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## Siemens XHQ Operations Intelligence Software in the MindSphere Cloud: New Possibilities to Extend XHQ's Advantages Even Further

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*Siemens XHQ Operations Intelligence Software is helping industries worldwide to drive their digital transformations. Now that XHQ can run in the Siemens MindSphere cloud, it holds even greater transformational power. That's because MindSphere offers the amplifying power of advanced analytics and machine-learning, plus the ability to port XHQ data to other cloud-based applications. This paper provides insights into Siemens MindSphere as a way to magnify XHQ performance with these enhanced capabilities.*

## Introduction

Years ago, the chief technology officer at a major global manufacturer lamented that his company was “drowning in data, but thirsting for relevance.” If anything, the situation for most businesses has since gotten worse. By some estimates,<sup>1</sup> the world generates 2.5 million terabytes of digital data *each day*— and it’s growing ever faster. And data growth is such that 90 percent of the world’s data today has been generated since 2015.<sup>2</sup> Clearly, to say that data is exploding may be an understatement.

Why all this data? We can credit the Internet of Things (IoT) and a vast subset called the Industrial IoT. Both refer to the internetworking of billions of devices with embedded electronics, software, sensors and so forth, enabling them to collect and exchange data. As just one example, a single, self-driving car is expected to spawn 4 terabytes of data daily,<sup>3</sup> with 10 million such vehicles forecast to be sold by 2020.<sup>4</sup>

Across every industry, executives and managers at all levels — especially those working with operational technology (OT) in factories and other industrial facilities — must make sense of the torrent of data coming at them. It springs from the many diverse sources and systems that typically span today’s sophisticated industrial enterprises. While these systems are needed to help manage manufacturing operations, they also must be capable of generating and distributing production reports, calculating key performance indicators, and archiving genealogy records, among many other tasks.

At the same time, a plant’s business and operational systems must also be able to respond to the many users who require data in different combinations, aggregations, and contexts to make their decisions quickly and reliably. Even with these systems in place, those users, or their supporting staff members, can spend the better parts of their days in collecting, normalizing, correlating, analyzing and reporting data, all done to help improve operating visibility and decision-making.

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<sup>1</sup> DN Capital. “Beyond Big Data to Data-Driven Decisions.” <http://dncapital.com/thoughts/beyond-big-data-to-data-driven-decisions/>

<sup>2</sup> IBID.

<sup>3</sup> Nelson, Patrick. “Just one autonomous car will use 4,000 GB of data/day” Network World, December 7, 2016. <https://www.networkworld.com/article/3147892/internet/one-autonomous-car-will-use-4000-gb-of-dataday.html>

<sup>4</sup> Garret, Olivier. “10 Million Self-Driving Cars Will Hit The Road By 2020 -- Here's How To Profit” Forbes. March 3, 2017. <https://www.forbes.com/sites/oliviergarret/2017/03/03/10-million-self-driving-cars-will-hit-the-road-by-2020-heres-how-to-profit/#64b514107e50>



## XHQ Operations Intelligence software: Transforming industry via real-time, actionable insights

But even if all the staff time spent gathering, manipulating and reporting data from various sources and systems was free, industrial plant operators could still suffer the costs of not-so-transparent operating visibility and sub-optimal decision-making. The reason is simple: *the data is not real-time*. Often, it's not close. It can be days or weeks old, more useful for lagging indicators than for leading ones.

Sometimes old data can be worse than no data because it can be misleading and therefore misinform assumptions and decisions. In other words, plant operators can assume their production lines are healthy and the coming days' output sufficient to meet near-term customer commitments, but that might not be the case: a critical motor, for example, may be about to throw a bearing and the spare motor has been on back order for weeks now.

While situations like these are far too common in industrial plants around the world, they don't have to be. XHQ Operations Intelligence software from Siemens provides a layer of real-time data visibility over diverse operational and business systems. It can automatically extract and aggregate up-to-the-minute data from those sources and display it in an intuitive, easy-to-read dashboard format. And it can span multiple sites across different geographies, even continents, for views across an entire industrial enterprise.

