

## IDC PERSPECTIVE

# Evaluating OSIssoft: Adding Intelligence to IoT Analytics and Information Management

Stewart Bond

Maureen Fleming

## EXECUTIVE SNAPSHOT

---

### FIGURE 1

---

#### Executive Snapshot: Evaluating OSIssoft – Adding Intelligence to IoT Analytics and Information Management

OSIssoft is the most widely deployed solution for capturing data from sensors and smart devices across manufacturing, energy, utilities, pharma, life sciences, transportation, and facility management. Solutions are centered around the PI System that stores time series data in its original fidelity and assembles into digital twins within an asset framework that also provides context and can blend operational data with business and environmental information for IoT analytics insights and information management.

#### Key Takeaways

- The PI System exists in many industrial IoT (IIoT) environments, used to collect data from sensors and smart devices, often overlooked for IoT analytics and information management, in favor of using a data lake or data warehouse to blend IoT data with disparate business and environmental data for analytics.
- The PI Asset Framework provides IoT data intelligence, delivering clean data in context for operational analytics, and it can connect disparate data to asset models for analytics and information management.
- The PI System can be leveraged for IoT analytics and information management, primarily focused on operational intelligence for machine and operational data and providing a repository on which partners and customers can build advanced IoT analytics, data science, and machine learning solutions.

#### Recommended Actions

- Evaluate the capabilities of the PI Asset Framework against IIoT data cleansing, preparation, and analytical requirements; opportunities exist to perform IoT analytics without building a data lake.
- Use the PI Asset Framework to enrich IIoT data with business and environmental context information in support of analytical use cases that can correlate operational performance with business outcomes.
- Consider adding non-IIoT time series data analytics to the PI System; application and system logs, database change logs, and other streaming data can be ingested, maintaining original event fidelity.
- Leverage PI Event Frames and notifications to identify exceptions and anomalies, bringing them to the attention of operational and business management staff for remediation.

Source: IDC, 2018

## SITUATION OVERVIEW

---

OSIsoft is the provider of the most widely deployed Internet of Things (IoT) analytics and information management platform, the PI System. OSIsoft is well known and broadly implemented in process and discrete manufacturing, energy, utilities, pharma, life sciences, transportation, and facility management organizations. The time series data managed in the PI System is leveraged by virtually all IoT analytics platforms for machine learning (ML)-based predictive analytics.

Founded in 1980 as Oil Systems Inc., the company debuted the PI System in 1985 as a process historian for collecting production and process data for the oil industry. It soon began to branch into other markets like paper and utilities. The company also put emphasis on expanding the capabilities and functions of the PI System. In 1994, it came out with ProcessBook, an add-on data visualization/business intelligence application. Then in 2004, it came out with Asset Framework (AF), an early version of digital twin technology that effectively allowed a user to combine the data streams from a single asset, process, or plant into a single model. As a result of these technology enhancements, the PI System has evolved into a platform for data-driven decision making and IoT analytics. OSIsoft says that its goal is to be a data infrastructure utility for operational data that can enable as many people as possible within an organization to use operational data and conduct self-service analytics.

OSIsoft has recently begun to expand its cloud and analytics portfolio. OSIsoft Cloud Services allow equipment makers to embed PI System functionality into their products for cloud-based monitoring services, and OSIsoft has developed a set of integrators to stream data from the PI System to cloud platforms and applications like Microsoft Azure, SAP Leonardo, and SparkCognition for more complex analytics problems.

OSIsoft's 2017 revenue surpassed \$430 million and for the past five years has had a year-over-year growth range of 8-17%. As of 2018, OSIsoft had about 1,300 employees serving customers in seven traditional industries, namely, oil and gas, utilities, pharma, chemicals, paper and packaging, water, and mining. OSIsoft recently extended capabilities to support four new industries: facilities (including datacenters), food and beverage, transportation, and discrete manufacturing.

### OSIsoft PI System Overview

OSIsoft's primary runtime component is the PI Server, which is used to capture, store, and manage data being emitted from sensors in machines running in the industrial Internet of Things (IIoT). This type of technology in the operational technology (OT) world is commonly known as a data historian. Data historians are engineered to collect and efficiently store data in a time series database and connect to multiple types of technologies, such as SCADA systems, programmable logic controllers (PLCs), and distributed control systems (DCS). Historians capture analog and digital readings, product and process quality information, and alarm notifications when operations exceed normal limits. Historians may also perform data aggregations, analysis, and visualization of the time series information.

