

A Data Infrastructure to Transform Operations

From asset to process to operational intelligence...



Summary

Across all industries, there are assets everywhere, all generating critical time series data. As the volume and sources of asset data constantly expand, there are multiple challenges to creating insights that impact operational performance. Operators, engineers and managers face a data deluge that comes from diverse systems and has a heterogeneous array of units, protocols and formats. For analysis and reporting, users often wrestle with data stored in multiple systems with very little associated context. The difficulty surrounding accessing, finding and integrating vital operational data in a timely manner often results in underutilization for initiatives such as asset health, product quality and genealogy or process efficiency. What's needed is an environment that breaks down these barriers. An environment that connects all operational information sources in a coherent and scalable way and empowers people to leverage data to generate the insight that leads to actionable information, best practices, analysis and continuous improvement. An infrastructure.

in•fra•struc•ture [in-fruh-struhk-cher]

Is generally defined as the set of **interconnected structural elements** that provide **framework supporting** an entire structure of development ¹

¹ ONLINE. JANUARY 7TH 2014. [HTTP://EN.WIKIPEDIA.ORG/WIKI/INFRASTRUCTURE](http://en.wikipedia.org/wiki/infrastructure)

This paper discusses how adopting a data infrastructure for time series data will lower many of the barriers that industries face when creating a data-driven culture to transform decision-making, system optimization and enterprise performance.

Background

Industries depend on machines that are subject to age, defects and accidents. For years, engineers and managers have used machine data to create insight to address, prevent or even predict problems, ultimately improving productivity while reducing operating costs and downtime. The need to harness ever growing volumes of machine data for decisions at all levels of the enterprise is more critical now than ever. Leaders are working to extend the value of operational data by shifting from decentralized to centralized information management systems that connect people, sites and span business departments; however, very few industries have standardized technologies that support centralized data access as part of an overall strategy to drive excellence.

This paper discusses how an infrastructure enables users to leverage data from all parts of the enterprise to improve key initiatives such as asset health, process efficiency, resource utilization, product quality and automate reporting. Adopting a data infrastructure transforms operations by removing many common barriers to accessing and sharing data and information. It empowers users to generate data-driven insights and supports decision-making that drives continuous improvement and operational excellence.

Common time series data challenges

Despite the universal recognition that data is critical to smart operations, rarely does operational data inform decisions at all levels of the enterprise. Why?

- Operational machines produce massive volumes of data and have automation and process control systems that do not often automatically communicate with one another. Enterprise data records are often incomplete, fragmented and frequently inaccessible to many users.
- As connected assets and increased connectivity lower the barriers to capturing even more data, most systems cannot scale to handle increased data volume.
- Traditional data archives lack context information that facilitate data sharing throughout the entire enterprise. Without context valuable operational data often remain underutilized, sequestered or unavailable to users unfamiliar with control system naming conventions.
- Data collected and stored by sequestered point solutions have disparate sources or formats. Reporting, calculations and roll-ups require manual data entry, are prone to error and are time- and labor-intensive.
- Many interfaces are at the asset location. Accessing information at remote sites or from centralized centers can be challenging, delaying or preventing the timely use of valuable information.
- Connecting data from isolated point solutions, applications and historians requires skilled resources, customized solutions and adds IT complexity and cost.



DATA INFRASTRUCTURE IN ACTION - DATA ON THE SPOT, IN CONTEXT

Juwi manages the entire value chain for wind power generation systems, including planning, development, financing, construction and operations. Juwi was using 24 different customized operations software packages to manage their growing wind turbine fleet. The PI System™ simplified operations by consolidating operational data and creating a unified user interface to serve operational, production, financial and reporting needs. Even with a small team, Juwi can easily provide up-to-the-moment information to customers, exchange data with outside groups such as grid operators and customer energy trading systems and satisfy growing reporting requirements.

