Challenges, Opportunities, and Strategies for Integrating OT and IT with the Modern PI System

Strategy
Architecture
Security
Governance
Hardware

OT

IT

OSIsoft®

As pervasive sensor technologies, connectivity, and real-time analysis lower barriers to enabling digital business, many enterprises are focusing on strategies to capitalize on OT-IT integration.

Over the last several decades, as industries transitioned from analog and pneumatic controls to digitalized PLCs, DCS, and SCADA systems, Operational Technologies (OT) have provided plant personnel with ever increasing volumes of data to monitor, optimize, and control industrial processes; however, there has not been a clear path for organization to leverage this data outside of OT domains. Differences in IT and OT functions, technology stacks, and cultures have created significant barriers to OT-IT convergence.

At present, technology alone does not guarantee competitive advantage. More and more, business transformation is linked to creating an overarching digital strategy to integrate data from all parts of the enterprise. Especially for asset-centric industries, harmonizing OT and IT systems will enable leaders to uncover latent ROI and establish new levels of transparency to drive overall enterprise performance.

For this paper, OT-IT convergence focuses on linking the data models for each domain and can be defined as:
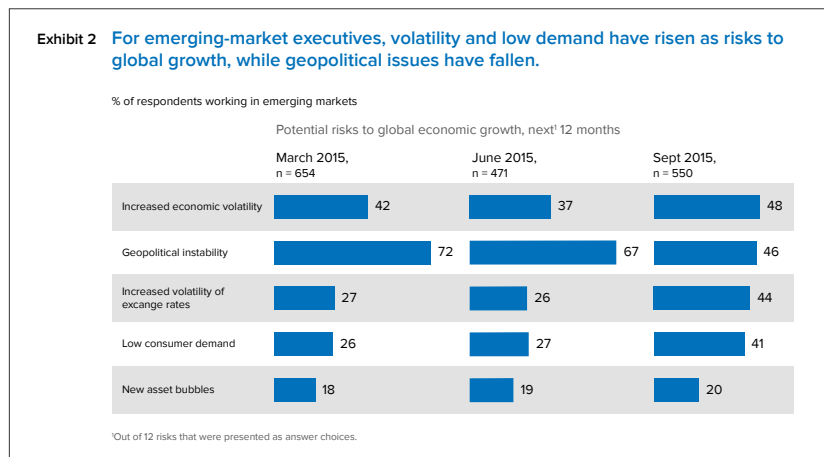
> **An enterprise initiative to develop and utilize a common technical infrastructure that aligns Operational data (OT) with business data (IT). OT-IT convergence harmonizes operational and business data, enabling leadership teams to calculate enterprise KPIs and track how asset performance, process efficiency, and quality affect revenue.**

This paper explores the challenges, benefits, and how the modern PI System™ can support OT-IT convergence strategies. Successful execution will uncover latent value of existing industrial sensor-based data ecosystems to transform operations, business intelligence, and enterprise performance.

Why now?

Today's technology offers enterprises unprecedented ability to leverage data to develop intelligence for decision support, both in real time and over time. Enterprises that adopt a technology strategy to align core operations with overall enterprise objectives can generate data-driven information at hand to be more agile, resilient and innovative – ultimately reducing cost and mitigating risk. External factors driving OT-IT strategies include:

VOLATILITY Enterprise globalization, economic instability and aging infrastructures require industries to be more agile. Connecting OT to business tools enables them develop predictive information to reduce operational variability, and base workflows and capital planning on actual operational history and data.

Exhibit 2 For emerging-market executives, volatility and low demand have risen as risks to global growth, while geopolitical issues have fallen.

% of respondents working in emerging markets

Potential risks to global economic growth, next[1] 12 months

	March 2015, n = 654	June 2015, n = 471	Sept 2015, n = 550
Increased economic volatility	42	37	48
Geopolitical instability	72	67	46
Increased volatility of excange rates	27	26	44
Low consumer demand	26	27	41
New asset bubbles	18	19	20

[1]Out of 12 risks that were presented as answer choices.

Economic Conditions Snapshot, September 2015: McKinsey Global Survey results

IoT Reduced costs of sensors and connectivity has made it more feasible to create a comprehensive digital footprint of operations, including mobile assets and workforce. As the data volume and variety continue to expand, integrated OT environments and interoperability with IT systems will become necessary.