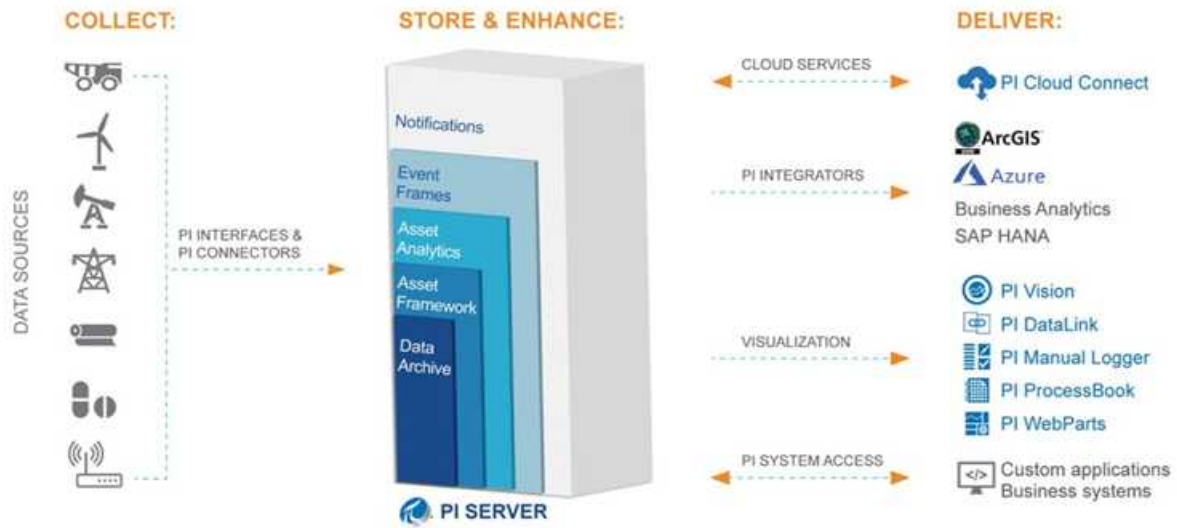
The PI System is an out-of-the-box platform that provides the capabilities to build IoT-specific applications but goes beyond the role of a traditional historian by also enabling ingestion of events from sources other than operational assets, such as servers, networking equipment, and business applications, into its time series database, allowing the events to be used in asset modeling, analytics, and monitoring enabled by PI Asset Framework. AF is a representation of physical assets in digital twins and is the basis for enabling operational data intelligence, time-based queries, event monitoring,

and proactive notifications. It also offers a suite of applications for operational analytics and integration with external systems for business analytics and decision-centric computing applications.

Figure 2 illustrates the context in which a PI System from OSIsoft can be leveraged within organizations to bridge OT and information technology (IT).

