The Cloud for Manufacturing

Manufacturers today are faced with challenges unlike any in the past. The world is moving faster and is more connected than ever before. In addition, a turbulent world economy, explosive growth in consumer technology, and rapidly changing and sometimes unpredictable consumer purchasing behaviors all bring both opportunity and risk. For these reasons, there has never been a more important time for manufacturers to invest in the next generation of industrial automation solutions: the time is right for manufacturing to embrace the cloud.

This white paper examines the intersection of manufacturing and cloud computing and shows how the cloud can help manufacturers reduce costs, increase agility, and optimize performance to drive profitability.

Invensys—a leading provider of automation and information technology, systems, software solutions, services, and consulting to the global manufacturing industry—and Microsoft work together to deliver cloud-based solutions that are designed specifically for manufacturers. These joint solutions harness the power of the cloud, while operating within the real-world constraints of manufacturing.
# Table of Contents

Manufacturing: How the Cloud Helps ............................................................................................................... 2
  * **External forces** ........................................................................................................................................ 2
    - A challenging economy ............................................................................................................................ 2
    - A global marketplace: collaboration with suppliers ............................................................................... 2
    - Complex and evolving regulatory and compliance issues ................................................................. 3
    - Reducing vulnerability and staying secure .......................................................................................... 3
  * **Internal forces** ....................................................................................................................................... 4
    - A changing workforce ............................................................................................................................ 4
    - Big data .................................................................................................................................................. 4
    - Agility ..................................................................................................................................................... 5
    - The pressure to innovate ....................................................................................................................... 5
    - Making investments future-proof ......................................................................................................... 5

Applying the Power of the Cloud for Industrial Automation ........................................................................... 7
  * Which processes are right for the cloud? ...................................................................................................... 7
  * Architectures for the cloud ......................................................................................................................... 9

The Cloud Explained ....................................................................................................................................... 10
  * Cloud deployment models ......................................................................................................................... 11
  * The Microsoft cloud: Windows Azure .................................................................................................... 12
  * Comparing deployment costs .................................................................................................................. 13
  * Bridging the gap between on-premises and hosted cloud solutions ...................................................... 14
  * Data protection .......................................................................................................................................... 14
  * What do Invensys and Microsoft offer? .................................................................................................. 15

Cloud Solutions for Manufacturing .................................................................................................................. 15

Conclusion ......................................................................................................................................................... 16

Learn More! ....................................................................................................................................................... 17
Manufacturing: How the Cloud Helps

Today’s manufacturers face a myriad of challenges. Turbulent economic times, an aging workforce, the arrival of big data, complex regulatory and compliance requirements, and the constant pressure to innovate and stay of the competition—they all make it difficult for manufacturing plants to remain profitable.

Cloud-based automation solutions—such as the joint solutions from Invensys and Microsoft—can help manufacturers succeed in the face of external and internal forces, whether they are economic, social, or performance/operational based.

<table>
<thead>
<tr>
<th>External forces</th>
<th>Internal forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>A challenging economy</td>
<td>A changing workforce</td>
</tr>
<tr>
<td>A global marketplace</td>
<td>Big data</td>
</tr>
<tr>
<td>Complex regulatory/compliance</td>
<td>Agility and innovation</td>
</tr>
<tr>
<td>Vulnerability and security</td>
<td>Making investments future-proof</td>
</tr>
</tbody>
</table>

**External forces**

- **A challenging economy**

  The global financial crisis and steady state of unemployment, devalued dollar and flat consumer spending are driving down manufacturer’s margins. Many manufacturers are starting to rethink offshore manufacturing’s “true costs” and are “re-shoring” to restore profits, compliance, and quality levels.

- **A global marketplace: collaboration with suppliers**

  Manufacturers can increase efficiency and performance by integrating and collaborating with suppliers, but might worry about controlling and sharing external access without compromising or unnecessarily extending internal access.

