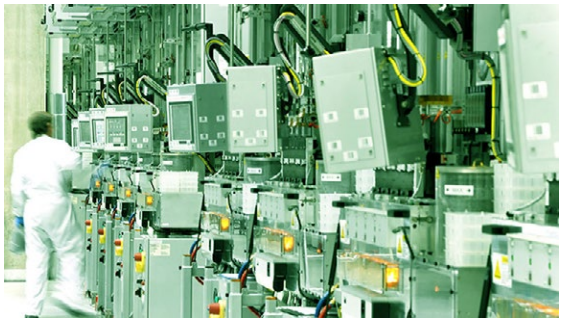
SUPPORTING A SERVICE-ORIENTED APPROACH IN THE IIOT

January 11, 2022

The Industrial Internet of Things (IIoT) continues to grow at pace. It provides real-time visibility of operations across factory floors and supply chains, yielding big gains in efficiency, safety and uptime.

An aggressive growth rate fueled by the COVID-19 pandemic galvanized more machine-to-machine and human-machine digital interactions to maintain staff safety. Analyst firm Meticulous Research forecasts the IIoT market will reach $263.4 billion by 2027 at a CAGR of 16.7% while Grand View Research puts the figure at $1.1 trillion by 2028.

Despite the advantages of connecting industrial machines and tools, and teaming factory data with cloud apps and supply chain systems, barriers to joining the IIoT remain. Bain & Company consultancy reported in 2019: "Predictive maintenance is just one of many use cases that customers have had difficulty integrating into their existing operational technology and IT systems."



The IIoT is a major shift away from SCADA, but it brings huge gains in productivity, serviceability and flexibility as part of your digital transformation.

This article explores how that integration barrier can be overcome through the adoption of Service Oriented Architecture (SOA), microservices and the Open Platform Communication Unified Architecture (OPC UA) standard for industrial automation communication.

IIoT offers visibility, delivers value

Happily, a plethora of third-party apps that extract data from industrial equipment and utilize the cloud are proving the value of the IIoT. One example is an application that collects nitrogen fertilizer concentration, temperature, pressure, drain-liquid level and other data from tanks and sends it to the cloud for analysis, saving farmers contamination cleanup services and government fines. Building equivalent applications in house without IIoT-friendly frameworks and standards would be complex and expensive. Companies would need expertise in embedded software, industrial-communication protocols, IoT cybersecurity and cloud APIs.

Technologies that address system integration, application design and industrial communication are emerging to make the IIoT more attractive. Together, they allow machines to exchange data, and developers to architect applications into pieces of discrete functionality. When paired with a standard interface, the data becomes a service that can be more easily shared. This approach will enable assembly lines to access parts on a just-in-time basis, or trucks to be safely controlled from the cloud, as numerous devices publish everything from their location to their status.

Shareable services herald Industry 4.0

SOA, or service-oriented architecture, was defined in the 1990s. It was conceived to make software components interoperable and reusable via service interfaces. This means the "services" can be more easily used by new products without them understanding exactly how the service is generated. For the IIoT, sensor outputs become services that any device can access. The interfaces used are loosely coupled, meaning it is easier and safer to share services.

This practice has found a new purpose in the IIoT. Thanks to the loose coupling provided by the defined service interface, manufacturers can pick and choose from a variety of software components or services available and team them with their industrial data and machines. This makes it an affordable and low-risk way to innovate and implement smart ways to run plants and processes.

Microservices complement SOA as "an application architectural style and an application-scoped concept," according to IBM. This effectively decouples the components used, which is said to improve scalability by enabling a component to be replicated in a cloud service, in accordance with the workload. And because the microservice only exists while needed, it makes better use of compute resources. Agility is also improved, by allowing developers to include and evaluate new microservices independently without impacting the rest of the system. Furthermore, overall resilience increases because the system isn't dependent on just one instance of a microservice.

A microservice enables the internals of a single application to be broken up into small pieces that can be independently changed, scaled and administered. It doesn't define how applications talk to one another; for that we are back to the enterprise scope of the service interfaces provided by SOA. Together they play a key role in enabling and releasing value in the IIoT.

The third piece of the service-oriented jigsaw that enables participation in and exploitation of the IIoT is the OPC UA standard for machine-to-machine communication in industrial automation. UA stands for Unified Architecture and it was developed by the OPC Foundation to improve cooperation in an industrial environment. It achieves this using an extensible service-oriented architecture that can be embedded into microcontrollers on the factory floor as easily as it can be integrated into cloud-based servers. It brings essential features to a network, such as server identification, data hierarchy and read/write permissions.

