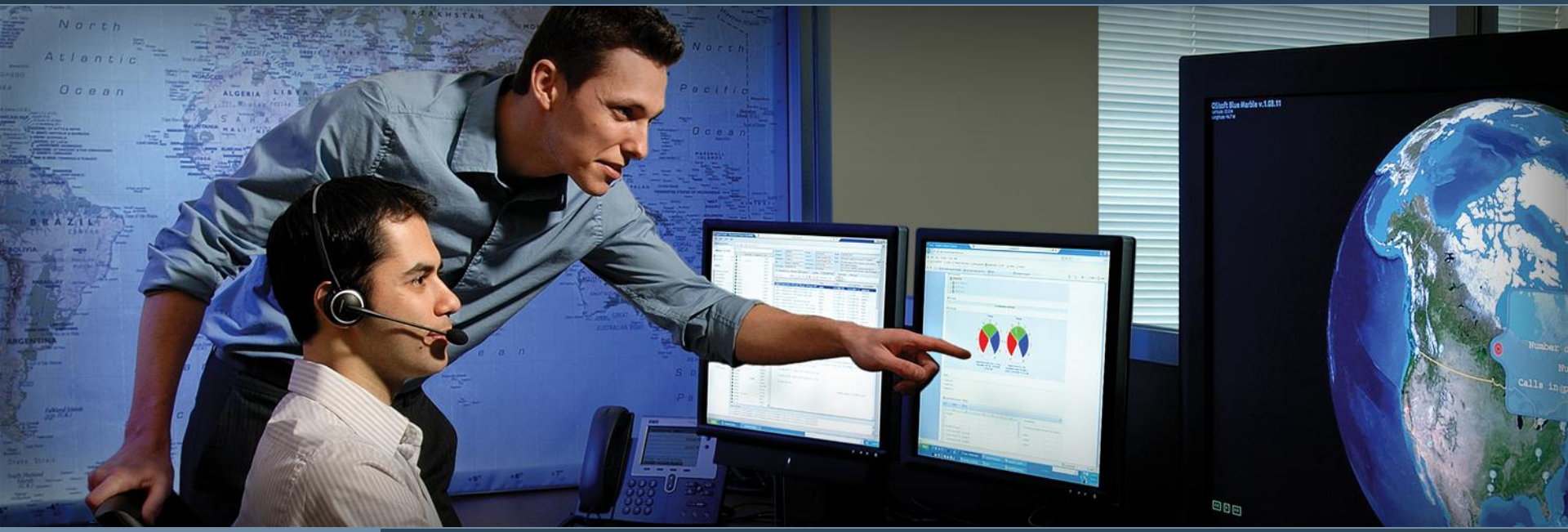
Regional Seminar Series

Warszawa, Poland



The Value of Real-time Infrastructure

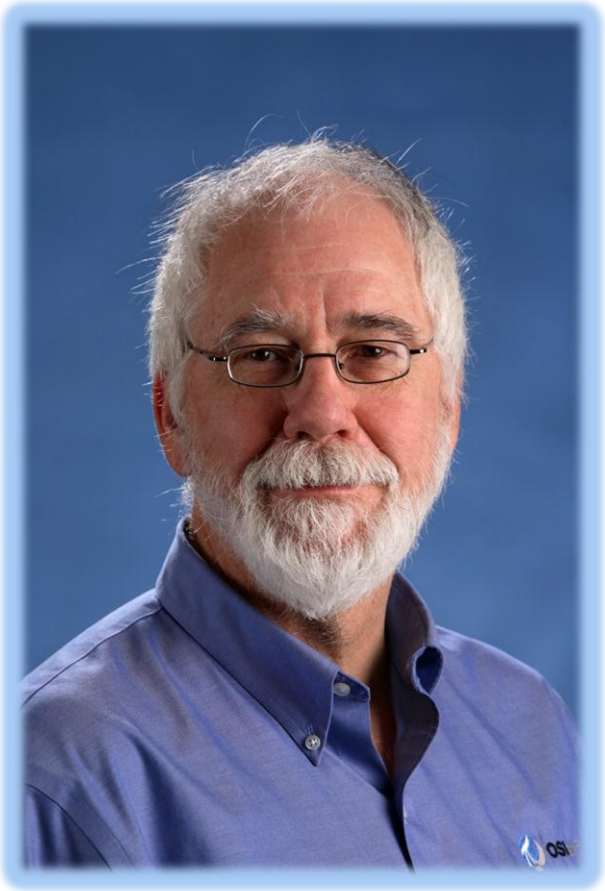
Zsolt A. Oros
Sales Account Manager, CEE
OSIsoft Europe Gmbh.

7 October 2010

Topics of Discussion

- Introduction
- What is the PI System and its Impact on your Business?
  - The reason for a Real-time Infrastructure
  - How does it fit into your exisiting infrastructure?
  - System Overview
  - Benefits & Value Creation Mechanism
- The Value of PI System in Industries
  - Use Cases & Examples
- Summary

Great People - Significant Achievements



"We are rewarded when we deliver superior value. This means delivering a platform on which our customers can continuously improve their business performance."

Dr. J. Patrick Kennedy,
CEO & Founder

OSIsoft LLC. celebrates the 30th Anniversary of foundation of the Company !!!

Our footprint in Central Eastern Europe

Accepted by Local & Global Players

MAŽEIKIŲ NAFTA

ORLEN

Slovnaft

MOL

IES MEMBER OF MOL GROUP

ROMPETROL

LUKOIL

HELLENIC PETROLEUM

AES

Enel

VATTENFALL

GDF SUEZ

e·on Hungária

mondi

ТОПЛОФИКАЦИЯ РУСЕ

ArcelorMittal

USS

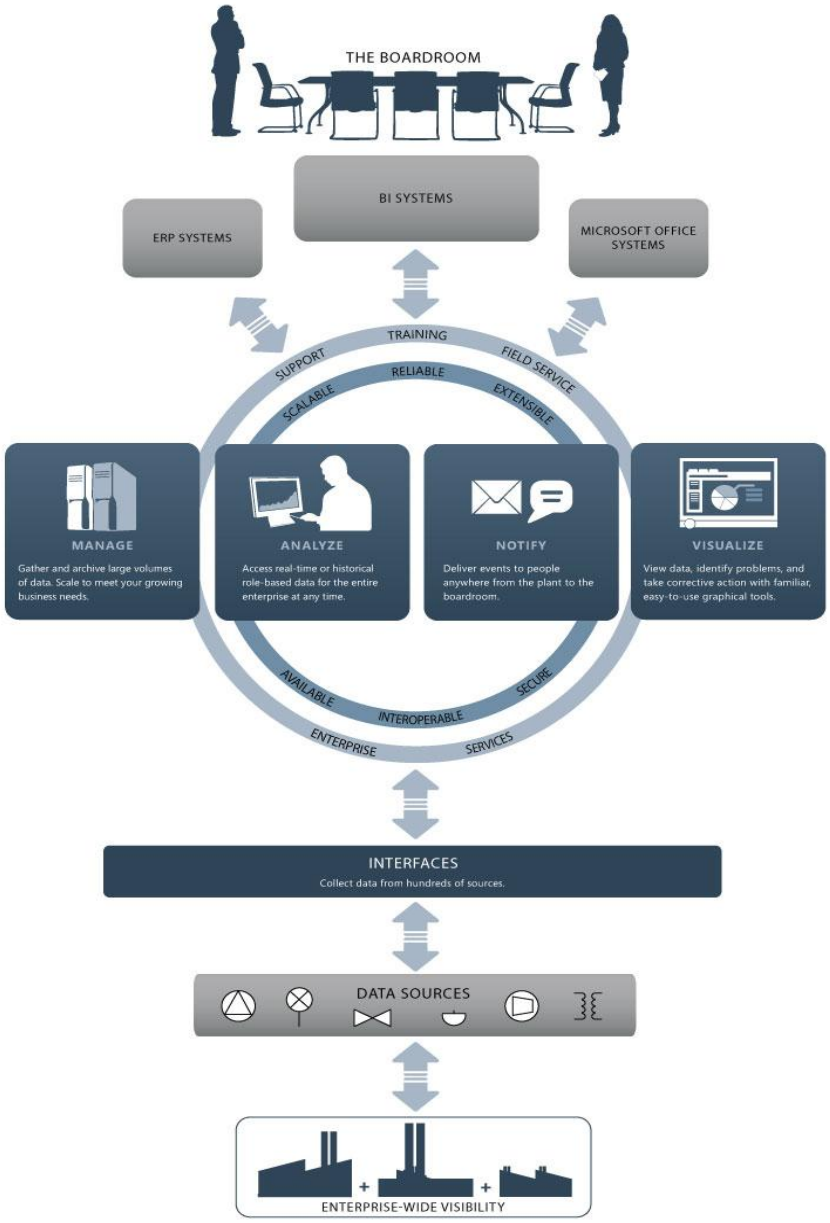
What is the PI System?

Real-time Infrastructure for the Enterprise

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW



Enterprise Infrastructure for management of real-time data and events

Continuous Monitoring

Performance - Availability – Security

Real-time Decision Making

Valuable business decisions based on actionable, Real-time Information

Real-time Communication

Between ISLANDs of data and information

Collaboration

Everybody works with the same Information – Rules – Tools

Adoption

To Changes in

- Business / Organization / Process
- Technology

From Local to Global

Backbone for Integration

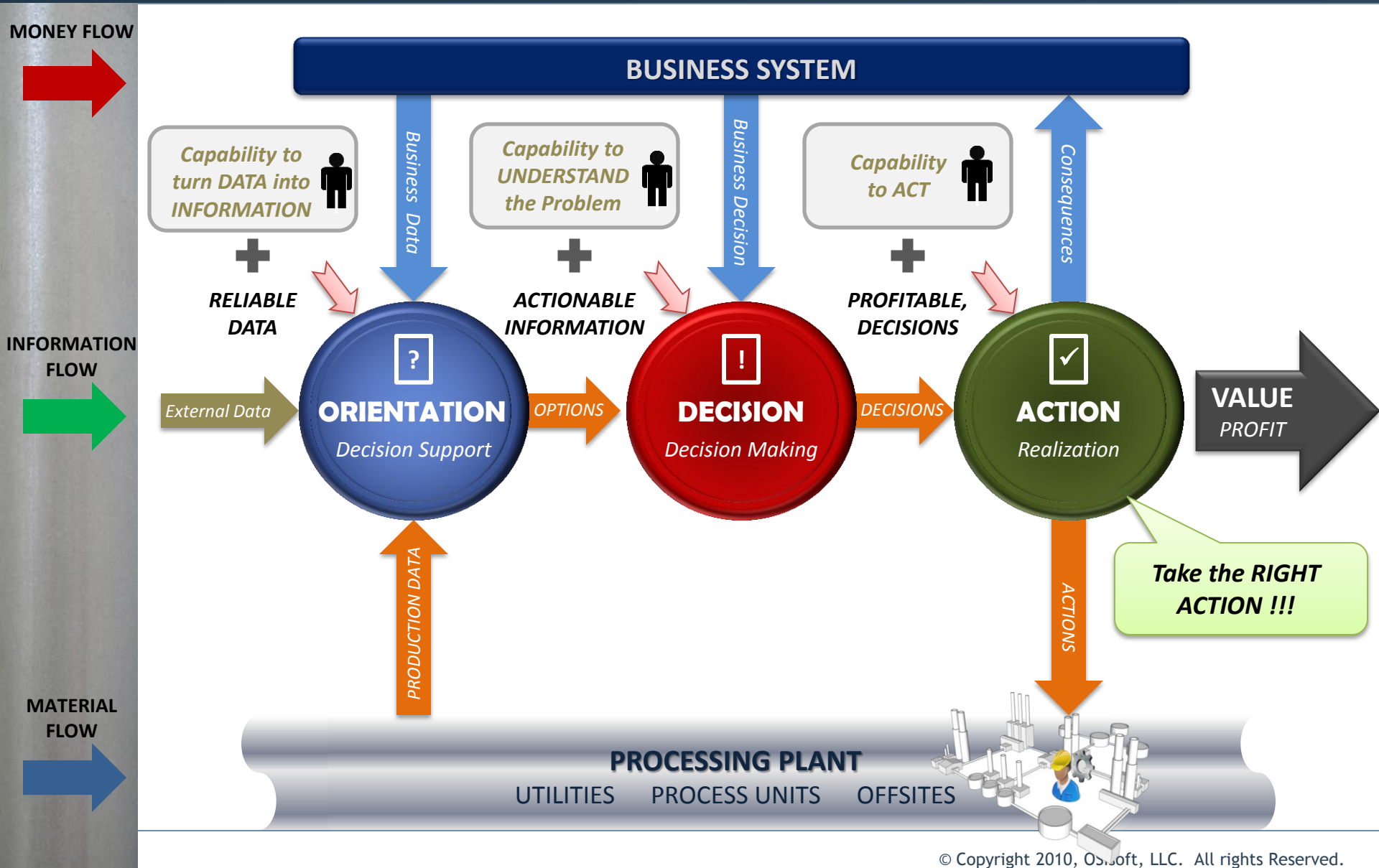
Plant to Business (P2B) Integration

Continuous Improvement

Across the whole Enterprise

The reason for a Real-time Infrastructure

Business Decision Cycle - Value Creation Process



The reason for a Real-time Infrastructure

Faster and Better Decisions

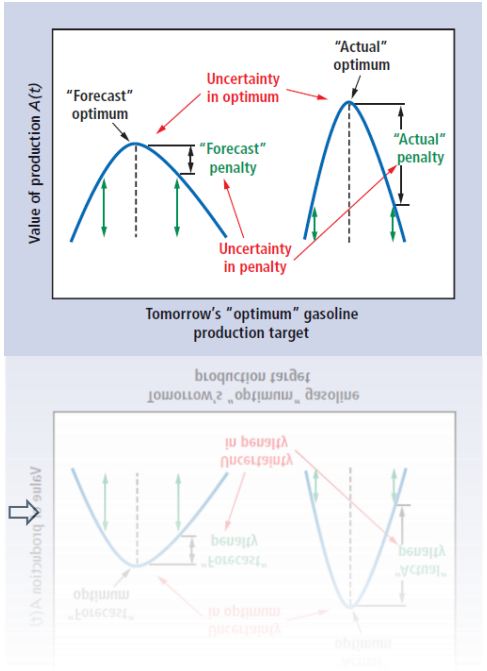
Information is as good as the decision made with it !!!