  Manufacturers need a way to separate and secure the information they want to share with their trusted partners and suppliers to reap the benefits of a tighter collaboration. They need to be able to share information without exposing themselves to the risk of unintentionally sharing sensitive and confidential material, such as their intellectual property.
Complex and evolving regulatory and compliance issues

Regulatory and compliance issues are a necessary reality of manufacturing; while critically important for consumer safety and protection, manufacturers typically have focused on the production process. With the advent of 21CFR Part 11, the Food Safety Modernization Act (FSMA), and other Good Manufacturing Practice (GMP) guidelines, manufacturers must not only show readiness, but also enforce compliance.

Reducing vulnerability and staying secure

Manufacturers must continuously ensure that their applications are fully patched and kept current to remain secure. They must take on the burden of checking for software patches, updates, and security notices, across multiple products and across multiple vendors.

It is, of course, extremely difficult to keep up. And although industrial automation was considered invulnerable to security breaches, the 2010 Stuxnet worm combined four zero-day vulnerabilities to target industrial control systems, according to the study “An Empirical Study of Zero-Day Attacks in the Real World.”

Cloud-based manufacturing solutions can help.

For the economy: Cloud-based manufacturing solutions can reduce the IT infrastructure, maintenance, and lifecycle costs of new or existing operational or process improvement projects by as much 54 percent. These solutions can save both money and time by increasing collaboration and reducing the time-to-market.

For the supply chain: The cloud model shifts the security context away from an internal network to a carefully controlled external security perimeter that is appropriate for suppliers to access. There is no need to grant suppliers direct access to the internal network. You can enjoy a tighter collaboration with your suppliers to respond faster to orders, adapt to quickly evolving consumer buying behaviors, and reduce inventory.

For security: Cloud-based solutions let manufacturers make sure that their PCs are fully patched and current. Automatic patching and upgrading is a core deliverable from Infrastructure as a Service (IaaS) or Software as a Service (SaaS) providers like Microsoft at the operating system-level and from independent software vendors (ISVs) such as Invensys at the application level.

For security and compliance: Often a point of discussion at the intersection of cloud and manufacturing, Invensys and Microsoft can provide support in meeting data security, regulatory and compliance requirements specific to manufacturing.

Cloud-based solutions make it possible for the large numbers of companies that share common industry-specific constraints to use a common pool of resources and best practices.
providers such as Invensys and Microsoft can respond to multiple customers by ensuring that their infrastructure, products, processes, and services meet or exceed the same constraints as their customers; customers can take advantage of (to the appropriate degree) the compliance of their solution providers as part of their own responsibility for those same compliance requirements.

By working with Invensys and Microsoft as trusted solution providers, it is possible to:

- Reduce liability and mitigate risks around both logical and physical data security and privacy.
- Benefit from higher and broader levels of data security and privacy audited and verified independently by third-party certifications.

For example, Invensys solutions can help meet FDA 21 CFR Part 11 regulatory compliance for the food and beverage and life sciences industries,\textsuperscript{10} and Microsoft data centers meet ISO/IEC 27001:2005 and SSAE 16/ISAE 3402 attestation along with HIPAA and HITECH.

### Internal forces

- **A changing workforce**

  As the baby-boomer generation exits the workforce, manufacturers must maximize the effectiveness and retain the knowledge base and skill sets of a shrinking pool of senior experts. Conversely, the new millennials—those born between 1980 and 2000—bring a new set of expectations—social, mobility, and ever-present data—that manufacturers need to address.

  Manufacturers must re-think the work environment. Will employees be allowed to use their tablets and smart phones in addition to their laptops? Will they be allowed to take their data with them for continuous remote analysis?

- **Big data**

  The adoption of Ethernet-based industrial equipment and networked equipment in industrial automation has significantly increased over the past decade, leading to the exponential increase in managing the data coming from systems, applications, and devices. Data capture, mining, analysis, storage, and archiving are known as big data and manufacturers are realizing that big data must be accessible to be useful. Providing employees with the information to ask the right questions and perform the right analysis allows manufacturers to reap the full benefits of big data.