Opportunity

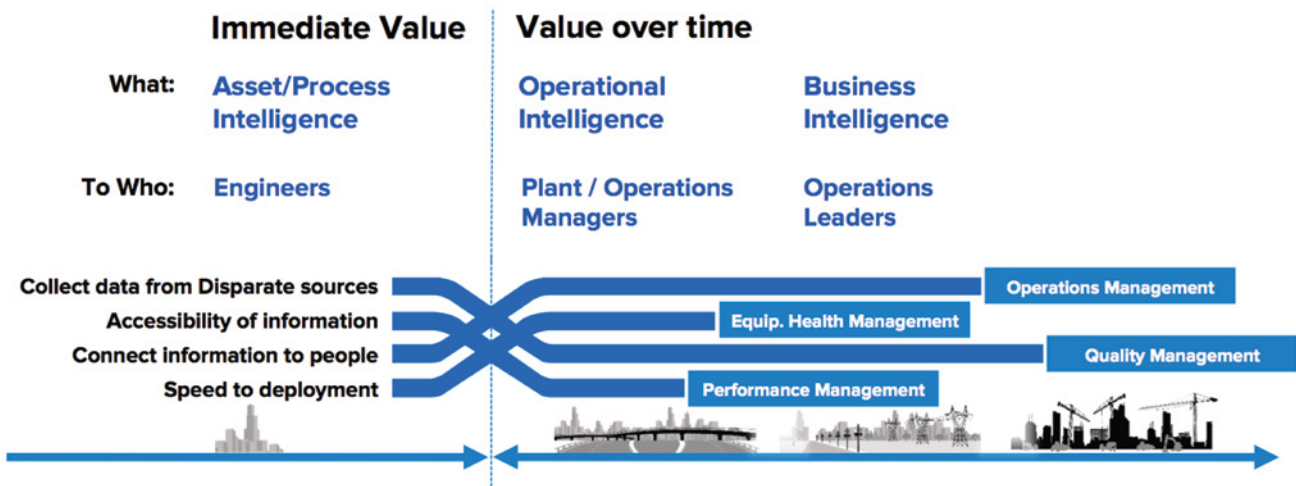
Data cannot deliver insight, enable real-time decisions or lead to action unless it is easily available to people and systems that can act on information. Through pervasive connectivity, scalability and a highly developed asset modelling system that scales across geographical, logical and organization boundaries, an infrastructure removes the work and barriers associated with capturing, finding, converting and organizing operational data. It empowers and liberates operators, analysts and managers to focus on making confident, real-time decisions to transform operations. When operators, engineers and managers access data through a common infrastructure, they can create enterprise-wide Operational Intelligence that supports Asset Health, Process Efficiency, Resource Management, Quality, Regulatory Reporting and Compliance as well as creating end-to-end enterprise visibility and reducing total IT complexity and costs.

INSTEAD OF...	WHAT IF...	WHO BENEFITS?
Managing data with different communication protocols, different units of measure, different data intervals and different storage systems	All your data spoke the same language? Was easily shared?	All
Data being accessible only at its source, through IT or at dedicated work stations	Subject matter experts could access real-time and historical data from anywhere? On any device?	Operators, plant managers, engineers, service vendors
Manually accessing, integrating and analyzing siloed data to support roll ups, BI analysis and reports.	Business Centers, Centers of Excellence or Service Providers could collaborate around a single source of data?	Plant and business managers, IT
Reacting to failures after they happen, carrying high spare part inventory costs due to lack of insight into actual asset condition...	Data could be used to predict failures or trigger maintenance and responses to faults before they happened?	Operators, managers and plant engineers
Having unique KPIs at each site and poor visibility into systemic “bad actors”	All sites could gain efficiency through shared data access, collaborative analysis, standardized KPIs and collaborative insight?	Operators, engineers, managers
Creating customized code as well as constantly maintaining dozens of customized applications and point solutions with limited shelf life	A data infrastructure created an economy of scale by reducing customization, centralizing data and consolidating applications.	IT, business managers

What is a Data Infrastructure?

Historically, the word infrastructure has been used to describe the basic physical structure needed to support operation of a society or enterprise including roads, bridges, water supplies, sewer lines, electrical grids, telecommunications, etc. In more recent years, however, the term infrastructure has also begun to encompass more of the organizational concepts that support overall health of the enterprise. A software data infrastructure to distribute operational data and information is one of the most recent examples of this later concept.