Information must be **TIMELY, MEANINGFUL & ACTIONABLE**

There are two very important aspects to it:

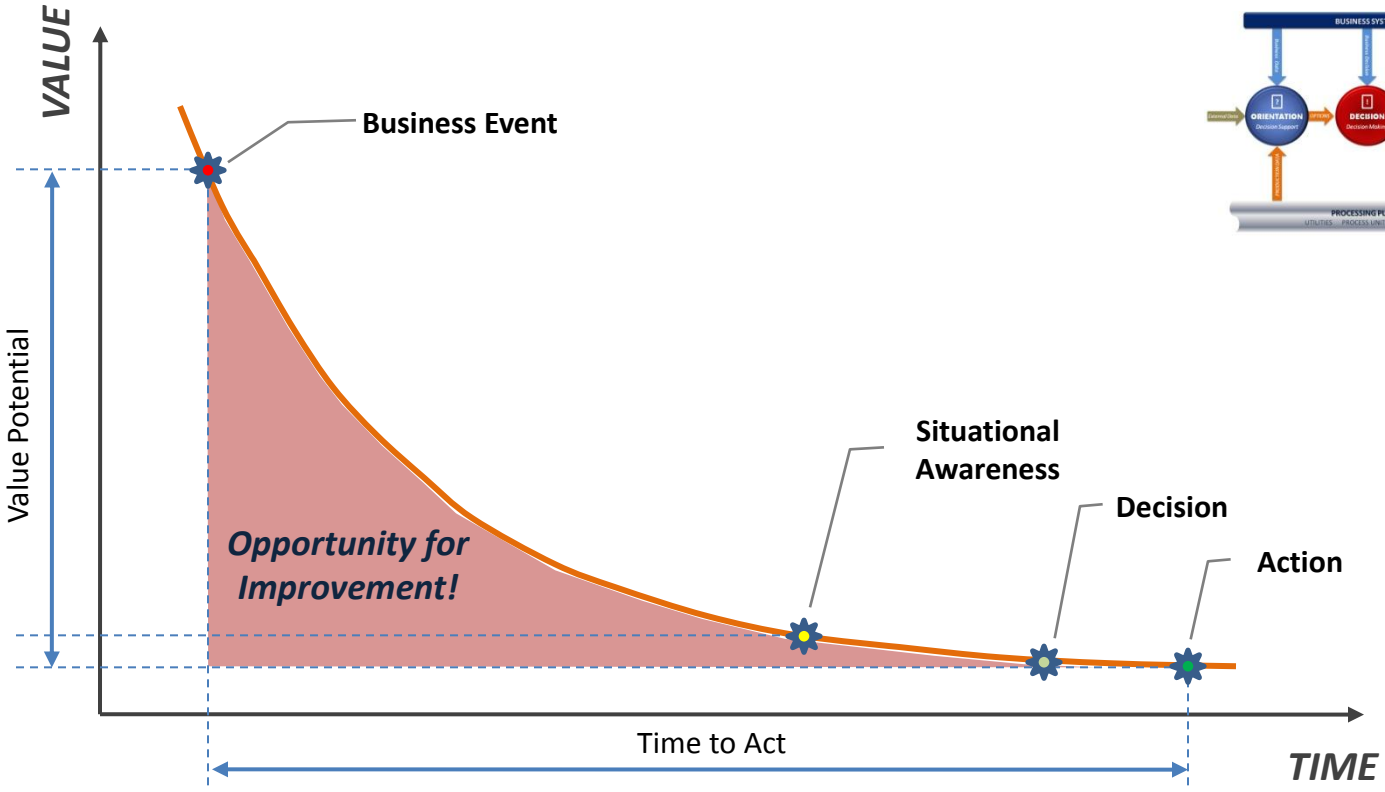
1. ***Reduced Time to Decision***
   - » Faster time to decision ⇨
   - » Reduced Cycle Time ⇨
   - » Faster time to market ⇨
   - » **HIGHER REVENUE** of products

2. ***Improved Decision Quality***
   - » Reduced Decision Uncertainty ⇨
   - » Better quality and more products ⇨
   - » **LOWER COST** of production



The TIME Aspect

How to Improve?

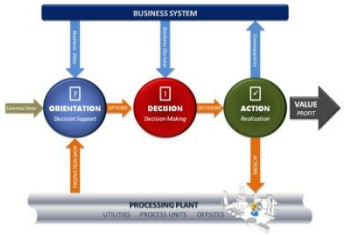


Ultimately, Value can be obtained from

- ReducingTime to Decision by *Improving Situational Awareness*
- Situational Awareness can be improved by having *data available in real-time* in their original resolution

The TIME Aspect

Improving Situational Awareness



VALUE

Value Potential

Business Event

Situational Awareness

Decision

Action

Improved Situational Awareness

The result of collecting and representing data and events in their original resolution

Action

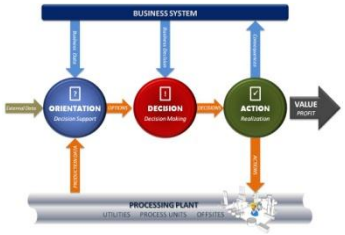
Time to Act

TIME

Distribution of time between a Business Event and the Corresponding Action

The TIME Aspect

Improving Situational Awareness



Improved Situational Awareness

The result of collecting and representing data and events in their original resolution

Distribution of time between a Business Event and the Corresponding Action

The QUALITY Aspect

Reducing Uncertainty by Turning DATA into KNOWLEDGE

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW

BUSINESS SYSTEM

ORIENTATION Decision Support → DECISION Decision Making → ACTION Realization

ORIENTATION
Decision Support

*Tools to make the Information **ACCESSIBLE** and **VISIBLE** to provide **UNDERSTANDING***

ANALYTICAL** capabilities for turning **INFORMATION** into **KNOWLEDGE

DATA COLLECTION** and **MANAGEMENT** capabilites. Putting Data into **CONTEXT** to create **INFORMATION

***CONNECTIVITY** of all sorts of Data Sources. No matter which type*

DISTRIBUTE & VISUALIZE

ANALYZE

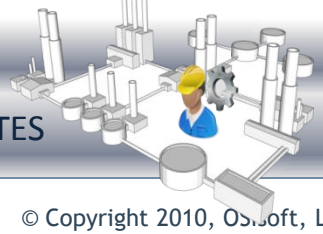
COLLECT & MANAGE

CONNECT

BEST AVAILABLE DATA from Trustworthy Sources

PROCESSING PLANT

UTILITIES PROCESS UNITS OFFSITES



The QUALITY Aspect

Reducing Uncertainty by Turning DATA into KNOWLEDGE

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW

BUSINESS SYSTEM

ORIENTATION Decision Support

DECISION

ACTION

WISDOM

EXPERIENCE

KNOWLEDGE

MODEL

INFORMATION

RULES

DATA

SENSORS

ORIENTATION

Decision Support

DISTRIBUTE & VISUALIZE

ANALYZE

COLLECT & MANAGE

CONNECT

PROCESSING PLANT

UTILITIES PROCESS UNITS OFFSITES

Why it is Important?

What is the basis of your decision?

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW

BUSINESS SYSTEM

Millions of Data OR a few actionable Information?

WISDOM
EXPERIENCE

KNOWLEDGE
MODEL

INFORMATION
RULES

DATA
SENSORS

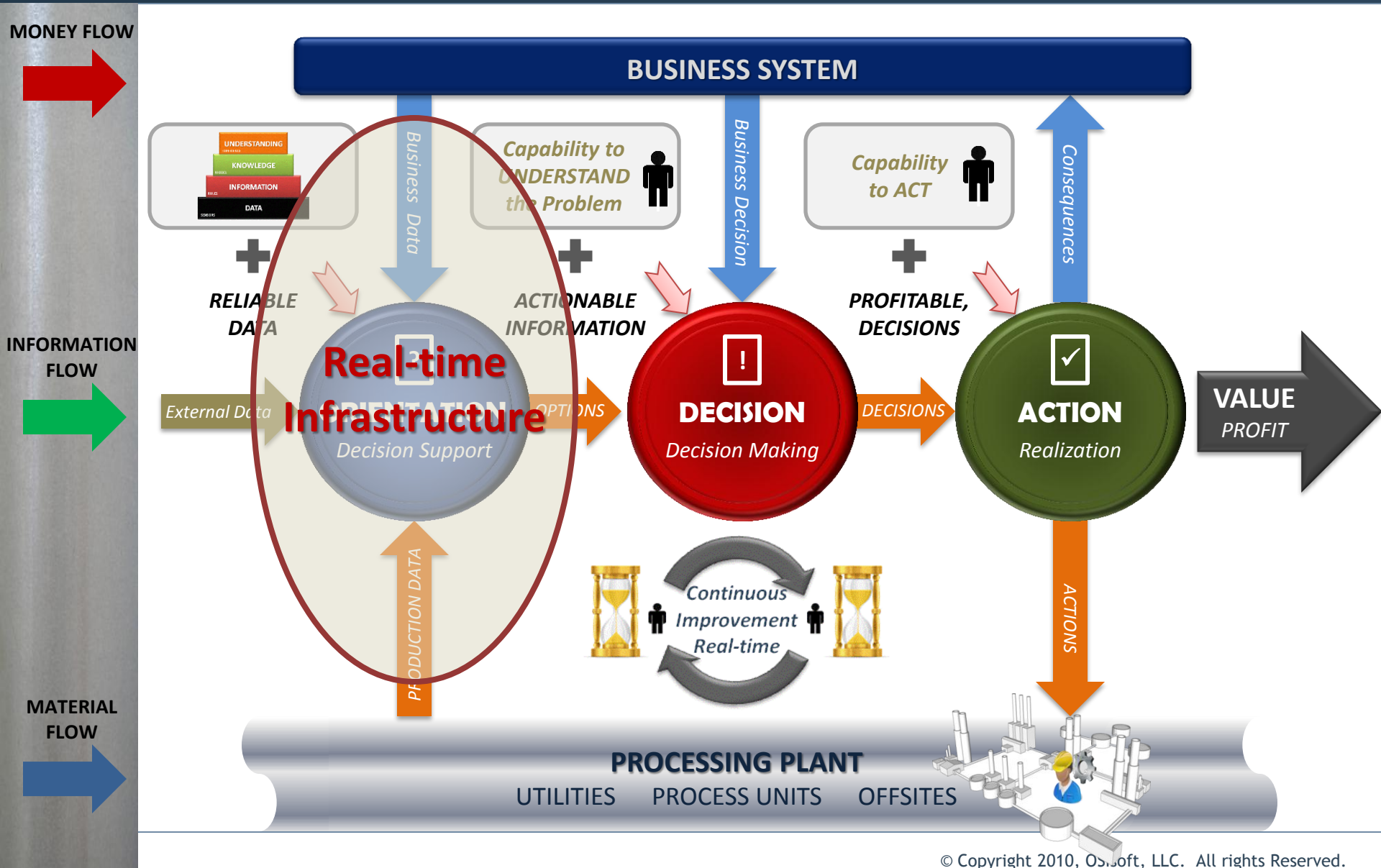
Understanding **Context** **Simple** **Order**

Mystery **Void** **Complex** **Chaos**

PROCESSING PLANT

UTILITIES PROCESS UNITS OFFSITES

The place for Real-time Infrastructure:
Foundation for Real-time Decision Support



How does it fit into your existing Infrastructure?

Typical Situation - Hundreds of Islands

OSIsoft.

MONEY FLOW

INFORMATION FLOW

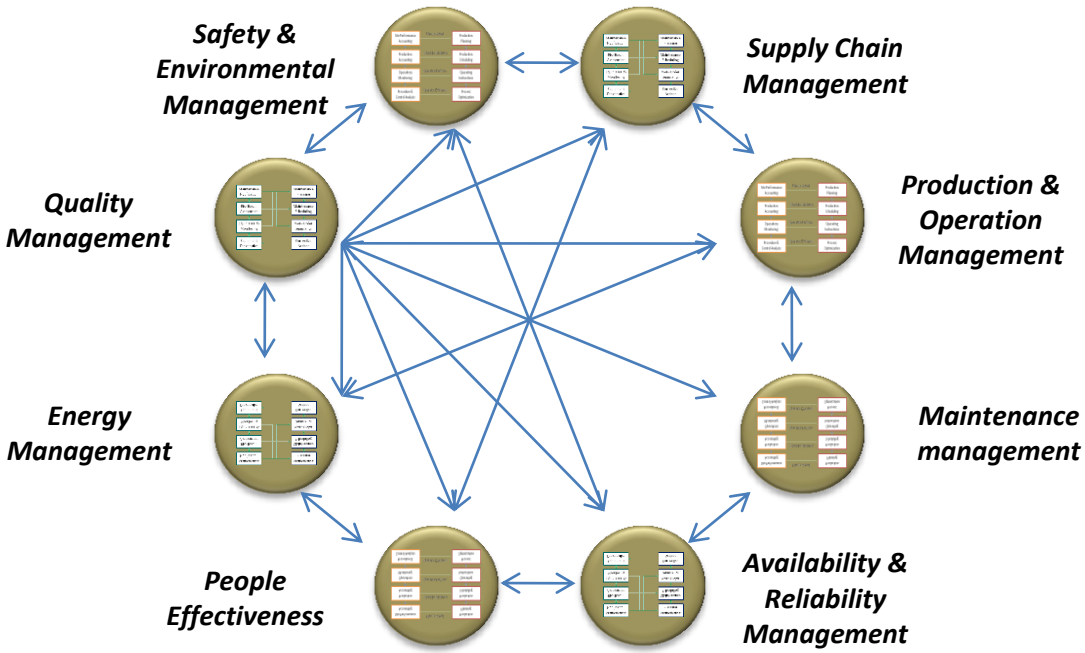
MATERIAL FLOW

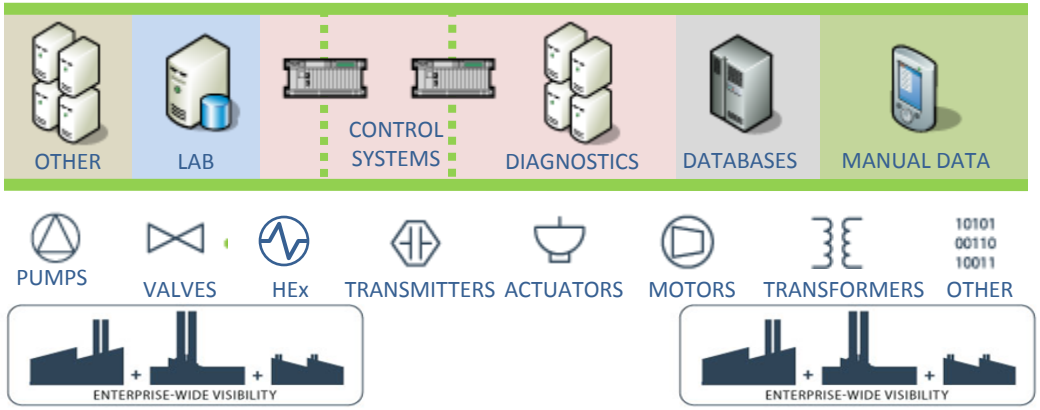
SAP PARTNER · mro software ALLIANCE PARTNER · Sun microsystems

Microsoft .net · Microsoft Office

Honeywell · ABB · SIEMENS · EMERSON · invensys · YOKOGAWA

BUSINESS SYSTEM





ISA95

Level 4 Issues:

- **Islands**
  - Number of Business Processes
  - Various Systems – Solutions & Applications
- **Boundaries**
  - Organisational
  - Communication
- **Time**
  - Time to decision

Business Planning & Logistics

Level 3

- Various Analytical & Visualisation Tools

Manufacturing Operations Management

Level 2

- **Monitoring**
- **Decision Making**

Supervisory Control

Level 1

How to Collaborate?

