COTS Software for Real-Time Situational Awareness of Industrial Operations

by Paul Hagan
OSIsoft

DISCOVER **THE POWER OF PI**

Real Time Situational Awareness for Industrial Operations

- Intellectual Property – Real Time Operations and Performance

- Real-Time/Historical operational and performance data.

- Validate/Cleanse/Reconcile into Information

- Role Based Decision Support into ERP Strategy.

- Organizations that empower their employees with this information significantly increase productivity, performance, reduce cost and improve Return On Investment.

During this Presentation we will:

- See examples of how Industrial companies have implemented and benefited from COTS deployments.

- How does this impact network performance and application availability?

- Discuss integration with Enterprise Resource Planning (ERP) system – SAP
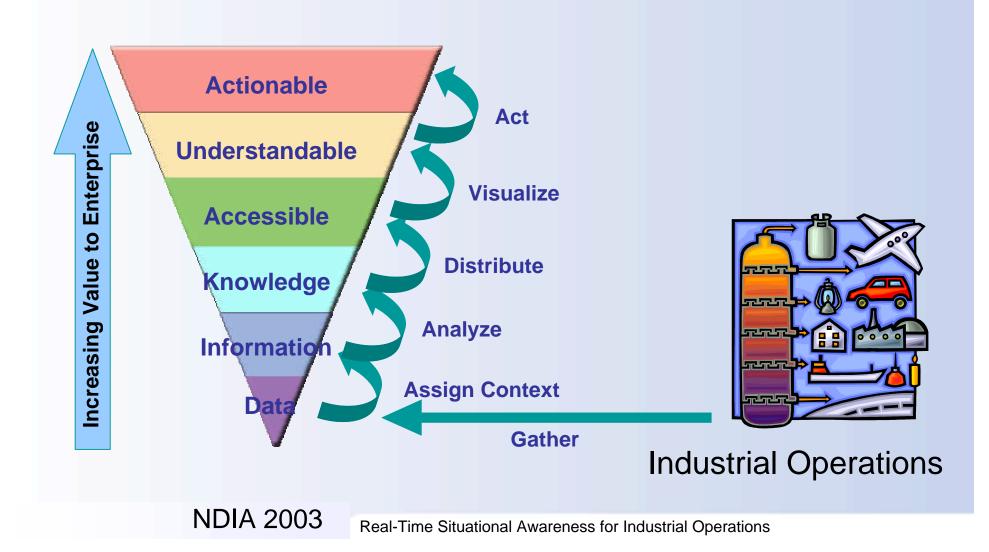 - Industrial Case Studies

- Entertain questions

Real-Time Situational Awareness for Industrial Operations

A Lesson in History from an Automation and Enterprise Software perspective

- Late 1970s and 1980s – Automation

- Late 1980s - Manufacturing Resource Planning Systems - MRP and MRP II.

- Mid 1990s - present, Enterprise Resource Planning - ERP systems to understand and optimize asset performance and costing.

Real-Time Situational Awareness for Industrial Operations

Data – Knowledge – Dissemination – Action Infrastructure

Increasing Value to Enterprise

- Actionable
- Understandable
- Accessible
- Knowledge
- Information
- Data

Act

Visualize

Distribute

Analyze

Assign Context

Gather

Industrial Operations

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Fundamental Key to Success

The objective of the last 25 years has been to put the Right Information into the hands of the Right People to make the Right Decision, or … Role Based Decision Support.
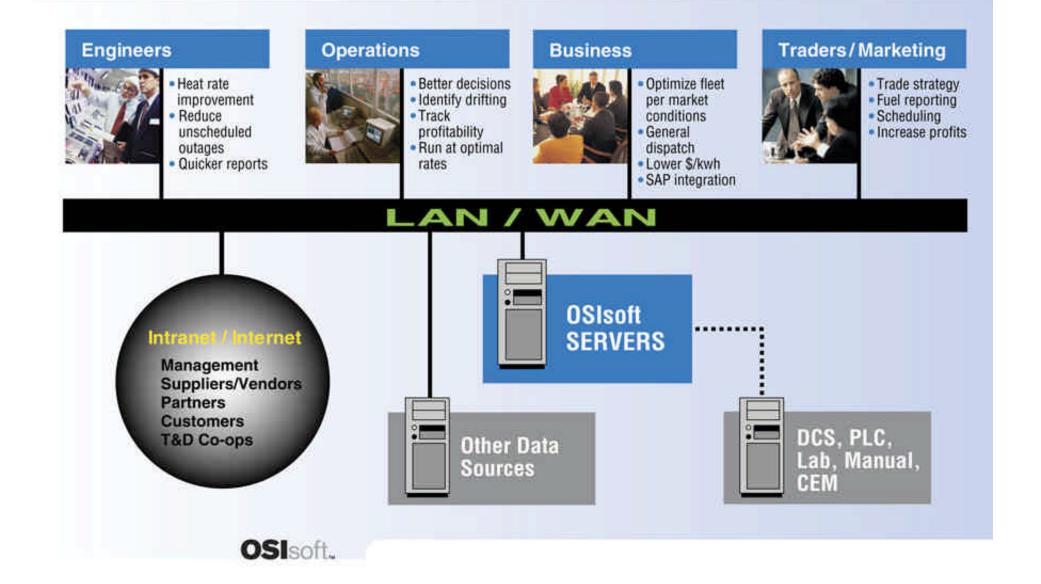
The most successful companies have implemented software systems with both a real time and historical data availability.