  According to Cisco, there will be a 24-fold increase in machine-to-machine (M2M) traffic between 2012 and 2016—this means more than 10 billion connected devices.\textsuperscript{11} How can an organization scale and effectively manage the data generated from those devices?
- Agility

Manufacturing is as much about what to manufacture as about how to manufacture it in the most cost-efficient and timely way, while maintaining quality, containing costs, and protecting brand. Manufacturers constantly seek to determine what consumers will want next and how to respond before the competition reacts.

Manufacturers must be able to adapt to changing market demands by modulating their production capacity and re-aligning their processes, people, and equipment. They must constantly maintain their IT infrastructure in the background, addressing security, high availability, data redundancy, geo-sensitive caching, performance, disaster recovery, and more.

- The pressure to innovate

Manufacturers must constantly innovate to stay relevant and ahead of their competition. But if they expend effort on mitigating internal resource and staffing conflicts, how can manufacturers maintain readiness? These pressures can stifle manufacturing innovation. Meanwhile, the drive of consumers is moving forward fast.

- Making investments future-proof

Manufacturers are frequently tasked with justifying investments well beyond the return on investment (ROI) period to ensure maximum utility of, and return on, their capital. This means that manufacturers must not only be strategic in how they invest their resources as a company, but also be internally competitive in how they allocate their resources.

It is extremely difficult to predict the future. Consider the fate of five Navy Ticonderoga-class AEGIS cruisers that were destroyed because they were too expensive to maintain; the underlying technology simply could not keep up with future demands.

Cloud-based manufacturing solutions can help

For the workforce: Cloud-based manufacturing solutions extend the reach of senior workers by providing access to geographically remote sites, delivering real-time, on-demand video and data access to domain experts, making it possible for them to directly participate in remote operations through centralized cloud-based workflows and instant messaging. Senior advisors can assist through immediate remote audio/visual collaboration—without the need for travel time and without the loss of fidelity inherent in stop-and-go communication, such as email, voicemail, and paper-driven processes.

For training, cloud-hosted resources can serve as the back-end of realistic, graphic-intensive virtual reality simulation training programs, ensuring that knowledge is captured and passed on.
Capturing procedural knowledge and collaborating around shared and secured data is faster and easier from virtually anywhere, on any device, and at any time.

For the millennial workforce, cloud-based solutions can deliver the social, mobile, analytics and cloud experience. Data can be shared on a mobile device from anywhere while online and at any time. Centralizing data lets even geographically separated employees collaborate. Providing this experience and environment for new employees can also act as a competitive strategy to acquire and retain talent.

For big data: cloud-based solutions can manage the storage, scale and analytics of Big Data. These solutions can keep data secure while simultaneously making it more accessible. For example, Invensys automation software’s industrial business-intelligence layer, paired with Microsoft data centers and infrastructure layers, deliver cost-efficient storage and the insight to drive data-driven decision making. Solutions from Invensys and Microsoft make data accessible to the users, rather than just the analysts. It is also possible to add Invensys’ Managed Services to provide baseline reporting and analysis of your applications.

For innovation: Cloud-based solutions let manufacturers access new capabilities faster because of the reduced setup time, cost, and complexity. These solutions let manufacturers experiment, share, and collaborate on new features and capabilities without significant cost or disruption to resource allocation, letting them spend more time innovating and less time maintaining the status quo.

For agility and innovation: Cloud-based solutions support fluctuating demand, automatic scaling of resources, and instant provisioning of new capabilities, and can remove the burden of licensing and IT infrastructure maintenance from the manufacturers.

The marginal cost of an additional space or (virtual) compute resource, complete with automation software, is lower because the cloud offers economies of scale.

A service provider like Invensys can make it possible for a manufacturer to create a central template-driven development environment, in which engineering work can be tried, captured, and re-used across multiple groups or projects. The manufacturer can opt to securely let partners, suppliers and even customers collaborate in the environment without the worry of providing access to the private company network.