Sensing & Control

How to Improve?

Level 0

Process

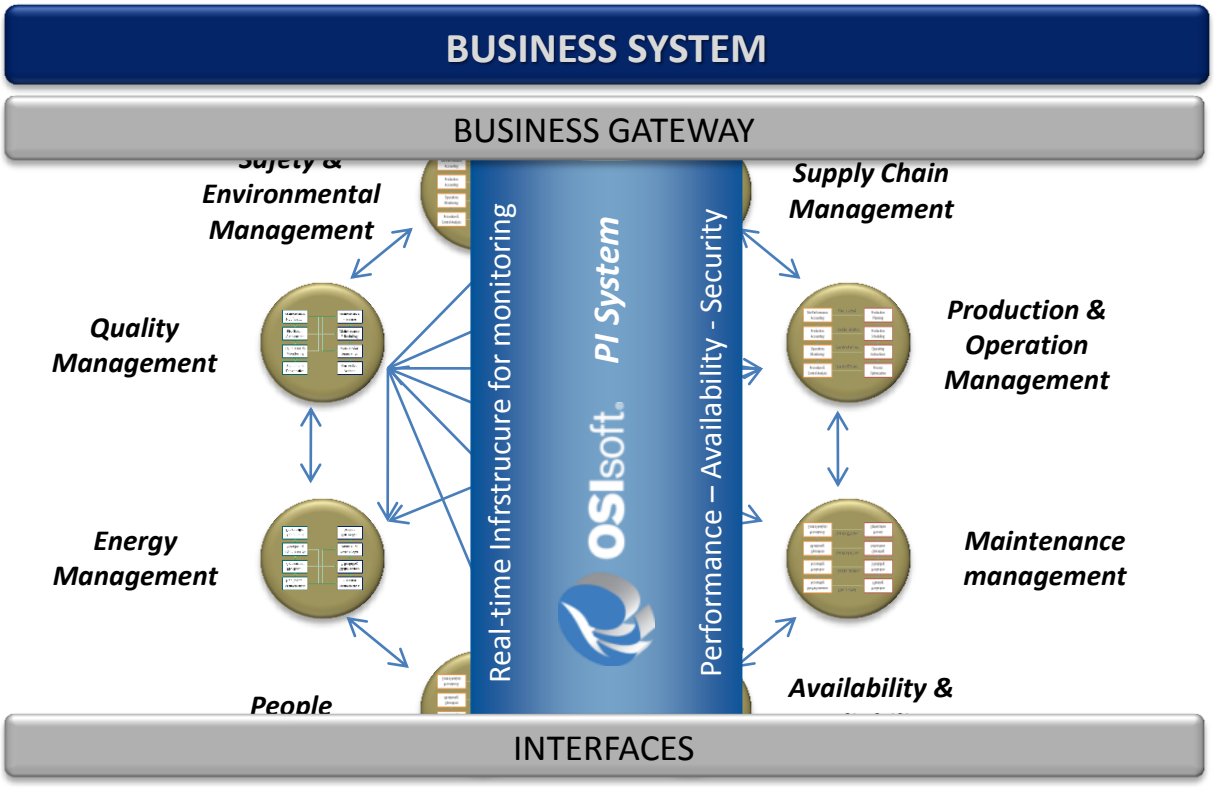
How does it fit into your existing Infrastructure?

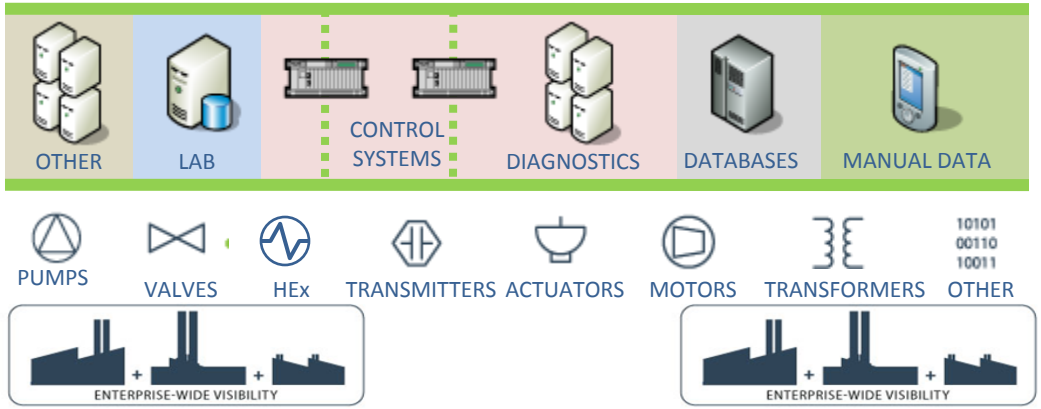
Integration of Islands

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW





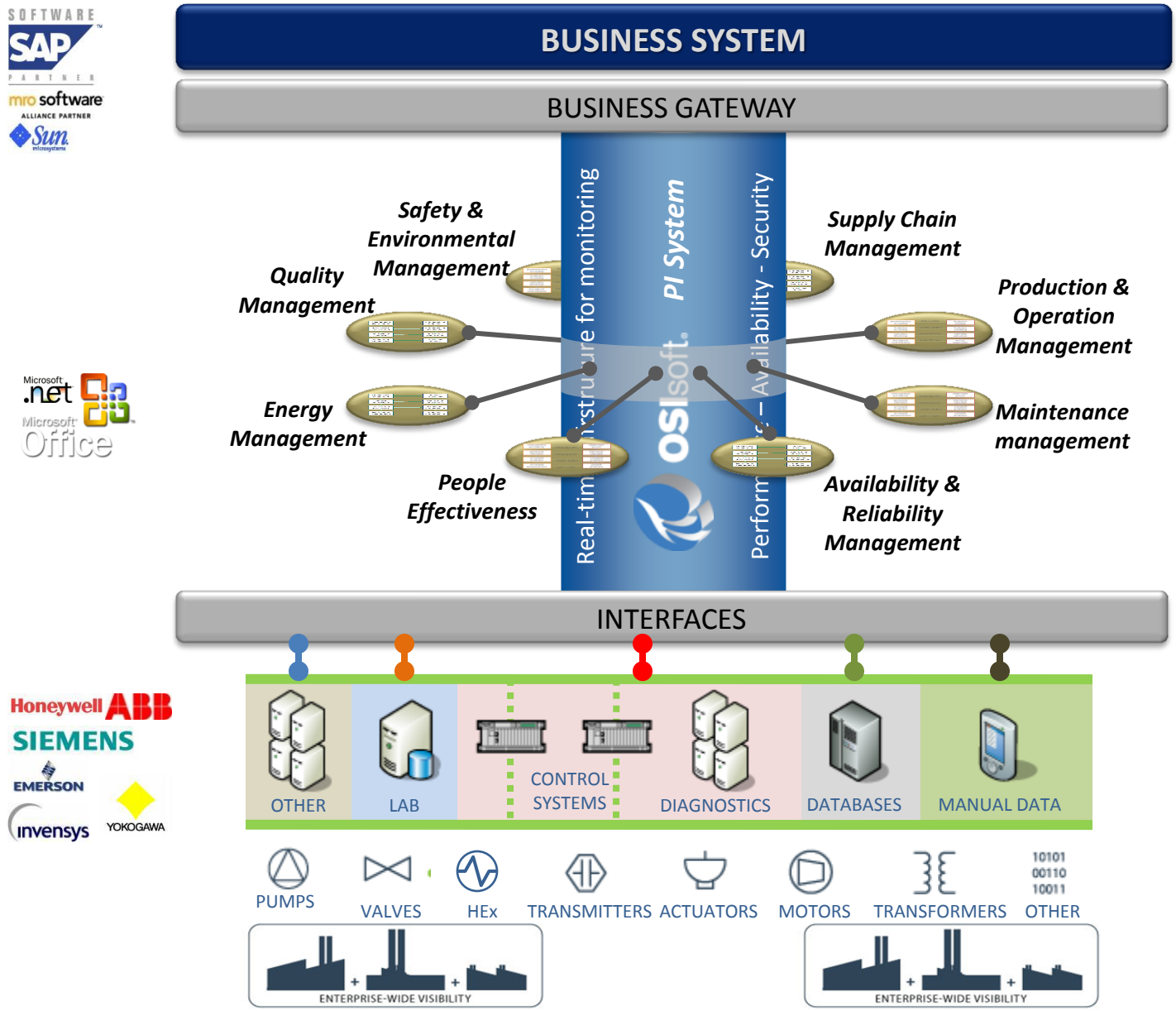
How does it fit into your existing Infrastructure?

Data foundation for all Business Processes

MONEY FLOW

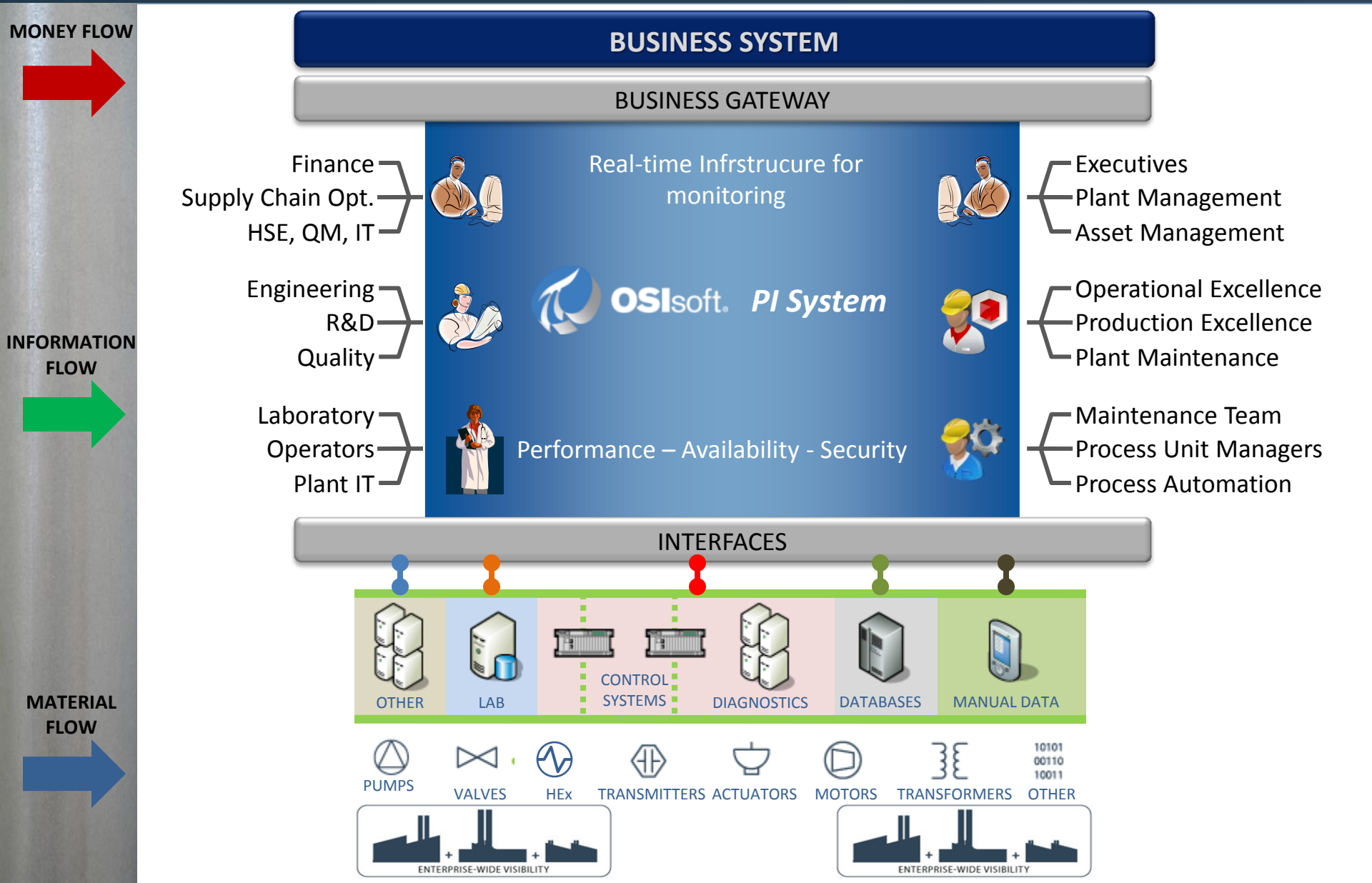
INFORMATION FLOW

MATERIAL FLOW



Collaboration

Everyone works with the same Information - Rules - Tools



How it is Structured?

