What to Consider When Starting Your Industrial Internet of Things Journey

By Keith Blodorn
ProSoft Technology

Do you consider yourself an Internet of Things Engineer? You should! Think about what the Internet of Things really means. According to Wikipedia, the Internet of Things "is the network of physical objects or 'things' embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the manufacturer, operator and/or other connected devices..."[1]   As an automation industry veteran, that sounds really familiar. We have been connecting intelligent devices to control networks for decades. We're pioneers!

So, then, what's all the fuss about? Looking through automation-oriented magazines and websites, the Internet of Things seems to be all anyone talks about. In the industrial world people call it the "Industrial Internet of Things" or "Industry 4.0" or any number of other names. But fundamentally, what is so different between this new-fangled buzzword and connecting a motor overload relay to a plant communications network like we were doing twenty years ago?

On one hand, these are basically the same idea. The Industrial Internet of Things (IIoT) is about intelligent devices like overloads, photo eyes, variable frequency drives, or PLCs providing data that we use to make our processes more efficient. IIoT is a name for a trend that has been going on in manufacturing and process control for years – remember "shop floor to top floor"? In fact, U.S. manufacturing productivity has increased 225 percent since 1972,[2] thanks in large part to advances in automation technology. More data from more intelligent sensors allows us to design machines that run faster, with less waste. Analysis of process data from those machines lets us find waste points, and eliminate them. IIoT is about gathering more data from more intelligent things, and using powerful analytical tools to find and eliminate waste.

On the other hand, the technology behind the IIoT represents a shift in the use and scale of Internet technologies in automation. The Internet age is built on interoperability, and the value of many different systems being able to work together. The Internet has enabled incredible new business models that have driven tremendous economic growth. According to the Boston Consulting Group, "if it were a national economy, the Internet economy would rank in the world's top five... ahead of Germany"[3]! The Internet impacts virtually every aspect of modern life, including the way we make

---

[1] https://en.wikipedia.org/wiki/Internet_of_Things

[2] http://mercatus.org/publication/us-manufacturing-output-vs-jobs-1975

[3] https://www.bcg.com/documents/file100409.pdf

products. The technologies behind the Internet's interoperability are key to IIoT and its promise of tremendous new ways to improve our processes.

Let's look at some of the ways old-school automation engineers are making use of IIoT concepts to improve their operations, and what considerations all of us should keep in mind.

Remote Monitoring and Equipment Access

I know, we've been connecting to PLCs remotely for as long as most of us can remember! In the old days, remote access meant installing a serial modem connected to a dedicated phone line, so the machines we made remote access-capable were limited to the most critical operations. The links were only for remote troubleshooting, and typically could only be accessed by a small number of people who knew the routine for connecting to the modem. Some installations would use the modem link to transfer data, but typically at very low speeds and only periodically. We really had to carefully consider what data was important enough to transmit, since our communications link was expensive and its capacity was limited.

What's changed in the IIoT world is the proliferation of wireless connectivity, especially cellular networks and wireless LAN. By some estimates, 85 percent of the world's population will be covered by high-speed cellular data networks by 2017[4]. This has had several effects that change how we should approach remote access and equipment monitoring. First, it's becoming feasible to gather a LOT more data from remote machines. Since 2008, the average cost per MB of cellular data has dropped 98 percent, from $0.46 per MB to just $0.01 per MB[5]. Now, all that data that we used to deem not important enough to transmit can be made available from our remote sites. Already, we see new data analytics tools becoming available to turn that previously discarded operational data into process-improving gold nuggets of knowledge.

Second, accessing the equipment and the data no longer needs to be limited to the domain of HyperTerminal-wielding geeks. As consumer demand has driven rapid development of Internet-based user interfaces, these same technologies are making remote access to industrial equipment, and especially to process data, more accessible for more people throughout the organization. We may not want more people monkeying around in our PLC code, but giving the quality engineers easy access to production data helps them identify more opportunities to streamline production and eliminate errors.

Finally, machine builders and control engineers responsible for widely dispersed global operations can build reliable connectivity into their systems without the need for custom infrastructure and integration at the end site. Cellular technology that works on networks worldwide allows these

---

[4] https://mobiforge.com/research-analysis/global-mobile-statistics-2014-part-b-mobile-web-mobile-broadband-penetration-3g4g-subscribers-and-ne

[5] https://mobiforge.com/research-analysis/global-mobile-statistics-2014-part-b-mobile-web-mobile-broadband-penetration-3g4g-subscribers-and-ne#unlimiteddata

engineers to design their system around a standard remote connection, and reasonably expect that connection to work wherever the machine ends up. For mobile equipment, access is available just about anywhere the equipment goes. This simplifies the design and maintenance of the system, and enables the machine OEM to build high-value applications that make use of an "always connected" machine.

Machine and Process Control

IIoT technology is not just about cellular connections to remote machines. We are seeing new networking approaches to the old requirements of connecting sensors, operator interfaces, controllers and ERP systems that take advantage of the networking technology of today's Internet. Major automation vendors like Rockwell Automation® and Schneider Electric® have been offering industrial Ethernet connectivity for PLCs and related devices for more than a decade. Industrial Ethernet protocols like ODVA's EtherNet/IPTM provide the kind of performance required for automation systems, while also enabling interoperability with the massive Internet Protocol-based network infrastructure found in virtually every organization. This means that automation engineers can have the best of both worlds – high-performance networks for connecting the automation control components, and a global infrastructure that enables many other applications to easily integrate with important process data. There are many applications that benefit from this convergence.

