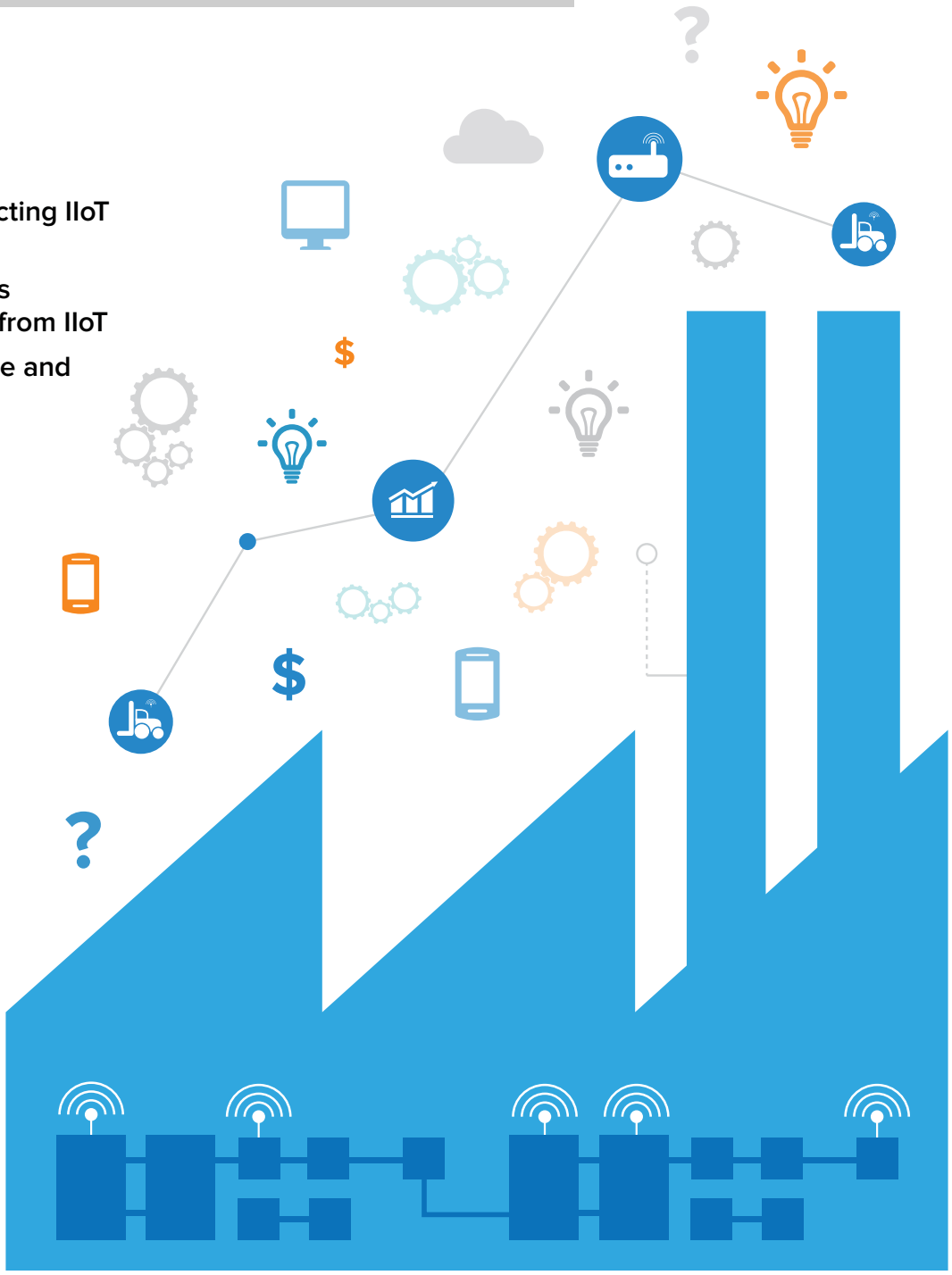
WHITEPAPER

Connecting IIoT Assets to the PI System Expands Enterprise Visibility and Intelligence

Topics



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Introduction

Over the last several decades, as industries have transitioned from analog and pneumatic to digitalized controls, sensor-based data has been key to lowering industrial operating costs, reducing risk and managing asset lifecycles. In today's operating environments, IIoT's pervasive sensor technologies along with improved connectivity and real-time analytics promise to expand the impact of operational data by closing information gaps, sharpening insight and creating new business models.

