SPOTLIGHT *series*

The Critical Case for the Intelligent Edge

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In an era where the term IoT (Internet of Things) is basically an umbrella that encompasses everything that is/can be connected to the network, what is missing? When it comes to real-world manufacturing, something extremely meaningful: the ability to perform real-time, deterministic operations on that IoT device to produce a given result. Deterministic processing is an absolute necessity, and to ensure it, we need to embrace the intelligent edge.

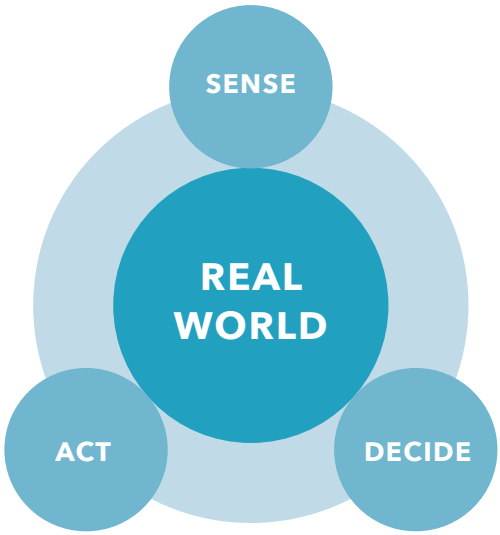
KINGSTAR

The Unconnected: Every Device Is An Island

Not long ago, especially in industrial automation and manufacturing, the production floor was a veritable Fort Knox. We fought the system activation battle on an almost daily basis as systems were essentially in fully secure areas and not able to be connected, even for short controlled times, to activate software. Today, while production areas have not been completely opened up, the transformation has been nothing short of phenomenal. Modern systems are not only connected to each other and internal management systems but to the cloud as well.

Logically, as depicted in the image below, there were largely independent systems that sensed their environment, did some processing on that information in conjunction with its purpose, and then took some action to change the world, i.e. adjust the motion of an axis or set an output.

These systems generally required no external communications to execute their purpose; they were islands. Now everyone wants their systems connected to embrace the real or perceived value of the cloud. It seems the waters of isolation have started to recede and the islands have become peninsulas.



Edge Computing Takes Hold

Once the initial hype of the Internet of Things calmed down, people began to realize that it's not all about the cloud. You still need the devices that interact with the real world to do actual work and supply the information needed to the cloud for doing analytics. There is nothing new and special here. These are the devices and systems we are all used to dealing with in industrial automation and manufacturing.

What is new is the type of information that is being collected and shared with the new cloud-based expert systems. The use of analytics data pushed back to the edge device for consumption and use in the process itself is new and noteworthy as well. To stick with the geography analogy, the peninsula now has a two-way highway. Data flows in both directions and is used on both ends, versus previous scenarios where process data was communicated to server systems for either auditing-only efforts or out-of-band processing.

The Transition to the Intelligent Edge

Over the past 3 – 4 years, we have almost come full circle in how we think about IoT, especially as it relates to industrial automation and manufacturing.

In the early days of cloud adoption, it was all the rage to talk about the IoT device simply being a conduit to the cloud, where all the magic would happen. In the more recent past (1-2 years), folks started to come back to their senses, realizing that these so-called IoT devices still had a significant amount of processing power which could be used. But a new term was needed to rebrand the power of local processing while still hyping the power of cloud computing. There needed to be a story that stretched from the real-world to the cloud and back.

And so the term "edge computing" was coined: basically a fun new term for something we had already been doing for years.

Enter the Critical Edge

What is the "Critical Edge"? In a nutshell, it refers to the ability of the aforementioned Intelligent Edge to perform deterministic processing in addition to all the other capabilities that made it intelligent in the first place.

Today's systems have so much processing power, they are capable of doing many different functions in a manner that allows for a high amount of capability integration onto a single system platform. This is extremely powerful in its own right, as a developer can start with a system that he/she knows is capable of achieving the performance required while squeezing as much out of the system as possible. This allows for the performance per cost ratio to increase dramatically; the proverbial more-bang-for-the-buck. And who doesn't like that?