**How it works.** Siemens XHQ Operations Intelligence software is non-intrusive. This means it lightly accesses a variety of real-time and diverse back-end data sources to gather information. Sources can



include automation systems, data historians, MES operational databases, ERP and financial accounting systems, laboratory information management systems, asset condition monitoring systems, warehouse management systems and relational databases.

Once collected, the information is aggregated and combined with other data. This information is then put into role-based contexts and presented to users through live views that are accessible from any desktop computer, laptop, tablet or smart phone. The role-based web views can be especially

valuable by giving users dashboards tailored to each individual's needs, whether a user is a maintenance engineer on the production floor or part of senior management in a far-off boardroom.

**Proven worldwide.** XHQ Operations Intelligence software has proven itself the world over for more than two decades in continuous process and batch industries, primarily focusing on downstream, midstream and upstream oil and gas production, as well as chemicals. Unlike many of the systems it draws from, XHQ solutions can be quickly developed and deployed—often in days or weeks rather than in months or years. They are built by combining simple, reusable object components with specific graphical representations to create comprehensive, real-time, information-rich models and intuitive displays.

Also helping to accelerate deployments is object reuse: XHQ information components and their graphical representations can be adapted and repurposed for use at one plant or facility, then quickly deployed at another. All changes to the base definitions are inherited and automatically updated, wherever the components are used. That can be, for example, throughout a complex refinery or even across many refineries, each on different continents.

What's more, XHQ software's scalability supports deployments with hundreds of thousands of tags, with millions of database and business application records, thousands of converted schematics, and thousands of users. For all its transformational power, XHQ now has a way to magnify its benefits many times over with Siemens MindSphere.



## Siemens MindSphere: A cloud-based, open IoT operating system that can amplify the capabilities of XHQ Operations Intelligence data

For many reasons, cloud computing has taken enterprise information technology (IT) by storm, helping to drive digital transformations by:

- **Offering on-demand, turn-key IT infrastructure** that is always updated and highly secure with virtually limitless scale.
- **Saving capital expense as well as time and effort** needed to acquire and maintain needed hardware.
- **Providing a flexible pay-as-you-go cost model** via subscription-based pricing.
- **Delivering economical access** to platform-as-a-service (PaaS) functions, such as high-performance computing, as well as to software-as-a-service (SaaS) applications, such as advanced data analytics and machine learning.

Many global IT suppliers have successfully launched their cloud platforms, but have focused on enterprise IT, not industrial OT. Among them are SAP, Microsoft Azure, IBM Watson, Accenture and many others. All typically come with their own tools and applications, while supporting the most widely used ones from each other, plus open-source resources, too. All were designed and architected for best-effort IT packet requirements, but none for the critical, real-time deterministic packet demands of industrial OT. That's where MindSphere enters the picture.



**The Siemens difference.** Siemens offers the MindSphere IoT operating system in the form of a platform as a service (PaaS). In other words, it's a cloud-based service that enables customers to develop, run and manage their applications without the complexity of building their own infrastructures or managing complex software stacks. MindSphere leverages an industry-standard cloud application platform that abstracts the infrastructure so that developers can focus on application innovation. This platform is collectively developed by global enterprises and vendors using open source governance. With an infrastructure-agnostic foundation, MindSphere applications can run on the customer's preferred cloud infrastructure, such as Amazon Web Services, Microsoft Azure, SAP Cloud Platform and Atos Canopy.

By having an open-source architectural foundation, MindSphere facilitates its adoption by an installed base of more than 30 million Siemens automation systems as well as by users of third-party automation systems. That's especially helpful if plant operators have already embarked on their digital transformation journeys using other clouds. In many cases, customers have done so on the IT side of their businesses but not yet on the OT side. Either way, an open architecture of MindSphere extends Siemens' long tradition of supporting open industry standards across all of its OT product lines.

To help customers and partners build and integrate their own software applications and services, MindSphere delivers open application programming interfaces (APIs) and development tools. With these tools customers can deploy software applications in hours or days instead of weeks and months. Modularizing monolithic software solutions with these interchangeable applications offers customers much more flexibility and tailored functionality, faster and more cost-efficient updates and agile development.