Today, one can find many subtle variations in IIoT definitions. For the purpose of this paper we will define IIoT as:

DEFINITION:
The connection of digitally networked sensors and sensor-based data to visualization and analytics environments hosted in the cloud or on premises. IIoT enriches existing data ecosystems to enhance decision support for actions influencing control, design and service in industrial operations.

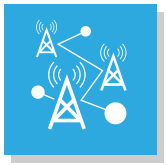
One of the principal challenges that IIoT promises to resolve is making data from remote, mobile and geo-dispersed assets available in and outside the enterprise; however, without foresight, IIoT applications could end up silo-ing this data from existing enterprise data systems. This paper highlights technology that captures data from distributed assets and combines it with existing data management systems. Organizations can derive value from creating these hybrid data infrastructures by extending the scope of enterprise visibility and intelligence.

Challenges Around Connecting IIoT Assets

As new industrial sensors and devices unleash more and more data, data management and governance challenges that have pervaded operations for decades will become a more pressing reality of the future. At the same time, capturing high quality data to operationalize remote or mobile assets will present new ones.

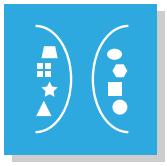
Scale

The sheer volume of IIoT data will demand more system scalability in respect to data collection, storage, analytics and visualization. Sophisticated users will require a consistent, curated view of all the information in a format where it can be easily consumed.



Traversing Networks

As mobile assets travel through WANs, maintaining reliable data streaming may mean connecting across multiple network types, including satellite, cellular and wi-fi. Optimizing cost and ensuring secure transfer also factor into choice of network connection modes.



Silos

Purpose-built systems produce data-silos that create barriers to using data for multiple purposes and by multiple stakeholders. Without foresight, adopting IIoT solutions could create new silos, undermining the intent to harness IIoT to create an integrated view of enterprise performance.

Endpoint or device management

Broadly deployed edge devices and sensors may be expendable and/or change locations. Concentrators, aggregators, gateways, head- end systems may be needed for sensor lifecycle management and maintaining a consistent data footprint.

Context

Unlike sensors in traditional PLC, DCS and SCADA, IIoT sensors can be geo-dispersed with no inherent physical locus. To capture the richness of information illuminated by IIoT sensors, multiple technologies will be required to link sensor data with real-time operational context.

Network management

As the number of IIoT-enabled devices continue to grow, tools that manage and optimize endpoint devices on the network in respect to system-wide needs such as network provisioning, reporting, diagnostics and usage.

Connectivity

Increases in the number of data acquisition “protocols” are creating a greater (not lesser) need for new “interfaces” for device networking and integration with existing data ecosystems.

Security

IIoT security strategies need to address both endpoint and central vulnerability. System architectures will need to consider criticality of data source, buffering software update and network bandwidth requirements.

How the PI System Enables Industries to Derive Value from IIoT

For over 30 years, OSIsoft has produced software to capture, store and make high fidelity operational and sensor-based data available to a broad set of people and systems. The PI System is designed to be industry- and vendor-agnostic and scale to enterprise needs – both in terms of volume and breadth of data sources. As the de facto standard for operational data management systems, the PI System has been deployed in 125 countries at over 17,000 sites. Collectively, our customers visualize, analyze and store over 1.5 billion sensor-based data streams. As IIoT continues to grow, integrating vast quantities of sensor-based data sets promises to enable innovation and business transformation. In this data-rich environment, the modern PI System enables enterprises to:

UNIFY FRAGMENTED DATA ENVIRONMENTS - A fundamental value of the PI System has always been integrating disparate data sources to create a unified data layer that is available to multiple enterprise stakeholders. As such, a PI System infrastructure provides consistent engineering units, a common time scale and a shared reference system when implemented across distributed assets and processes. Even if data sources originate outside of traditional organizational, geographic or security boundaries, the PI System liberates data from purpose-built applications and resolves fragmented OT landscapes. Operational and IIoT data become available to more enterprise personnel and for a broader array of purposes.

IMPROVE DATA GOVERNANCE - Without an overarching semantic structure to ease data access and use, operational data often remains "dark" or underutilized, reducing its impact past local boundaries. The PI System incorporates a metadata layer which enables people to create a common nomenclature and reference system by structuring data through familiar asset-based context. As advances in IIoT, connectivity and analysis platforms lower barriers to leveraging sensor-based data for operational intelligence, the PI System can improve governance to ensure that IIoT data can be integrated, visualized and stored, in context, with existing operational data.