Enterprise Role Based Decision Support

Engineers
- Heat rate improvement
- Reduce unscheduled outages
- Quicker reports

Operations
- Better decisions
- Identify drifting
- Track profitability
- Run at optimal rates

Business
- Optimize fleet per market conditions
- General dispatch
- Lower $/kwh
- SAP integration

Traders / Marketing
- Trade strategy
- Fuel reporting
- Scheduling
- Increase profits

LAN / WAN

Intranet / Internet
Management
Suppliers/Vendors
Partners
Customers
T&D Co-ops

OSIsoft SERVERS

Other Data Sources

DCS, PLC, Lab, Manual, CEM

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Real Time information can be used to optimize decision making routines.

- Acquire

- Verify

- Process

- Disseminate

The Process of _acquiring, verifying, processing and disseminating asset performance information in near real time provides instantaneous feedback to the decision making teams and engineers that are continually optimizing and maximizing net portfolio positions._ Although current optimization tools require static curves, near real time bias of the curves can more closely approximate real unit operations.

TXU

There are Operational Risks with Assets

Generation Unit

- Availability

- Reliability

- Performance

The operational risks associated with generation assets include availability, reliability and performance.

Availability and reliability are typically trends that can be predictably quantified using recent historical information. Performance is a moving target influenced by a variety of issues, some controllable and some not.
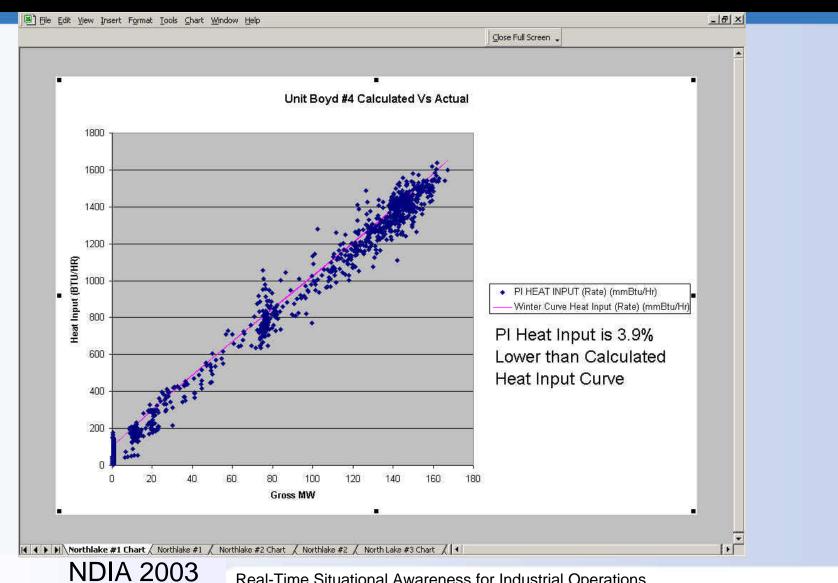
Decision Support

TXU

Performance information is the cornerstone for the decision making process

- **80 – 90% of the cost basis is directly affected by performance**

- **Heat Rate is the Performance Metric for Utilities**

Performance information is utilized in budgeting, strategic planning, unit commitment, fuel acquisition, risk valuation, benchmarking, emissions management and unit dispatching, among others. The issue of concern is that performance measuring information is usually acquired under the best possible conditions, at infrequent intervals, and does not necessarily project current operations. *The ability to accurately track and predict performance characteristics increases the accuracy of, and reduces the risk of, all facets of the planning, analysis and delivery process.*
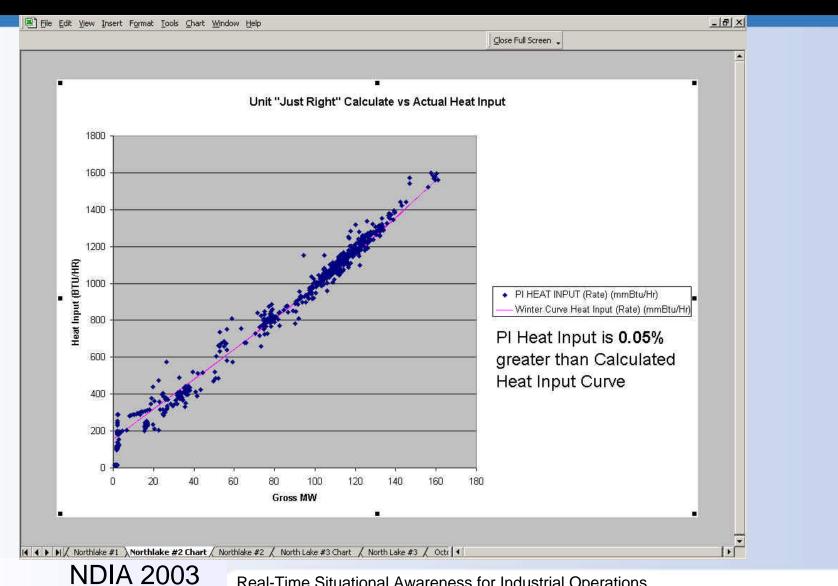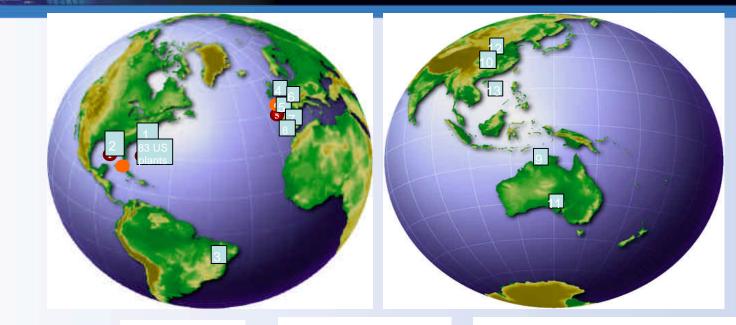
Real-Time Situational Awareness for Industrial Operations