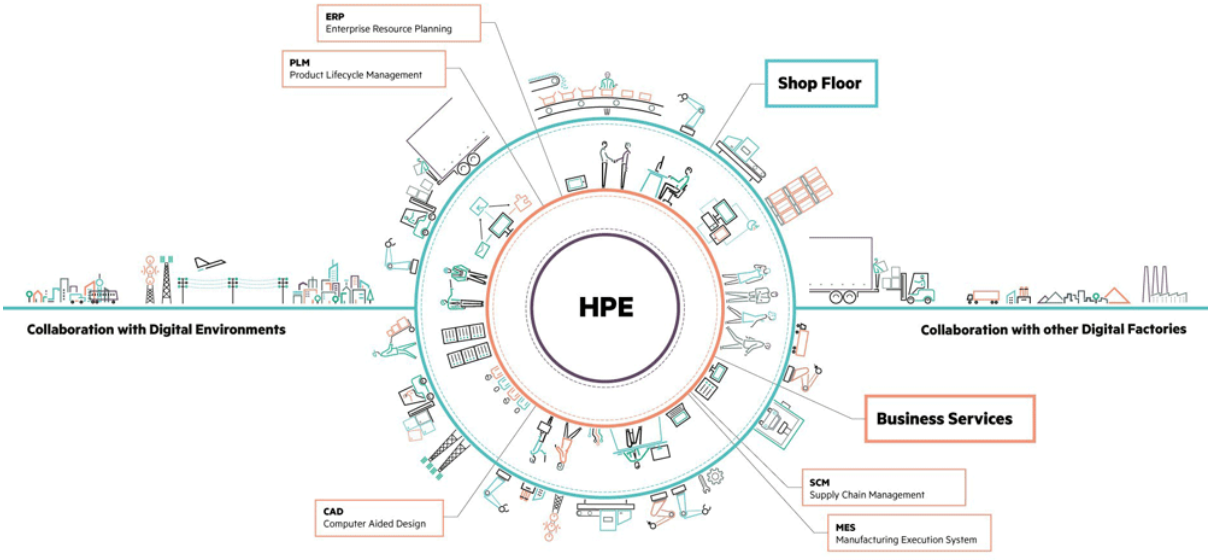
OPC UA uses binary UA and XML formats to secure and exchange messages, and Microsoft's COM and DCOM protocols, as well as the OPC Public Key Infrastructure (PKI). In resource-constrained devices, binary UA is recommended as it needs less compute power.

Die casting is one example of a critical industrial process that could benefit from this development. Normally, proprietary interfaces to peripheral equipment do not allow information exchange between the various manufacturers involved in the cell. Using OPC UA enables fast assembly and commissioning, optimal productivity and quality monitoring, and cell participants to connect to external systems.

OPC UA promises to deliver what the manufacturing automation protocol (Map) dreamed of back in the 1980s, and way more. General Motors designed the Map communication protocol stack to link islands of operational automation on the factory floor. OPC UA reaches higher, enabling manufacturers to plug their operating machinery into the cloud and harness data analytics and machine learning to gain visibility of machinery performance and improve uptime and efficiency.

Cloud picking and factory dashboards

An early demonstration of the value a service-oriented approach to Industry 4.0 came from Hewlett Packard Enterprise Services in conjunction with Fraunhofer. HPE demonstrated its Converged Plant Infrastructure, which included a "Virtual Fort Knox'' app store of cloud-based industrial services and applications. These featured a dashboard to view, fine-tune and optimize distributed factory operations. Another app used algorithms in the cloud to teach designated robots on the factory floor how, where and when to select components, while cloud navigation taught heavy goods vehicles how to self-drive.



Edgeline from Hewlett Packard Enterprise (HPE) is one example of how operations and information can be successfully and productively combined. (Source: HPE) Click for larger view.

SUPPORTING A SERVICE-ORIENTED APPROACH IN THE IIOT

January 11, 2022

Harnessing the cloud and its resident innovative applications and services is critical for manufacturing, which has been a neglected sector. The IIoT, crucially, provides industry players with the capability to connect factory floor sensor data and machinery with products, processes and people, and to scale these up and down as market conditions require. COVID showed that many manufacturers' response to the pandemic was binary; to stay open or shut down. By contrast, a digitized operation powered by native-cloud apps and services enables multiple factories to be optimized, and assembly lines to be scaled up or down according to demand.

Conclusion

Catalyzed by the global pandemic, a trio of service-based architectures for integrating systems, designing applications, and for orchestrating industrial communication are cohering in the IIoT. Manufacturers can join the digital party and, using real-time data, machine learning and data analytics, streamline production, innovate products and unlock value in ways as yet unforeseen.

Avnet
2211 S. 47th Street
Phoenix, AZ 85034
1-800-332-8638
avnet.com