Fundamental Layers of PI System

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW

BUSINESS SYSTEM

BUSINESS GATEWAY

Real-time Infrstrucure for monitoring

OSIsoft. *PI System*

Performance – Availability - Security

INTERFACES

OTHER | LAB | CONTROL SYSTEMS | DIAGNOSTICS | DATABASES | MANUAL DATA

PUMPS | VALVES | HEx | TRANSMITTERS | ACTUATORS | MOTORS | TRANSFORMERS | OTHER

ENTERPRISE-WIDE VISIBILITY

ENTERPRISE-WIDE VISIBILITY

PI System

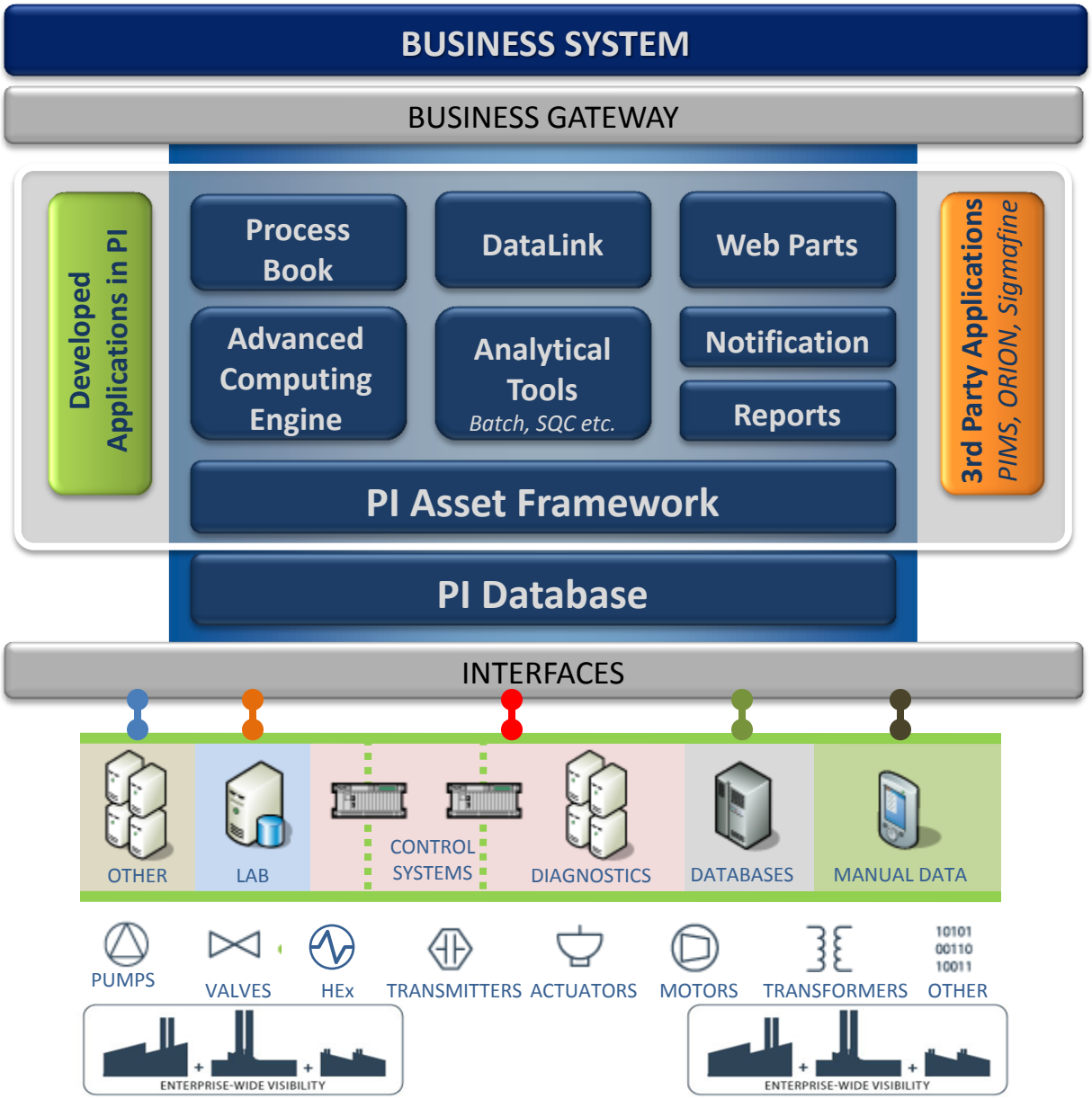
- Present (Visuals)
- Analyze (Analytics)
- Manage (Servers)
- Connect (Interfaces)

How it is Structured?

MONEY FLOW

INFORMATION FLOW

MATERIAL FLOW



PI System

- Present (Visuals)
- Analyze (Analytics)
- Manage (Servers)
- Connect (Interfaces)

PI System Overview

Connect

Collect data from hundreds of sources.

Interfaces

Manage

Gather and archive large volumes of data. Scale to meet your growing business needs.

Servers

Analyze

Access real-time or historical role-based data for the entire enterprise at any time.

Analytics

Present

View data, identify problems, and take corrective action with familiar, easy-to-use graphical tools.

Visuals

The OSIsoft PI System is the highly scalable and secure real-time and event infrastructure that connects people with the right operational and manufacturing information at the right time to analyze, collaborate, and act.

CONNECT- Interfaces

Connect to over 400 data systems and sources

Measures and aggregates a broad range of data types

Connect

Collect data from hundreds of sources

- Real-time
- Relational
- Transactional
- Custom
- Web Services
- AMI
- IT

MY SUPPORT | PRODUCTS | DOWNLOAD CENTER | KNOWLEDGE CENTER | CONTACT US

PI Interfaces

PRODUCTS

- PI Servers
- Client Products
- Layered Products
- OPC
- Interfaces
- COM Connectors
- System Management
- RLINK
- ECHO
- PI Protocol Converter
- OSIsoft MDUS
- Prerequisite Kits

RELATED PRODUCTS

- COM Connectors

PI Interfaces Search

siemens

Search | List All

• Standard • Maintenance • 3rd Party • Non-Standard

Name	Platform	Current Version	Shipping Version	Part#	APS Status
Siemens RXS4 Meter	NTI	1.0.0.1	1.0.0.1	PI-IN-SI-RXS4-NT	
Siemens S5 PLC				See Comments	
Siemens S7 PLC				See Comments	
Siemens S7-200 PLC's				See Comments	
Siemens SIMATIC Batch Interface	NTI	1.0.1.0		PI-IN-SI-SBAT-NTI	
Siemens Simatic Net (TI-505, S5)	NTI	1.4.2.1	1.4.2.1	PI-IN-SI-SIMAT-NTI	
Siemens Simatic Net S7	NTI	1.0.0	1.0.0	PI-IN-SI-S7-NTI	
Siemens SINAUT				See Comments	

MANAGE - Server

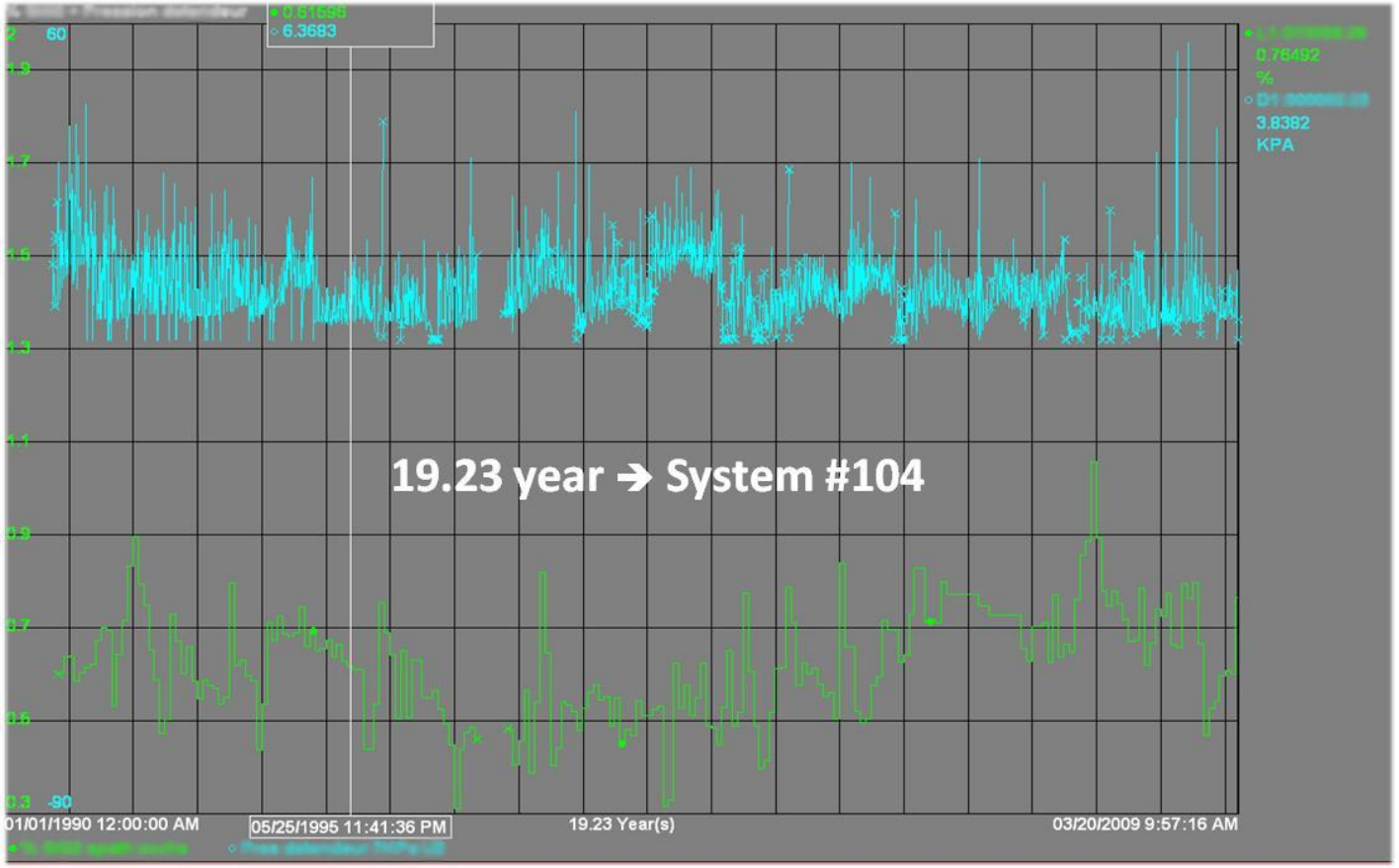
Reliably gather, archive and serve large volumes of data

Designed for time series and non time series data

Manage

Gather and archive large volumes of data. Scale to meet your business needs.

- PI Server
- System Management
- System Access
- PI Asset Ffamework



MANAGE - Asset Framework

Gather and archive large volumes of data. Scale to meet your business needs.

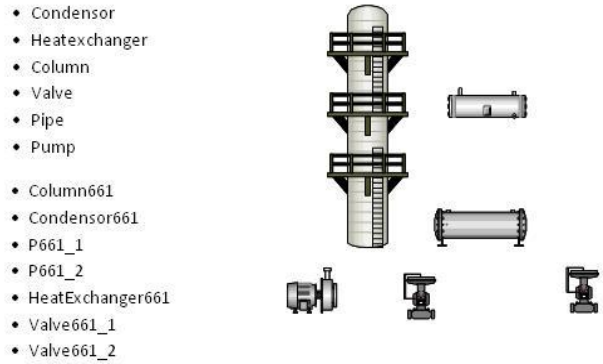
- PI Server
- System Management
- System Access
- PI Asset Ffamework

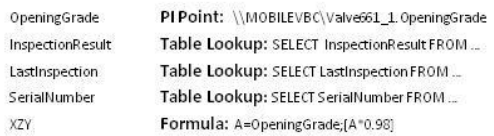
Contextualize, structurize and enrich data

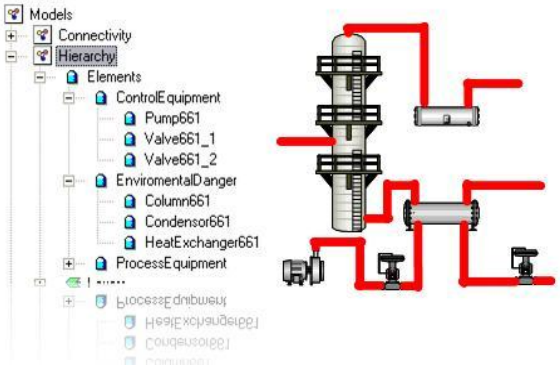
Represents the entire Asset Structure of the Plant

Shaping your data by:

1. **Defining types of assets** → Templates
   Schema how to attribute Elements
2. **Association to a "real" asset** → Elements
   Created from Template
3. **Describing the "real" asset** → Attributes
   having Units Of Measurements (UOM)
   can come via data references from everywhere
4. **Physical/logical asset structure** → Hierarchy
5. **Assets connectivity** → Models
   Model : Collections of connected elements







ANALYZE - Analytical Capabilities

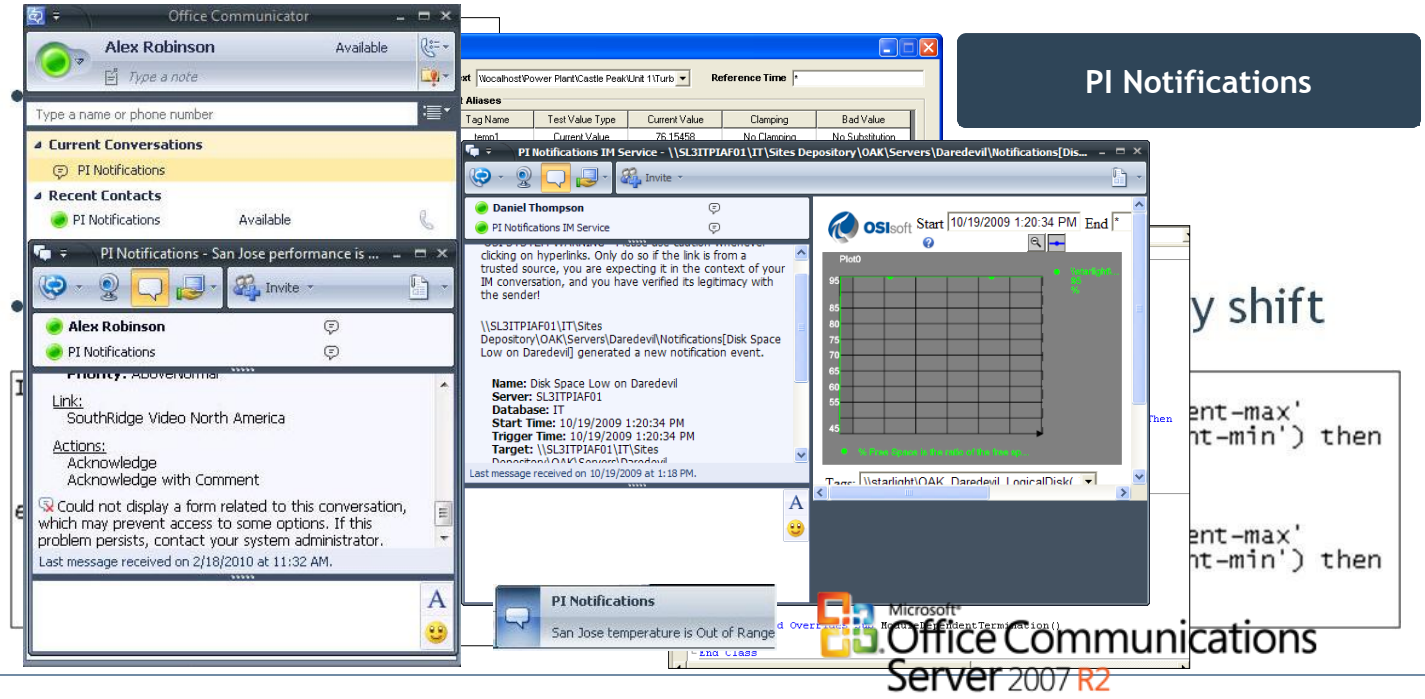
Access real-time or historical role-based data for the entire enterprise at any time.