For many industries, deriving insight from large amounts of data to improve process efficiency, asset health and product quality can be a lever of competitive differentiation. A data infrastructure acts as an information highway that parallels the physical infrastructure. It carries topologically mapped signals from machines, sensors and external data sources to individual users, Centers of Excellence and centralized diagnostic centers for common visualization and collaborative analysis. A data infrastructure creates an economy of scale by reducing the complexity and cost of storing months or even years of high fidelity data. Finally, through enhanced connectivity, an infrastructure ensures that people have the information they need to make decisions - no matter where they are, what device they use or what role they play.



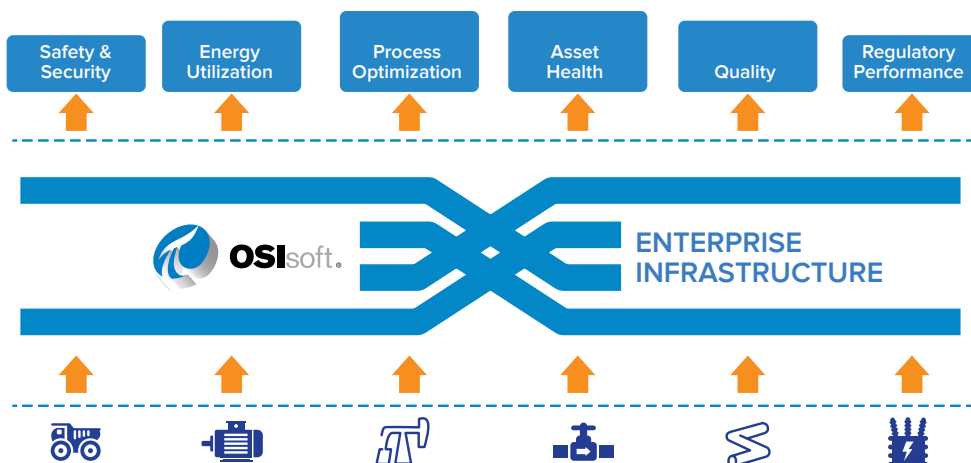
Strategic Advantages

As the number of connected machine networks and information continues to grow, operational technologies generally lack structure to support ease of access and use by the consumer. Without a structure, users tend to create personal data stores for their own internal use, resulting in information silos, and in some cases, multiple versions of the truth. In addition, many data owners and consumers are ensnared in complex, inefficient communication channels that require significant time and resources to navigate and maintain.

An infrastructure differs from fragmented application portfolios in several key ways. A data infrastructure removes many of the barriers to holistic, enterprise-wide information flow by providing:

1. One version of the truth
2. Connectivity across assets & sites
3. Bridge to external systems

Finally, an infrastructure is not static. Instead, it enables an organization to adapt to unavoidable change in business, process and technology by creating a constant state of readiness. The infrastructure enables users to connect to new assets, data sources and applications without ripping and replacing its core structure.



PI System Benefits

For over 35 years the PI System has delivered a data infrastructure which is now deployed at over 17,000 sites globally. Our customers have seen the following benefits from embracing a common infrastructure strategy for enterprise sensor-based data.

Complex to Simple: The PI System creates a common data foundation that scales to an enterprise level. Disparate data sources, multiple control systems, information silos and non-standard naming data conventions turn into a single, comprehensible source of information. Engineers, subject matter experts, centers of excellence and business managers have easy access to a single version of the truth.

Greater situational awareness: Agile and real-time monitoring capabilities enable rapid responses and ensures that vital data are continuously monitored. Roll-up and asset-based calculations identify faults, process inefficiencies and underperformance within and across sites.

Easy access, user configurable: An infrastructure includes self-service tools that empower line of business users to build their own role-specific displays and reports using easy-to-configure, out-of-the-box tools, reducing the need for customization, IT or data scientists. These tools can reduce turn-around time, custom coding and 3rd-party application costs.

Information in Context: Infrastructures incorporate metadata layers to provide operational context to augment a user's understanding of raw data streams in relation to assets, systems, processes and plants. Complex calculations are automatically performed, while maintaining accurate context, on both incoming data streams and archived data to generate meaningful information.

Reduced IT Complexity and Cost: Deploying a common software system between Operational technology (OT), automation systems and enterprise business applications simplifies the integration and architecture of OT and IT systems. Maintaining this layer also offers overall system agility. Enterprises can rapidly take advantage of advances in IT applications, technology and solutions without having to re-integrate or rip and replace enterprise OT architectures.