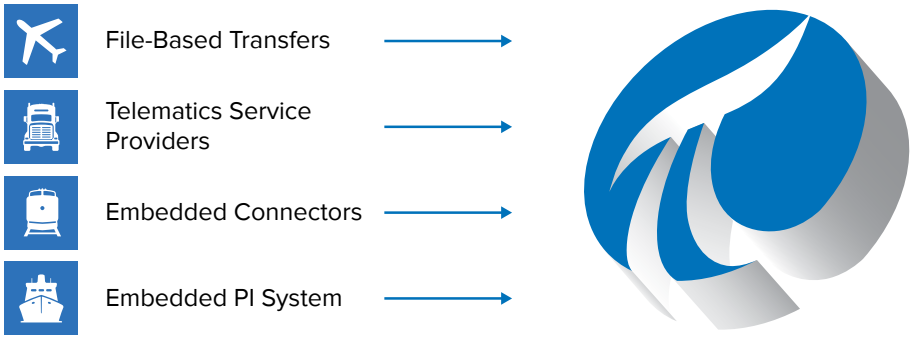
ADVANCED INTEGRATION - By nature, sensor-based data (including IIoT) has gaps, unexplained spikes or shifts in baselines, creating significant challenges when trying to merge it with structured data used to generate business intelligence. The PI System has out-of-the-box tools to shape and push IIoT data with context into IT systems. These tools provide both native connectivity to bridge operational and IIoT data with analytics platforms and business systems without programming or custom coding.

SECURITY – The PI System has always provided a secure bridge between sensor networks and control networks to enterprise business systems. Each component of the PI System has built-in capabilities that ensure that data is securely collected from endpoints and networks and delivered to enterprise management systems and users. When an overall system architecture is designed, components are deployed at specific locations to meet overall security requirements. The PI System can work with other security tools such as data diodes, VPNs and encryption techniques to augment cyberdefense architectures.

Connecting Remote, Mobile and Geo-Dispersed Assets

IIoT delivers value by extending operational visibility for asset owners to areas and assets outside traditional enterprise walls. Wireless data transfer and exchange are also creating shared data ecosystems, enabling owner-operators and a constellation of industrial partners (e.g. OEMs, consultants, industrial aftermarket service providers) to collaborate around a common data set. Rather than offering a single connectivity approach to satisfy a majority of the market, considering factors such as the complexity of the asset, network availability and bandwidth, communication method or operational requirements around latency or data exchange are leading to one of the four connection strategies enabled by the PI System.

Four Ways to Connect IIoT Assets to the PI System



File-Based Transfers

Background: Over time, industries have incorporated data loggers into valuable or critical assets to ensure that they can retrieve data when needed. File-based transfers leverage existing investments in these data loggers and are a reliable way to securely transmit data from critical assets to a central repository.

OSIsoft: Once data has been transmitted to a file server, OSIsoft's interfaces and connectors define data structures of any file and parse them so that the PI System can ingest them. Data files from mobile or remote assets are ingested into the PI System in a batch mode using a universal file loader interface (UFL) or connector. Even if files are transferred out of order, the PI System can re-orient data and put it back in order so that it remains indexable and consistent with enterprise data.

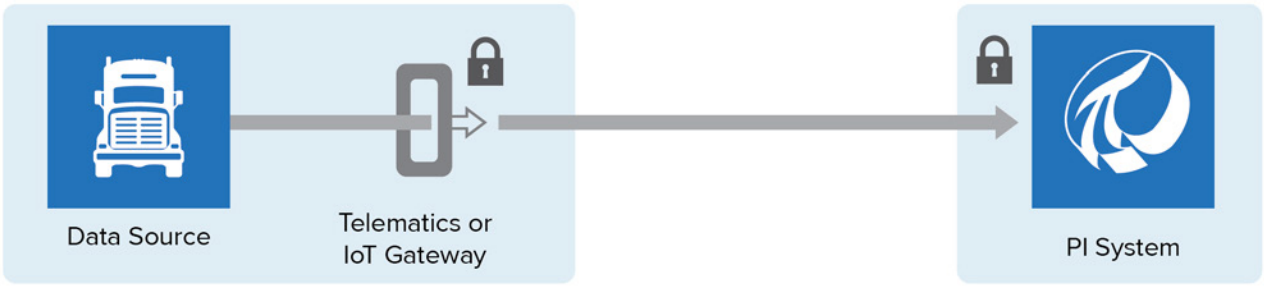
Trade-offs & Benefits: File-based transfers are a simple, mature data transfer solution that leverages existing investments. All that is needed to run file-based transfers is an IP connection, so they can be implemented quickly. Although there are challenges with scale, it is very flexible and can work with legacy systems including Digital Voyage Recorders (DVR) as well as IIoT gateways and other data loggers. Because data is transferred in batches, file-based transfers are suitable when modest latency (data visualization, analysis, response) can be tolerated, for example for post-hoc analysis.