**FIGURE 2**

**OSIsoft PI System Context**



Source: OSIsoft, 2018

**Alignment of the PI System with IDC's Decision-Centric Computing Framework**

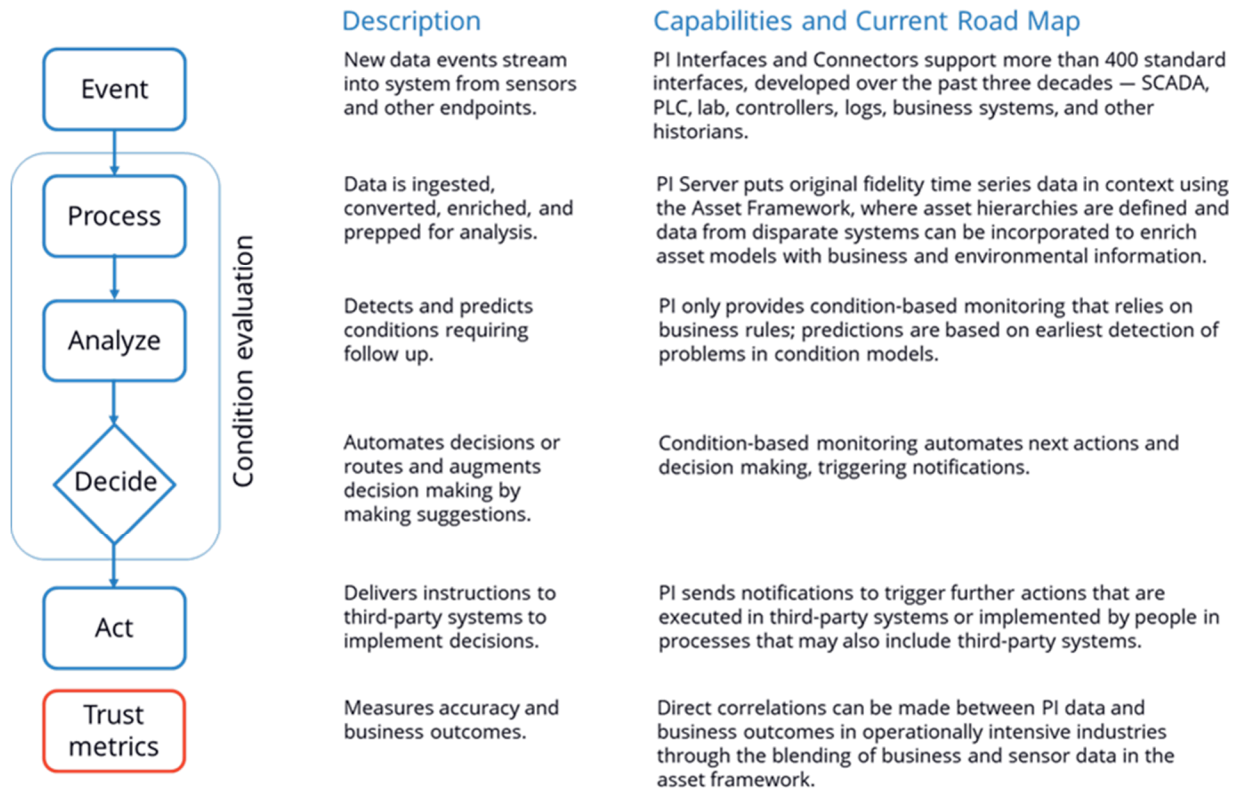
To evaluate and monitor the progress of products that deliver IoT analytics-based solutions, a framework based on a design pattern IDC calls "decision-centric computing" is used. Decision-centric computing is an event-driven style of building solutions that puts decision automation at the heart of the solution. Decision-centric solutions continuously receive and analyze data to predict when decisions need to be made, systematically learn how to automate those decisions, and act on each decision to improve performance.

For more information about the IDC framework, see *Introducing Decision-Centric Computing* (IDC #US43282917, December 2017).

Figure 3 shows the alignment of OSIsoft capabilities and road map with IDC's decision-centric computing framework. IoT analytics initiatives commonly start with improving situational awareness, and OSIsoft is on pace with this approach.

**FIGURE 3**

**OSIsoft Alignment with IDC's Decision-Centric Computing Framework**



Source: IDC, 2018

**Capturing Events**

The OSIsoft PI System uses PI Interfaces and PI Connectors to collect time series data at runtime from smart devices such as sensors, actuators, intelligent motor control systems, controllers, and terminals. OSIsoft supports more than 450 different types of connections to the IIoT, including legacy proprietary and modern open protocols that are providing the application of OSIsoft in non-IIoT solutions.

As an example, OSIsoft is being used to manage job scheduling and provisioning within datacenters to optimize power consumption and reducing costs while still meeting SLAs. PI Interfaces also support connection to mobile assets and receiving data over wireless connections. PI Interfaces and PI Connectors are engineered to communicate with the PI Server and ensure delivery of readings even in situations where network reliability is questionable. In addition, events emitted from business applications can be ingested into the PI Data Archive (DA).

**Process and Analyze**

At the heart of the PI System is the PI Server, in which the PI Data Archive, PI Asset Framework, Asset Analytics, PI Event Frames (EF), and PI Notifications provide process and analyze capabilities,

informed by operational data intelligence captured by the PI System. The PI Server is a Windows .NET application and uses Microsoft SQL Server for data persistence. At design time, PI Server is configured for PI Connectors and PI Interfaces, asset modeling is performed in the PI Asset Framework, and PI Event Frames are defined for monitoring and notifications. The PI System is traditionally an on-premises installation, but OSIsoft recently released OSIsoft Cloud Services with three distinct use cases: connecting assets, data preparation for data analytics and data science, and data sharing. OSIsoft also supports implementation of PI Server on Amazon Web Services (AWS) and Microsoft Azure's infrastructure as a service in bring-your-own-license configurations. The PI System can also be installed on IoT gateways from vendors such as Dell, HPE, and ADLINK. In detail:

