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The role of the industrial PC in digitalization

Industrial PC features are perfectly positioned to help machine builders overcome challenges of digitalization

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Executive summary

The factory floor is changing to a place of an increasingly digital nature. More intelligent automation and connected devices are changing the face of traditional production to a more flexible, reliable and transparent environment.

As machine builders and end-users move to a digitalized manufacturing approach, industrial PCs (IPCs) are well placed to play a key role in enabling data access and analysis in a secure setting. Machine builders must ensure that end users are able to maximize machinery to its full potential, meeting the demands for increasingly customized products.

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This paper explores the trend to digitalization in industry, the impact on machine builders and the role industrial PCs can play in overcoming key challenges. The discussion focuses on the IPC attributes that make them so well placed to help develop digitalization in industry. It will also discuss the key concerns of machine builders and the reasons why IPCs are increasingly being adopted to help drive key business metrics.

IPCs have the perfect mix of performance and reliability, essential when dealing with large (and increasing) amounts of production data.

Introduction

PC-based automation to play a key role in digitalization

What is digitalization? It's the implementation of digital technology to improve business processes and drive new business models. In an industrial setting, this means networking devices using digital protocols, to enable real-time access to production data. Intelligent automation devices and software can then be used turn the data into usable information to aid decision making.

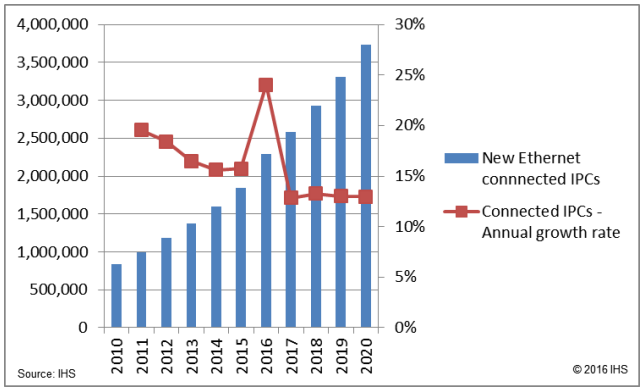
With the drive to digitalization, and trends such as Industrie 4.0, smart manufacturing and the Industrial Internet of Things (IIoT) gaining traction, machine builders face a number of challenges. Particularly in consumer-related sectors, machine builders are increasingly being tasked with improving the flexibility of production and reducing the change-over time between production runs. Simultaneously, machine builders must also increase efficiency and shorten product time to market.

Industrial PCs (IPCs) are well positioned to help machine builders (and their customers) to overcome these challenges. They have an openness and flexibility which means, for control and visualization applications, machine builders and end-users can quickly and easily develop applications to best meet specific requirements.

IPCs also have the perfect mix of performance and reliability, which are essential when dealing with large (and increasing) amounts of production data. With processor performance increasing and relative costs continuing to decline, industrial PCs are capable of handling and processing large sets of complex data.

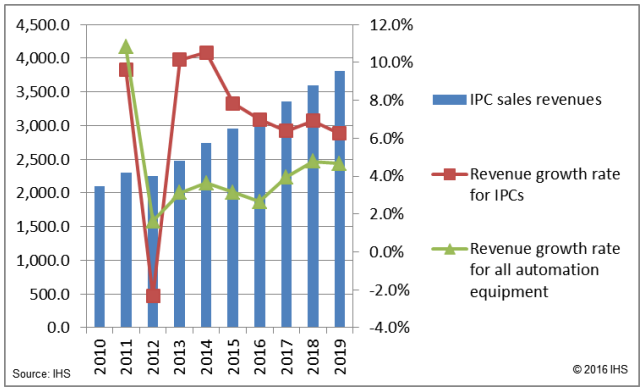
Storage options and falling costs have also enabled ruggedized IPCs to store data reliably even in harsh environments. IPCs are particularly well-suited where legislation dictates that production data must be logged accurately. Those that have integrated displays can also be used for shop-floor operators to visualize data.