Decision Support

Real-Time Situational Awareness for Industrial Operations

Decision Support

Real-Time Situational Awareness for Industrial Operations

AEP Global View

North America

AEP Wholesale
75 plants in Fleet

Plus
IPP Cogen

Brush II
Fort Lupton
Mulberry
Orange
Eastex
Frontera
Newgulf
Sweeney

Latin America

1. Region Office:
Washington, D.C.

2. Investment:
Bajio (50%
ownership)
Mexico

3. Investment:
Vale (44%
ownership)
Brazil

Europe

4. Region Office: London

5. Investment: Yorkshire
 Electricity Group
(50% ownership)

6. Investment: SEEBOARD
(100% ownership)

7. Investment: Medway
Power Plant
(37.5% ownership)

8. Investment: South Coast
Power Plant (50%
ownership)

Asia/Pacific

9. Region Office: Sydney

10. Country Office: Beijing

11. Investment: CitiPower
(100% ownership)

12. Investment: Nanyang General Light
Electric Co., Ltd (70% ownership)

13. Investment: Pacific Hydro, Ltd.
(20% ownership)

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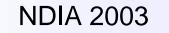
MR5 Controllable Cost Display

Muskingum River Unit 5 Operator Controllable Costs

598   MWG.IPW
2/2/00 12:51:21 PM

Controllable Cost	Units	Actual	Target	Design	Deviation from Target (Btu/Kwh)		Cost ($/Shift)
Main Steam Press	PSIG	3,615	3,600	3,500	-20	50	-$12.34
Main Steam Temperat	F	999	1,000	1,000	-20	50	$10.82
1st RH Steam Temperat	F	1,028	1,024	1,025	-20	50	-$19.60
2nd RH Steam Temperat	F	1,049	1,034	1,050	-20	50	-$69.35
1st RH Attemperat	klb/hr	107	100	0	-20	50	$10.85
2nd RH Attemperat	klb/hr	0	0	3	-20	50	-$0.03
Excess A	%	19.2	18.8	18.8	-20	50	$15.03
Exit Gas Temperat	F	294	294	290	-20	50	$3.50
Steam Coil Air Heat	klb/hr	0	4	0	-20	50	-$30.87
Condense	in. of HG	1.91	1.98	1.84	-20	50	-$60.19
HP Feedwater Heat	Btu/Kwh	-6	0	0	-20	50	-$28.54
LP Feedwater Heat	Btu/Kwh	-13	0	0	-20	50	-$77.39
Auxiliary Pow	Mw	23.5	22.3	22.7	-20	50	$124.65
Total Operator Contollable					-20	50	-$140.29

Instant Gross Load	598	Mw	Feedwater Flow	3.45	mlb/hr	Calculated Heat Rate	9062	Btu/Kwh
Instant Net Load	577	Mw	Fuel Flow	431.97	klb/hr	Design Heat Rate	8869	Btu/Kwh
Load Control (AGC)	ON		Air Flow	4.57	mlb/hr	Heat Rate Deviation	192	Btu/Kwh

Target Deviation 497 Btu/Kwh
Dev. From Target   Btu/Kwh

Unit Summa	Guidanc	Boiler Schema	Turb/Cond Schem	FW Heaters Schema	Air Heater Schema	Sootblower Tren

Canal Electric Case Study

- Business Objectives:
  - Improve Performance
  - Reduce Emissions

Combustion - Normal Operation

REDUCING ENVIRONMENT

OXYGEN RICH ENVIRONMENT

CO

Efficiency

NOx

Low CO

20%

Excess Fuel

Air Flow

Excess Air

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Aggregate Excess Air

Optimized Combustion - With Reduced O2

REDUCING ENVIRONMENT

OXYGEN RICH ENVIRONMENT

Same SAFETY Margin

CO

Low CO

Eff Increase

Efficiency

NO_x

NOx Reduction

Excess Fuel

18%   20%

Excess Air

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Real-Time Situational Awareness for Industrial Operations
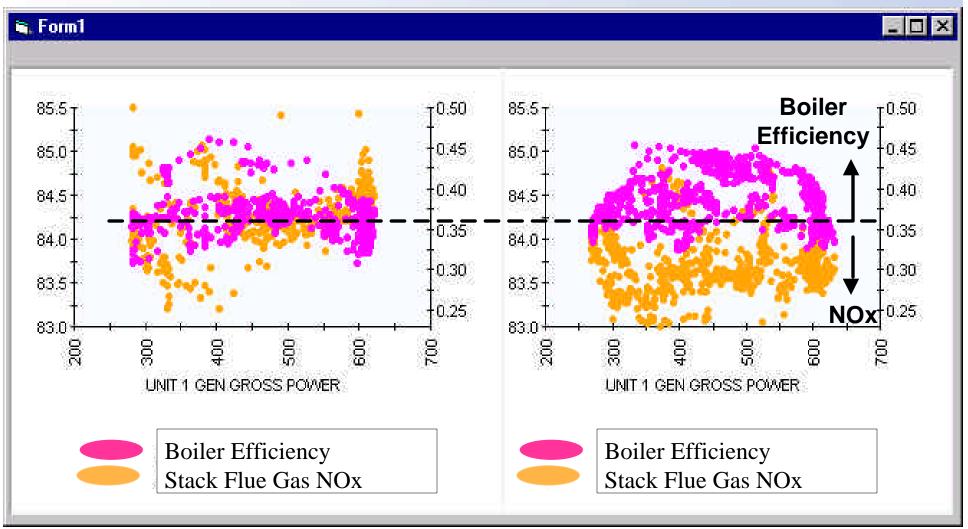
Aggregate Excess Air