For investments in technology and future-proofing: By nature, the business-delivery model and its associated services have an ongoing lifecycle that grows and adapts. The cloud model decouples the traditional need to make up front, long-term capital expenditures to solve today’s problems from the future business benefits that those investments bring.
Because cloud-based solutions use hardware that is managed, monitored, and maintained by the provider, the hardware’s depreciation, utility, and fit for purpose is also the provider’s responsibility. Up front capital expenditures (CAPEX) are replaced by lower, predictable, operationally driven (OPEX) annual subscriptions that can be adjusted at any time.

For example, the joint solutions from Invensys and Microsoft are adaptable and future proof because they start with the idea of a reliable and scalable software platform instead of a set of discrete software products. The Wonderware System Platform from Invensys acts as an “industrial operating system” by providing common services, such as visualization, configuration, deployment, communication, security, data connectivity, data storage, and management. Combined with desktop, server, virtualization, and cloud platforms from Microsoft, the two companies are uniquely positioned to address both the present and future needs of manufacturing.

### Applying the Power of the Cloud for Industrial Automation

Improving quality and productivity while reducing operating expenses and waste remain at the heart of every continuous process improvement initiative. A hosted solution can directly contribute to the bottom line of almost any area of manufacturing process improvement.

**Which processes are right for the cloud?**

Figure 1 shows a matrix of candidates for hosted industrial automation solutions.

![Figure 1. Matrix of candidates for hosted solutions for industrial automation applications](image)

The spectrum of candidates for hosted industrial automation solutions crosses two dimensions: latency and criticality. Latency refers to real time versus transactional events, while criticality refers to low impact versus high impact, including safety considerations, financial considerations (for...
example, exposure to financial risk because of a loss of revenue or a break in production because of system failure), and legal considerations (for example, regulatory compliance or intellectual property protection).

For manufacturing, safety of personnel, product, and equipment are of critical importance. Ensuring high levels of safety often requires physical line-of-sight vigilance; immediate equipment response times to emergency shut-off or kill switches, and highly robust systems for stringent process and quality control.

Similarly, there are certain critical dependencies that only make sense to manage on-premises to guard against interruptions to production and public exposure to intellectual property, and to meet certain aspects of regulatory compliance.

As a general rule, anything that is directly related to the physical output of the production process should stay on-premises. Anything that is not critical to the process, but rather is complementary or is a supporting component, can be a good candidate to be hosted on the cloud. For example, optimization, analysis, reporting, alerts and notifications, simulation, testing and development—these activities traditionally have little or no impact on safety, legal or financial risks, are tolerant of latency, and can safely be considered to be cloud-hosted.

Table 1 shows typical manufacturing-specific business needs that can be met with cloud-based solutions delivered from Invensys and Microsoft.

**Table 1. Typical business needs that can be addressed with cloud-hosted solutions**

<table>
<thead>
<tr>
<th>Reporting and analytics</th>
<th>Collaboration and work task execution</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Long-term process historians</td>
<td>▪ Workflows and certain types of procedural enforcement</td>
</tr>
<tr>
<td>▪ Manufacturing business intelligence</td>
<td>▪ Shared development and collaborative testing</td>
</tr>
<tr>
<td>▪ Process or batch summary reports</td>
<td>▪ Virtual reality simulation and training environments</td>
</tr>
<tr>
<td>▪ Energy management</td>
<td>▪ Condition-based maintenance (CBM)</td>
</tr>
<tr>
<td>▪ Mobile summary reports, alerts and notifications</td>
<td></td>
</tr>
<tr>
<td>▪ Dashboards, key performance indicator (KPI) monitoring, and other web portal–based solutions</td>
<td></td>
</tr>
<tr>
<td>▪ Process analytics (especially for post-production optimization and root-cause analysis)</td>
<td></td>
</tr>
<tr>
<td>▪ Manufacturing Execution System (MES) reports</td>
<td></td>
</tr>
<tr>
<td>▪ Remote diagnostics and system health monitoring</td>
<td></td>
</tr>
</tbody>
</table>
Architectures for the cloud

**Figure 2** starts with a Data Historian—an optimized database structured to access and store real-time, time stamped event data. Historians traditionally store millions of “tags” of process data and are a critical contributor to operations reporting and analysis. In this example, the Historian is “tiered” to provide a secondary data layer for storage/reporting. The Tier-1 Historian is on-premises, but the Tier-2 is hosted in the “cloud.”

