Automation + Cloud = Big Benefits from Industrial IoT

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KEY TAKEAWAYS

- Technology, connectivity, enhanced analytics are enabling the IIoT.
- Despite IIoT's promise, organizations often encounter roadblocks.
- The IoT is driving paradigm shifts that benefit industrial organizations.
- Cloud computing solutions like AWS offer unlimited compute and storage.
- AI and machine learning help businesses extract meaning from data and extend their services.
- APIs provide a scalable way to develop new products.
- Edge computing extends the cloud to the factory floor or the field.
- Many industries are streamlining business processes by leveraging Siemens MindSphere.
- Adopting the IIoT requires a phased approach.
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OVERVIEW
Companies are just scratching the surface of how digital technologies can enhance industrial processes and machinery. By integrating data from machines, vehicles, and connected products, organizations can improve efficiency and proactively identify issues in the field before they become real problems. The Internet of Things is transforming industrial manufacturers, large-scale real estate companies, utilities that manage power grids, and more.

Siemens and AWS have partnered to combine their industrial knowledge and cloud technology expertise into MindSphere 3.0, a platform that supports Industrial Internet of Things initiatives such as data-driven action and process integration, as well as product and business model innovation.

CONTEXT
Tim Wormus and Tom “Elvis” Jones discussed the benefits companies are deriving from the Industrial Internet of Things.

KEY TAKEAWAYS
Technology, connectivity, and enhanced analytics are enabling the Industrial Internet of Things.
The Industrial Internet of Things (IIoT) is transforming industrial organizations ranging from manufacturers to large-scale real estate companies and utilities. However, organizations are just scratching the surface of what is possible. Three trends enabling the IIoT are:

1. **Cloud computing is the backbone of IoT technology.** Statistical process control has been used for decades in industrial manufacturing. Historically, however, it has been performed on-premise. Traditionally, systems haven’t allowed teams to integrate vast volumes of data to identify trends and potential problems. The rise of cloud technology makes this possible.

2. **Increasing connectivity provides greater transparency into products and processes, which saves money.** Consumers are familiar with connectivity in the context of social media. The commercial world introduces greater complexity to connectivity since some systems were online long before the Internet existed. In addition, data in commercial settings is more voluminous than in the consumer context. Industrial equipment often generates thousands of data points; a single facility generates millions of data points.

3. **The value of IIoT data and analytics has the potential to open new revenue streams.** Yet, today less than 5% of all data generated by manufacturing plants is analyzed for insights. Companies must shift to being proactive, rather than reactive. Harnessing rich data enables organizations to be predictive.

Despite the promise of IIoT, organizations often encounter roadblocks.
Common IIoT hurdles include:

1. **Getting started with digitalization.** Teams may struggle to identify end-to-end solutions that can be easily implemented and that accelerate innovation to deliver ROI.

2. **Piecemeal IIoT solutions that don’t meet specific needs.** To deliver real insights and value, organizations often need integrated IIoT solutions that are tailored to their specific needs.

3. **Meeting stringent security and compliance requirements.** Companies need secure ways to connect devices and transfer device data to the cloud for processing.
Predictive maintenance is an obvious use case for the Industrial Internet of Things. However, a single company may have multiple predictive maintenance applications. They need a platform, not piecemeal IoT solutions.

Tim Wormus, Siemens

The Internet of Things is driving paradigm shifts that benefit industrial organizations.

The Internet of Things is motivating companies to rethink every element of their business. Three significant paradigm shifts are:

1. Moving from hardware dependency to software. Shifting from hardware to software is fairly simple. One example is data centers. Moving data to the cloud increases flexibility and reduces costs.

2. Users and operators become designers. Flexible connected systems are enabling mass customization. It is easier for companies to give customers exactly what they want.

3. New business models are possible. Companies can shift from selling products to selling usage. For example, an industrial air compressor manufacturer may install a compressor and have the customer pay based on usage, instead of buying the equipment outright. This eliminates large capital purchases for customers and delivers more predictable revenue for manufacturers. It also opens new markets for manufacturers, since they can target smaller customers who can’t afford to purchase equipment.

The benefits generated by the IIoT aren’t limited to one industry. One recent survey found significant adoption of IIoT in fields like facilities automation, mobile device management, fleet management, and smart cities.

Much of the activity is near-term optimization using existing assets.

IoT Adoption Trends

<table>
<thead>
<tr>
<th>Biggest Year-Over Year Gainers: IoT Initiatives</th>
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<tbody>
<tr>
<td>Facilities Automation: +8.2%</td>
</tr>
<tr>
<td>Mobile device management: +4.5%</td>
</tr>
<tr>
<td>Fleet management: +4.3%</td>
</tr>
<tr>
<td>Smart City: +3.7%</td>
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Enterprises are deploying IoT...

... with the main IoT drivers today primarily inward-facing

Cloud computing solutions like AWS offer unlimited compute and storage, as well as access to services.

The AWS cloud offers a way for organizations to access servers, networks, virtual machines, applications, and higher-level services over the Internet or over a private connection to the cloud. Since AWS provides virtually unlimited compute and storage resources, customers can upload their data to the cloud and analyze it there. No upfront capital expenditure is needed.

AWS has a global infrastructure. Every data center has its own power and Internet connection, so customers can build highly available applications in a geographic region.
EXECUTIVE SUMMARY

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Siemens chose AWS for the MindSphere 3.0 platform because AWS provides unmatched infrastructure and technology capability. The building blocks provided by AWS enabled Siemens to deliver MindSphere 3.0 in a short period of time.