The market intelligence firm IHS Global estimates that all IPCs shipped in 2015 were network-enabled and a high proportion were connected to factory-floor networks. Data can therefore be interrogated locally, and communicated and accessed, ensuring that potential problems are identified quickly and that decisions to ensure production up-time are fully informed.



This ability to integrate IPCs easily into existing networks using IP-based communication technologies enables shop floor data to be shared with engineers and others involved in production. This expands to the enterprise, and to service engineers, who are able to remotely access IPCs to monitor processes and make changes where necessary. There is the potential to save vast amounts of time and resources, through reducing local engineering support, monitoring component performance and reducing failure, and improving reaction times to alarms.

IPCs are already deployed in large numbers in many industries and regions. The latest insight from IHS Global estimates 2015 sales of nearly $3 billion, which equates to shipments of 3 million units. Sales revenues are forecast to grow at an annual rate of 7% to 2019, as the trend to digitalize gathers pace.



Machine-builder challenges

What are the key concerns of today's machine builders?

Every machine builder, no matter its size, region or industry sector, aims to sell more machines and increase profits each year. This isn't new or any different from other industries. What is relatively new is using networked automation technology to improve machine flexibility and to integrate processes with the broader supply chain to better meet the special demands of their customers (users of machinery) and those of their customers' customers (end consumers of products).

At the very least each machine builder will want to maintain market share, in an increasingly digitized and technology-focused industry. Keeping up with, or even getting ahead of, the competition, in terms of machine throughput, efficiency, up-time, and quality is paramount.

Beyond hardware, and as machines become increasingly commoditized, machine builders are looking to create new revenue streams. Some streams are enabled through digitalization. Today, machine builders are looking to tap into operating rather than capital expenditure; offering machinery as a service rather than a standalone sale. Connected automation, including IPCs and SCADA systems, forms a critical part in enabling this service approach.

With intelligent automation products and better access to production data through growing industrial networks, machine builders are in a position to leverage data better and to offer add-on services with machinery purchases. In essence, they will be selling up-time and throughput rather than a piece of machinery. This includes real-time maintenance scheduling, reduction of warranty costs, remote engineering support, improved troubleshooting and better tracking and transparency of machine performance and the installed machine base overall.

Particularly as sales of mid- to high-end machine builders come under pressure from low-cost competitors, these additional services are a key differentiator where tangible value can be provided to the end-user.

One challenge that automation vendors, machine builders and end users must all address is that of security. With increasing levels of networking and data sharing, all parties must work together to ensure that production data is secure. Unless assurances can be offered on a minimum level of security, any digitalization of end user production will be limited. Security needs to be at the center of all technologies and components used in machinery that will form part of an industrial network, as this will form the basis of digitalization. Machine builders and end-users need to think of security holistically, including hardware and software, together with training and education of personnel on changing security risks and how best to protect against security breaches.

How can IPCs help machine builders to overcome these challenges?

First of all IPCs are extremely flexible. Their make-up and highly specifiable nature mean that they are well suited to a broad range of industry sectors, applications and environments. Machine builders have great scope to tailor IPCs so that they meet specific requirements. This could relate to ruggedisation, processing performance, storage and software capability, visualization, control, security provision and networking compatibility. Siemens offers a range of design and customization options, which enables machine-builders and end users to tailor products specific to the application.

This flexibility also means that IPCs can easily be adapted as requirements change. In a sense they are future-proofed, as working practices of machine builders and end users change over time.