File-based transfers can be used to transfer data from any asset that has a data logger including off-highway trucks, trains, scientific equipment and airplanes. In some cases, IIoT data can be aggregated and transmitted back to gateways through a UFL mechanism. Protection is offered through a secure connection and by preventing denial of service through file parsing.

Telematics Service Providers (TSP)

Background: Today, industries have deployed hundreds of commercial TSPs, primarily for traditional fleet management. TSPs provide applications that make mobile asset data (location, direction and speed) actionable so industries can assess fuel economy, routing logistics and GPS location across fleets of mobile assets. TSP systems ultimately optimize insurance costs, on-time arrivals and driver safety compliance. As fleet management includes more data-driven processes like condition-based maintenance, data requirements are expanding past purpose-built applications.

OSIsoft: TSPs often support proprietary output files that can be parsed for history recovery or batched file mode as done with file-based transfers. Complementing TSPs with the PI System allows owner-operators to use data for a richer application set including condition monitoring, asset-performance monitoring and on-time arrival.



Trade-offs & Benefits: Connecting TSP with a PI System infrastructure can help owner-operators lower TCO for larger asset fleets through maintenance schedules and asset lifecycle management based on actual asset history rather than reactive or calendar-based schedules. TSP's also deliver device and network management capabilities, which are needed for Connected Services and large-scale deployments. These systems typically support web service-based interfaces and API's that include asset schemas and metadata context, but depending on the TSP and data set, may require custom code to implement. Generic connections through web service interfaces and connectors (like Rest/UFL or OData) can be established.

Embedded Connectors

Background: In the past, transferring data from remote assets have often required VPNs or home-grown systems, necessitating a separate data integration layer at the enterprise level. Especially for small owner-operated fleets, maintaining multiple VPNs and integration points restricted the ability to scale with growth.

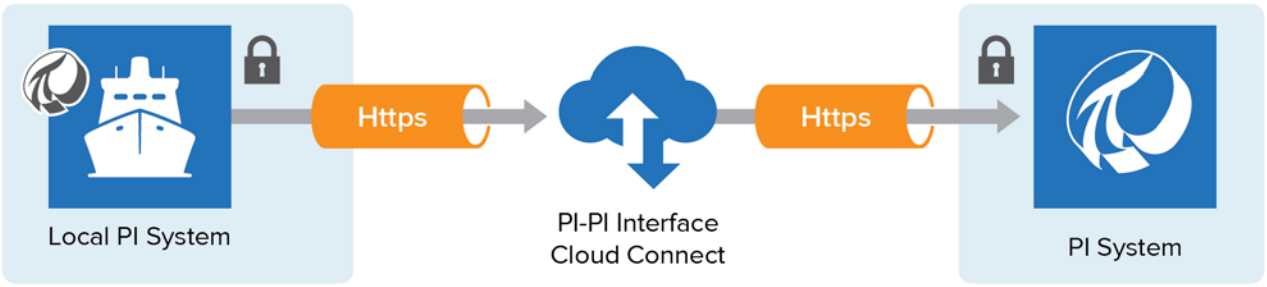
OSIsoft: Embedding connectors in remote devices and IoT gateways does not require VPNs and provides both data collection and central data governance. Embedded connectors support both industry-standard protocols and provide metadata and I/O maps so that assets can self-identify and configure within a larger operational context.

Trade-offs & Benefits: Several leading suppliers are currently embedding connectors on proprietary devices and platforms. This strategy is a good fit for owner-operators who are focused on data collection or integrating data with other device and management tools as a function of their business model. Embedded connectors support a wide range of fleet device solutions and provide a way to map standard and non-standard CAN I/O and Diagnostic Trouble Codes (DTCs) to troubleshoot or develop more predictive indicators. For service providers and OEMs, embedded connectors can facilitate data transfer back to central monitoring and diagnostic centers and provide built-in end-to-end protection that isolates and protects data source through a read-only mode.