In addition, customers have access to a wide range of AWS services. These include core services such as virtual machines, as well as security-specific services like identity and access management, key management, web application firewalls, and more. In 2017, AWS launched over 1,400 new services and significant features. Customers can use this work to accelerate their innovation.
Al and machine learning help businesses extract meaning from data and extend their services.

In the industrial space, organizations are using artificial intelligence to extract greater meaning from data. As data lakes grow, it becomes difficult for humans to write queries to pull data. Tools like artificial intelligence, machine learning, and deep learning that analyze the data are growing in importance.

AWS supports many machine learning frameworks including MXNet, TensorFlow, and Caffe. These can be run natively using the AWS Deep Learning AMI (Amazon Machine Image). Customers can also utilize AWS machine learning specific tools, such as Alexa services that voice-enable applications and Amazon Rekognition, which performs image recognition and analysis of static images or video.

AI and machine learning help businesses add value and iterate their services. This is relevant for activities like predictive maintenance.

Machine learning and artificial intelligence are important for predictive maintenance. We can understand the condition of a piece of hardware by collecting data in the field, building a digital twin of that specific device, and simulating how it will wear over time.

Tom “Elvis” Jones, AWS

APIs provide a scalable way to develop new products.

APIs, or application programming interfaces, are a way that software applications can communicate with one another. All AWS services have a restful API which can be called programatically. The Siemens MindSphere platform also includes an API.

APIs enable organizations to achieve scale, since it is possible to create new products by calling these interfaces. For example, a Siemens MindSphere API enables developers to access all machine data in an app.

Edge computing extends the cloud to the factory floor or the field.

Edge computing is processing that occurs on the factory floor or in the field. It is typically used for mission-critical applications when bandwidth is low. A growing trend is training machine learning models in the cloud and running them on devices at the edge.

Bottling plants are one example where edge computing is reducing maintenance costs and improving equipment uptime. In bottling plants, many small motors push conveyor belts. Although these motors are lower power and inexpensive, they are critical to the bottling process. If one motor fails, the entire line stops.

Historically, bottlers have used aggressive maintenance schedules to examine motors. If a motor might be failing, it is swapped out immediately. This is expensive from both an equipment and a labor perspective. Siemens is working with a partner to introduce low power sensors to bottling plants. The vibration-detecting sensors are attached to the motors and connected to a Bluetooth mesh network. Within a week or two of failure, motors begin to vibrate at a higher frequency. When this occurs, the sensors signal that the plant should check that motor.

With this approach, bottlers reduce their overall maintenance load and downtime. Looking ahead, sensor information could be integrated with a scheduling application so problematic motors are automatically added to the maintenance schedule.
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Many industries are streamlining business processes by leveraging Siemens MindSphere.

Companies are utilizing Siemens MindSphere to increase efficiency using the IIoT:

1. Siemens Circuit Breaker Factory. This facility has 14 production lines. Circuit breakers must be tested to a certain degree of tolerance. The plant management team wanted an overall equipment effectiveness (OEE) calculation that combines information about availability, performance, and quality. Data is collected from the plant testers and pushed to MindSphere, and then results are displayed in a web-based dashboard. In the coming months, the factory expects to increase its OEE by 10%.

2. Ham-Let Group. This company manufactures industrial valves for liquids and gases. Ham-Let uses MindSphere to perform deep analytics and visualization for specific valves. It also uses AWS Green-grass, an edge computing service with machine learning models. Ham-Let trains models in the cloud and then pushes them down to individual valves for real-time analysis. Thanks to this new approach, the company has changed its business model and now sells valve operating hours.
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3. Dell. Dell utilizes the MindSphere platform to gather and generate product intelligence. Dell sends large volumes of IoT data to MindSphere which is contextualized with supplier information. This enables Dell to conduct root cause analysis very quickly and identify how field failures may affect their products. The company can now identify and isolate problems in hours, rather than days.

Adopting the IIoT requires a phased approach.

Organizations are using the Industrial Internet of Things today. Successful companies typically adopt a phased approach that starts by connecting systems and assets to support activities like condition monitoring and asset performance.

The next stage is data-driven process integration which enables predictive maintenance. An integrated data model also supports optimization and data exploration. The ultimate goal is to learn and innovate. This often means creating new business models and transforming entire business processes.
EXECUTIVE SUMMARY

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BIOGRAPHIES

Tim Wormus  
Vice President, IIoT Strategy and Implementation Americas, Siemens

Tim is a leader in the intelligent application of analytics technologies, including the open cloud based operating system for the IoT MindSphere. He has held development and market facing roles at Genedata, Inc., Tibco Spotfire, Perkin Elmer, and H2O.ai. Today, he acts in a leadership role for Siemens as VP for IIoT Strategy and Implementation in the Americas. His team is revolutionizing how companies do business. Tim and his team work with customers and partners to help identify how to apply the appropriate technology solution to the challenges specific to their industry, size and corporate goals, in order for them to best achieve tangible returns.

Tom “Elvis” Jones  
Solutions Architect, Amazon Web Services

Tom spends his time focusing on the complex challenges of strategic partners in the Design, Engineering, and Manufacturing space. His career has spanned both the hardware and software sides of the house, including work at Red Hat, Transmeta, and Pratt & Whitney, giving Tom an extremely broad technical experience across multiple industries and verticals. He is a white-paper author, a patent holder, a training material builder, a DevOps expert, an active Maker, a mountain biker, and above all, a passionate technologist. He has been known to go far out of his way for pinball and fondly recalls playing “Adventure” on an ADDS Viewpoint ASCII terminal.