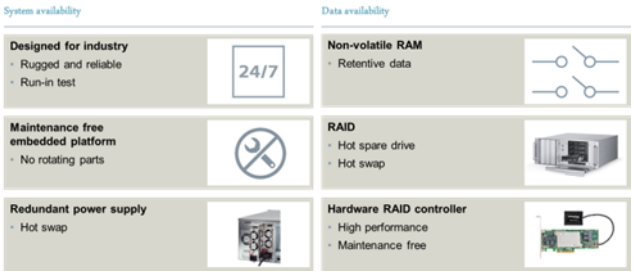
One example that is already having an impact on industry is the use of mobile devices. Both industry-grade and consumer devices are being used to visualize machinery production when mobile. However, rather than replacing mounted terminals, they are being used as a complement; the adoption of both mounted and mobile devices will continue to grow. Some mobile devices can be used for data management and system integration; others can offer flexible data access and visualization.

This last point is important. Machine builders and end-users will all have slightly different programs that they need to run on an IPC. An IPC is one of the leading automation components that provides the flexibility and performance (through multiple cores) to run various software and applications simultaneously. Software is becoming increasingly important as data gathering, analysis, interpretation and dissemination are required for the benefits of digitalization to be maximized.

Second, IPCs pack a punch in terms of performance and have longevity on their side. As components are miniaturized, and box IPCs in particular become more compact, machine builders can save cabinet space whilst at the same time continuing to improve system performance. Better display technology for panel IPCs enables intuitive visualization and ease of use, with larger display sizes useful in complex applications. Even with this increasing performance, average selling prices of IPCs continue to decline by about 2% per year.

Siemens IPCs are highly reliable automation components with long-term availability. Products are available that can be placed in the most hostile environments, operating reliably for years with very little attention. More and more IPCs are fanless and use solid state storage, eliminating moving parts, which helps to improve reliability further and reduce replacement rates of

components. Any components that require changing are easily accessible, with availability commonly extending beyond 10 years.

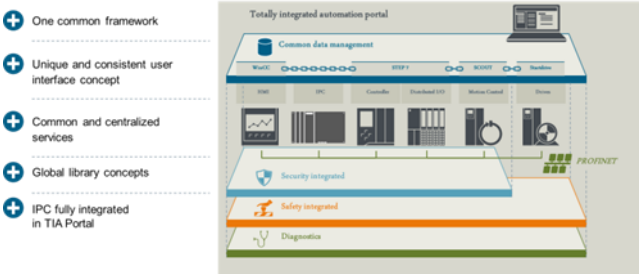


Finally, IPCs are considered a key component when machine builders are trying to reduce the time to market for their customers (machine users).

With integrated diagnostics, modular build, and intuitive visualization, IPCs have a crucial role in reducing machine downtime both through individual component durability and the insight they provide more broadly into the machine overall.

The speed at which IPCs can assess data and put it in the hands of the people that need it most is second to none, again helping to improve machine performance. Integrating standalone IPCs with more extensive automation solutions and networks is important to ensure that machine operators and production management have a complete information picture, rather than assessing machine performance in isolation. Networking of components and integration of systems will drive the industrial internet of things (IIoT).

Siemens Totally Integrated Automation (TIA) portal, a common engineering platform for automation solutions, allows easy integration of IPCs into a complete automation system. This gives the machine builder a common basis of data management and a consistent backbone for networking, safety, security and diagnostics. Compatibility and ease of integration using a standard platform such as the TIA portal forms the basis for digitalization, for which the IPC attributes are perfectly suited.

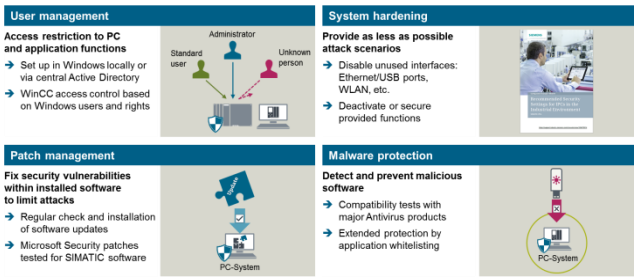


Automation and IPC trends

Connectivity and security

As industrial networks grow and are integrated with other business systems (including SCADA and energy management), and with increasing levels of security threat, the connectivity and security of components is a critical consideration. A security breach can lead to loss of intellectual property, plant downtime, sabotage, data manipulation and unauthorized use of system functions.

