What the digitalization wave means to machine builders

An interview with Dr. Rainer Beudert

Background

Evolving customer needs and industrial digitalization trends have introduced new machine design and building process changes. The marketplace need for “smart” machines has rendered the traditional machine design process inefficient and design time and cost have increased as a result. This intensifies the pressure on machine builders to profitably deliver machines with that contribute to improved Overall Equipment Effectiveness (OEE), increased safety and reduced operating cost.

Q&A session

We sat down with Dr. Beudert to catch up on the fast-moving digitalization trend and to find out how his company, Schneider Electric, is responding. The company recently announced an industrial architecture dubbed “EcoStruxure Machine,” and we wanted to find out how the working lives of machine builders will be affected.

How does the digitalization trend impact the competitiveness of a machine builder?

In the digital context era of today, the more innovative the machine builder, the better his position in the market. The advent of smart machines is enabling machine builders to innovate in ways that were never before possible. The concept “smart machine” implies a machine that is better connected, more flexible, more efficient and safe.

In layman's terms what is EcoStruxure Machine?

EcoStruxure Machine is a three-layer architecture that harmonizes connected products, edge control and apps, analytics & services. These layers are integrated to facilitate applications such as Augmented Reality (AR) through connectivity and mobility, cloud analytics, and cybersecurity. EcoStruxure Machine can be delivered to end users through reference designs, pre-configured solutions, and prefabricated solutions. It can be configured as an entire plant or it can start out as an individual infrastructure product.

Let's digest some of what you just said. What do you mean by a "connected product" and why is that important?

Two trends are driving towards enhanced connectivity of technologies and applications. On a macro level we are seeing a standardization on Ethernet-based protocols as the networking standard of choice. This means that the vast majority of industrial devices will now speak the same connectivity "language". For example, at Schneider Electric most of our hardware devices provide Ethernet communications. Examples include the Modicon family of logic and motion controllers, the LXM drives and the Altivar family of variable speed drives.

In addition, cloud computing and the Industrial Internet of Things (IIoT) are creating an environment where more openness is equating to higher efficiency. As a result, systems that have traditionally been excluded from the sphere of communication can now be cost-effectively provided with the necessary intelligence to both gather and forward data.

The technical effort now required to extract information from a dedicated device to an information recipient such as the cloud or a maintenance technician is minimal. In the past, to execute the same task was complex, expensive and time consuming. The proliferation of "connected products" means more data is generated. Now, as part of the digitalization full picture, that data can be cost-effectively and quickly analyzed via software algorithms. In the end, this "one/two punch" of more data and enhanced analytics helps to greatly enhance overall machine builder productivity and performance.

You mentioned an "edge control" component to EcoStruxure Machine. Why is that relevant to the machine builder?

Not every smart machine will always be connected to the cloud. In some cases, broadband limits mean that considerable latency will be experienced when sending and receiving data to and from the cloud. Such latency is unacceptable in cases where machines run on very short cycle times. Therefore, buffering mechanisms that store and aggregate data locally at the edge level can help address this latency problem. Machine builders need to understand these concepts and to begin configuring intelligent aggregators that can store such data thereby enabling their end user customers to optimize the efficiency of their operations.

Imagine you are generating a huge amount of data from your machines and you want to measure the amount of friction being generated between moving parts and the impact of that friction on overall machine speed. If you collect the data every second you quickly capture

1 gigabyte of friction-related data that would need to be sent to the cloud and analyzed.

It makes much more sense to collect the data via a local measurement, establishing minimum and maximum friction thresholds. Therefore, data and only valuable data are sent up to the cloud when it's necessary. This is what is meant by edge aggregation of data. Such an environment helps to achieve the goal of sending the minimum, maximum and average friction data of the machine parts in question over the last hour, day, or week depending upon the business requirement. Then analysis can be performed over a defined period of time.

In order to perform such data collection, aggregation and analysis, core devices require the intelligence and communications capabilities to make it happen. Schneider Electric's intelligent PLCs (devices like the Modicon M251, M241 and LMC, for example), connect to databases via tools like SQL connector and provide the appropriate interfaces to other systems that are capable of storing data via OPC Unified Architecture (UA), MQTT, Ethernet and other mainstream standards.

Earlier you mentioned the concept of enhanced data analytics. How are machine builders involved in this aspect of industrial digitalization?

Machine builders might no longer have to rely only on selling functional machines at an aggressive price to compete. In this newly digitalized world, gaining market share will require a more intensive analysis of customer machine data. This both helps to enhance the customer's operational productivity and allows the machine builder to sell the customer a new service. In fact, proven business models have flourished where machines are not sold but are provided as a service (Machine-as-a-Service). End users lease the machine at a nominal cost and outsource the technical responsibility. They compensate the machine expert with either a low regular payment or a pay per use to the provider of the machine analysis service. The Xerox corporation deployed this successful service model for 60 years as they managed most copiers in the vast majority of commercial office buildings.

Since digitalization is now opening up much more connectivity between machines, doesn't this increase the potential for cybersecurity threats? How should a machine builder respond to this issue?