RISK Over time, OT environments have obscured overall enterprise visibility as personnel have managed operations through a complex portfolio of diverse, purpose-built applications. Also, lack of version control, outdated security protocols, and legacy systems in the OT can lead to information gaps, systems vulnerability, and IT complexity.

SCRUTINY Regulatory compliance and public scrutiny are no longer limited to financial auditing but also the effects of operations on the environment, workplace safety, and surrounding communities. Negligence or failure to comply with stricter standards can have severe financial consequences and undermine license to operate.

COLLABORATIVE ECONOMIES For enterprise initiatives such as product genealogy, supply chain management and emissions reporting, operational accountability stretches beyond traditional boundaries and across extended value chains. Moreover, connected product and services are introducing the need for collaborative data ecosystems that connect industries with suppliers and customers.

# Persistent Challenges to OT-IT Convergence

The design of OT and IT systems have traditionally met specific requirements in order to serve distinct enterprise functions and user bases. These differences in technology, organizational culture, and function created an early wedge between OT and IT environments. The division has persisted, creating barriers to capitalizing on the benefits of OT-IT convergence.

TECHNOLOGY In the 1980's, technical limitations prevented shared resources and architectures. IT systems were purchased as best-of-breed applications deployed on site-centric mainframes. As the commoditization of technology, standardized operating procedures, and the emergence of the PC drove IT outsourcing, OT migrated toward tiered control systems, segregation of control layers, and adopting networking protocol standards. More recently, OT systems share IT-like characteristics such as the use of tools like Microsoft® Windows® have become integrated into these environments.
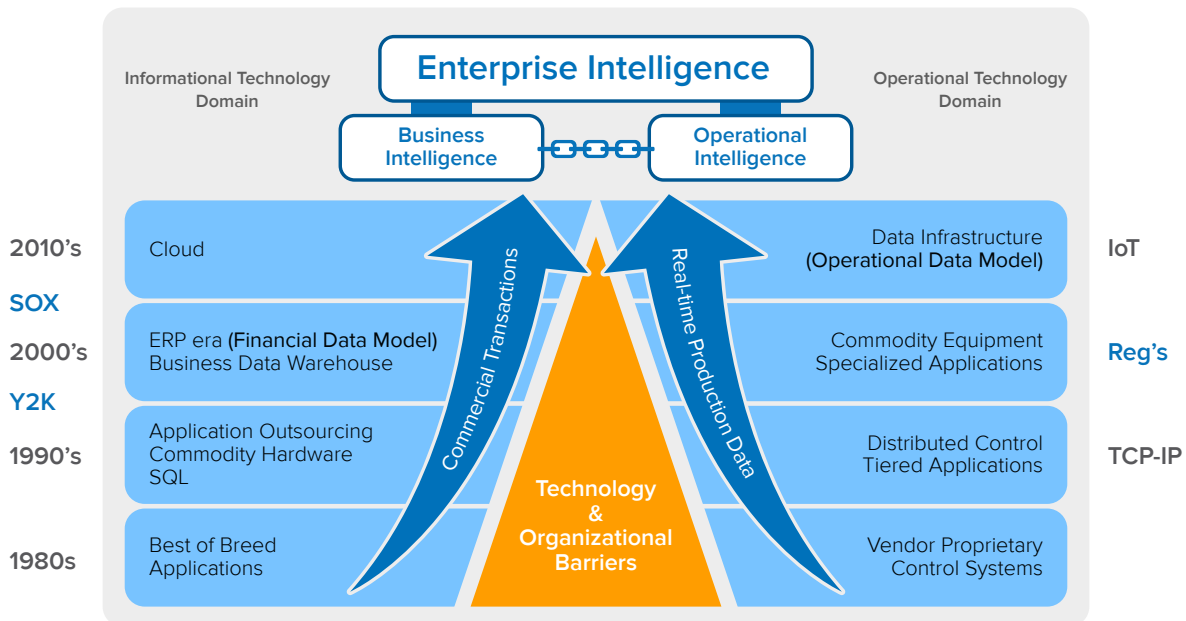
INTERNAL AND EXTERNAL DRIVERS Early IT systems were proprietary, required internal resources and programmers and used to calculate dollar-denominated actions, payroll, and cost of transactions. In contrast, OT were turnkey, vendor-proprietary systems designed to operate vendor-specific equipment. Later, Y2K ushered in ERP systems, and industries converged on standardized IT applications, data models and architectures. Regulations like Sarbanes-Oxley (SOX) further drove standardization of IT systems and data warehousing for analytics as financial reporting became mandatory. In contrast, regulatory requirements have not driven a consistent need to create enterprise OT KPIs. Unlike IT, current OT environments rarely have centralized governance and consist of many specialized, purpose-built systems that address local or project-based issues.