- The **PI Data Archive** is a time series database that is only limited by the amount of storage capacity available. Decades of data and petabytes of online capacity are possible if the underlying infrastructure can accommodate them. Sensor readings are captured with original fidelity, identified in the system by PI Tags. OSIsoft claims that the PI DA can store up to 1 million events per second, with one of its largest installations managing 25 million PI Tags. A PI Tag can be one of several different data types such as decimal, floating point, integer, Boolean, blob, string, and something called a digital state. A PI Tag also contains data intelligence in metadata attributes such as description and point source: where the data is coming from. These tags are what give users the ability to query the PI System by date and time to construct the state of any given asset at a point in time.
- The **PI Asset Framework** maps the sensor readings in PI Tags into models providing a digital representation of the physical asset. Models are created at design time to define the hierarchy of sensors within components that make up the physical asset, as part of a larger asset, at a specific location within a site, and/or within a specific site. An example of child-parent relationships in the PI AF is illustrated in Figure 4. The AF provides opportunities to build relationships among assets and build templates for common assets, accelerating hierarchy development and deployment. In connection with the DA, the AF provides the operational state of the asset such as active power, position, temperature, vibration, flow rate, and/or any other attributes that describe the asset's operational condition and context for each PI Tag sensor reading.

Additional metadata is added to the models such as manufacturer information, last maintained date, geographic location (for fixed assets), and other attributes that provide context and intelligence about the asset. The PI AF also provides the opportunity to add dynamic attributes from data sources external to the PI System. This provides organizations with the opportunity to enhance insight and visibility into relationships between assets and external factors such as market, environmental, supply chain, regulatory, or other relative data points.

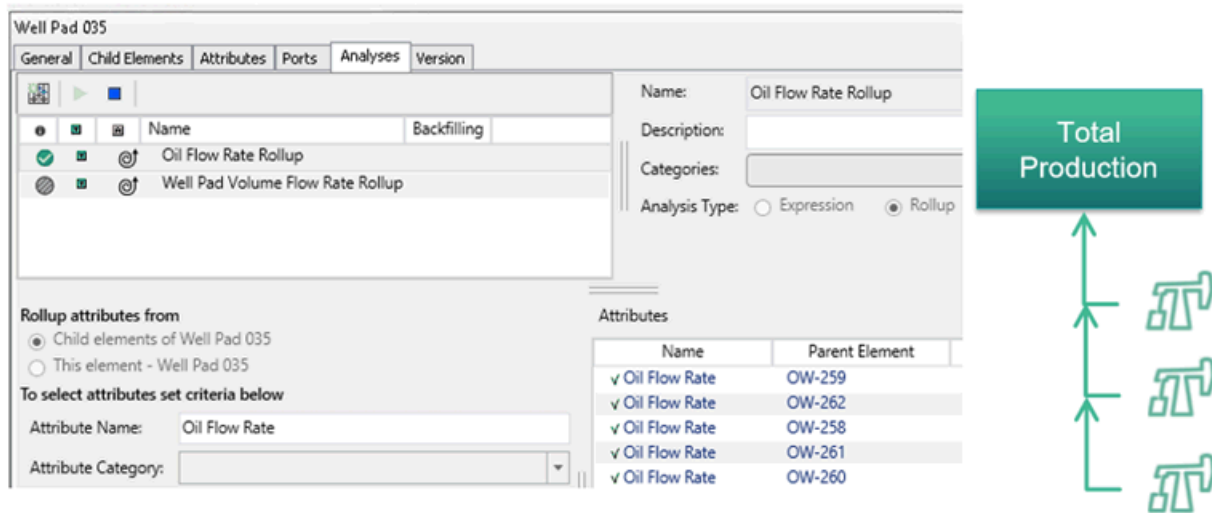
Connections to external databases are configured during asset modeling, and attribute values are populated on demand at runtime when asset analytics are performed. Figure 5 illustrates an external data element of Electricity Cost Factor that is queried on demand at the time of data consumption (display or in analytics), and specifications for the asset such as impeller size and model number are static attributes added to the model at deployment time.

Other examples of use cases that leverage external dynamic data are forecasting power generation by wind farms and solar farms through integration of weather forecast data; optimizing natural gas production within market demand and pricing forecasts; adjusting production rates based on rate of arrival of goods in the supply chain; and integration of storm data with sewer and water management assets to proactively plan for overages and contingencies.

- **Asset Analytics** leverages the PI AF and PI DA to turn data into key performance indications (KPIs), enabling real-time metrics and analytics of assets and rollups through the hierarchies to site levels. Users can build an analytic template for one type of asset and then deploy across the entire collection at each site to accelerate time to insight. Asset Analytics gives organizations real-time views into the total production across all sites, the operational health of assets and sites, and the use of predictive analytics to anticipate failures and optimize maintenance efforts to reduce downtime.
- **PI Event Frames** provide users with the ability to define conditions that would result in an event of interest for analytics, anomaly detection, and notifications. PI EF can be configured to provide a summary of attribute values within the period of time of an event instance, which can also make it easier to integrate operational data with external data sources for advanced analytics. OSIsoft extends the use of templates into PI EF, improving employee productivity by automating the population of consistent summaries as data is being collected and analyzed within windows of time.
- **PI Notifications** can leverage the PI AF and its associated analytics and PI EF models, sent to operations personnel when KPI thresholds are met or exceeded, failures occur, or other anomalies are identified. Anomalies can also include the absence of receiving a PI Tag reading when one was expected. Anomalies can be the result of an operational issue, or it could also be an issue with the quality of data being received in the PI System. The ability to address issues as they are occurring will help improve the integrity of sensor data and insert higher levels of trust users place in the data and the results of analytics.