Yes, the mere fact that the volume of connection points is increasing means that the cybersecurity threat is rising. Digitization and cybersecurity are 100% linked, therefore one should not move forward without the other. It's up to each organization in the industry – technology suppliers like Schneider Electric, machine builders, and manufacturing plant end users – to understand where vulnerabilities lie within each of their areas of responsibility along the value chain. Vendors contributing new technologies should offer IIoT compliant architectures (like EcoStruxure Machine) that incorporate end-to-end cybersecurity at the product, edge control, apps, analytics, and services layers.

Machine builders need to make sure that the components they obtain from suppliers have undergone a Secure Development Life Cycle (SDL) process. Within the context of SDL, secure architecture reviews are performed,

threat modeling of the conceptual security design takes place, secure coding rules are followed, specialized tools are utilized to analyze code, and security testing of the product is performed. These actions help to 'harden' products, making them more resilient against cyberattacks. In this way, as new products replace old, entire systems evolve to become more cyber secure.

At Schneider Electric, new devices also undergo a security certification process that conforms to the new Achilles Level certification standard. The cybersecurity and physical robustness of the devices like our PLCs is tested. In addition, tools such as Secure Boot and firmware signing are features getting added to our new devices.

How does an architecture like EcoStruxure Machine directly benefit a machine builder?

Consider the three critical phases of a machine's life cycle: design and engineering, commissioning and operation, and maintenance and service. In each of these areas, digitalization, and a corresponding platform architecture such as EcoStruxure Machine, can play a profound role in both reducing machine builder internal costs and in creating new revenue streams.

In the design and engineering phases, for example, collaborative engineering software tools enable simulation of how parts will work in the machine *prior* to assembly of that machine. This allows testing on a virtual machine first before the actual machine is assembled. Engineering efficiency also improves through automated code analysis, code generation and testing. Such automated engineering and simulation capabilities can reduce time-to-market by up to 30%. These concepts are designed into the Schneider Electric EcoStruxure Machine Expert engineering environment (as an extension of the popular SoMachine engineering tool). This software solution allows the machine builder to develop, configure, and commission the entire machine, system or even factory in a single software environment, including logic, motion control, HMI, and related network automation functions. Predefined templates save engineering time by applying complete pre-built libraries and even new machine modules.

EcoStruxure Machine Expert supports edge control functions through a rich portfolio of the Modicon PLC product families (e.g. M241, M251, LMC and many others). Connectivity is enhanced through easy integration within OPC UA server, MQTT, and SQL connector environments.

During the commissioning and operations phases, digitized machines, once delivered, have to be integrated into the manufacturing line on the operations technology (OT) level as well as into the information technology (IT) environment. As networks and systems converge, communications protocols need

to be compatible. If not, data will remain isolated and real-time sharing of information with key stakeholders will be made impossible. The integration of IT and OT networks and systems is critical to achieving the benefits of smart manufacturing (i.e., reduced downtime, lower energy consumption, operator safety, preventative maintenance and manufacturing flexibility). End users and machine builders also have to consider how the smart machines will integrate beyond the factory floor and into the wider organization and supply chain. This is where the breakthroughs of digitized technologies can begin generating exponential productivity benefits.

Tools like EcoStruxure Machine Expert contribute to this overall process by supporting important machine implementation phases such as commissioning through mobile technology and IT integration, and adherence to widely accepted standards like PackML. These new tools can improve the speed of machine integration and the efficiency of operation by up to 40%.

In the maintenance and service phase, advanced monitoring of customer machine assets enables predictive maintenance and the resolution of issues before any unanticipated downtime occurs. Products like the Schneider Electric EcoStruxure Machine Advisor enable machine builders to branch out into the area of digital services by allowing remote tracking, monitoring and fixing of machines in the field. This greatly facilitates maintenance operations and significantly reduces support costs. In addition, tools such as the Schneider Electric EcoStruxure Augmented Operator Advisor help field technicians with graphical step-by-step maintenance procedures that present themselves on a tablet or smart phone, and with remote experts that leverage augmented reality to guide on-site "over the shoulder" maintenance work when required. Together, these digitized support tools can reduce the time for corrective actions by up to 50%.

Machine builders have much to look forward to in this new world of digitalization.

Dr. Rainer Beudert is currently Director of Automation System and Software Marketing within the Schneider Electric Automation Industry Business. Dr. Beudert has consulted on the topic of industrial Ethernet networks for companies like Arcelormittal, Audi and BMW and published several articles about Ethernet TCP/IP in German automation media (Elektro Automation and others). He has contributed to various standardization committees and is a member of ODVA – CoChairman of SIG Machinery and member of OMAC Working Group Pack Safety/Pack Connect, the OPC foundation and the "Kompetenzzentrum Industrie 4.0" of TU Munich.

schneider-electric.com

© 2018 Schneider Electric. All Rights Reserved. Life Is On Schneider Electric is a trademark and the property of Schneider Electric SE, its subsidiaries and affiliated companies.
998-20251701_GMA-US

Life Is On Schneider Electric