MindSphere provides a wide variety of APIs for developers which facilitate the development of applications and considerably reduces development costs.

Another important MindSphere distinction is Industrial-grade, OT cyber security, based on ISO 27001, IEC 62443 and BSI industry standards. Data in motion is always encrypted using 256-bit SSL/TLS encryption or better. Data at rest is stored in highly secured infrastructures provided by leading cloud data center partners (IaaS). These professional IaaS providers can offer much higher security standards, than typical on-premise and local data storage.

**Moving OT to MindSphere.** Like XHQ Operations Intelligence software, MindSphere is designed to be easy and fast to set up, configure, and use inside hours, not months or years like deployment of many complex software applications can require. With PROFINET or other industrial Ethernet protocols, operators only have to plug in the MindConnect device — a hardened Siemens SIMATIC Nanobox industrial PC — to a piece of designated plant equipment or the plant network.

Then they can configure the device via the MindSphere cloud to begin using available MindApps immediately. Fleet Manager, for example, can be used for real-time monitoring of equipment assets for performance assessment with visual analysis. Benefits of this approach include:

- **Increasing asset uptime and availability:** Predict what impacts could arise from failures to run timely maintenance of machines, thereby reducing or preventing disruptions due to unplanned downtime.
- **Optimizing assets:** Identify the best configurations for plant equipment to reduce energy consumption and manage peak loads better.
- **Increasing maintenance efficiency:** Prolong maintenance cycles over equipment's expected lifetime.

## XHQ Operations Intelligence Software on MindSphere: Amplifying its capabilities and possibilities

While Siemens XHQ Operations Intelligence software will continue to be offered as a premise-based application, it has been successfully deployed on a virtual machine in the MindSphere cloud as a software-as-a-service (SaaS) solution. This combines the best of both worlds: XHQ features and capabilities with MindSphere's cloud advantages, including access to advanced analytics, machine learning and other sophisticated applications, such as Siemens COMOS plant engineering software.

For example, XHQ cloud deployment eliminates the capital expense associated with buying servers to host the software, as well as the operating expense of then maintaining them. Updates and patches can be rolled out automatically with little or no service disruption. If more CPU, storage or networking resources are needed, they can be automatically provisioned immediately. A SaaS model can also help minimize licensing costs associated with other third-party commercial elements in the XHQ software stack, such as for an operating system and virtualization software.

**Use case #1: Predictive analytics.** Along with these basic cloud advantages, running XHQ on MindSphere can bring it new capabilities from other MindSphere-based applications, such as machine learning and advanced analytics. To illustrate the latter, consider how XHQ Operations Intelligence can be used with Siemens MindSphere Advanced Analytics software, jointly developed with Atos, a worldwide software development leader.

In this use case, data drawn from sensors across a plant is uploaded to MindSphere via an on-premise and secure gateway, the MindConnectNano. XHQ data from a variety of other system sources throughout a plant— from data historians, databases, spreadsheets and other applications — are loaded via the XHQ Connector Service. This analytic gateway is an XHQ-based application that interfaces XHQ to MindSphere Advanced Analytics.

Data experts then select from available algorithmic workflows, such as a linear regression workflow that is commonly used in predictive analytics. Alternatively, they can upload their own custom analytic algorithms. Either way, the production data is analyzed either on a one-time basis or periodically on a schedule with automated uploads of the most current XHQ data drawn from plant sources in real-time.