![Figure 2: Invensys Tiered Data Historian solution (simplified architecture)](image)

Error! Reference source not found. shows a deployment of a multi-site implementation using Workflow software. A central workflow server is hosted in the cloud, with workflows (tasks, events, notifications) deployed to personnel at the sites.

![Figure 3: Invensys Workflow in the cloud](image)
Figure 4 shows an example of smart device enabled reporting, in which manufacturing data is pushed out to the Windows Azure cloud and then to one or more Windows-based devices, including a Windows 8 laptop, a Windows Surface tablet and a Windows Phone 8 smartphone.

![Figure 4. Invensys and Microsoft reporting solution](image)

**The Cloud Explained**

There are three basic cloud models:

1. **Public cloud:** In this model, the services and infrastructure are provided off-site, over the Internet. Public clouds offer the greatest level of efficiency in shared resources, though provide the least amount of direct control over the shared data.

2. **Private cloud:** In this model, the services and infrastructure are maintained on a private network. These clouds offer the greatest level of security and control, but because the organization must still purchase and maintain all the software and infrastructure, cost savings are reduced and the IT management burden remains relatively unchanged.

3. **Hybrid cloud:** This model is a mix of public and private cloud, which lets an organization keep each aspect of the business in the most appropriate environment.
For industrial automation companies, Invensys believes that the hybrid cloud model can offer the best compromise for manufacturers between the benefits and challenges of public and private cloud deployments, backed by an experienced domain partner like Microsoft.

Cloud deployment models

Figure 5 shows cloud services by deployment model: on-premises, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

- **On-Premises**
  The on-premises model allows a user to “host” their applications within the four walls of their enterprise. However, cost efficiencies can still be gained; even with an on-premises model, it is possible to lease software to reduce upfront costs through a subscription, instead of purchasing licenses. It is also possible for manufacturers using an on-premises model to add a remote system health and diagnostics monitoring product, such as Invensys’ Proactive Systems Monitoring Services (PSMS) to ensure performance and security. Invensys PSMS is a set of tools designed to monitor Wonderware software applications and system health, with assessment and optimization services for optimal system performance. PSMS is delivered either through the Invensys Secure Cloud or on-premises for customers that want more active responsibility of IT administration.

- **Infrastructure as a Service**
  By using IaaS, a service provider deploys, manages, and services the underlying industrial software virtual resource platform, with only domain-specific applications, configurations, and data left for the manufacturer to manage. This model offers the benefits of sourcing
hardware and its management at a lower price point because of the economies of scale, but lets the manufacturer retain direct ownership and responsibility for the configuration. Invensys offers a pre-configured IaaS platform that brings the benefits of hosted cloud services to industrial automation.

- **Platform as a Service**
  Using PaaS, a service provider deploys, manages, and services the majority of the solution stack, including solutions sets. For Invensys, this includes domain-specific applications such as Workflow, Business Intelligence for Manufacturing (Wonderware Intelligence), Energy Management (Corporate Energy Management), and Manufacturing Execution Systems (Wonderware MES); the manufacturer only needs to manage data and specific configurable instances.

- **Software as a Service**
  Using SaaS, a service provider deploys, manages, and services the entire solution stack. The manufacturer retains ownership of the data, including the right to expatriate (remove) the data at any time.

The **Microsoft cloud: Windows Azure**

Windows Azure is an open and flexible cloud platform for building, deploying, and managing applications and services. Invensys and Microsoft have teamed to supply manufacturers with a robust cloud platform based on Windows Azure. It can support Invensys’ manufacturing and infrastructure management customers with all delivery models—IaaS, PaaS, and SaaS.

Figure 6 shows how Microsoft delivers IaaS, PaaS, and SaaS with a comprehensive set of software solutions, including Windows Server with Hyper-V, Microsoft System Center, and Windows Azure.