In many industrial applications, moving equipment presents a major challenge for communication to the sensors, actuators, and controls on that equipment. Many products exist to try to solve this problem, from slip rings to flexible cable trays to festoons.

However, these hard-wired solutions add cost and complexity while increasing the maintenance requirements for the machine. Meanwhile, we roam around our offices and homes with continuous connection to the Internet – no festoons in sight! Today's automation engineers are taking advantage of the Internet Protocol-based industrial technologies to design more reliable networks for moving equipment. Wireless LAN products
designed for the harsh industrial environment and optimized to handle protocols like EtherNet/IP allow engineers to eliminate the cost and downtime of frayed cables, yet still take advantage of high data rates and application-specific requirements like machine safety and time synchronization.

Asset Mobility

One area of automation where IIoT technology is creating new opportunities involves taking the network connection anywhere in the plant. Old systems offered only so many places to "plug in." Operators had to run the machine from one place – the operator panel. Maintenance had to jot down measurements and observations to enter into the maintenance management system when they got back to the shop. Control engineers could only program PLCs by plugging into the PLC, or to the PLC's physical network through a proprietary adapter.

In a world where I can set my home thermostat while walking through an airport, we don't have to

live like this! Automation systems are now benefiting from the same "network everywhere" mindset as our home and office environment. Using industrial hotspots, control engineers can connect to the automation system easily from anywhere in the plant. The same wireless network allows maintenance applications running on smart phones or tablets to access and update equipment records, capture and store photos, and even help maintenance technicians troubleshoot machines. Operators and supervisors can view the status of a machine from anywhere, and even control the machine.

Things to Consider

The Industrial Internet of Things opens up some interesting new possibilities for automation, so you should begin planning how you can get your system "IIoT Ready." The good news is that you likely have many pieces in place already – intelligent field devices, industrial networks, perhaps even some Internet Protocol-based infrastructure. Here is some food for thought as you consider how your system can fit into this new world of connected machines.

•   **Network Migration –** While many of your field devices are likely already on a network, it is probably not an Internet Protocol-based network. Not to worry! As you see the need to move device data up to higher-level systems, you won't need to scrap that tried-and-true device network. Gateway devices and in-rack protocol interfaces in your controller allow you to easily connect those older networks to the IP-based applications that need that device data. Serving up data from smart devices adds value to your operation, but it doesn't necessarily require changing everything that is already there.

•   **Cybersecurity –** While the interoperability of the IIoT brings great benefits, it also opens up new risks that we need to address. In reality, many automation systems are already "connected," so cybersecurity should already be on your mind. It is important to understand what equipment can be accessed by whom, what connections are necessary and not necessary, and how data that's transmitted outside the boundaries of your organization's network is protected. For example, a cellular modem that provides remote access to equipment should be set up to authenticate users through a RADIUS server, provide access to only specific devices for specific operations (by disabling unused network ports), and support secure data exchange methods like IPSec and Virtual Private Networks. In short, your IIoT deployment plan should fit in with your company's Defense in Depth security strategy. While these steps won't protect the system from every possible attack, they will make things far more difficult for any nefarious actors.

•   **Effective Energy Management –** A great place to start your IIoT journey is effective energy management. Energy costs such as electricity, compressed air, natural gas, water, and steam are no longer considered overhead. Corporate sustainability objectives in many companies are requiring that energy costs be properly allocated by department, process, or facility. Typical savings when energy costs are optimized can be 5 percent to 15 percent. Some stats to consider: Ten percent of all electricity is consumed to create compressed air, and 30 percent of all compressed air generated is never used due to waste and leakage. But the boilers, power meters, chillers, and air handlers all speak proprietary protocols such as BACnet®, Metasys® N2 and LonWorks®. Think of the savings to your production line if you could move the data collected by these networks into your PLC, where it

could be analyzed and optimized.

• **Design Connectivity In –** Network connectivity through cellular, WLAN, or wired Ethernet should be designed into your system when you can. IIoT applications will continue to evolve and grow in the value they can deliver, so it makes sense to build Internet Protocol into your systems even if you're not using IP-based networks for control. The data in the machine has value, and you (or your customer) will want to tap into that value sooner or later. Consider how wireless technologies can layer on top of your current network, or perhaps replace an older networking technology.

• **Start Small –** Vendors everywhere have grand visions for what the IIoT can do for manufacturers. But remember, you don't need to dive in head first to get benefits from IIoT. Look for applications in your industry that make sense, and give them a try. One of the best parts of the IIoT concept is its scalability – Internet-based applications can just as easily serve one deployment as one million. Pick an interesting application, and run a pilot in a small area. There's no better way to learn about a new technology than by giving it a go.

• **Get Help –** Most importantly, work with vendors you can trust. When it comes to industrial networking, ProSoft Technology® has been helping engineers get different equipment all talking the same language for more than 25 years. We can help you navigate your IIoT course, from connecting older Modbus® and PROFIBUS® networks to enabling remote equipment connectivity via cellular networks. When you're ready to start the next phase of your IIoT journey, we're here to help make it happen!

Keith Blodorn is a Director of Program Management at ProSoft Technology. He has worked in the Industrial Automation industry for more than 20 years.