Business Impacts

Once an infrastructure establishes a foundation to ease data access, analysis and collaboration, your organization can launch programs backed by high fidelity data to transform the way data impacts your business.

Process Efficiency:

Real-time data helps avoid unexpected downtime, process defects and potential safety issues through automatic alerts triggered by preset thresholds. Over time, users can set baselines, monitor asset performance, standardize best practices and maximize efficiency. Establish and automatically report standard KPIs to measure performance.

Asset Health and Condition-Based Maintenance:

High fidelity data gives insight into asset health indicators. Data can alert individuals or outside systems to initiate maintenance based on actual asset conditions. A rich, complete archive of historical data establishes a basis for accurate root cause analysis, predictive insight, continual improvement, decision support and smart expense allocations.

Resource Management:

Managing energy, water and raw materials are critical to controlling costs and long-term risk. High fidelity data enables decision-makers to establish baselines, create visibility into asset- or process- or site-specific consumption patterns, verify the accuracy of energy costs and charges, identify underperforming assets and generate effective plans of action.

Regulation & Compliance:

An infrastructure captures and integrates diverse sources of data, even if they originate from different systems or sites. Users can consistently and accurately roll data up to create accurate compliance or business reports without manual data entry or analysis. Environmental, safety and compliance reporting can be automated for daily, weekly or yearly intervals.

Safety & Security:

For many industries, safety and security are a top priority. An infrastructure constantly delivers information to identify operational risks, even before they happen, and alerts operators, plant and business managers of conditions that could harm employees or the surrounding environment.

Product Quality and Genealogy:

An infrastructure ensures that users can capture operational data that reveal variability or defects in process parameters or conditions affecting product quality. Users can better control operational environment to improve consistency and quality across batches, shifts and sites. Data used for quality and traceability can also be used for rapid electronic reporting and audits.

A Data Enabled Enterprise

As industries work to leverage digital information to gain competitive advantage, they face many common barriers to creating cultures where people consistently create insight that creates impact at an enterprise scale. Too often, data projects address only narrow sections of a business and have discrete timelines and objectives instead of supporting programmatic approaches or continuous improvement. Operators and managers can lack confidence in information derived from multiple, disconnected systems. An infrastructure unifies disparate data sources, information silos and non-standard naming data conventions caused by a complex systems landscape to build a single, comprehensible source of reliable data. Instead of wrestling with access, conversions and confusing labels, users have instant access to high fidelity data with operational context, even if they reside across traditional geographical, logical or enterprise boundaries. The power of **ONE** information source in the hands **MANY** builds a collaborative foundation to link **intelligence** from asset to asset, asset to process and process to plant, and plant to enterprise. With the ability to shape, validate and protect valuable operational data, an infrastructure enables Operational Intelligence that impacts performance at all levels of the enterprise.



DATA INFRASTRUCTURE IN ACTION

VÉOLIA EAU monitors all aspects of water treatment and distribution for 4 million end customers across 5219 miles of pipeline. Véolia unified energy, water and pipeline data with a centralized PI System infrastructure. The PI System simplified data access and analysis for quality, production and cost analysis. As a result, Véolia has reduced energy spend by **6%** and pipeline leakage by **7%** and introduced a revolutionary “Water Traceability” to provide **FULL AUDITABILITY** by tracking water from its source to customer destination to meet safety standards at the lowest cost.

The OSIsoft Vision

With the belief that people with data can transform their world through operational intelligence, OSIsoft created the PI System as an open data infrastructure to capture and store sensor-based time series data. For over 30 years, OSIsoft has delivered the PI System with the singular goal of connecting people across operations to data and operations. Today, the PI System is embedded in critical infrastructure 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, pharmaceuticals, transportation, critical facilities and many other industries. OSIsoft remains faithful to its original mission – to push the edges of innovation and create an open data infrastructure that brings high fidelity sensor-based data from disparate operational sources to people in all corners of our customers' enterprises, wherever, whenever and however it is needed. OSIsoft is a privately held company headquartered in San Leandro, California, U.S.A., with offices around the world.

