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The New Cornerstone of Your Smart Factory: iPC-Based Control with Dual Operating Systems on Hypervisor, at the Edge of EcoStruxure™

by Philippe Gelin, Elder Akpa and Toru Terada

Executive summary

A new category of PC-based control that runs dual operating systems on top of a hypervisor for a real-time soft PLC with Windows openness in a single edge device is emerging.

The need for data management and flexibility is always growing to facilitate efficient visualization, smart manufacturing, digitization, IIoT, edge computing, artificial intelligence, etc. This requires direct interaction with the control application. At the same time, the automation architecture needs to be simplified at the edge control level to improve productivity and performance.

iPC-based edge control with dual operating systems provides the next stage for digital transformation and experience. It is reliable and part of end-to-end cybersecurity for more efficient operations and maintenance of capital assets.

Are you ready to test out this new category of edge devices as an early adopter, to move a step forward in the smart factory journey?

Introduction

Industrial demands for data management and flexibility are constantly growing in areas such as efficient visualization, smart manufacturing, digitization, Industrial Internet of Things (IIoT), edge computing, and artificial intelligence, to name a few.

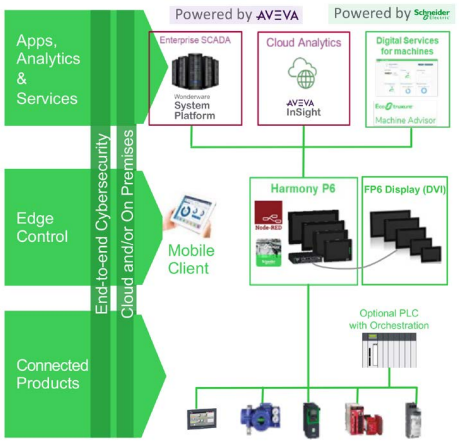


Figure 1

Harmony P6 industrial PC at the edge of EcoStruxure in a smart factory, running dual operating systems for PC-based control.

IIoT-enabled devices, gateways, edge boxes, and industrial PCs running at the edge of industrial automation control systems improve productivity and performance, becoming the next step in the digital transformation.

Nowadays, those devices are highly reliable and contribute to end-to-end cybersecurity for more efficient operation and maintenance of capital assets. Leveraging digitization, flexibility, and cybersecurity, they make the most of data to drive profitability, efficiency, and productivity.

For people working with automation, these components cut implementation time and are becoming increasingly cost-effective. The best of those devices can be delivered ready to enable soft PLCs for control. They also empower the workforce by improving visualization, running associated software, and connecting OT and IT for data management and asset performance optimization.

The convergence of control, visualization, and openness in a smart factory

Automation managers want to share information between PLC control runtime and other software, but most of their questions about machine control are related to the software add-ons.

They need more powerful controllers, IT/OT communication, cybersecurity, and openness with third-party Windows software. At the same time, they also need to simplify their control systems for greater machine and plant productivity.

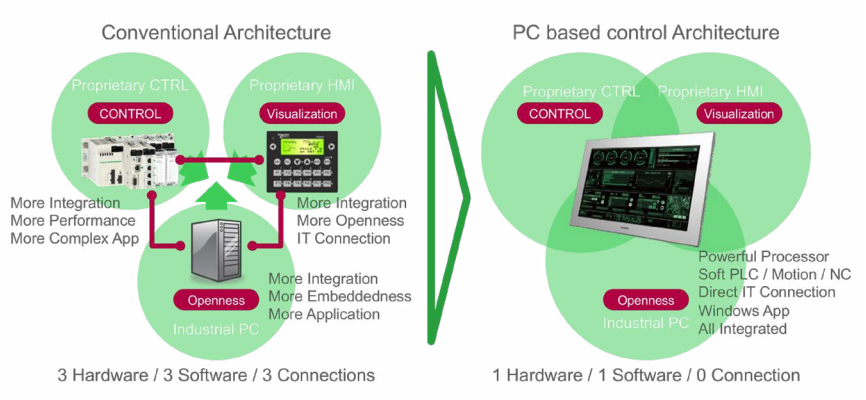
Achieving this involves the convergence of control, visualization, and openness, bringing more integration and performance in a single piece of hardware with less effort to connect the multiple automation and software applications. This will reduce product and labour costs. Figure 2 gives an overview of this convergence of control, visualization, and openness into a single piece of hardware.