FIGURE 4

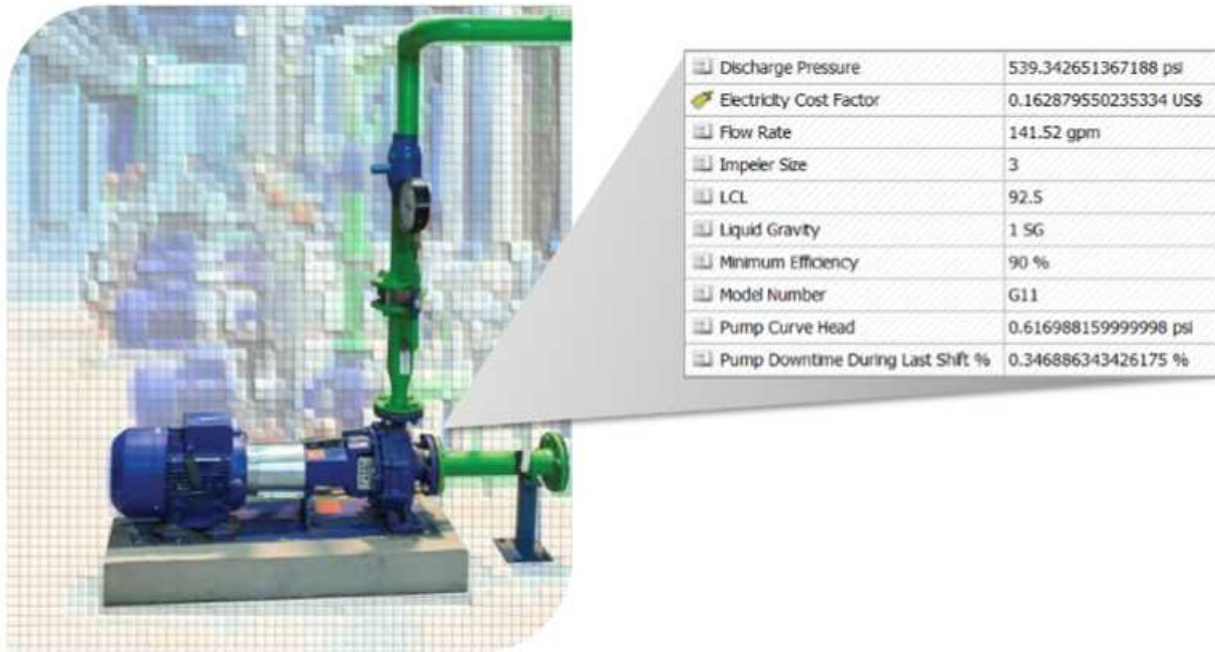
### PI Asset Framework Rollup Modeling



Source: IDC, 2018

FIGURE 5

Asset Example



Source: OSIsoft, 2018

**Visualization and Integration with the PI System**

Results of runtime analysis of data in the PI System are delivered to users and external systems for analytics and visualization through cloud services, integrators, client applications, drivers, and APIs. These components are available at an additional cost and licensing models differ; server-based components will be licensed similar to the PI Server, whereas end-user applications are licensed on a per-seat basis. Further:

- **Cloud Services** include PI Cloud Connect and PI Integrators. Cloud Connect is a cloud-based mechanism to secure data movement between PI Servers across corporate boundaries. OSIsoft Cloud Services also offer connectivity with remote assets without the need for a PI System at both endpoints. OSIsoft is available in the Microsoft Azure marketplace and can be deployed on Amazon Web Services infrastructure as a service. Enabled by cloud connectivity, OSIsoft partners with original equipment manufacturers (OEMs) with an offering called Connected Services. Embedding the PI System into OEM hardware and software provides opportunities for the OEM and OSIsoft to actively monitor the health of equipment deployed in the field.
- **PI Systems Integrators** provide out-of-the-box connectivity to technologies that are part of common patterns across implementations. Examples include:
  - ESRI ArcGIS to add geospatial context
  - RLINK for certified connectivity to SAP applications, Maximo, Indus, and JD Edwards/Peoplesoft

- AWS S3, Athena, Redshift, Kinesis Greengrass, and the AWS IoT solution
- Azure IoT, HDI, SQL Data Warehouse, Event Hub, and Stream Analytics feeding the Cortana Intelligence Suite
- Business analytics connections to Tableau, Tibco Spotfire, QlikView, and MS Power BI, and SAP HANA for high-performance analysis of time series sensor data

The list of integrators continues to grow with customer demand.