Proven, Measurable Results

Canal Electric Results

- Lower NOx (10% to more than 45%)

- Improve Heat Rate (0.5% to more than 2%)

- Substantially Reduce Cost Of Emissions Retrofits

- 240 BTU/kwh Heat Rate improvement, 2% annual Heat Rate gain @ $20/ton of coal on a 1150 MW Station …
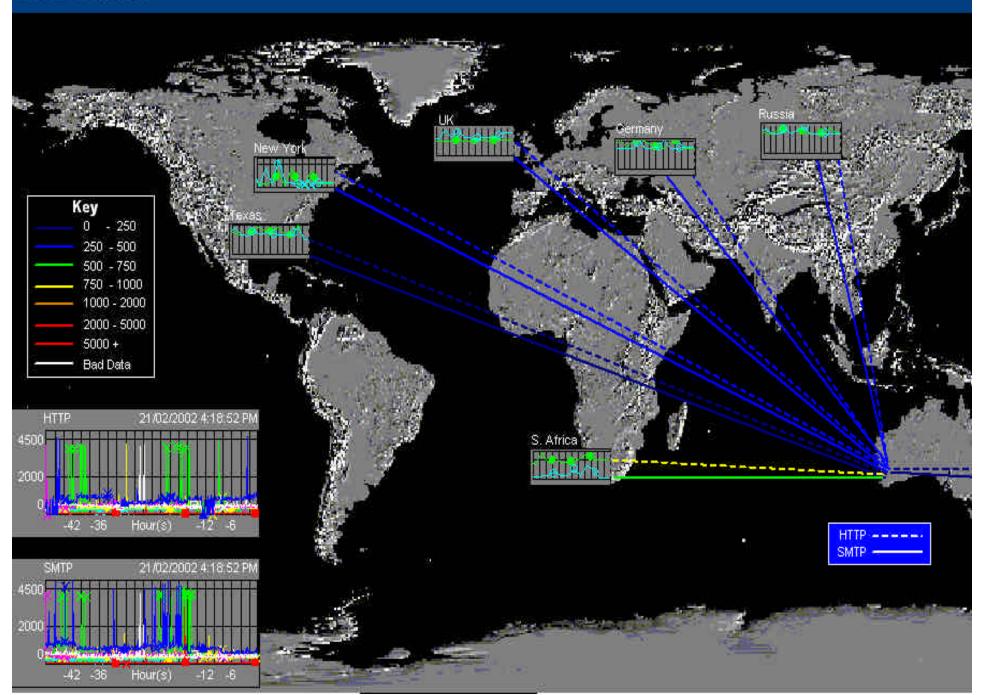
over $2 million annual savings

Real-Time Situational Awareness for Industrial Ope

Exposing the Criticality of Networks

- What about my networks?

- Getting the right data into the hands of the right person highlights network performance, and application availability.

- Availability and Performance

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VPN Latency

Key
	0 - 250
	250 - 500
	500 - 750
	750 - 1000
	1000 - 2000
	2000 - 5000
	5000 +
	Bad Data

New York

Texas

UK

Germany

Russia

S. Africa

HTTP   21/02/2002 4:18:52 PM

4500
2000
0
-42 -36   Hour(s)   -12 -6

SMTP   21/02/2002 4:18:52 PM

4500
2000
0
-42 -36   Hour(s)   -12 -6

HTTP -------
SMTP ———

Identifying, Solving and Preventing IT Problems

- Identifying a network or application problem is the first step. This seemingly simple fact highlights the need for the history of network operation especially for intermittent problems.

- We need to know if the problem is:

  - **Hardware**
    Server, Router, Firewall, Switch, etc
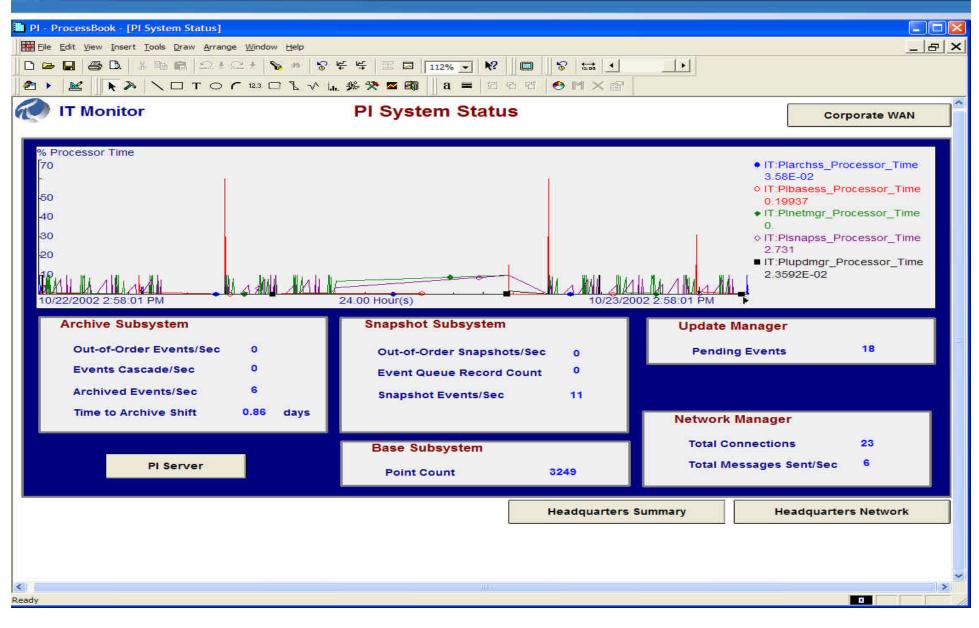 - **Software**
    Operating System, Application, etc.
  - **Networks**
    Local Area Network, Wide Area Network, Remote Locations