The trend toward industrial PC-based edge control for large machines and lines is boosted by the increasing complexity of applications that require more functionality, flexibility, scalability, and openness to digitization. The most demanding sectors are conveying in warehouses (e.g. transport/roller belt, low speed sorters, uncoordinated crane stackers, baggage handling, etc.), food and beverage machinery and installations (e.g. stretch wrappers, stretch hooders, enrobing machines, bread/cookie/pasta/protein lines, aquafarms, or snack process lines), distributed water and wastewater plants (including pumping boosters), automotive (e.g. discrete production lines, or calendaring/mixing for EV batteries), semiconductor (e.g. IC discrete grinding, or lamination) and more in mining, mineral, and metal activities.

This approach makes no compromise in the scalability of the solution, from small architectures with entry-level edge boxes to the most powerful industrial PCs that run several instances of soft PLCs in parallel to address the different parts of a process and communicate with multiple software on Windows. Fortunately, the reliability of industrial PCs is now approaching that of PLCs, with maintenance fees and costs continuing to come down.

Figure 2

The convergence of control, visualization, and openness for a smart factory



The Harmony P6 iPC with dual operating systems runs EcoStruxure Automation Expert and multiple software associations

The Harmony P6 industrial PC with dual operating systems can run EcoStruxure Automation Expert (EAE) for distributed control at the edge for large machines and lines. This enables smart design and engineering which reduces implementation time.

This device is versatile and open to any application running Linux or Windows software at the edge: HMI, stand-alone SCADA, IoT applications with cloud connections, engineering and maintenance tools, thin clients, third-party applications, etc. Now, soft PLCs on Linux also have a real-time patch with the EcoStruxure Automation Expert Soft dPAC. EcoStruxure Automation Expert manages the complete distributed control application across the PC-based control and alongside other PLCs and drives in the field.

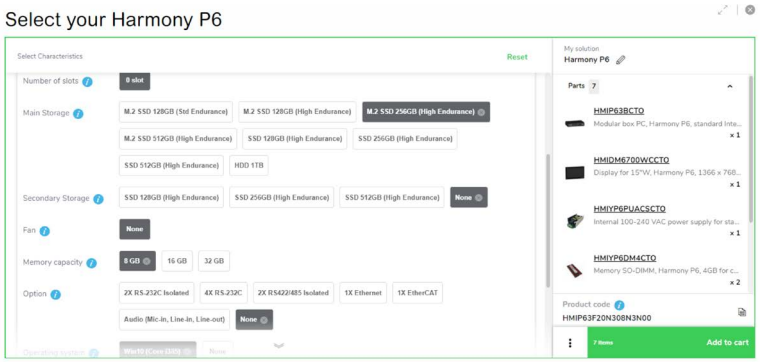
Edge boxes and industrial PCs offer reliability throughout the full lifecycle for investment continuity. Their robustness is similar to that of HMI industrial operator panels or PLCs for asset reliability and optimization, with reduced failure rates, easy maintenance and replacement, advanced industrial certifications, high environmental resistance with conformal coating, high availability with optional battery backups, redundant storage, configurable and noise resistive wide touch screens, and a long lifecycle of their embedded grade CPUs available in the market for up to 15 years.

To make selection and delivery simple despite the numerous options available, Harmony P6 offers an online configurator (Figure 3) with an enlarged line-up for millions of possible configurations (CPUs, memory, storage, operating systems, extensions slots, screen displays, associated software, etc.) linked to a design tool that makes it easy to define complete automation architectures and solutions. Then, fast delivery from regional centers further speeds up the commissioning of such ready-to-use configurations.

Figure 3

The Harmony P6 selector for fast delivery of ready-to-use configurations with dual operating systems for PC-based control (under development).