![Figure 6. The Microsoft cloud continuum](image-url)
Table 2 shows the various cloud deployment options and some typical use cases.

Table 2. Deployment models and use cases

<table>
<thead>
<tr>
<th>Deployment model</th>
<th>On-premises</th>
<th>Infrastructure as a Service</th>
<th>Platform as a Service</th>
<th>Software as a Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical use case</td>
<td>Operating requirements demand specific implementations of hardware and/or highly customized software. Hardware and software are critical to safety, real-time process control, or have high intellectual property value.</td>
<td>Hardware configuration is flexible but software requirements are domain specific or require environment-specific implementations.</td>
<td>Hardware and software can be flexible. Needs industry standards and best practices. Only requires implementation specific configuration and data.</td>
<td>Only the interaction with and output of the application and its functions and features are desired. No particular software or hardware requirements.</td>
</tr>
</tbody>
</table>

Comparing deployment costs

Table 3 shows the typical costs of an on-premises model compared to a subscription-based SaaS model. Note that the cloud-hosted SaaS option is significantly less complex and can be easily scaled up or down as needed because there is no commitment period.

Table 3. Cost comparison between On-premises and SaaS models

<table>
<thead>
<tr>
<th>Item</th>
<th>On-Premises</th>
<th>SaaS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensing</td>
<td>Varies</td>
<td>Included</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Varies (typically 15%-20% of licensing costs, annually)</td>
<td>Included (performed automatically)</td>
</tr>
<tr>
<td>Support</td>
<td>Varies (typically 22% of licensing costs, annually)</td>
<td>Included</td>
</tr>
<tr>
<td>Hardware</td>
<td>Extensive</td>
<td>Included (sized automatically)</td>
</tr>
<tr>
<td>Implementation</td>
<td>Varies (additional cost in time)</td>
<td>Included (with rapid provisioning)</td>
</tr>
<tr>
<td>IT infrastructure</td>
<td>Extensive</td>
<td>Included (scaled automatically)</td>
</tr>
<tr>
<td>Payment</td>
<td>Up front</td>
<td>Typically by user/usage per month</td>
</tr>
</tbody>
</table>
Bridging the gap between on-premises and hosted cloud solutions

In all hosted cloud-based deployment models, there is a link between the required manufacturing systems and applications on-premises and the portion of systems and application that are hosted in the cloud (which varies according to deployment model). Cloud-hosted solutions can be used to partially offload services, or to extend capacity and resources depending on the need. Cloud-hosted solutions are designed to complement existing investments and need not replace any existing working systems.

Data protection

Data protection tops the list of concerns of many manufacturers when they consider cloud-based solutions. Manufacturers worry about whether the solution provider can provide adequate protection in multi-tenant environments (a single cloud environment for multiple users) that might also store data from their competitors. They worry about the safety of moving data between the manufacturing plant and the cloud, as well as how to ensure that no residual data remnants remain if they move to another cloud service provider.

The cloud environment presents new challenges in securing data, mixed trust levels, and the potential weakening of the separation of duties and data governance. With the hybrid cloud, there is an additional challenge of protecting data as it moves back and forth from the enterprise to a public cloud.

Data protection extends to securing the physical perimeter of data centers and ensuring that personnel who have access to the data can be trusted. Data protection involves security of the systems that house, process, and exchange data. Security authentication, authorization, and encryption apply at both the application and infrastructure level.

Data protection in the cloud does not rely on a single defense strategy. All policies, procedures, and implementations do not assume that there will be a single attack vector, but instead prepare for multiple threats. The approach, called “defense in depth,” ensures that if any one defense mechanism is compromised, the exposure is still contained by the additional layers of defense.

With a cloud-based hosted solution, manufacturers own and control access to their own data, and can extend their existing on-premises security model to the cloud. For example, manufacturers can extend their Active Directory Domain Services (AD DS) identity management
to Invensys cloud-hosted solutions to let employees to benefit from single sign-on (SSO) while retaining control over data access policies.

What do Invensys and Microsoft offer?