- **Visualization** of data and analytics in the PI System is available in a set of applications and drivers available from OSIsoft. Further:
  - PI Vision enables display of PI Server data on tablets and phones and in web browsers, as illustrated in Figure 6. PI Vision replaced the former Coresight product and has been an unheralded success story, primarily because of the ability to create customized displays of assets and asset analytics.
  - PI ProcessBook gives users the ability to create graphical dashboards and displays that can show the flow of goods and materials through operational areas and schematics for key equipment.
  - PI DataLink gives users the opportunity to leverage PI Server data in Microsoft Excel for spreadsheet analytics and reports.
  - PI WebParts provides the opportunity to create dynamic dashboards in Microsoft SharePoint where PI Server data can be combined with information stored in SharePoint.
  - PI ManualLogger provides users with the ability to enter data manually into the AF for assets on which data capture is not automated.
  - PI BatchView enables viewing of real-time process data within the context of batch processes in product manufacturing, improving operational analysis for more on-spec batches and demonstrating compliance with regulations.
- **PI System Access** is available through a set of developer technologies including:
  - PI SQL Framework that includes OLEDB, ODBC/JDBC drivers, and a PI SQL client application for data-level access to time series data in the AF and DA
  - PI Web API providing program-level access to PI Server
  - .NET Framework, an SDK for foundational-level access to the PI Server capabilities
  - PI OPC Servers for supporting commercially available OPC clients that use the OPC Data Access and Historical Data Access standards

These technologies can offer extension, customization, and control of the PI system from external applications.



**FIGURE 6**

**PI Vision**



Source: OSIsoft, 2018

***Implementing the PI System***

Implementing the PI System is an effort that is more likely performed by resources associated with operational technology, although OSIsoft is beginning to see more information technology resources get involved, especially in cases where IIoT data is intended to be leveraged beyond operations alone.

The PI Server environment is first installed and configured with the necessary high availability and load balancing, depending on nonfunctional and business continuity requirements for the solution. PI Interface and Connector installations are required to begin collecting data from sensors and smart devices, after which PI Tags and the PI DA are configured to receive the streams of data. The AF model is built out to give the sensor data context and provide the basis for Asset Analytics to be consumed by applications and external systems. Analytics and notifications are then defined based on the parameters and requirements of the solution. Applications and system connectivity is then configured for visualization and external data consumption. OSIsoft Cloud Services enable hybrid architectures, facilitating the flow of data between PI Servers across corporate and cloud security zones.

The amount of time it takes to implement the solution is dependent on the number of tags and asset models defined in the AF. Seasoned experts in the PI System can create an asset model in 15-30 minutes, depending on the complexity of the hierarchies of PI Tags that make up the digital representation of the asset. Asset models are combined into complete processes and plants. If an organization had to build out 100 different asset models, it could take about a week of effort, but then the models can be used as templates to create instances of multiple assets as process and plant

models are defined. The amount of time required to fully implement the AF grows with complexity of process and plant models.

OSIsoft offers some basic templates and learning courses, and a group focused on customer success helps organizations get started with PI System solutions. There are also several industry-specific solutions available from partners and systems integrators that have built solution stacks to further accelerate implementation for quick wins. The experience and knowledge provided through OSIsoft partners may also provide higher returns on investment.

## **Licensing**

The software is grouped into bundles for purchasing. The main component is PI Server, which includes the DA, AF, notifications, and analytics. Pricing is dependent on the number of tags that are to be maintained in the system, except in cases where enterprise license agreements are in place. PI Connectors and PI Interfaces are added to the implementation as necessary for collecting data from sensors and smart devices. Licenses are traditionally perpetual, with an annual maintenance fee; however, OSIsoft is beginning to offer subscription licenses for on-premises implementations and cloud services.