IPCs can form a key part of network validation that contributes towards industrial (automation) security. As the following graphic illustrates, IPCs role in network security can take a number of forms.



From the use of restricted user rights and regular security software checks and updates, to disabling unused interfaces and ports, and searching for malicious software, IPCs can play many roles in securing automation systems.

Increasing importance of software

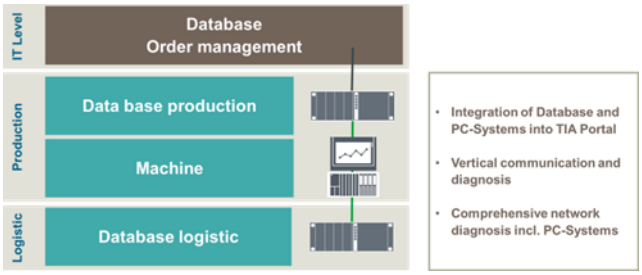
IPCs are among a number of automation components that can be used for machine visualization and control. But no other brings together the performance, openness, ease of use and flexibility to do both so effectively.

We live in a world of increasing data, where more and more devices, machines and people are connected to one another. IPCs have developed into automation components that enable connectivity and data management from the factory floor to the enterprise. No other automation device has the breadth of functionality or attributes so well suited to this data-driven world.

Applications previously favoured by IPCs or PLCs have merged in recent years. IPCs have penetrated hybrid and process industries to a greater extent (as well as discrete industries), although PLCs still dominate control applications. IPCs are becoming a more viable solution to PLCs and DCS for some applications, particularly as the benefits of IPCs used with an integrated software PLC become more evident in high-end applications. These include openness, motion control, real-time complex computation, determinism and low hardware costs.

Automation in the cloud

The use of the cloud to analyze and store information is now commonplace in many sectors. With production data increasingly in demand, and the challenges and costs of managing data via hardware servers, the use of the cloud in industrial production settings will grow strongly.



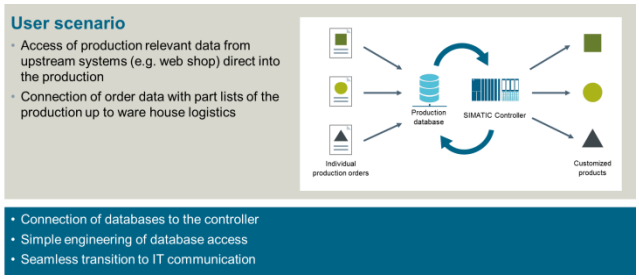
IPCs, such as the Siemens MindConnect Nano, are well positioned to play a key role in streamlining production data at the field level, to help speed-up analytics in the cloud. IPCs can be used to interrogate data and intelligently communicate information that needs to be stored or analyzed further; this takes pressure off the cloud and makes for a more scalable system. This will also help to make information available more quickly, reducing backlogs.

An IPC can be integrated at the controller level of an automation solution. It can be used to filter data before it reaches the server, with information then distributed to multiple thin clients to aid visualization. This filtering of data creates a more distributed architecture, with intelligence on the factory floor reducing the burden on central servers. Potentially, this will lead to lower hardware server costs as the reliance on them for data processing and storage is partially reduced. This also lowers the risk to production up-time associated with hardware server failures, and promotes a more scalable system. The use of IPCs aids continuous operation, long-term availability, scalability and easy configuration.

Case study – The Cloud and IPCs

Consumer demand for customized products has led to increased numbers of product options in many sectors. To meet this demand, many manufacturers offer personalized products, which creates complexity and a significantly higher volume of production data than from a less flexible production environment. As well as moving production data upwards to the enterprise, digitalization also has the aim of sharing production-relevant data that is generated in higher-level systems (e.g. Web shop, order management) directly to production, to facilitate customized production and avoid duplicate entries.

