Life Is On | Schneider Electric

Value-Focused Industrial Internet of Things – Just a Hype or a Real Business Value?

by Peter Martin
Vice President, Innovation and Marketing
Process Automation
Schneider Electric

Executive summary

There has been significant hype and discussion with respect to the Industrial Internet of Things (IIoT). Understanding the potential value from IIoT does require a basic understanding of the underpinning technologies. After a short discussion of the technological areas, our focus will shift to the incremental value that can be unleashed for industrial enterprises.

Almost every conference and journal is filled with articles and references to IIoT, focused on such technical issues as connectivity, mobility, cloud-based computing, big data analytics, and open networking. There is so much focus on the *technology* underpinning IIoT that some industrial professionals are starting to wonder if there may be any business value.

The truth is that there is a considerable amount of discussion on technologies without the perspective of what value those technologies may provide. But it would be a huge mistake not to investigate the true value potential of the technologies underpinning IIoT that may be able to drive for industrial operations. In fact, the value potential enabled by IIoT technologies is so significant that some regard the current period in the evolution of industry as industry's fourth industrial revolution. If industrial companies approach this new era from the perspective of unleashing incremental value from industrial operations and businesses, the results can be revolutionary.

Understanding the potential value from IIoT requires a basic understanding of the underpinning technologies. There are five common technological areas discussed as part of IIoT: Connectivity, mobility, cloud computing, analytics, and cyber security. After a short discussion of each of these, our focus will shift to the incremental value that can be unleashed for industrial enterprises.

Connectivity

Perhaps the most frequently discussed characteristic of IIoT is connectivity. Technology has evolved to the point at which almost any intelligent object can connect with any other. It is important to note, though, that for two objects to connect there must be at least a minimal level of intelligence in both since connectivity is predicated on intelligence. Therefore, the prerequisite to connectivity is intelligence. In the case of industrial operations, the objects that need to interconnect, and thereby to be intelligent, are the industrial assets, such as pumps, mixers, and evaporators.

The key to understanding the value of IIoT is how today's non-intelligent asset can become an intelligent asset and what the intelligence in those assets can accomplish that is not being accomplished currently. Making a non-intelligent industrial asset intelligent involves adding computer-based intelligent components to the asset that have the ability to measure and control the operation of the asset through sensors and actuators. These intelligent packages are commonly referred to as cyber-physical systems (CPS).

The basic intelligence in a CPS associated with an industrial asset provides the ability for that asset to connect with other industrial assets. It is important to note that making an asset intelligent and connecting two assets together add no value unless the intelligence and connectivity lead to incremental value-adding functionality. Making assets intelligent not only enables connectivity, but also provides the opportunity to do new and different functions in the asset. This will be discussed in more detail in a later section.

Mobility

The advancements in digital technologies that have increased the communication and interaction between humans and intelligent systems have grown as fast as any area of digital technology over the past decade. Today, humans are more connected than ever before. Additionally, humans can interact with industrial operations through automation technologies in incredibly flexible ways. Operators no longer need to be in control rooms, in plant or even in the same country to effectively connect with automation systems. With the advent of CPS technology, operators, maintenance professionals, and engineers will be able to access any industrial asset from anywhere in the world. This provides a degree of personnel *mobility that was* previously never available.

There is another aspect of mobility that is gaining importance. A number of industrial assets, such as trucks, earth movers, and trains, are naturally mobile as they perform their work. The expansion in technology that enables effective personnel mobility can also be utilized to support mobility of these industrial assets.

Once again, as with connectivity, mobility by itself may not drive the incremental value for industrial operations. But mobility can be an important enabling capability of an overall value-focused production plan.

Cloud Computing

Cloud computing involves using remoter servers hosted on the internet to store, manage, and process data. The appeal of cloud computing is that the data and applications do not need to be maintained on local servers. This can reduce the level of expertise required at each local server making it simpler to manage data and applications and can reduce the number of required subject matter experts. Cloud servers may be hosted on the industrial site, remotely within the industrial company, or in third-party facilities depending on the degree of security and services required. Some suppliers offer services and applications in the cloud to supplement what is being done locally. This can help expand the functionality provided by a system in a cost-effective manner. There is great potential in cloud computing, but serious consideration needs to be invested to determine what should be done locally and what can be done in the cloud for industrial companies as well as what additional functionality could be implemented to drive business value.

Analytics

Analytics involves the systematic analysis of data and is sometimes used to refer to the output of such analysis. With IIoT the amount of data being made available is becoming massive. As a result, the discussion related to IIoT analytics is often referred to as Big Data Analytics. But it is important to realize that there is value in analytics regardless of the amount of data involved. In fact, some very valuable small data analytical approaches can be done locally while the slower, big data analytics are done in the cloud.