CULTURE Historically, OT and IT have had different "owners" with different priorities and backgrounds. OT personnel, including the COO, typically have deep industry backgrounds while CIOs and IT personnel have computer sciences or commercial training. Imposing traditional IT governance can often interfere with OT protocols that support real-time production parameters and thus profit and loss responsibilities. More recently, however, analysts suggest that CIOs should be familiar with and support operational requirements. As IT-like technology pervades OT, basic skill sets required for IT and OT are also converging. Nonetheless, resistance to change, fragmented OT, fears of security breaches and risk to process integrity weigh heavily against efforts to align architectures across functional departments. **Even as technical barriers to OT-IT convergence fall, traditional cultural and functional boundaries remain.**
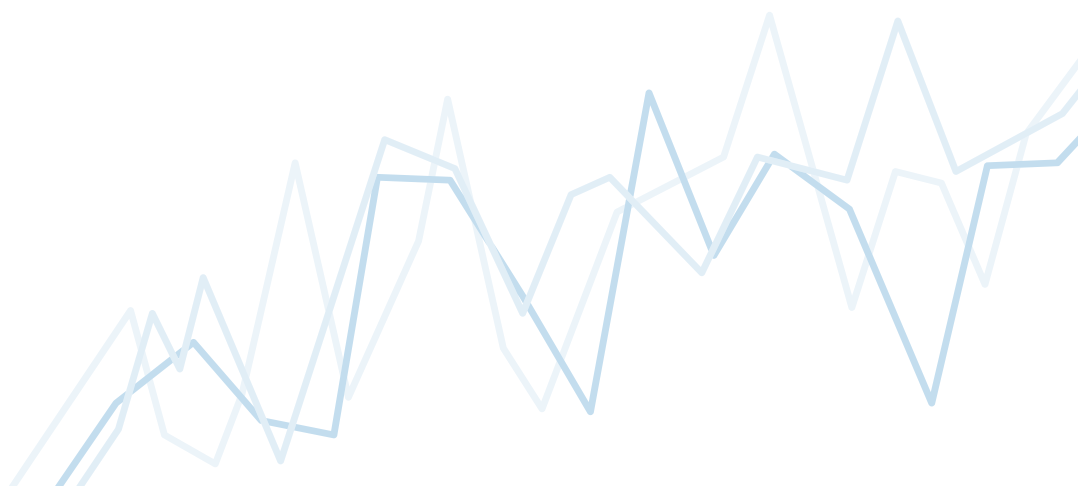
Role of the modern PI System infrastructure

For over 30 years, OSIsoft has produced the PI System to capture, store and make high fidelity data available to people and systems. As IoT continues to grow, integrating vast quantities of sensor-based data sets with IT systems promises to enable innovation and business transformation. In this data-rich environment, the modern PI System has evolved to enable OT-IT convergence in three principal ways:

UNIFIES FRAGMENTED OT ENVIRONMENTS As one of its key findings in regard to OT-IT integration maturity, Gartner cites that, **"OT system integration is typically purpose-built, limiting access and use of OT data for wider purposes. Enabling them to work together to maximize business efficiency (while avoiding negative consequences, risks and pitfalls in the process) makes CIOs' task more challenging."** (Steenstrup, K, Iyengar, P, 2016 Strategic Roadmap for IT/OT Alignment. Gartner. June 24, 2015)

The fundamental value of the PI System has always been to integrate disparate data sources to create a unified data layer spanning the enterprise. A PI System infrastructure also provides consistent engineering units, a common time scale and a shared reference system. People can access both real-time and historical data from all operational sources such as pumps, turbines and engines even if data sources originate outside of traditional organizational, geographic or security boundaries. Using the PI System to create a single infrastructure **resolves fragmented nature of typical OT landscapes and makes data available to more roles and for a broader array of purposes.**

ENHANCES DATA GOVERNANCE As part of initiating an ERP project, the first work product is chart of accounts, or master classification system to define accounts, charge codes, accounting codes, etc. Referencing the chart of accounts for financial transactions is key to developing sound business intelligence.