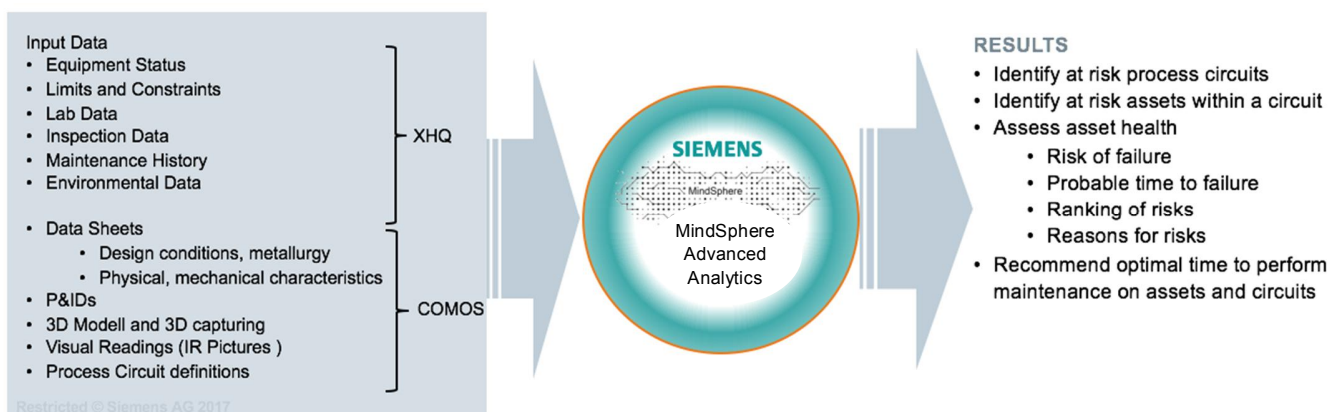
Once a particular analytics workflow is run in MindSphere Advanced Analytics, the results are brought back into the XHQ Operations Intelligence software. At that point, they are made available for plant operators on their dashboard displays or, if action is needed, alerts can be issued. Of course, the results can be saved for historical archiving.

**Use case #2: Fixed asset maintenance.** Another XHQ/MindSphere use case example — fixed asset maintenance intelligence — addresses the question of finding the best time to perform maintenance on the different equipment around a plant. Problems arise when maintenance is performed too soon, as excessive costs can be incurred and the equipment isn't available during maintenance, potentially disrupting production. Conversely, if maintenance is performed too late, costly failures can occur, resulting in unplanned downtime.

The solution? Extract real-time operations intelligence data with XHQ, send it to the MindSphere cloud where it is then combined with data from Siemens COMOS plant asset lifecycle management software. XHQ then handles the interaction with the MindSphere Advanced Analytics application that performs advanced analytics on the combination of this plant- or even equipment-specific data set.

Given these data inputs, the fixed asset maintenance intelligence solution created for this use case can employ advanced machine learning algorithms from the MindSphere Advanced Analytics application. In turn, this can determine the integrity, risks, and best time to maintain or replace fixed assets such as piping, heat exchangers, and vessels across the plant, as illustrated in Figure 1, below.

**Figure 1.**





## Conclusion: Deploying XHQ Operations Intelligence software in the MindSphere cloud can help extract deeper real-time insights from OT data to improve plant performance

As one of the largest segments of IoT, industrial devices are certainly adding to the world's ever-rising tide of data. But the good news is that the situation doesn't have to swamp operators of factories, refineries and many other types of industrial facilities. In fact, data's increasing availability can actually help them to do their jobs much better given the right tools. Siemens XHQ Operations Intelligence software is one such tool. And, by combining it with Siemens MindSphere, users can gain even deeper insights to address complex issues in ways not possible before.

As this paper's two use cases show, the insights drawn by XHQ Operations Intelligence software can be amplified when it is hosted in the MindSphere cloud. That's because doing so enables the data to be subjected to further scrutiny by advanced analytics and machine learning. XHQ data can also be combined with data from other applications, such as Siemens COMOS software, for entirely new solutions that can help to maximize asset utilization while helping to minimize disruptions.

Of course, operating XHQ Operations Intelligence software on the MindSphere platform also enables users to gain the upsides of an OT-specific cloud model. They can eliminate capital and maintenance expenses required by IT hardware infrastructures; ensure security and upgrades are always addressed; and gain a flexible, pay-as-you-go subscription model.

Adding these benefits to the advantages of drawing deeper, real-time XHQ insights via analytics and machine learning make the approach truly compelling. Ultimately, running XHQ Operations Intelligence software on the MindSphere cloud can help users to drive not only more profitability but also a sharper competitive edge.

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