## **The PI System Versus Data Lakes**

IT project teams that perform IoT analytics in a data lake solution built using big data technologies for persisting sensor data, curating, blending, and performing analytics in streaming and batch-oriented processes can spend a lot of time collecting and preparing sensor data in the lake so that it can be leveraged for trusted business analytics in context. The PI System is a platform out of the box that can take effort to set up and configure for operational assets, but organizations with established data lakes for IoT analytics that have turned to leveraging the PI AF and Event Frames have been able to significantly reduce data collection and preparation efforts because PI automates preparing sensor data in context through the intelligence it adds to the raw data. OSIsoft suggests that up to 80% of the time invested in sensor data collection and preparation in IoT data lakes can be eliminated with the PI System. Unfortunately, some of the organizations using the PI System in combination with a data lake limit the PI System to the function of a data source only and are not aware of the value the PI AF and Event Frames can bring to the solution.

A platform of capabilities for IoT analytics and information management developed on a data lake itself typically:

- Has a smaller up-front price tag compared with the PI System
- Has higher labor cost using internal staff and professional services
- Requires the construction and management of time series data
- Requires development and management of all of the metrics and business rules needed for operational intelligence
- Provides ML-based libraries that can be trained and implemented by data scientists

All components of the PI System are built to integrate and complement each other and designed for use with the industrial Internet of Things, providing the type of data intelligence that is equally applicable to many other IoT analytics and information management domains.

## Competition

OSIsoft is competing with several other vendors in the IoT analytics and information management market, in the following segments:

- **IoT data collection and management tier:** Competitors in this space include vertical IoT platform companies and horizontal data integration companies, including GE Digital (Predix), PTC (ThingWorx), Hitachi Vantara, Siemens (MindSphere), BSquare (DataV), IBM, ScaleOut (StreamServer), Cloudera, HortonWorks, Informatica, Oracle, SAP, SAS, and Talend.
- **IoT asset analytics solution tier:** Competitors in this space that have packaged at least the analytical portion of asset performance management under some variation of the term *predictive maintenance*, or condition-based maintenance, are Uptake Technologies, Bosch IoT Analytics, C3 IoT, Microsoft, SAP, Siemens (XHQ), and Splunk (IAI).
- **Digital asset (twin) solutions:** Competitors in this space are focused on OT verticals and include companies such as DNV-GL, GE Digital, Hitachi Vantara, IBM, and Oracle.
- **Process historians:** Competitors in this space include Wonderware, GE Predix, PTC ThingWorx, Siemens (SIMATIC), INTECH, Aspen Technologies, and Rockwell Software (FactoryTalk), to name a few.

## Challenges for OSIsoft

- The biggest challenge OSIsoft faces is a perception in the market that the PI System is simply a process data historian, limited to sensor data collection. Aside from the connectivity and integration capabilities, the PI AF supports a sophisticated metrics capability backed by time series data. Many organizations working on IIoT projects have the PI System installed somewhere but limit it to a back-end source of sensor data that is forwarded to a data pipeline or data lake without structure or context. They aren't utilizing the value of what they already pay for with OSIsoft. Many organizations that use the PI System aren't aware of the leverage they can gain by using PI System features, especially the Asset Framework, metrics linked to time series, Event Frames, notifications, visualization, process flow, and batch analytics.
- OSIsoft will need to consider adding advanced analytics capabilities into its portfolio, especially to support the use of machine learning for predictive analytics. OSIsoft currently looks to partners for these features, and yet there are several open source machine learning, natural language processing, and artificial intelligence projects that OSIsoft could leverage and add into its portfolio.

The reason we believe OSIsoft needs to make this shift is to show broader relevancy of the PI System for the full spectrum of IoT analytics and information management. Currently, customers may want to use the PI System for data ingestion, processing, and condition-based monitoring but then they have to go to a third party for ML-based predictive analytics. The third party typically already has a full platform, and the PI System is pushed back to the data input tier of a solution. Plugging in the advanced analytics gap will solve that problem.

- OSIsoft needs to improve implementation and system help automation to gain better leverage from the Asset Framework and metrics. Templating each asset and Event Frame can automate part of the deployment, but the effort associated with creating AF models and Event Frames in the first place can be labor intensive, depending on the complexity of model hierarchies and number of different assets that need to be modeled.
- OSIsoft is responding to the need for more automation through a project called PI health, an initiative that is focused on improving the health of data in the PI System. There is a common misconception that all data coming from devices is quality data, but it can contain false

positives, anomalies, and inconsistencies that require automated fact-checking for cleanup before downstream decisions are made on poor quality data. Data intelligence inherent in the PI System is foundational for the success of PI health.