- Advanced Computing Agent
- Performance Equations
- PI Notifications
- PI Reports™
- Batch
- Statistical Quality Control (SQC)

Convert real-time data into actionable information

Measure and improve business performance

- **Equations**, calculations, aggregations, filters, business rules
- CEP (Complex Event Processing) & Post processing
- **Reports, Notifications and Alerts**
- **Monitor** business & operational performance in real time



VISUALIZE - Visualization Capabilities

Gain a comprehensive view of operational information

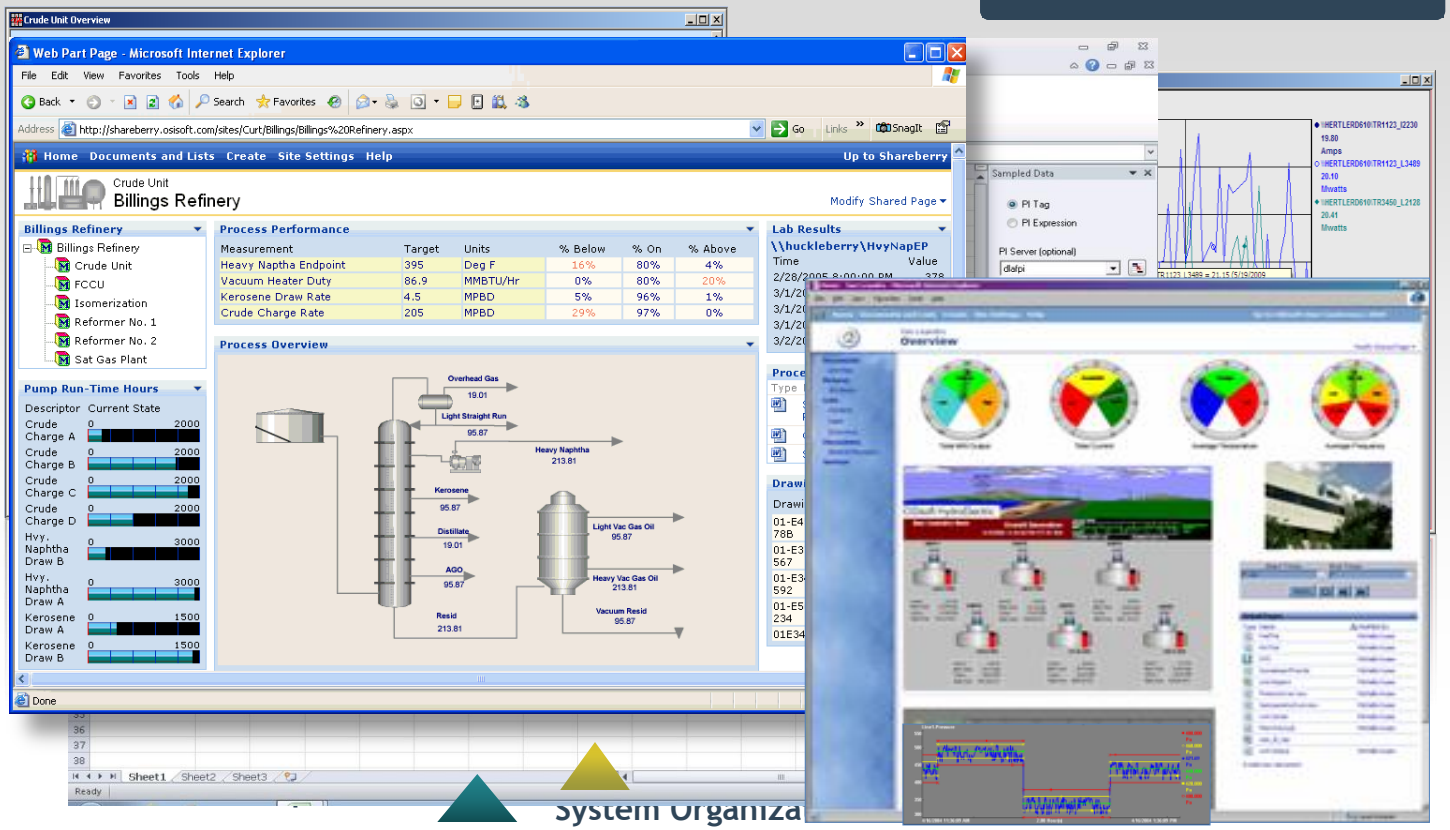
Empower informed decisions and drive business success

Present

View data, identify problems, and take corrective action with familiar, easy-to-use graphical tools.

- ProcessBook®
- PI DataLink™
- DataLink for Excel Services
- PI BatchView
- PI WebParts™

PI WebParts™

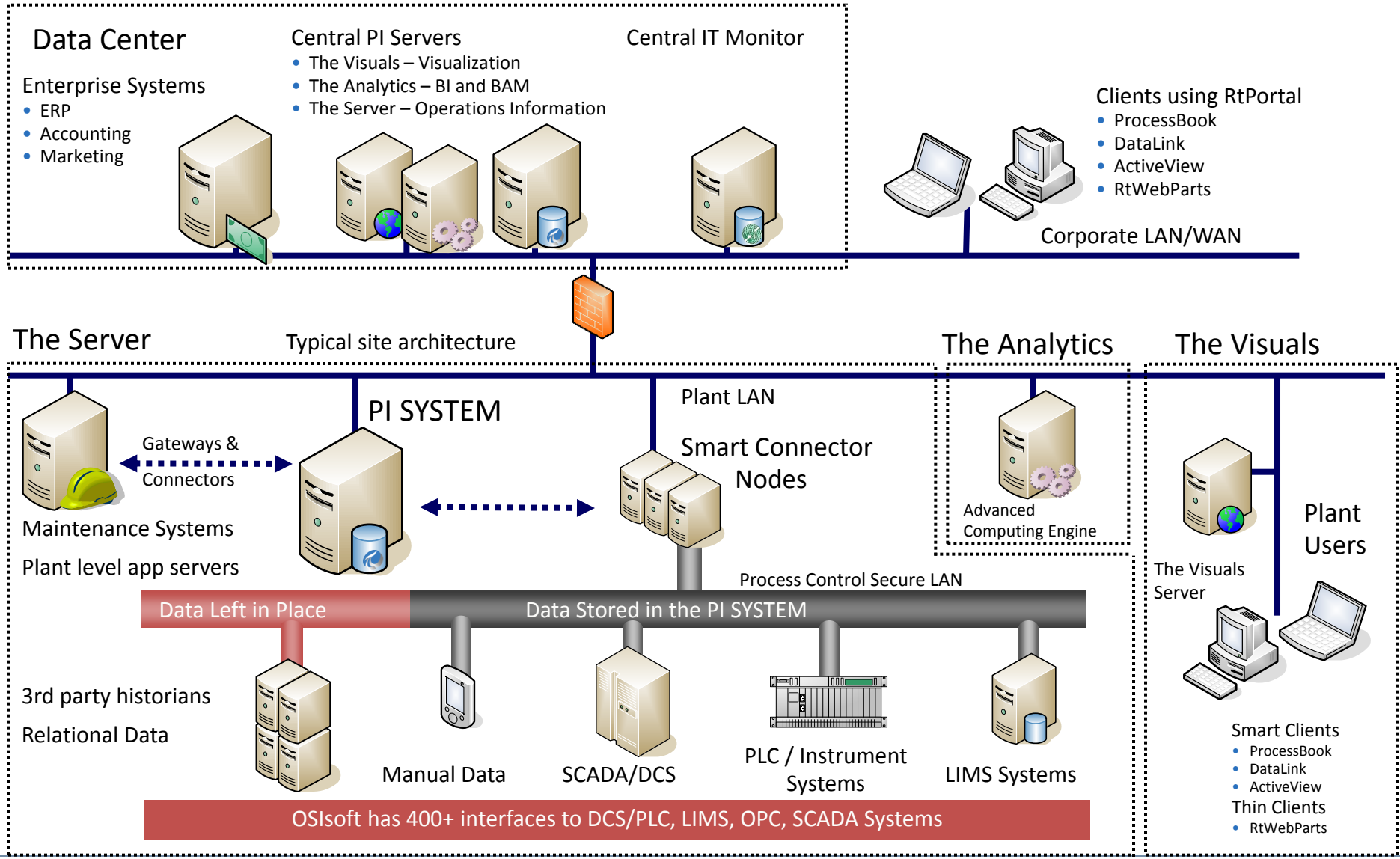


Provide access to real-time information from anywhere

Access to historical process information for analysis and reporting

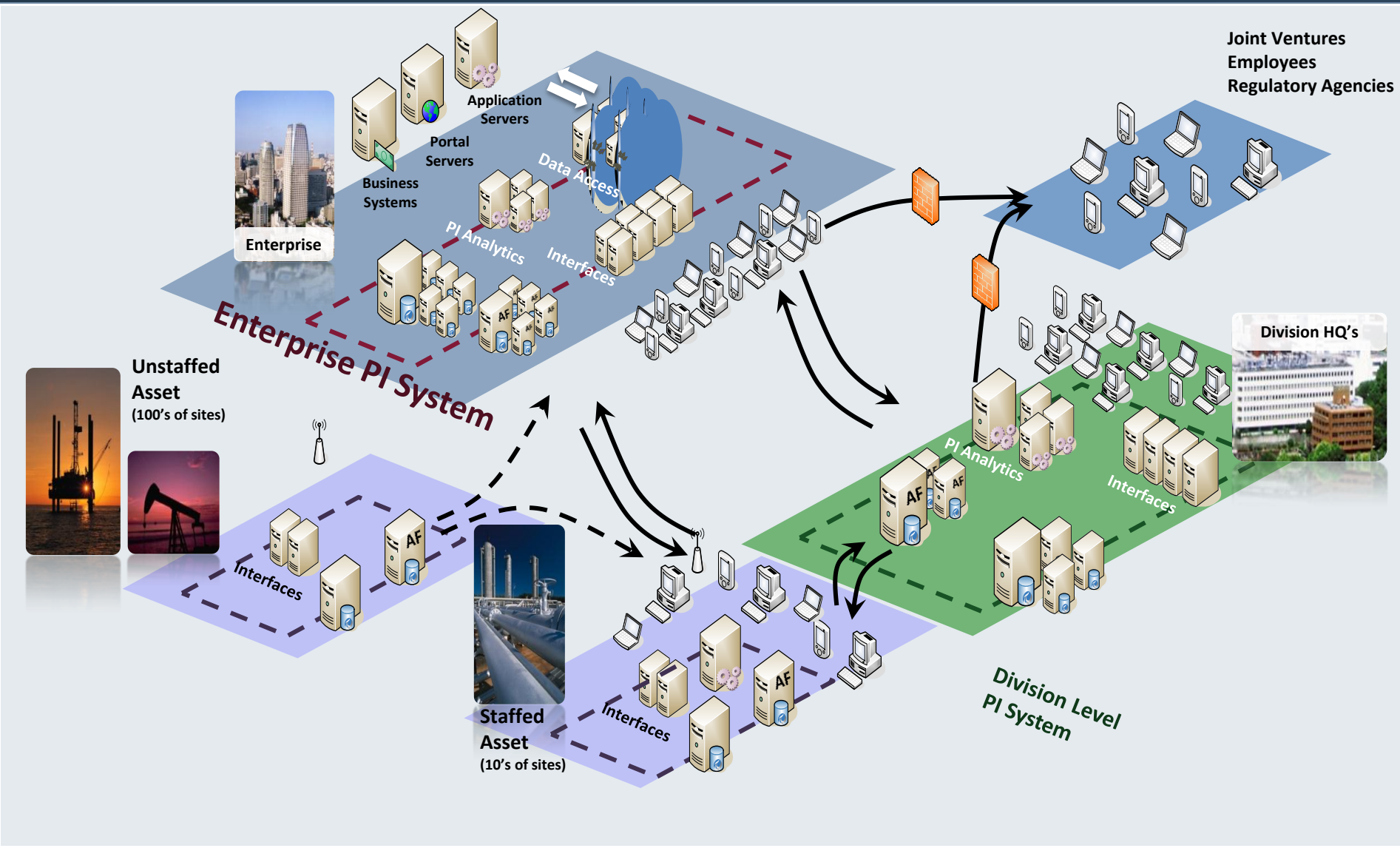
Typical System Architecture at Local Level