Embedded PI System

Background: For years, the PI System has provided an industrial data infrastructure so that line-of-business stakeholders can manage immediate operational environments as well as understand interactions across processes and assets. At times, the operational complexity of the asset itself, especially for remote assets like large marine vessels or offshore platforms, are very similar to what is typically seen in an industrial plant. Often, these “assets” have local personnel who reside on-board and require real-time data from disparate systems for situational awareness. Data from these assets are also transmitted to and monitored at centralized operating centers. Limited connectivity and low bandwidth can prevent reliable data transmission to remote subject matter experts at these operating centers as well as suppliers and service providers.

OSIsoft: As in the plant environment, the PI System integrates data from diverse control systems so both local and remote stakeholders can access data in a uniform way and gain system-wide visibility. The PI System compresses data, including aggregating it analytically, to reduce the volume of transmitted data while preserving the value of information. Finally, implementing a full PI System on assets that have the local processing power enables users to deploy a variety of data exchange tools that buffer data and preserve operational context.



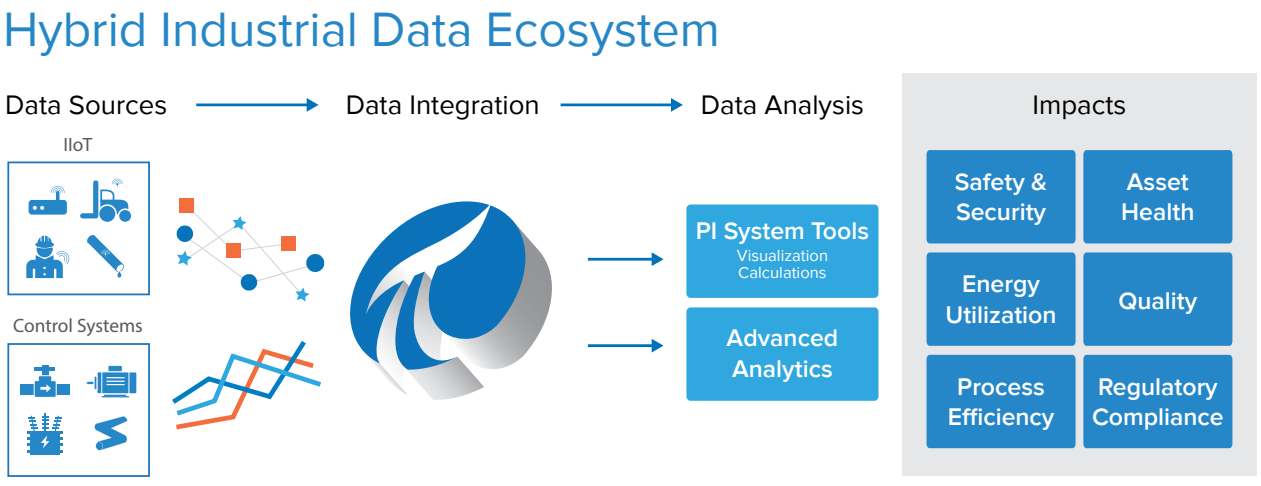
Trade-offs & Benefits: For these "assets," this complete approach is needed when operators and applications need local data available in real time and stored for post-hoc analysis. Frequently, these are larger assets have periods of non-connected modes and very high communication costs. Embedding a full PI System on remote assets is also a good option if asset systems are not consistent across the fleet.

Summary

To fully capitalize on industrial data, business leaders are faced with finding ways to bring two diverging forces together. On one hand, sensor-based data is growing, both in volume and variety, and its sources are becoming more mobile and geo-dispersed. On the other hand, developing enterprise intelligence is relying more and more on the ability to integrate diverse data sets and tools including sensor-based data, transactional data, traditional BI tools and storage systems. Many studies and papers imply that the value of IIoT is tied to the volume of data that it will produce. Undoubtedly, the number of devices and sensors deployed in industrial settings is exploding; however, industries will monetize IIoT by creating "hybrid environments" that make IIoT data durable and integrate it with larger operational contexts and tools to generate actionable intelligence. In these environments, low-cost, low-energy sensors make it possible to operationalize structures, assets and environments where it was previously neither possible nor cost-effective.