Real-time processing and local analytics can operate on the same edge system that is not only connected to the cloud but is capable of independent processing as required. For example, the edge device can do enough intermediate analytics and storage to operate through a loss of connection to the cloud. Once communication is re-established, the local cloud and cloud are re-synched and operations continue all without any interruption to the process.

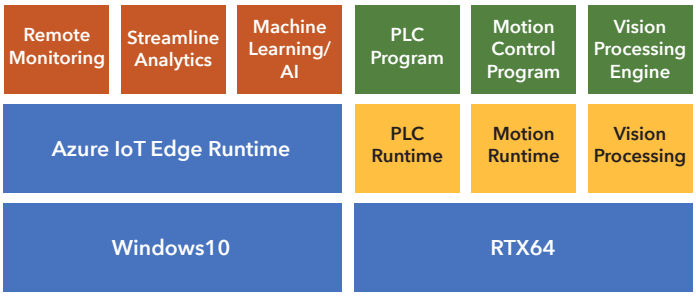
How It Changes the World (Beyond Analytics)

The ability to do real-time applications on a machine that can perform a multitude of different capabilities is on the horizon. Imagine a machine that has the hardware to be a 2D router, a 2D plasma cutter, and/or a laser, all of which have different control requirements. A single system that can get its personality downloaded to it is extremely powerful.

Now imagine a central control system that is connected to all these distinct machines and can be reconfigured on the fly to control one or more of them depending on its capabilities. This is a true world model where IT (information technologies) and OT (operational technologies) work in a valuable, symbiotic way to achieve synergies that haven't really existed until now.

The machines' underlying real-time applications (PLC, motion control, vision) can be downloaded to update the system at any time, ensuring that a machine's firmware (if you will) is always the most current. Once that is done and the system software is in an operational state, the actual programs that define the personality of the system (CNC router, plasma cutter, laser, etc.) are then downloaded to the system. Finally, once the system has a given personality, the actual production programs (part programs, conveyor loaders, etc.) are downloaded to tell the system what it will be producing and what to do with the part when complete. The production with this configuration continues until the next schedule change is required.

The level of software that is downloaded to define the system is shown in the following graphic.



In this case, the system is built on Microsoft technologies and IntervalZero's RTX64 real-time extension. It is a huge advantage as shown here, as Microsoft provides all the tools and runtimes needed to connect the system to the Azure IoT Hub in the cloud, as well as the IoT Edge runtime for the Edge device. On the critical side, IntervalZero supplies the RTOS and the KINGSTAR runtime for PLC, motion, etc. The maintenance implications of this model are tremendous. What if the machine that is described above doesn't have to be specifically designed? Imagine that the three layers of downloads could work on any Windows 10 machine with a baseline of functionality.

This would be huge for support and maintenance. If there is any failure of the system at all, you can simply swap it out with another Windows 10 machine that has at least the baseline of features and a real-time extension such as IntervalZero RTX64. The rest of the system's software and configuration can be updated from the cloud and off you go. No longer would there be a need for specific hardware to be designed and inventoried, and maintenance support personnel will no longer need to have specific knowledge of the computer systems and software in order to resolve the problem. This can seriously reduce the cost of hardware as well as personnel training.

Conclusion

The last few years have brought a significant shift toward a mixed solution of cloud and edge devices for the manufacturing and automation centers. These technologies are starting to gain steam and causing an acceleration in the capabilities of systems to not only generate data for insights, but use those insights within the process control loop on the edge.

We are potentially moving to a day when the actual PC system hardware becomes a commodity. In this scenario, the software and communications become extremely valuable and much more robust. As we move closer to this world, the tools will be absolutely critical to building these solutions, which will become more complex and powerful than we can even imagine. The hybrid combination of cloud intelligence and the intelligent edge is on the horizon, and with this synergy, one plus one may actually add up to more than two.