Infrastructure for a Plant or Site



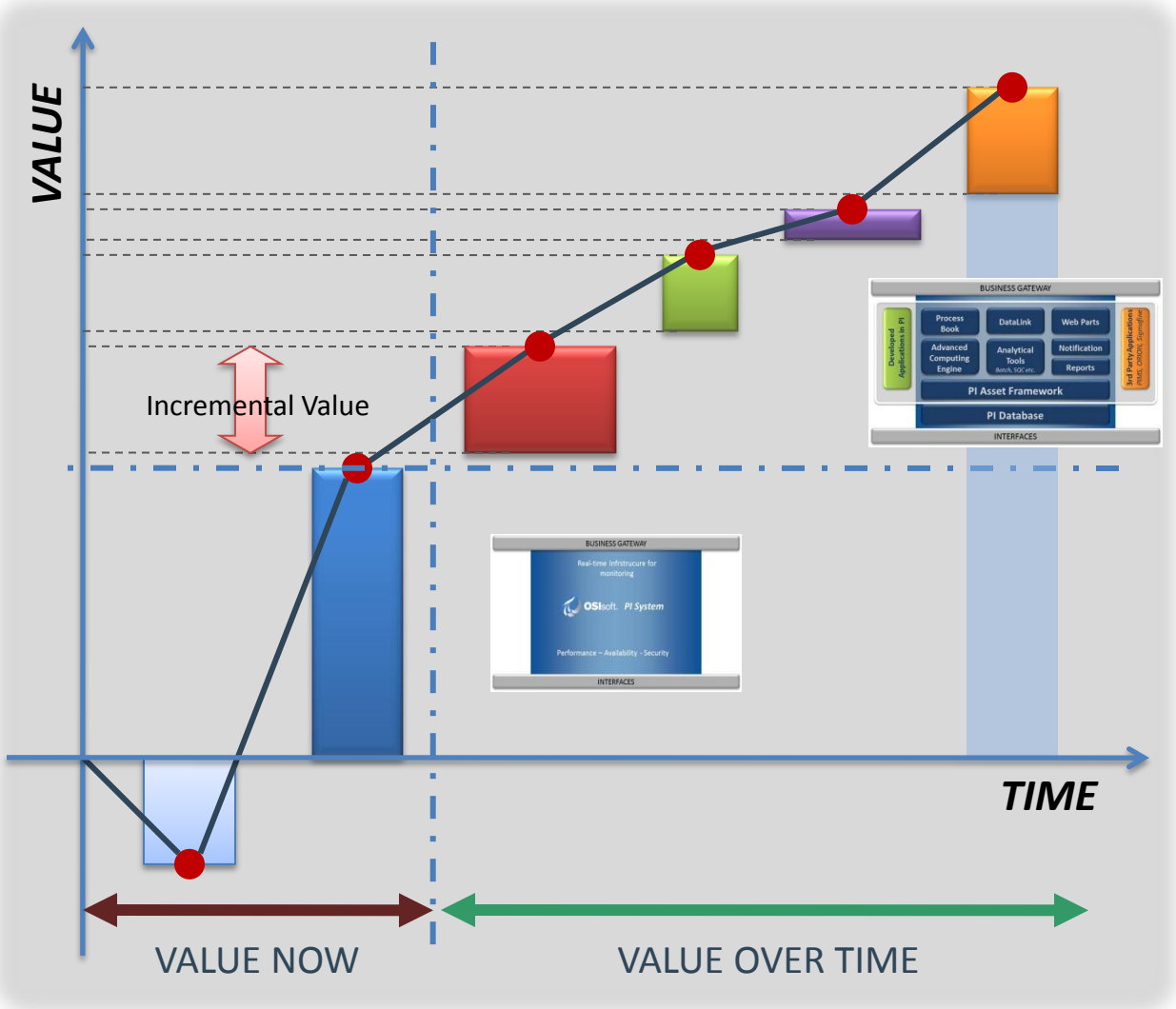
Moving from Local to Global

Real-time Infrastructure for the Enterprise



Value Creation Mechanism of PI System

Value Now, Value Overtime



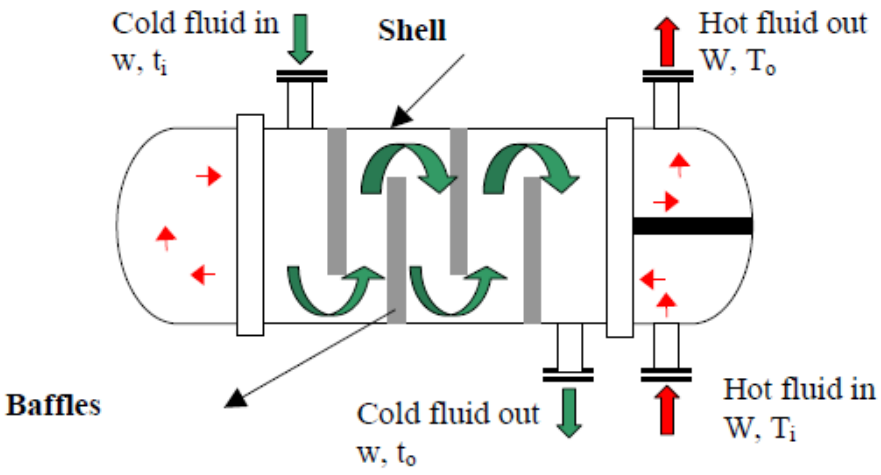
Application Benefits

- *Operations Management*
- *Environmental Reporting*
- *Equipment Health Mgmt.*
- *Performance Management*

Infrastructure Value

Initial Investment

Example: Heat Exchanger Performance Monitoring
CALCULATION ALGORYTHM



Heat Exchanger Key Performance Indicator:

Overall heat transfer coefficient

$$U = \frac{Q}{A \times \text{Corrected LMTD}}$$

RULE: *IF the heat transfer coefficient is decreasing, THEN the* ***Heat Exchanger FOULING*** *!!! Cleaining is required!*

Calculation Steps:

1. Heat Duty, $Q = q_s + q_l$
   $q_s = W \times C_{ph} \times (T_i - T_o)/1000/3600$
   $q_s = w \times C_{pc} \times (t_o - t_i)/1000/3600$
2. Hot Fluid Pressure Drop, $\Delta P_h = P_i - P_o$
3. Cold fluid pressure drop, $\Delta P_c = p_i - p_o$
4. Temperature range hot fluid, $\Delta T = T_i - T_o$
5. Temperature range cold fluid, $\Delta t = t_o - t_i$
6. Capacity ratio, $R = W \times C_{Ph} / w \times C_{pc}$ (or) $(T_i - T_o) / (t_o - t_i)$
7. Effectiveness, $S = (t_o - t_i) / (T_i - t_i)$
8. LMTD

   LMTD Counter current Flow $= ((T_i - t_o) - (T_o - t_i)) / \ln ((T_i - t_o)/(T_o - t_i))$
   LMTD Co current Flow $= ((T_i - t_i) - (T_o - t_o)) / \ln ((T_i - t_i)/(T_o - t_o))$
   Correction factor for LMTD to account for Cross flow

$$F = \frac{(R+1)^{1/2} \times \ln ((1 - SR)/(1 - S))}{(1 - R) \times \ln \left\{ \frac{2 - S(R + 1 - (R+1)^{1/2})}{2 - S(R + 1 + (R+1)^{1/2})} \right\}}$$

9. Corrected LMTD $= F \times$ LMTD

Example: Heat Exchanger Performance Monitoring
INFORMATION FLOW

OSIsoft.

CONNECT *Data Sources* → **COLLECT & ARCHIVE** *Heat Exchanger Data* → **CALCULATE** *Performance* → **VISUALIZE & NOTIFY** *The Right People* → **CORRECTIVE ACTION**

Control System
- DCS
- PLC
- SCADA

Real-time data:

Parameters	Units
Hot fluid flow,W	kg/h
Cold fluid flow,w	kg/h
Hot fluid Temp, T	^{o}C
Cold fluid Temp,t	^{o}C
Hot fluid Pressure,P	bar g
Cold fluid Pressure, p	bar g

Lab System
- LIMS

Offline data:

Parameters	Units
Hot fluid density, ρ_h	kg/m^3
Cold fluid density, ρ_c	kg/m^3
Hot fluid Viscosity, μ_h	MpaS*
Cold fluid Viscosity, μ_c	MPaS
Hot fluid Thermal Conductivity, k_h	kW/(m. K)
Cold fluid Thermal Conductivity, k_c	kW/(m. K)
Hot fluid specific heat Capacity, C_{ph}	kJ/(kg. K)
Cold fluid specific heat Capacity, C_{pc}	kJ/(kg. K)

Databases
- HANDBOOK
- ASSAY DB
- SIMULATION
- PROPERTIES DB

CALCULATION ALGORYTHM

Heat Transfer Coefficient; (U = Q / A x LMTD)

RULE

IF „U" IS BELOW A CERTAIN LIMIT, THEN HEAT EXCHANGER FOULING

- Maintenance task prioritization
- Heat Exchanger Cleaning
- Changing Operating Mode
- Re-planning / re-scheduling

Requirements:

- Connect all relevant data sources
- Collect & Archive Data
- Put the Data into Context
- Asset Centric Information
- Rigorous Calculation Capabilities
- Archive results
- Trending capabilities
- Visualisation capabilities
- Implementing rules
- Notify O&M Personnel

Example: Heat Exchanger Performance Monitoring

STEP 1: CONNECT RELEVANT DATA SOURCES

CONNECT
Data Sources

BUSINESS GATEWAY

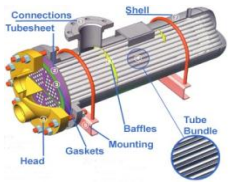
PI Database

INTERFACES

OTHER | LAB | CONTROL SYSTEMS | DIAGNOSTICS | DATABASES | MANUAL DATA

PUMPS | VALVES | HEx | TRANSMITTERS | ACTUATORS | MOTORS | TRANSFORMERS | OTHER

Heat Exchanger **Data appears in different systems** (data sources):
- Control System *(T, p, W)*
- LIMS *(density, viscosity)*
- Databases *(thermal consuctivity, heat capacity)*



HEx101

Example: Heat Exchanger Performance Monitoring

STEP 2: COLLECT AND ARCIVE EQUIPMENT DATA (Tag-based)

COLLECT & ARCHIVE
Heat Exchanger Data

BUSINESS GATEWAY

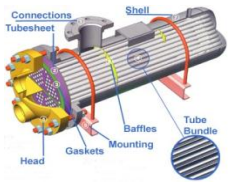
PI Database

INTERFACES

OTHER | LAB | CONTROL SYSTEMS | DIAGNOSTICS | DATABASES | MANUAL DATA

PUMPS | VALVES | HEx | TRANSMITTERS | ACTUATORS | MOTORS | TRANSFORMERS | OTHER

Heat Exchanger Data **is collected and archived** in PI Database *(TAGS)*



HEx101

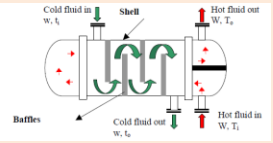
Example: Heat Exchanger Performance Monitoring

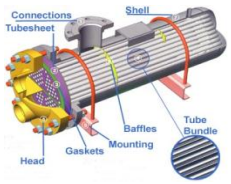
STEP 3: ASSIGN CONTEXT (Asset-based)

COLLECT & ARCHIVE
Heat Exchanger Data

Data is assigned to an individual equipment (heat exchanger 101):
• Asset-centric representation of data

HEx101

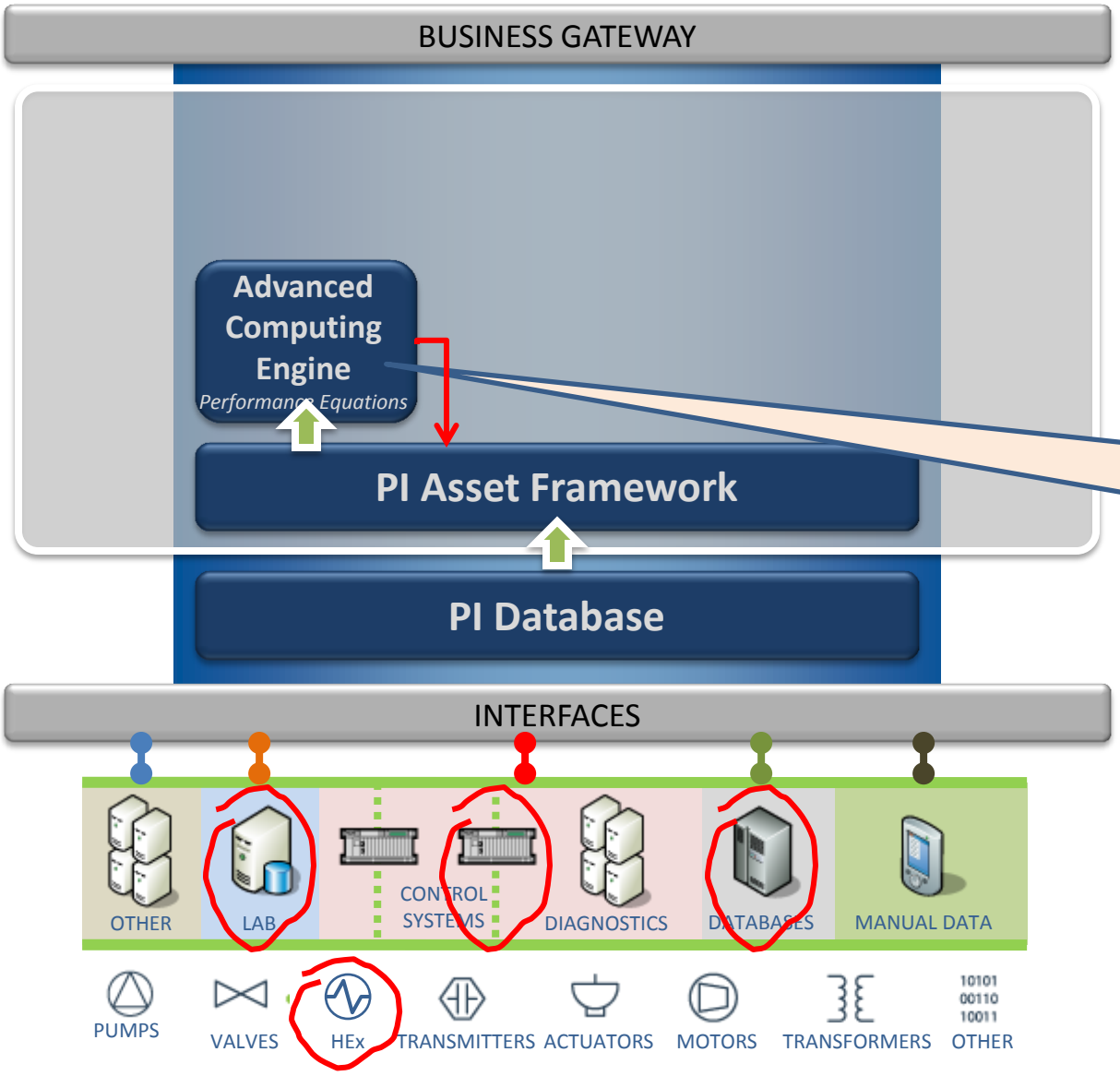




HEx101

Example: Heat Exchanger Performance Monitoring

STEP 4: CALCULATE PERFORMANCE MEASURES

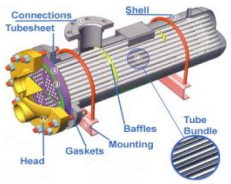


CALCULATE
Performance

Heat Exchanger **Performance is Calculated** in real-time:

$$U_{101} = Q_{101} / A_{101} \times LMTD_{101}$$

- **Archive** the result (U)



HEx101

Example: Heat Exchanger Performance Monitoring

STEP 5: VISUALIZE EQUIPMENT PERFORMANCE REAL-TIME

OSIsoft.