The modern PI System incorporates a metadata layer, Asset Framework (AF), which enables people to create a common nomenclature and reference system by structuring data through familiar asset-based context. AF can create a **chart of operations** to organize operational data in the same way that an ERP uses a chart of accounts to understand financial transactions. As advances in IoT, connectivity and analysis platforms lower barriers to leveraging sensor-based data for operational intelligence, creating an enterprise chart of assets can **improve governance, facilitate communication with IT, and enhances the role of operational data in creating enterprise intelligence**.

AUTOMATES CONNECTIONS Operations rely on the PI System to provide real-time data for optimizing industrial asset performance and process efficiency; however, time-series data is not immediately compatible with IT data or systems. By nature, time-series data has gaps, unexplained spikes, or shifts in baselines, creating significant challenges when trying to merge it with structured and transactional data.

PI System has out-of-the-box tools to shape and push time-series data with context into IT systems. These tools **provide both native connectivity and management of time-series data to bridge operational data with analytics platforms and business systems already in place with no programming or custom coding.**

Benefits

In consumer-driven industries, OT-IT convergence has enabled manufacturers to transform product design and supply chain management to meet changing consumer demand. In B2B or asset-centric industries like oil and gas, power generation or utilities, areas where OT-IT convergence enabled by the PI System can generate value include the following:

Improved bottom line OT data typically minimizes production costs through increased efficiency, equipment availability and reduced downtime. Unifying OT landscapes amplifies those effects by scaling best practices, validated models and liberating data for multiple purposes. Bridging OT and IT increases the prominence of operational data and enables a broader audience who can, for example, track financial impacts of decisions make in the production environment, adjust product output according to changes in market demand or base strategic planning on actual operational history - all without disrupting core processes. Simplifying complex architectures also reduces IT costs associated with maintaining purpose-built or systems built in house, manual data cleansing and custom coding associated with merging disparate data sets.

Improved Governance In fragmented landscapes, operational data lacks context that spans past local environments. Typically, only a few initial users responsible for control system naming convention can fully benefit from the value built into the semantic namespace. Others spend valuable time trying to find and integrate the "right" operational data for reporting and analysis.

Organizing data through an overarching context layer, or a **chart of operations**, democratizes valuable operational data so that it can propagate across traditional boundaries to create consistency around integrated enterprise KPIs, enable performance comparisons and drive adoption of common processes.

Risk reduction and resilience Consolidating OT systems will be necessary to handle expanding data sources, amount and variety. Consolidation also offers opportunity to identify functional gaps, underperforming or outdated legacy systems that can introduce vulnerability. Using the PI System to integrate OT and IT also eliminates one-off and homegrown solutions that require significant or unique resources to maintain or update over time. Finally, OT systems that capture data for preordained purposes lead to rigid data structures and certain obsolescence. Developed on platform neutral technologies, the PI System is designed to be source- and industry-agnostic and work as part of an overall IT structure that evolves as technology, business conditions and KPIs change.
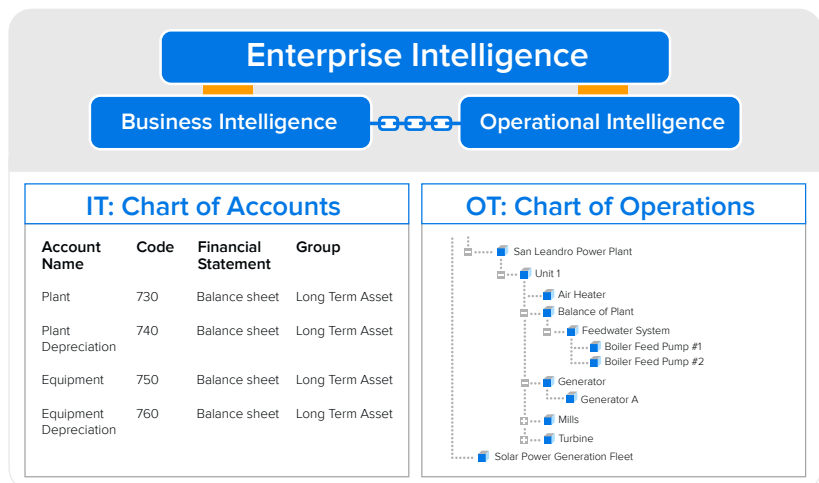
Example: OT-IT convergence enables proactive and risk-based maintenance strategies