- Understanding the history of operation can improve Network Performance, Bandwidth Utilization, and Capacity Planning.
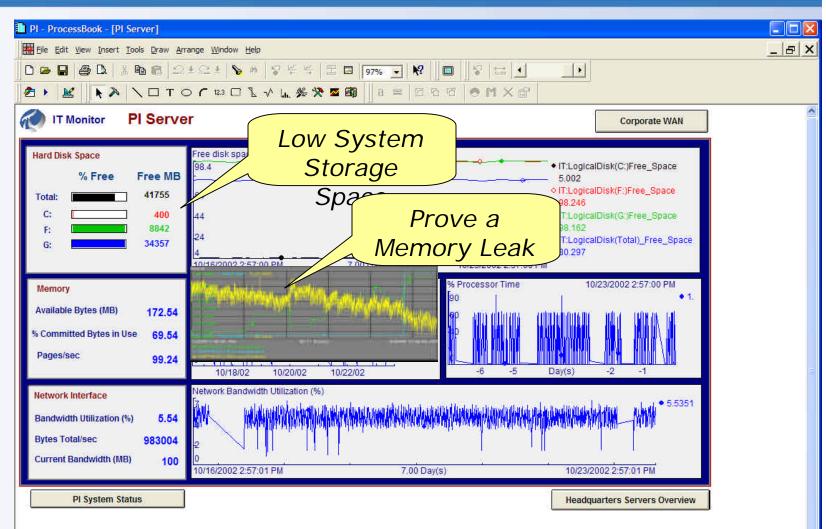
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Performance
Monitor Subsystems, Windows, Hardware

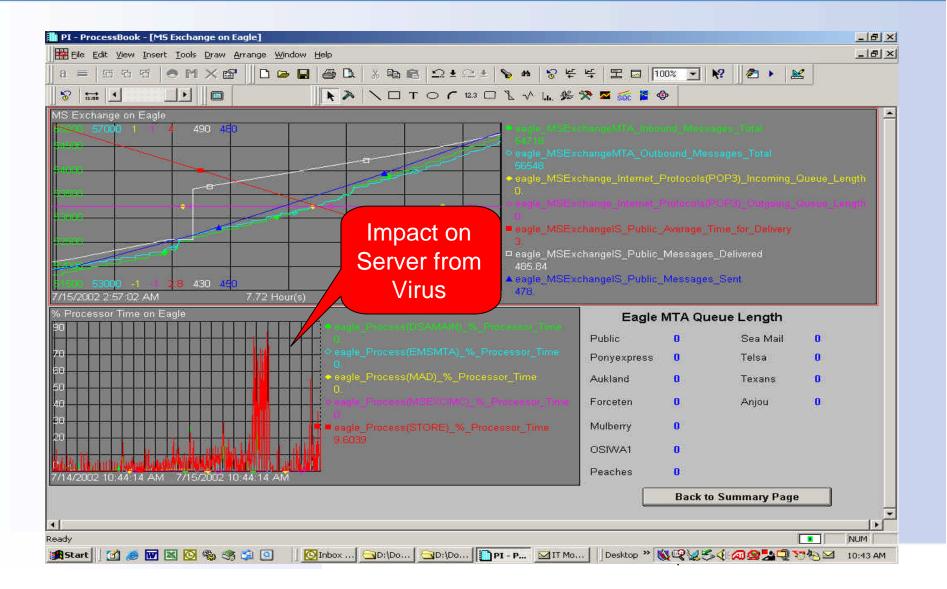# Performance
Monitor Disk Storage & Memory Capacity