BUSINESS GATEWAY

VISUALIZE & NOTIFY
The Right People

Process Book

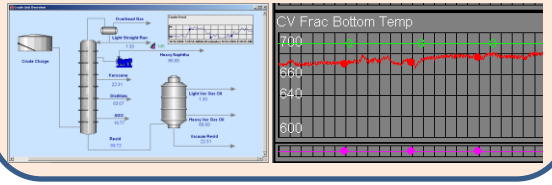
Advanced Computing Engine
Performance Equations

PI Asset Framework

PI Database

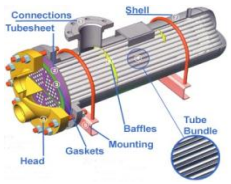
INTERFACES

Trend and Visualize heat exchanger data:



OTHER | LAB | CONTROL SYSTEMS | DIAGNOSTICS | DATABASES | MANUAL DATA

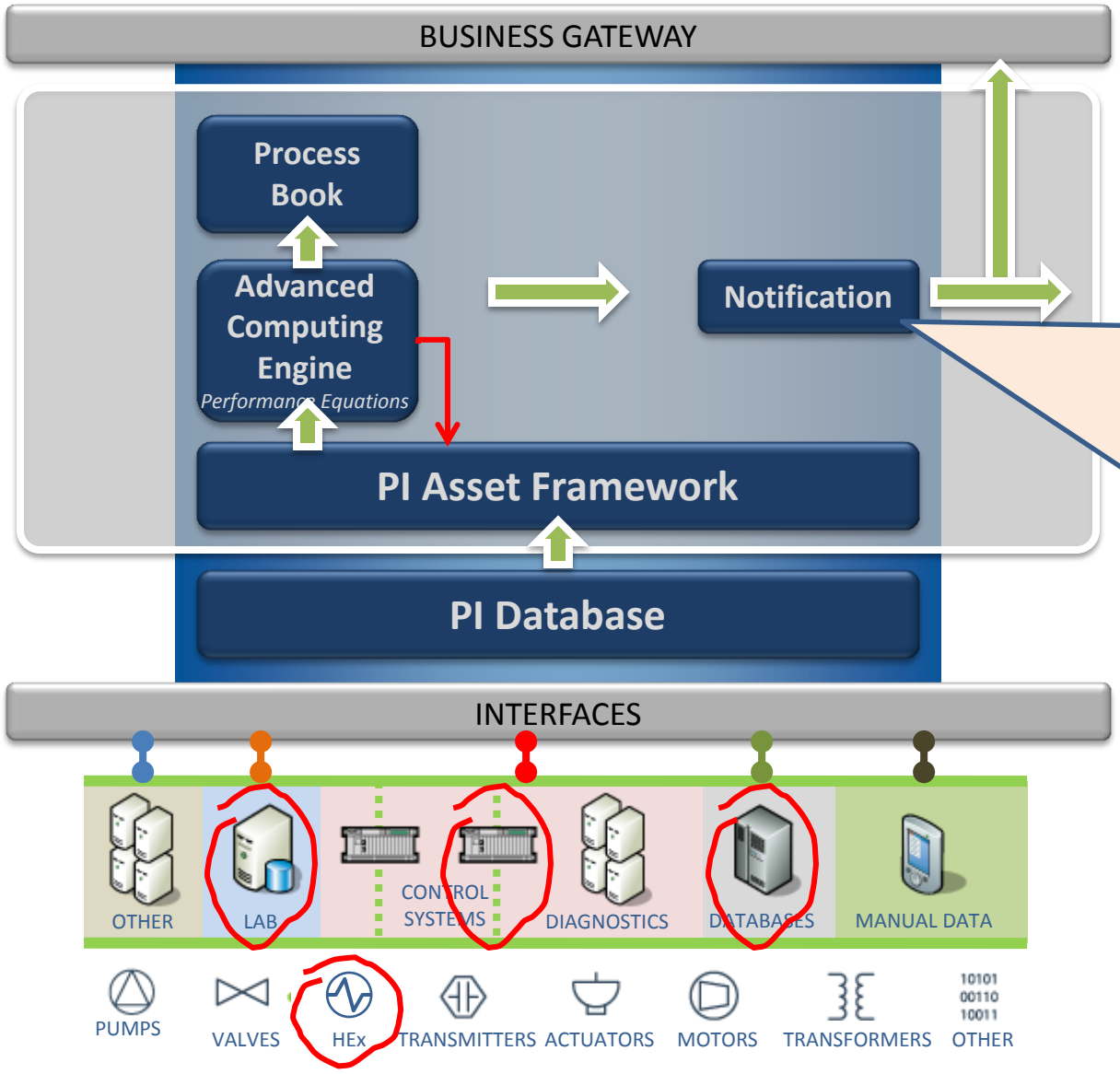
PUMPS | VALVES | HEx | TRANSMITTERS | ACTUATORS | MOTORS | TRANSFORMERS | 10101 00110 10011 OTHER



HEx101

Example: Heat Exchanger Performance Monitoring

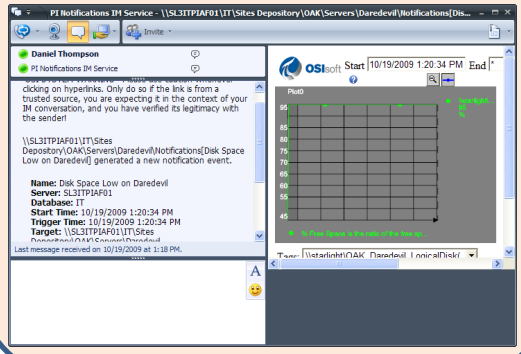
STEP 6: NOTIFY THE RIGHT PEOPLE AT THE RIGHT TIME

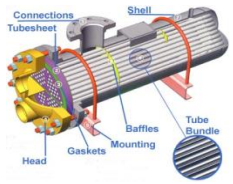


VISUALIZE & NOTIFY
The Right People

Notification is sent to shift operators and maintenance personnel, that:
HEAT EXCHANGER 101 IS FOULING

Maintenance Notification is sent to CMMS (SAP PM)



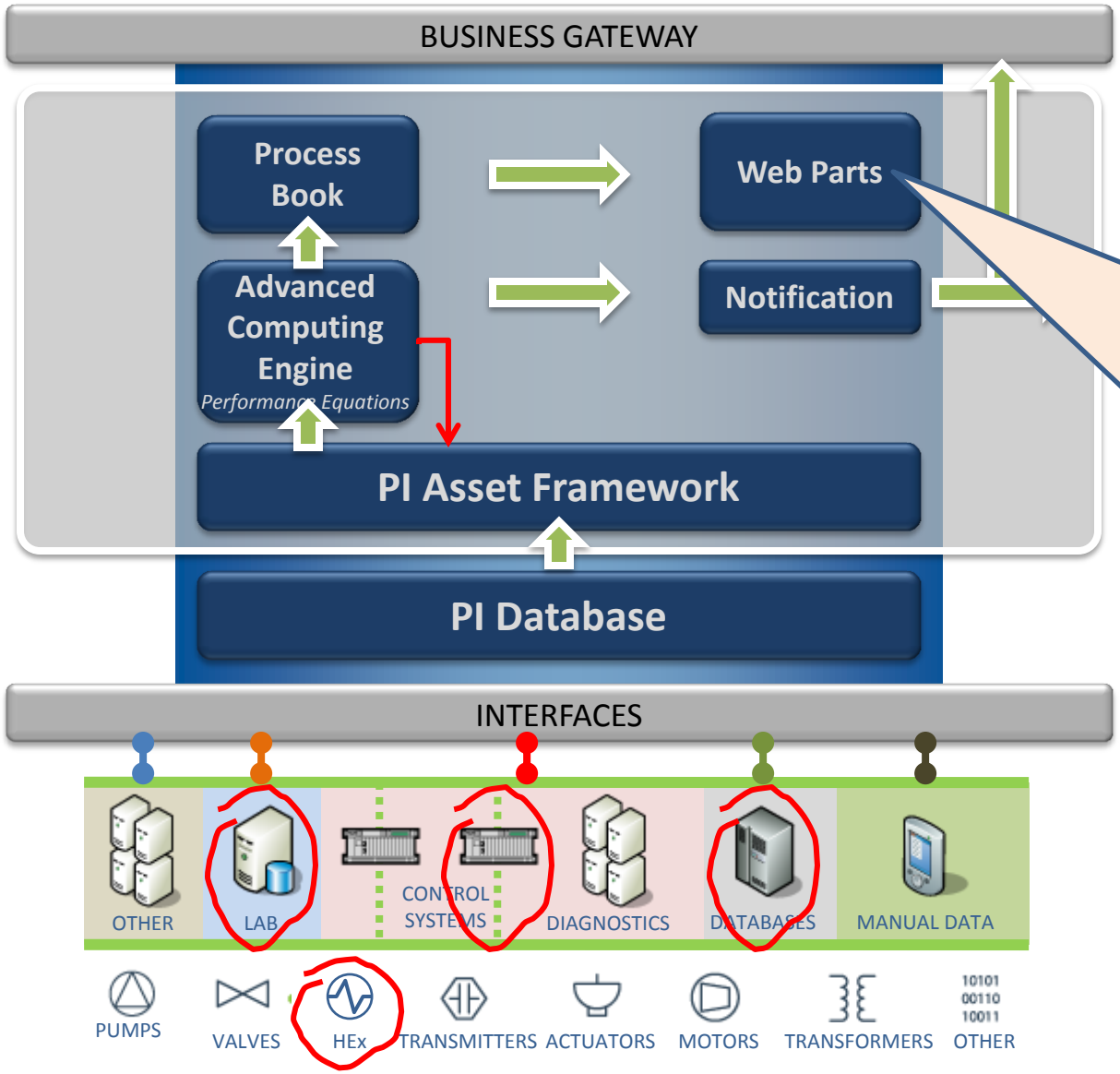


HEx101

Example: Heat Exchanger Performance Monitoring

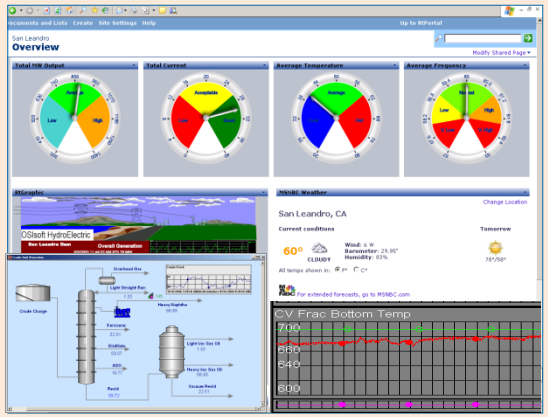
STEP 7: VISUALIZE OVERALL PERFORMANCE REAL-TIME

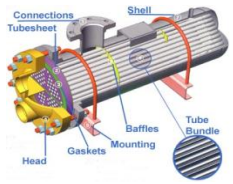
OSIsoft.



VISUALIZE & NOTIFY
The Right People

Visualize equipment, unit, plant, area **KPIs on Corporate Dashboard**





HEx101

Example: Heat Exchanger Performance Monitoring

STEP 8: REPORT ANOMALIES IN THE RIGHT FORMAT

OSIsoft.

VISUALIZE & NOTIFY
The Right People

BUSINESS GATEWAY

Process Book

Advanced Computing Engine
Performance Equations

Web Parts

Notification

Reports

PI Asset Framework

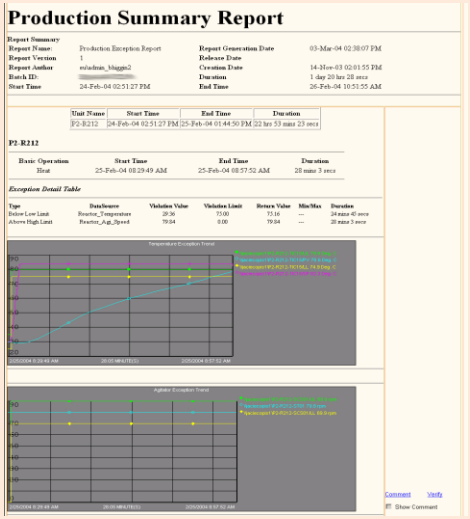
PI Database

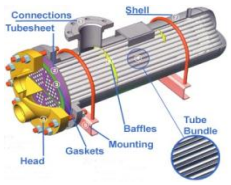
INTERFACES

OTHER | LAB | CONTROL SYSTEMS | DIAGNOSTICS | DATABASES | MANUAL DATA

PUMPS | VALVES | HEx | TRANSMITTERS | ACTUATORS | MOTORS | TRANSFORMERS | 10101 00110 10011 OTHER

Send report

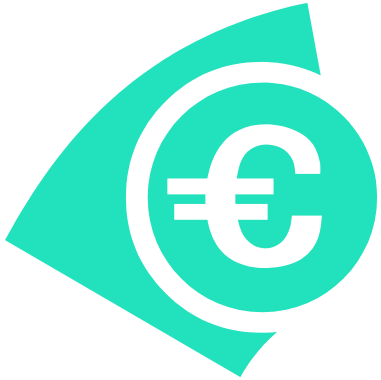




HEx101

Infrastructure Benefits

- Typical Benefit Areas of a Real-time Infrastructure:
  - **Increased production/decreased downtime**
    - » The PI System infrastructure can reduce downtime as a result of improved situational awareness and decision making.
  - **Reduced Energy**
    - » The use of PI System infrastructure would result a reduction in energy usage by improved analytics and visualization of operational data
  - **Reduced loss and downgrade**
    - » Reduced loss and downgrade from improved information and decision support systems across the value chain
  - **Reduced Capital costs**
    - » PI can provide improved operational information resulting in improved understanding and associated reduction in cap ex costs
  - **Reduced Maintenance costs**
    - » Reduced maintenance costs due to improved equipment/asset awareness, predictive analytic/notification, and ability to perform incident investigation.
  - **Reduced Chemical/additive costs**