https://www.se.com/ww/en/product-range/22953172-harmony-p6/

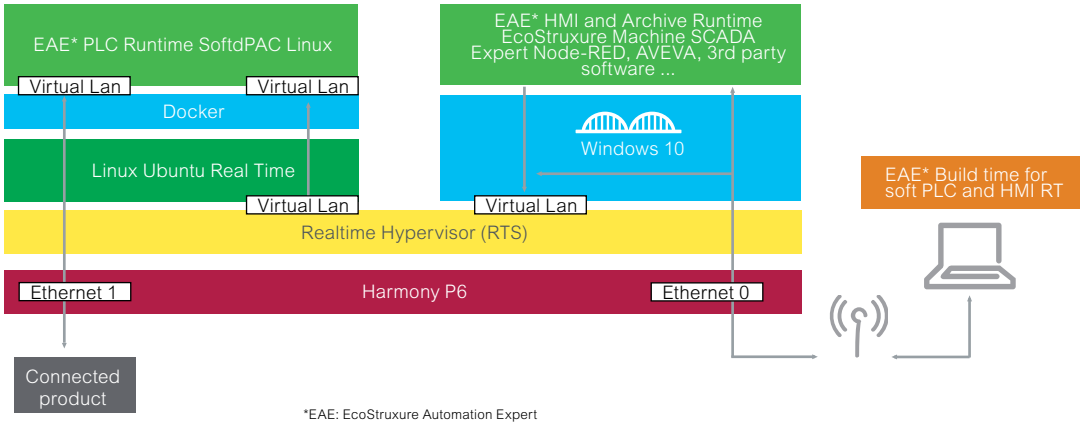


A new category of edge devices is simplifying automation architecture

The Harmony P6 can be delivered ready to use, with a hypervisor managing both real-time Linux and any software on Windows. The soft PLC EcoStruxure Automation Expert Soft dPAC is installed in a docker container on Linux with a real-time patch to control performance of connected devices in the field. A virtual internal LAN (Local Area Network), managed by the hypervisor, ensures communication between the two independent operating systems (Figure 4).

Figure 4

To be available in Harmony P6 Selector, as an additional Operating System option.



Windows can be updated and restarted on is own, without impact on the rest of the configuration. So, the soft PLC can independently manage the remote connected device without interruption. The automation engineer can remotely configure the different runtime software installed on either operating system, from his or her laptop with access to the necessary build time applications that run the project user files.

Likewise, the cybersecurity of each operating system is still managed individually, as it would be in two independent pieces of hardware. Such an edge device is designed and validated according to the ISA/IEC-62443 international cybersecurity standard for industrial automation, including security analyses, threat models and tests, user documentation, and more. This edge device benefits from secure boot and secure operating system settings (passwords, patches, etc.). The hardware encryption of the operating system, storage, passwords etc. is activated with the Trusted Platform Module available as default on the iPC, activated in Windows with the BitLocker feature.

In addition, the hypervisor brings stability and performance to the different software sharing the same hardware CPU. It allows for the fine tuning of the CPU priority allocations, especially between the resource-intensive graphics over Windows and the jitter reduction for the soft PLC control.

This dual operating system and software architecture leverages its performance with the event-driven EcoStruxure Automation Expert Soft dPAC according to IEC61499 (and no more cycling like in traditional control runtime solutions), to manage the distributed automation to more PLCs, drives, or even motion controller hardware if required in the field of the same automation application.

Conclusion

Are you ready to take the next step in your digitization journey by testing out iPC-based edge control with dual operating systems?

The two worlds of automation control with real-time operating systems and IT with Windows are now consistently digitized in a single edge device, simplifying the automation architecture and communication connections. While both are running simultaneously, their unique reaction time constraints, cybersecurity, and maintenance needs are still managed independently.

In such a dual solution, the EcoStruxure Automation Expert Soft dPAC can efficiently run the distributed control application of multi-controller architectures. Associated with other software (HMI, IIoT, AI, or third-party) manual operations for data collection and computing are eliminated, improving agility and performance. It creates opportunities for innovation within the smart factory journey, giving more capabilities to system integrators, machine builders, end users, technology companies, and data scientists to virtualize their know-how and empower the workforce.

Get ready to be an early adopter and discover the benefits. New edge devices with dual operating systems will become the cornerstone of the automation architecture, contributing to the digitization journey in start-up mode and moving to new business models in an agile, ramp-up manner. Numerous control systems are now successfully testing the benefits of this new category of edge devices that brings together control, visualization, and openness in a smart factory. What about yours?

About the authors

Philippe Gelin is the global industrial PC and Edge Box Marketing Manager at Schneider Electric. Based in France, he has more than 30 years of experience in the automation business. He manages the complete lifecycle of automation products (strategic investigations, product development, launches, offer management, etc.). With a background in both automation and business-to-business strategy and marketing, including innovations, he contributes to the adoption of industrial Ethernet and Modbus TPC. He has also produced publications on communities of practice management in the domains of HMI and cybersecurity for control systems and IIoT-enabled devices.

Elder Akpa is the leader of innovation projects in the global HMI business unit at Schneider Electric. He manages several investigative projects through the entire lifecycle defined by the Offer Creation team at the INNOVATE level. He is also in charge of the Techno-watch, offer exploration, and incubation projects at the HMI level. Based in Japan, he joined Schneider Electric in 2018 after earning his PhD in IoT and Ubiquitous Computing Systems.

Toru Terada is a software engineer in R&D of the global HMI business unit at Schneider Electric. With 20 years of experience in HMI, he has worked on several HMI product development and innovation projects, including Techno-watch, offer exploration, and incubation at the HMI level. He is also experienced in system architecture and field bus system design for numerical controllers.

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