Performance
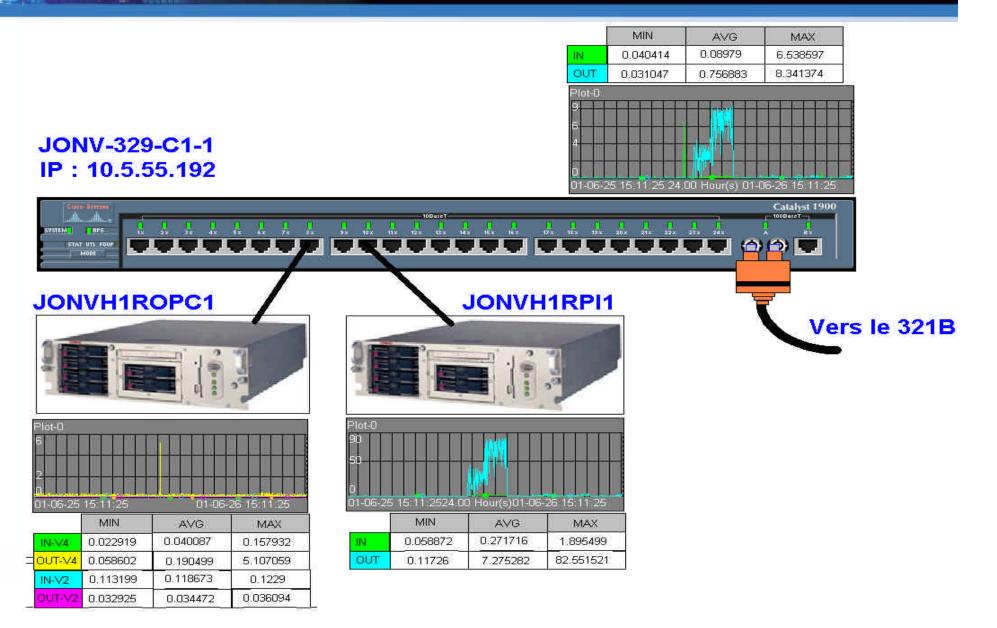## Predict Server Failure- Virus Attack In Progress

Impact on Server from Virus

Performance
Plan Capacity by Bandwidth Usage with SNMP

Case Study – Dow Corning

Monitoring: Global Networks

– US, Europe & Asia

- **Benefits of Monitoring Networks**
  - **Intelligently Eliminated Over Utilization of Networks, Servers & Applications**
    - Now Can Anticipate & Help Prevent Network Outages
    - Reduce Troubleshooting & Downtime

  - **Reduced costs for network bandwidth and line speed**
    - Monitored Service Level Agreement
    - Established baseline to prove usage needs

Real-Time Situational Awareness for Industrial Operations

Enterprise Resource Planning - ERP

- DOD has decided to standardize on SAP for ERP. Currently there is a major effort in deploying SAP within the Navy and the ARMY is doing infrastructure planning. This will ultimately impact all installations and intelligent weapon systems.
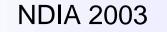
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Challenges

Gartner Group

"Manufacturing businesses that make investments in ERP-directed manufacturing applications that fail to provide for accurate *real-time information from the process* will achieve at least 50% lower ROI on those investments..."

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Why Link Plants to SAP

- ## Reduce cost, increase utilization
  - Perform maintenance on usage, not fixed-duration (calendar)

- ## Maintenance Problem Diagnosis
  - Timestamp comparison of PM notifications to other production events
    - Why recurring problems?
    - Equipment condition affect production/quality?

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Asset Management Strategy

- **Condition Based Maintenance**
  - Run hours
  - Service factor excursion
  - Start up/shut down effect and recording
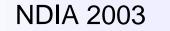 - Efficiency driven maintenance identification

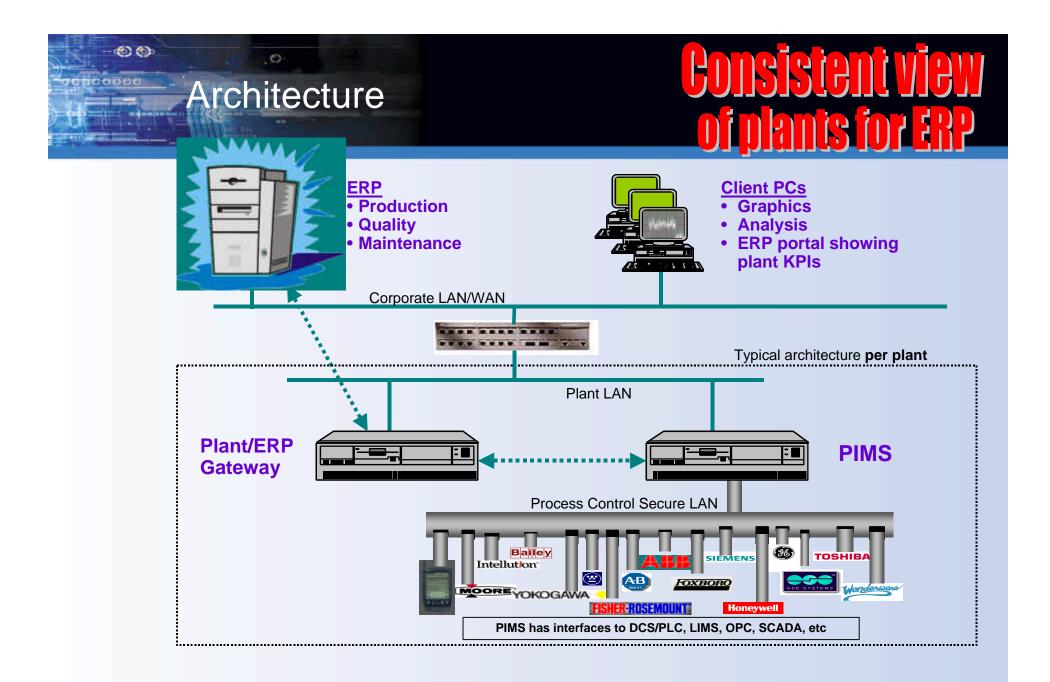- **Maintenance Problem Diagnosis**
  - Timestamp comparison of notifications to other production events
  - Why do we have recurring problems?
  - How does equipment condition affect performance?
  - Track asset performance to ensure acceptable operation