For many years, PI System data has supported asset health programs by providing both real-time data for situational awareness, fault detection and process exceptions as well as a means to access stored, high fidelity data for continuous improvement, forensic analysis and reporting. The following describe two examples of how OT-IT integration could enable intelligent asset health and lifecycle decisions:

CONDITION-BASED MAINTENANCE:
When enterprises rely on reactive, "run-to-failure" maintenance strategies, they incur costs due to reduced equipment availability, lost production time and maintaining larger spare parts inventory. Maintenance workflows based on vendor-recommended, calendar-based schedules are more proactive but are still conservative and not tied to actual equipment use.

Condition-based maintenance (CBM) enabled by the PI System leverages real-time condition monitoring to trigger workflows in Enterprise Asset Management systems traditionally maintained by IT. Because maintenance managers can continuously monitor limit exceptions or fault detections in real time, enterprises can use CBM to eliminate unnecessary maintenance costs, reduce downtime and extend asset lifecycle, reducing overall capital costs.

RISK-BASED MAINTENANCE
Is running equipment to failure always a bad option, even if it halts production? If operational and market conditions can be compared in near real-time, enterprises can balance the costs and benefits of running equipment past prescribed limits.

For example, integrated data sets can enable people to identify how current market conditions are favorable, predict specific equipment failure modes and if parts and people to make repairs are readily available. If market conditions are favorable and people and parts are on hand, the benefits of running to failure could outweigh costs. In another case, market conditions could be favorable but needed parts expensive and difficult to deliver.

Analyzing or predicting the business impact of decisions can only be done through comprehensive availability of authoritative, aligned data sets and having tools that can analyze it in meaningful and timely ways.

A Strategy to Embrace OT IT Integration

Fundamentally, OT-IT integration enabled by the PI System does not interfere with daily or mission-critical tasks on both operational and business side of the enterprise. Instead, making OT and IT systems interoperable enhances intelligence and real-time decision support in all parts of the organization.

As technological barriers to OT-IT integration shrink, implementing it at enterprise scale will mean overcoming cultural barriers, legacy architectures and resistance to change. For now, overcoming many of the barriers to execute full-scale OT-IT integration may not be feasible for large, asset-centric industries. Rather than adopting all-or-nothing approaches, identifying defined areas where OT-IT integration can deliver tangible value can accelerate buy-in from traditionally segregated roles and eventually earn support for robust, extensible architectures that support comprehensive OT-IT convergence. Part of that process includes eliminating systems that silo operational data and leveraging tools making it available to more stakeholders and systems in a scalable, secure way.

Summary

For over 30 years, industries have been leveraging sensor-based data to gain visibility into operations, support continuous improvement and generate information to optimize overall enterprise performance. As the global business climate grows more unpredictable and competitive, enterprises that can create a unified view of operational data and merge it with business information will be poised to respond to disruption and differentiate themselves. OSIsoft continues to advance the PI System to enable our customers to extend their data infrastructure by connecting to more data sources, systems and stakeholders.

As IoT, Big Data and advanced analytics play a more prominent role in industrial settings, OSIsoft and its extended Partner Ecosphere are working to support digital business leadership, enabling our customers and partners embrace OT-IT integration an extensible, scalable and persistent manner.

About OSIsoft

With the belief that people with access to data can transform their world, OSIsoft created the PI System to capture and store real-time sensor-based data. For over 30 years, OSIsoft has delivered the PI System with the singular goal of connecting people, assets and process through data. Today, the PI System is embedded in critical infrastructure and involved in some of the largest data initiatives around the globe. Sixty-five percent of the Global 500 process companies use the PI System to help transform operations. Our customer base includes Fortune 100 and Fortune 500 companies in power generation, oil and gas, utilities, metals and mining, transportation, critical facilities and other industries. OSIsoft remains faithful to its original mission – to push the edges of innovation and create software that brings high fidelity data from disparate operational sources to people in all corners of our customers' enterprises – wherever, whenever and however it is needed.

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