A PI System infrastructure serves as the backbone that integrates IIoT with core information systems. Connecting IIoT data to the PI System enables industrial leaders to extend the data infrastructure, expand operational visibility and create rich historical records of the behavior of mobile and geographically dispersed assets. This strategic approach provides a framework to optimize enterprise data governance and ensures that IIoT data can be used for a broad array of purposes and not trapped within purpose-built applications or silos.

Finally, IIoT sensors and devices produce data and information relevant to broader ecosystems. Sharing data across these ecosystems will transform communication between customers and businesses, creating new business models and associated revenue streams through opportunities such as data-driven service offerings or monetizing data itself.



Next Steps

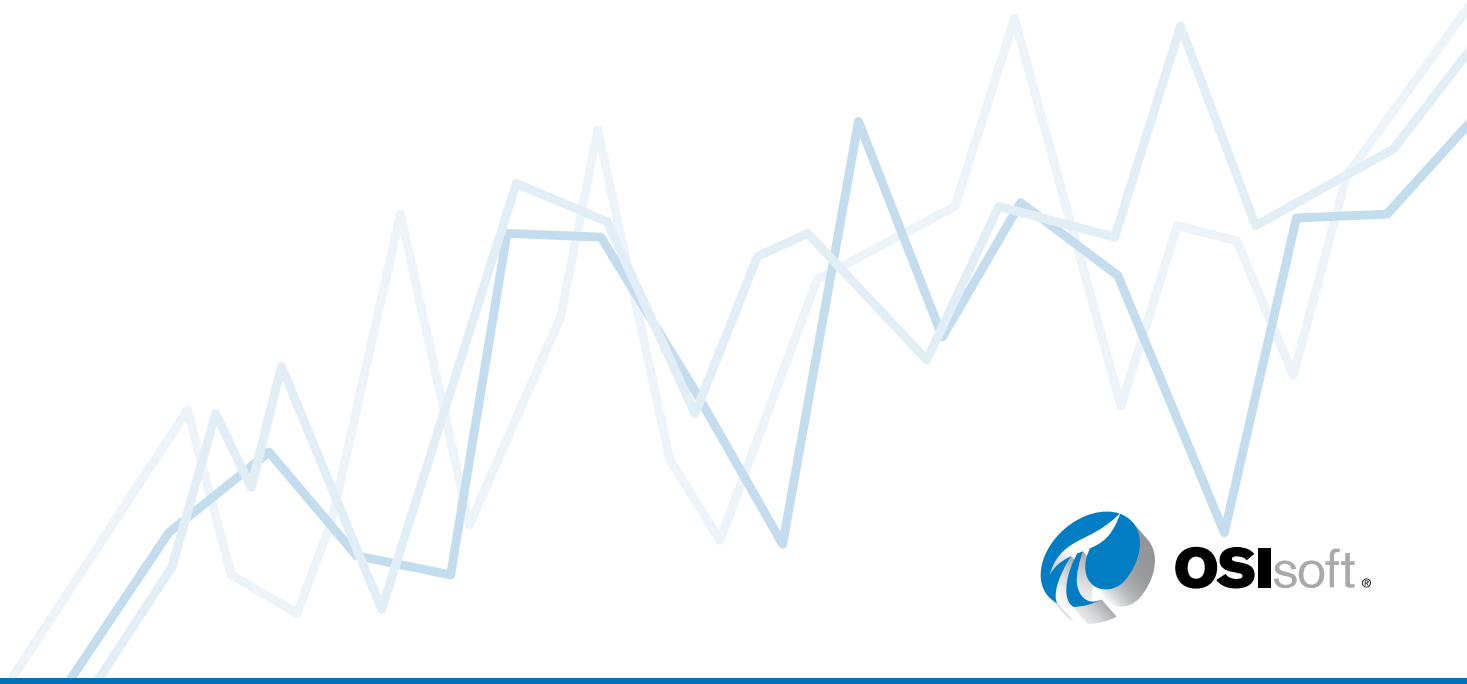
For over 30 years, industries have been leveraging sensor-based data to gain visibility into operations, support continuous improvement and generate information to optimize overall enterprise performance. As advances in technology make it more cost-effective to deploy IIoT, industries will need to develop a strategic approach to create hybrid data ecosystems that allow them to monetize IIoT.

As IIoT continues to evolve, OSIsoft and its extended Partner Ecosphere are working to advance the PI System to support change, enabling our customers and partners to embrace IIoT opportunities in a continued, 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 across operations to data and operations. 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.

For more information, visit www.osisoft.com.



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