- **Budgeting**
  - RLINK delivers validated actual readings into R/3
    - Trust the information
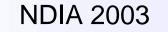   - Reduce maintenance costs
    - Risk assessment

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Architecture

ERP
- Production
- Quality
- Maintenance

Client PCs
- Graphics
- Analysis
- ERP portal showing plant KPIs

Corporate LAN/WAN

Typical architecture **per plant**

Plant LAN

Plant/ERP Gateway

PIMS

Process Control Secure LAN

Bailey
Intellution
ABB
SIEMENS
GE
TOSHIBA
W
A·B QUALITY
FOXBORO
GSE SYSTEMS
Wonderware
MOORE
YOKOGAWA
FISHER-ROSEMOUNT
Honeywell

PIMS has interfaces to DCS/PLC, LIMS, OPC, SCADA, etc

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Case Studies

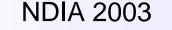NDIA 2003   Real-Time Situational Awareness for Industrial Operations

Power Generation

- ## Power Generation (USA)
  - ### Overhaul coal pulverizers
    - Costs US$150,000 every 18 months
    - Coal ground into fineness of talcum powder
      - Blown into furnace, mixed with air, burns 2500 degrees F

  - ### Overhaul based on total coal flow
    - PM has measurement point for coal flow total
      - Calculated in historian
    - Still operate safely, under warranty

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Power Transmission/Distribution

- ## Power T&D (USA)
  - $1B invested in 30,000 assets, spend $40M/yr on maintenance
    - Abnormal conditions found during substation inspections

  - Condition-based maintenance
    - Transformer tap changes every 10,000 operations
    - Circuit breakers (calculations)
      - Quantity: if gas added > 5 lbs and < 10 lbs per month on avg. over 6 month rolling period, schedule outage & repair seals

  - Transformers, circuit breakers, relays OK?
    - Reduce transformer & breaker maintenance costs

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- **Plant Profits**
- Estimated greater than $5,000,000 USD saved per annum:
  - At line recovery of batches
  - Automatic Data Entry
  - Fewer data errors and corrections
  - Predictive Maintenance fewer unplanned shutdowns
  - Assignable causes determined more quickly

ALUMINUM

- Showed quantified savings to the plants of $5 million per year.

- Overall, the operators gain more visibility, avoid spills, monitor plant emissions and environmental conditions more easily, and do a far better job of trouble-shooting problems.

Real-Time Situational Awareness for Industrial Operations

IRON AND STEEL

- Monitoring real time hearth temperatures set several production records.

- Using this real time process information, plant increased the life of their blast furnace shells by over 2 years, which now stands at 12 years. Their cost to reline the furnace is over $150 million.

- In their Utilities area, having access to real time data increased their boiler efficiency by 2.5%, which translates into $100,000 savings per year.

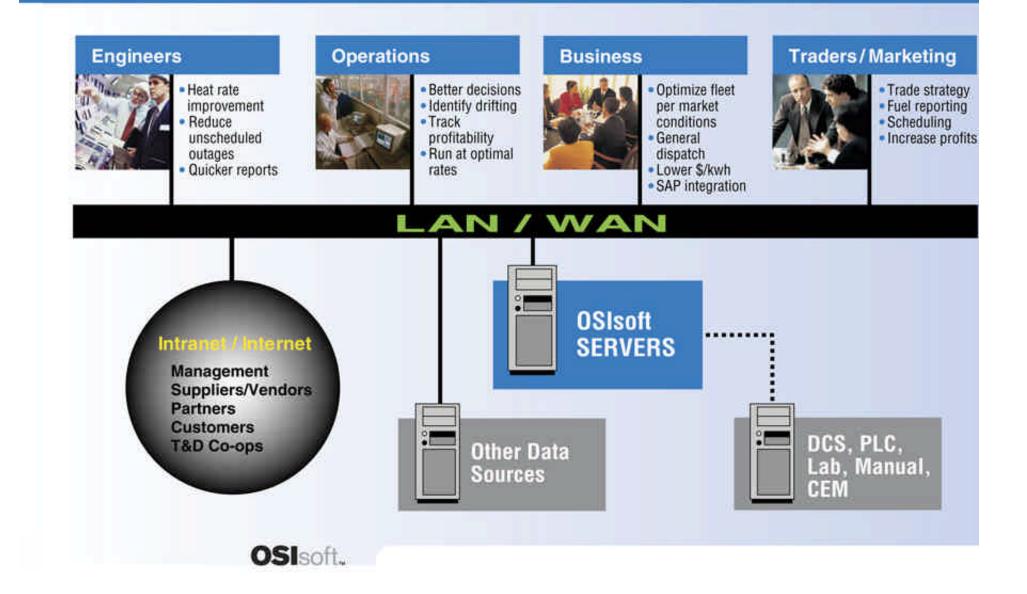Real-Time Situational Awareness for Industrial Operations

ERP Integration Conclusion

- Industrial companies synchronize decisions using ERP systems with real-time information … directly impact on business goals.

- Companies significantly increase their Return On Investment leveraging real-time and historical production information to improve asset efficiency, reduce operating costs, and improve personnel productivity.