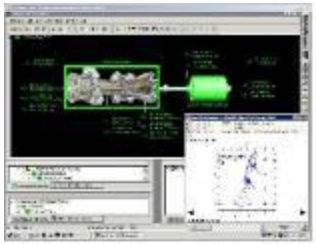
PI System in the Industries

Use Cases & Examples

BP Exploration & Production

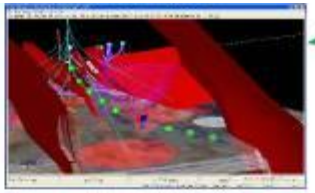
Real-time Data - Usage in Different Contexts

Rotating Equipment



Real-time Drilling

Drilling Visualization



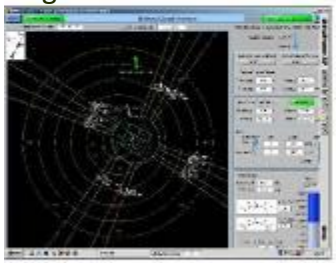
One Touch

Topsides Monitoring

PI

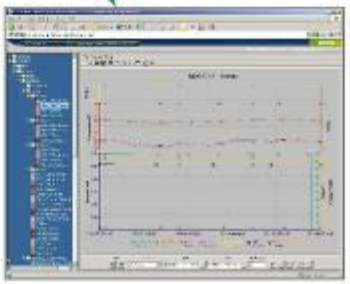
ISIS

Integrated Marine Monitoring

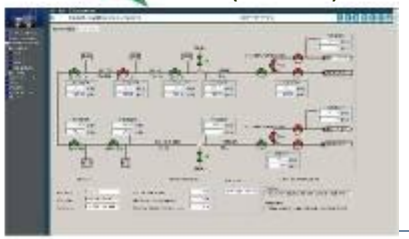


Fiber Optic Network

Process Net



AWS (Subsea)



Riser/Mooring Data

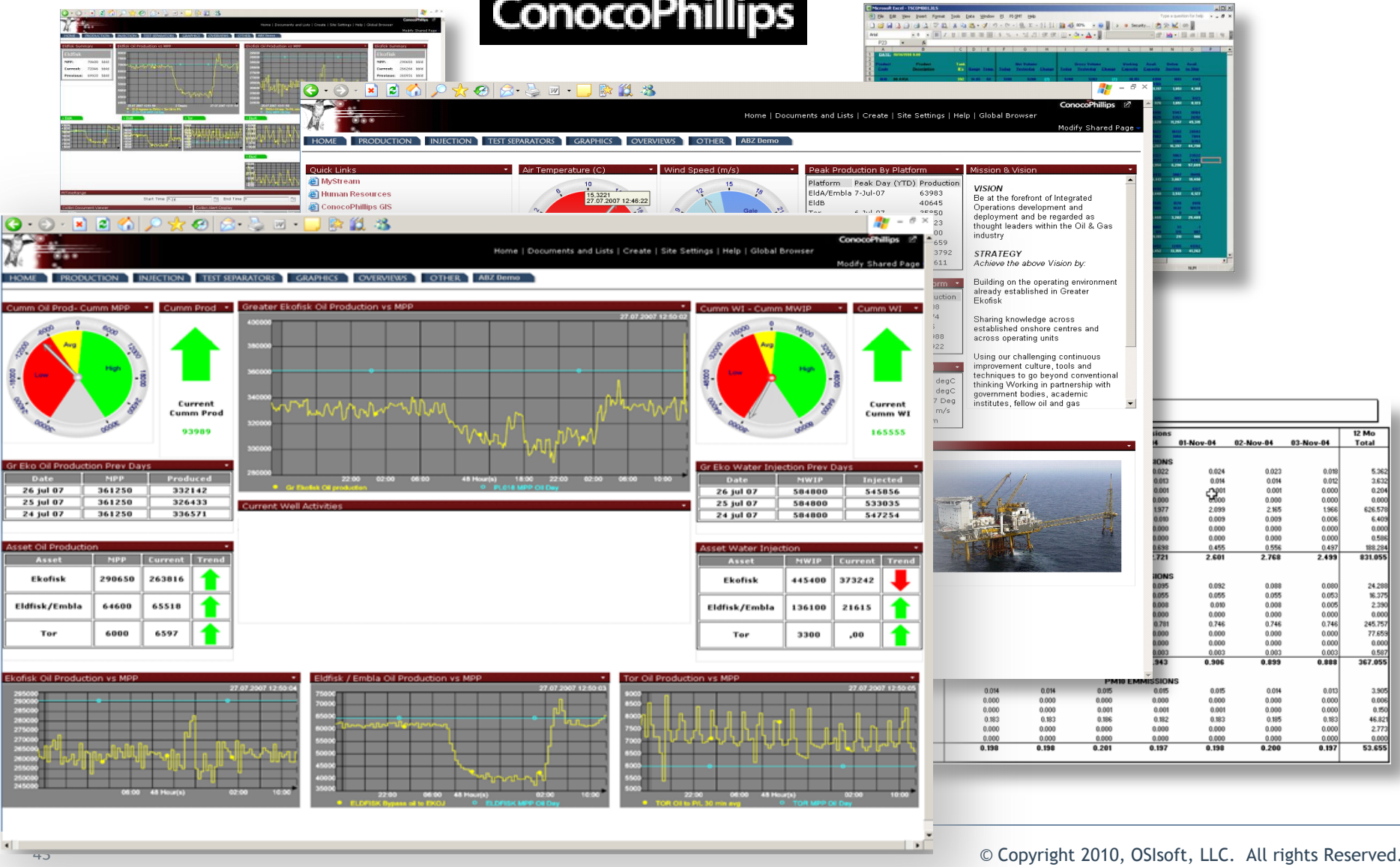
Subsea/Well Surveillance

Conoco-Phillips E&P - North Sea

Analysis Tools to Support Asset and Cross-Asset Collaboration

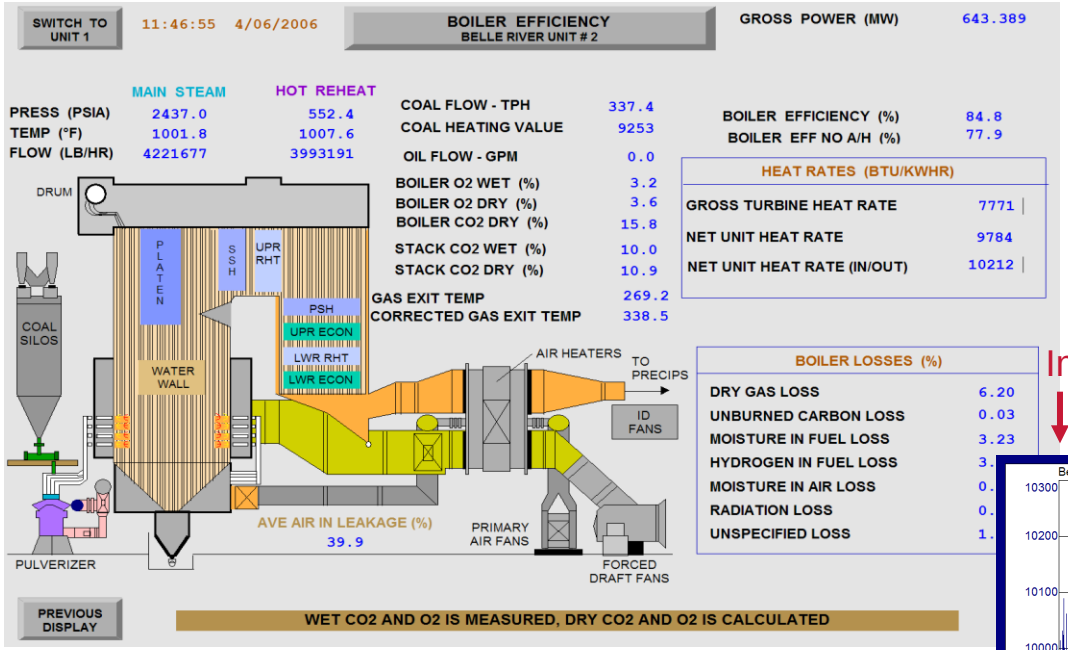
Production Analysis

Equipment Monitoring



Detroit Energy - Generation

Optimization of thermal performance while reducing emission

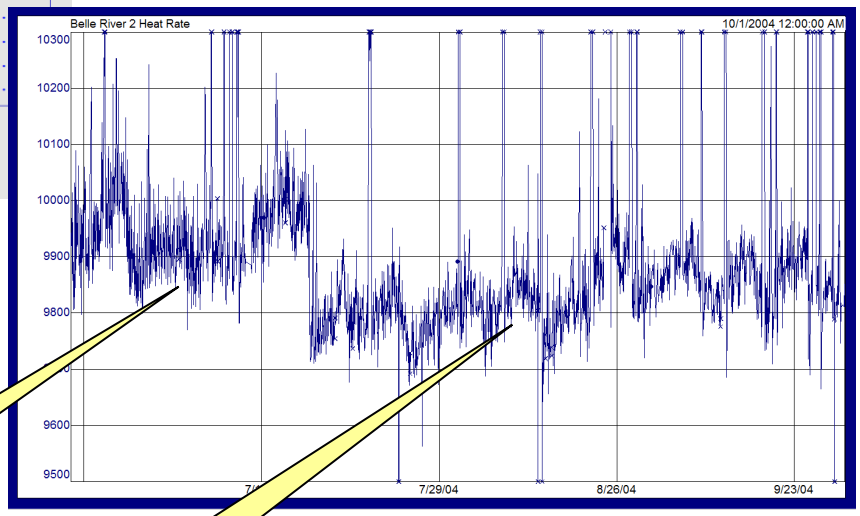


Improving Thermal Performance

NOx Reduction with Improved Heatrate

Before Implementation

After Implementation



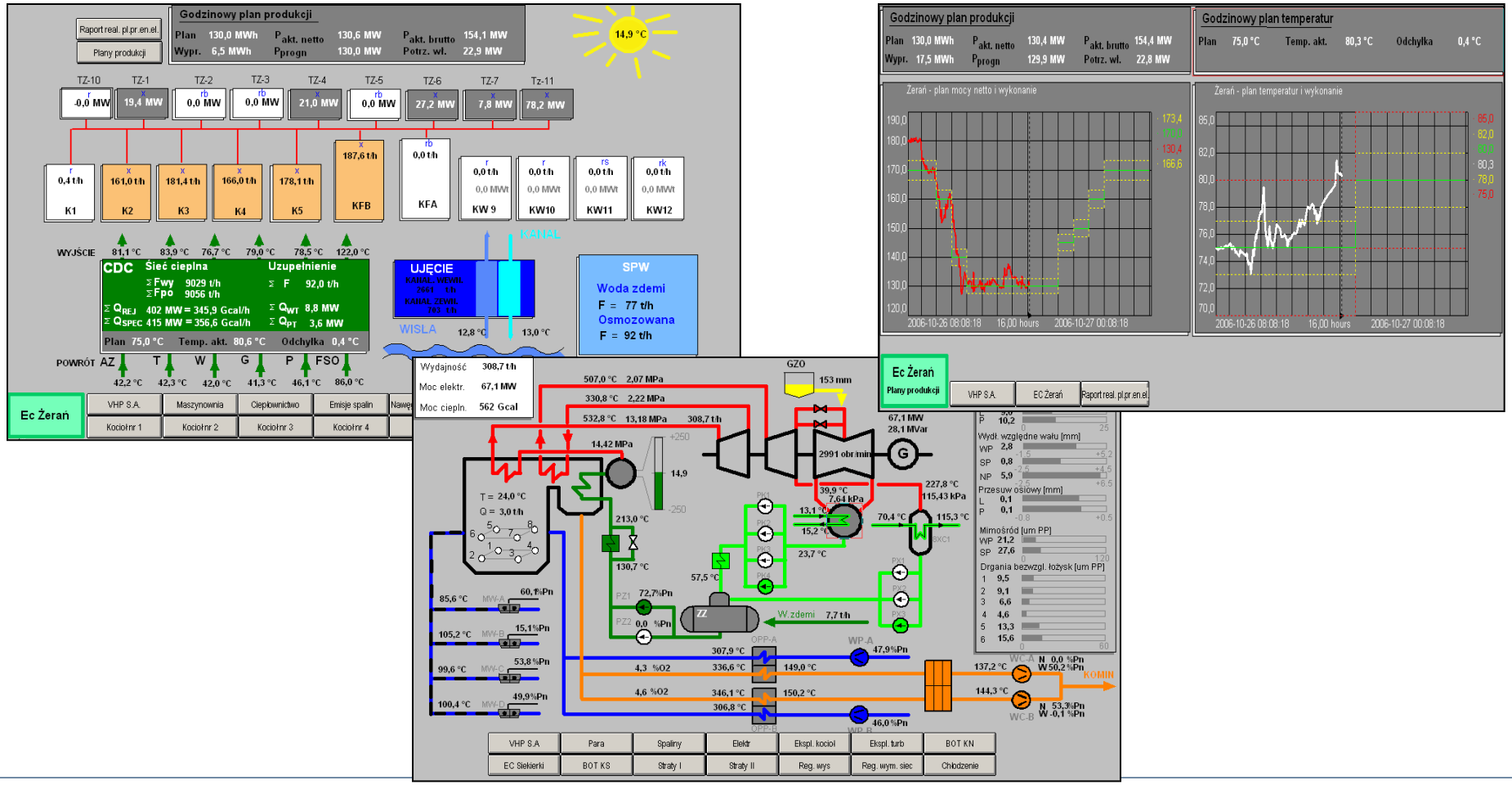
Primary focus is NOx reduction only

Focus on operating near NOx budget curve

Vattenfal Heat Poland

Real-time decision making and monitoring plan vs. actual

PI Process Book enabling graphical visualization of techological process



PEMEX, Gasatacama

Monitoring & Diagnostics Center

California ISO: Governor's visit

Summary

- We are focusing on ONE product, the PI System since ~ 30 years
- Our system is widely accepted globally and we have a very good reputation in the marketplace in all major industries
- The PI System
  - Creates an integration platform to all islands
  - Connects your plant floor data into the business process
  - Spans your supply
  - Enables collaboration and continuous improvement
  - Provides you with the capability of making profitable decisons real-time based on actionable information
- We understand the needs of all the major processing and manufacturing industries, so we are trusted by many prestigious Cement companies
- We provide 24/7 Technical Support

Thank you

777 Davis St., Suite 250 San Leandro, CA 94577