Invensys Managed Services provide for the proactive monitoring, maintenance, and management of virtual resources to ensure a reliable and persistent connection to data and applications. Invensys takes care of sizing hardware requirements as needs change, while maintaining automatic patching, upgrading, and servicing of applications.

Invensys cloud-hosted services also facilitate features such as a high availability, disaster recovery, and regional performance gains through the Microsoft geo-distributed data centers located around the globe, as shown in Figure 7.

Cloud Solutions for Manufacturing

While there is much discussion about which cloud-based technologies are most appropriate for manufacturing, there is widespread agreement that cloud-based hosted solutions can help manufacturers streamline operations, reduce operating costs, and increase productivity. Cloud-hosted solutions offer the potential to address many of the top concerns of manufacturers, including increasing overhead, security and availability of their business-critical applications, the high costs of hardware and software, and a lack of trained staff to support new infrastructure. Many cloud-based services and products are currently being developed specifically for manufacturers. These solutions use the cloud for reporting, training, and application hosting.
Mobile reporting, web-based dashboards, industrial business process management (BPM), and workflow automation are areas in which manufacturers are already benefitting from the cloud.

Cloud-based hosted solutions let manufacturers get started quickly and can easily scale as demand changes. Cloud-based hosted solutions can ease IT management and reduce server administration overhead; they can provide manufacturers with a highly available architecture, and can support collaboration throughout the manufacturing plant by increasing visibility and access to information. Cloud-based hosted solutions can address key manufacturing pain points, including IT costs, application lifecycle management and version control, patch management, and application monitoring and maintenance. Using a hosted solution can also help foster faster adoption of new products and technologies, even if customers lack the appropriate infrastructure.

Conclusion

The time is right for manufacturing to embrace the cloud.

By bringing together industrial thought and technology leaders, Invensys and Microsoft deliver cloud-based offerings to the manufacturing and infrastructure operations space.

According to Ravi Gopinath, president, Invensys Software Business, “Working with Microsoft reinforces the strategic alignment between our two companies, with a mutual goal of using Windows Azure technology to bring leading-edge cloud solutions to the industrial market. By offering cloud-based variants of our existing Historian and business process management solutions, we can help our customers lower costs, reduce systems complexity and cut hardware and software investments, while creating a high-performance environment for more agile operations management.”
Learn More!

You can visit the following websites for more information:

- Microsoft and Invensys Alliance web page
- Invensys Cloud for Manufacturing Solutions
- Microsoft Cloud and Datacenter Solutions Hub

For general information:

<table>
<thead>
<tr>
<th>Windows Azure Data Centers, the “Long Tour”</th>
<th>Start here!</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This video describes the Microsoft cloud and Windows Azure data centers, emphasizing their modular approach, energy efficiency, and sustainability.</td>
</tr>
</tbody>
</table>

| Invensys Cloud for Manufacturing Solutions | Invensys’ website provides descriptions of the available hosted solutions. Links on this site provide more information about SmartGlance, Tiered Historian, and Wonderware Workflow. |

| Introducing Windows Azure                  | This white paper introduces Windows Azure, the Microsoft cloud platform that lets developers run applications and store data on virtual machines in an Internet-accessible data center. |

Focus on security:

| Windows Azure Security Overview           | This white paper describes the array of controls implemented within Windows Azure, so customers can determine if these capabilities and controls are suitable for their unique requirements. |

| Microsoft’s Cloud Security Alliance (CSA) Membership | The CSA is a not-for-profit organization with a mission to promote the use of best practices for providing security assurance within cloud computing, and to provide education on the uses of the cloud to help secure all other forms of computing. The CSA is led by a broad coalition of industry practitioners, corporations, associations and other key stakeholders. Download Microsoft’s Security CAIQ Questionnaire. |

| Windows Azure Trust Center                | This website shows how Microsoft makes sure that your data is kept secure and private, and is managed in compliance with various industry standards. |

| Microsoft Global Foundation Services      | See how Microsoft manages data centers all over the world. Take a virtual tour of one of their data centers on this site. |