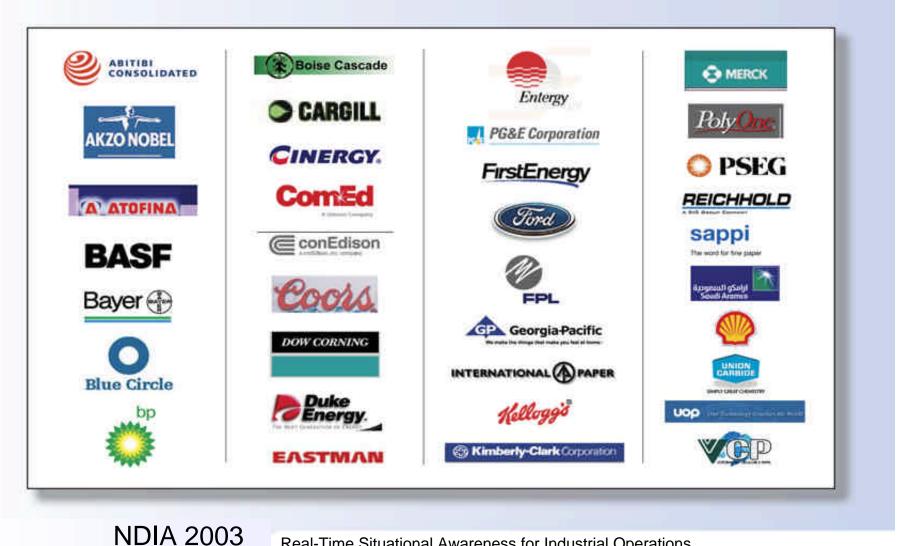- Role Based Decision Support integrated through ERP.

Enterprise Role Based Decision Support

Engineers
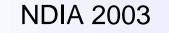- Heat rate improvement
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LAN / WAN

Intranet / Internet

Management
Suppliers/Vendors
Partners
Customers
T&D Co-ops

OSIsoft SERVERS

Other Data Sources

DCS, PLC, Lab, Manual, CEM

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THANK YOU

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- Support Slides

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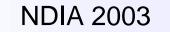
Customer Satisfaction, Reliability and ROI

" We saved 50 million over the course of our 10 year relationship with OSIsoft. The PI System is one of the best investments we've made in our business with significant payback."

Barry MacGregor
Dow Corning Corporation

" I don't know of any other software that can positively impact every important business driver - environmental, safety, quality, and ROI."

Dwight Stoffel
ATOFINA Chemicals, Inc.

" We have a critical need for instant and accurate data. OSI offers the Real-Time and historical process condition information that we need in order to meet our deadlines."

Bill Wight
Eastman Chemical Company

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Customer Satisfaction, Reliability and ROI

"PI is an asset that very quickly demonstrates its value to a company's bottom line."

Alex Grguric
Dofasco, Inc.

"RLINK saved us over $650,000 in labor costs."

Kris Zywicki
Dow Corning Corporation

"The pilot project was started in mid-March and went live at the end of June within budget. The success of this pilot allowed us to quickly move to converting our six automated plants over to OSIsoft's RLINK as our SAP interface. This will eliminate our custom interfaces in advance of a corporate plan to upgrade to the latest version of SAP."

Mr. Roger McKinney
PolyOne

"RLINK gave us the integration that resulted from the seamless flow of information from the process unit to business management."

Carlo Volpones
Polimeri

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OSIsoft is Successful Because PI Offers More Value

"If you are going to buy software,
buy it from a successful software company.
That will ensure that you are buying the best.
OSIsoft continues to grow financially and
technologically, offering even more value to customers
by reinvesting a large percentage of sales revenues
back into product development and upgrades."

Dr. J. Patrick Kennedy
President

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Improve Operational Efficiencies

- **Increased Operational Efficiency**
  - Reduced fuel consumption (Users report 1 to 2% Fuel Savings)
  - Management of controllable losses (Losses expressed in financial terms)
  - N0x and S0x monitoring and reduction

- **Improved Availability**
  - Better operator information and advice
  - Improved maintenance strategy

- **Better Asset management**
  - Designers have access to plant technical information
  - Enhanced plant monitoring (Plant comparisons)
  - Predictive maintenance (Monitor run-times and Start/Stops)

- **On line emission monitoring**

  Real-time information allowing immediate operator intervention

  Direct feed from the Continuous Emissions Monitoring System (CEMS)

- **Avoid competitive disadvantage**
  - Many Power Utilities already use PI

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COTS Results

- Expect a rapid direct payback that is 2 to 5 times your PI software investment in 12-18 months.

- PI users have reported a 10 to 30% reduction in controllable costs.

- The ability to monitor asset performance and production costs reported to have reduced raw material utilization from 1% to 5%.

- Expect the paradigm of "80% of the time spent collecting data / 20% of the time analyzing the problem" to change dramatically (5% / 95%)!
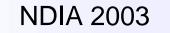
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Time

- According to Webster's New World Dictionary
- Time – every moment there has ever been or ever will be.

- "If it can be measured, it can be controlled." W. Edwards Deming
- "Knowledge is of two kinds: we know a subject ourselves, or we know where we can find information upon it." -Samuel Johnson, compiler of the first comprehensive English dictionary

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"It is not enough to do your best; you must know what to do, and THEN do your best." W. Edwards Deming

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History

- According to Webster's New World Dictionary
- history – the branch of knowledge that deals systematically with the past.

- Knowledge - **1.** The act or state of knowing; clear perception of fact, truth, or duty; certain apprehension; familiar cognizance; cognition. "**Knowledge**, which is the highest degree of the speculative faculties, consists in the perception of the truth of affirmative or negative propositions." *Locke.*

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