Order information must be merged with parts lists on production data servers to allow individual products to be produced without manual intervention. In addition, post production data, such as the delivery address, can also be accessed to ensure prompt and accurate logistics.



In some cases, the controller of the machine also needs to access order and production management data to enable individual and fully automatic configuration of the desired product. However, the data needs to be readable by the controller for this purpose. PC-based automation from Siemens enables direct exchange of data, for example with SQL databases.

Order information and related production data (e.g. parts lists) need to be accessible at all times, so must be available locally in the production environment. PC-based systems are required for this purpose. SIMATIC IPCs from Siemens can be integrated directly to the TIA Portal in the automation system providing the following advantages:

- Central overview of all IP addresses in production
- Consistent configuration of the network including all required components (switches, PC systems, controllers etc.)
- Integrated Ethernet network diagnostics throughout the entire production environment
- Integration of production-level IoT applications (e.g. intelligent databases) directly in the TIA Portal
- Seamless transition to IT communication (e.g. private cloud, Web shop)

Following the successful completion of its pilot phase, Siemens is now bringing the "MindSphere – Siemens Cloud for Industry" onto the market. The platform will initially be available as a beta release, which will be continuously further developed. MindSphere has been designed as an open ecosystem that industrial companies can use as the basis for their own digital services, such as in the fields of preventive maintenance, energy data management, or resource optimization.

Machine manufacturers and plant constructors in particular can use the platform to monitor machine fleets for service purposes throughout the world, reduce downtime and consequently offer new business models. MindSphere also forms the basis for data-based services from Siemens, such as for the preventive

maintenance of machine tools (Machine Tool Analytics) or integrated drive systems (Drive Train Analytics).

For connecting machines and plants to MindSphere irrespective of the manufacturer, Siemens offers a connector box, which has been developed further based on experience gathered during the pilot phase and is now available under the name of "MindConnect Nano".

This box IPC enables machine automation data to be seamlessly gathered via ProfiNet or OPC UA. Before leaving the Nanobox IPC, production data is already being analysed and streamlined before undergoing protocol conversion. At this point, the data is transferred securely via https, including VPN and firewall, to MindSphere or an alternative enterprise IT platform. Application-specific analytic software is then used to generate real-time information.

Conclusion

It is clear that the manufacturing landscape is changing. Automation vendors, machine builders and end-users alike are going through a period of transition, embracing connectivity, intelligence and the cloud to maximize machinery performance.

IPCs, already an established automation solution, are now at the forefront of this change. As manufacturing processes integrate more IT and digital technologies, IPCs have a unique set of attributes that contribute to data management, analysis, storage, security and visualization.

The general trend to digitalization – the networking of resources using digital technology and implementation of IT – will lead to wider connection of automation components, machinery, and personnel. As the amount of production data increases and factory floor systems are increasingly integrated with the enterprise, IPCs can help to manage and maximize the usefulness of that data. There's no value in gathering large amounts of production data if it can't be analyzed and made easily digestible in real time to the people that need it for decision-making.

Machine builders are increasingly making use of IPCs in a broad range of applications to help their customers realize improvements to output, uptime, quality and flexibility. IPCs are highly networkable and provide intelligence on the factory floor that can aid data management and analysis, continually sharing information upward to the network. They also have strong security credentials, even with remote access, and can be used to visualize data in real-time.
As industrial environments continue to digitalize, PC-based automation will play a key role. Machine builders and their customers face global competition and are increasingly focusing on how to improve performance and flexibility through transparency of production processes. Intelligent automation components like IPCs, provide secure access to production information, whether on location or remote, enabling more informed decision-making in constantly changing environments.

IPCs are a powerful, flexible and open automation solution, which are capable of helping machine builders and end-users face the challenges of digitalization, providing the functionality to help drive improved machinery performance and flexibility, together with service-related revenue streams.

Siemens AG
Digital Factory
P.O. Box 4848
90026 Nuremberg, Germany

www.siemens.com