## OSIsoft Strengths

OSIsoft's strengths can be put into three categories:

- Deep out-of-the-box understanding of the OT domain of IoT solutions with a strong orientation toward partnering, resulting in deep and broad experience and third-party support that can be leveraged in implementation.
- The ability to build operational digital twins that can link to business application data, bringing in opportunities for new correlations and analytical insight that can feed digital transformation (DX).
- The ability to capture, cleanse, and add intelligence to data made available by sensors on inanimate objects independent of OEM proprietary solutions or streaming from log files, persisting it in a time series database that enables an approach to metrics and operational data intelligence that can be leveraged in PI and downstream applications.

Data is the lifeblood of digital transformation, and OSIsoft solutions are not only a source of that lifeblood, but the data intelligence that the PI System can insert into the flow also enables contextual decision-centric computing using data that can be trusted, driving opportunities for digitally transformed operations and business outcomes.

## ADVICE FOR THE TECHNOLOGY BUYER

---

Don't overlook the opportunities available in the PI System to prepare IoT data for analytics and information management. We have taken inquiries from customers wanting to know how to cleanup IoT data that has been dumped into a data lake, highlighting that the data is difficult to understand, profile, and align with assets in processing locations, and very noisy, making it difficult to find the events of interest within the history of readings.

During these same inquiries, we also discovered that the OSIsoft PI System is being used to capture sensor data and pass it to the data lake, but without leveraging the AF, Event Frames, or Notification capabilities. While completely overlooked, the PI System could have provided the context, framework, and metrics out of the box. This is a very common scenario that needs to be addressed in the industry, and it will require education of IT on what OT solutions can offer, and how they can be applied:

- Use the PI AF to enrich IoT data with business and environmental context; IoT data on its own is valuable for operational intelligence, but when combined with enterprise application and environmental data, it can support more advanced analytics, insights, and direct correlations between operational and business performance.
- Total cost of ownership needs to be considered when approaching an IoT analytics and information management solution. Using a data lake versus the PI System is a classic build versus buy decision. Evaluating the core capabilities of the PI System will inform a team of what they need to build to establish a functioning platform based on a data lake. Aside from the low cost, open source-based approach inherent in using a data lake, there is also the need to identify the cost of third-party tools, the development effort, the risk of developer lock-in as they move on to new projects, and the time-to-value opportunity cost all need to be compared and contrasted with the strengths and challenges of the PI System.

- Enterprises are beginning to use the term *business digital twin*, which represents the current state, health, and performance of business entities in digital media allowing new use cases for KPI monitoring, event identification, and anomaly detection of business operations. The PI System should be evaluated for parts of the business digital twin use case as well.

## LEARN MORE

---

### Related Research

- *Splunk Moves into IoT Analytics with Industrial Asset Intelligence Solution* (IDC #US43812218, May 2018)
- *How Does Decision-Centric Computing Drive Digital Transformation?* (IDC #DR2018\_T3\_MF, February 2018)
- *Introducing Decision-Centric Computing* (IDC #US43282917, December 2017)
- *IDC TechScape: Internet of Things Analytics and Information Management* (IDC #US41841116, December 2016)

### Synopsis

This IDC Perspective describes OSIsoft and the application of its PI System to bridge the gap between OT and IT and positions OSIsoft within IDC's decision-centric computing framework for consideration in solutions that may fall outside of the scope of the industrial Internet of Things (IIoT).

"IoT sensor data on its own doesn't have a lot of value; it is dirty, unstructured, and disorganized, and unless the context in which it was captured is known, deriving insights from it is difficult without significant downstream data preparation efforts," says Stewart Bond, director of Data Integration and Integrity Software research at IDC. "OSIsoft's PI System collects sensor data, persists it into a time series database, and connects the physical to digital with its Asset Framework in which data is organized and structured with context and provides a suite of applications for operational analytics and a set of interfaces to the PI System that enables connectivity with business applications and non-IoT technologies, avoiding the need to perform downstream sensor data preparation in business analytics and decision-centric computing use cases."

## About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

## Global Headquarters

5 Speen Street  
Framingham, MA 01701  
USA  
508.872.8200  
Twitter: @IDC  
idc-community.com  
www.idc.com

---

### Copyright Notice

This IDC research document was published as part of an IDC continuous intelligence service, providing written research, analyst interactions, telebriefings, and conferences. Visit [www.idc.com](http://www.idc.com) to learn more about IDC subscription and consulting services. To view a list of IDC offices worldwide, visit [www.idc.com/offices](http://www.idc.com/offices). Please contact the IDC Hotline at 800.343.4952, ext. 7988 (or +1.508.988.7988) or [sales@idc.com](mailto:sales@idc.com) for information on applying the price of this document toward the purchase of an IDC service or for information on additional copies or web rights.

Copyright 2018 IDC. Reproduction is forbidden unless authorized. All rights reserved.