As the amount of available data started to increase, the natural question was whether analysis of all this data might be able to provide new insights into manufacturing and production operations. The discussion on Big Data Analytics is largely associated with the massive amounts of data available through cloud computing.

Although only the four most common technological categories associated with IIoT have been discussed, there are a number of additional emerging computer-based technologies that provide additional technological opportunities. The size and power requirements for computers continues to decline at a remarkable pace while the computing power, speed, and memory capacity continue to increase. The net result is that the technology underpinning IIoT is providing the opportunity to rethink the ways in which industrial automation has been approached.

DCS and PLC technologies have been in the marketplace for over 40 years with very limited substantive change. Most of the technological constraints that limited the design options of traditional automation systems are gone. Today, automation system designers can imagine what the ideal system should be in an ideal world. IIoT-based technology is enabling them to approach the ideal design. The real challenge is in imagining what additional business value these emerging systems may provide and designing them in a manner in which attaining that value is possible and even likely.

Cyber security

Cyber security is the protection of computer systems, software, and data from theft, damage, and disruption. Cyber security of industrial systems has been an issue well before the emergence of IIoT. But the expansion of open networking, intelligence, and connectivity resulting from the IIoT has combined to make cyber security even more critical than it had been. In fact, it is foolhardy to consider moving toward IIoT-based solutions without having a comprehensive cyber security strategy in place. Any benefits derived from an IIoT approach can be completely reversed without a well thought out and executed cyber security approach. It is difficult to overstate this requirement for industrial operations. It is best to think of cyber security as a prerequisite for moving toward IIoT.

Creating Value through the IIoT

The technological changes associated with the IIoT are providing unprecedented opportunities to consider how automation solutions can be redesigned to provide incremental levels of business value for industrial companies. Incremental value is based on incremental functionality provided by IIoT-based systems since value comes from functionality.

The incremental functionality associated with IIoT-based automation systems can be partitioned into two general categories: extended real-time control and extended analytical functions at transactional management levels. Real-time functions are those that must be executed within the time constant requirements of the process under control, whether a production process or a business process. On the other hand, transactional functions are those that can be executed on human schedules (daily, weekly, monthly etc.) and still be effective.

As the speed of industrial businesses have continually increased over the last decade, a realization has arisen that some functions that used to be effectively operated on a transactional management schedule, perhaps monthly, need to shift to real-time control operation to realize effective results. For example, energy cost control used to be a monthly activity since the price of most energy sources did not change but once every six to 12 months. With the deregulation of electrical and other energy grids, the price an industrial company pays per unit of energy consumed may change every few minutes. Trying to manage energy cost with monthly data in these instances is impossible. What is required is real-time control of these traditional business variables. This is introducing a new challenge to industrial businesses that IIoT technology is ideal to resolve.

At the control level, traditional process and logic control has been primarily utilized to improve the efficiency of industrial operations. Improving efficiency is necessary, but not sufficient in the current high-speed industrial business environment. What is required is extending the objective for real-time control beyond efficiency improvement to include reliability risk, safety risk, environmental risk, security risk, and profitability control. IIoT-based systems has the ability to deliver this control functionality cost effectively to each asset in an industrial operation, the control of each asset can be extended to all five of these control domains. This will essentially convert the assets in industrial plants from non-intelligent industrial assets to autonomous, self-optimizing assets. Since the base equipment assets combine into process units, process areas, and plants, each of these combinations can be thought of as a complex asset set and also be made to operate in an autonomous and optimal manner. This is similar to what is being done with self-operating automobiles today. If an automobile operating on an open highway system can be made to run autonomously, industrial assets, such as compressors, motors, pumps and evaporators should be able to run as well. All that is required is the effective application of real-time control. The extended real-time control can be a combination of feedback or predictive control. The advent of IIoT-based approaches, such as digital twins, enables effective predictive control for extended domains, such as profitability. The control strategy resulting from this extended real-time control approach can be thought of as an asset performance control strategy, since the performance of each asset is being controlled to make the assets autonomous.

The second opportunity for significant value improvement from IIoT-based automation systems is extended analytical functionality. The real opportunity is with the emerging large data sets made available through cloud computing approaches, vast quantities of data about industrial operations are being made available to the cloud providing a data perspective of industrial operations that has never been available before. The data is so vast and varied that new analytical techniques are required to time-effectively analyze

the data, identify patterns and relationships and make recommendations on how to better operate plants and enterprises. These new big data analytic engines are emerging based on new approaches to data science and analytical devices. Applications such as prognostics are emerging that will enable new insights on the operations of industrial assets enabling new management strategies for those assets. The strategies at this level of analytics can be referred to as asset performance management strategies.

A two level approach to the utilization of IIoT-based technologies will enable maximum value to be driven from industrial assets. Developing effective asset performance control strategies under asset performance management approaches is the right combination to optimize the value generated by all industrial assets and asset sets. Utilizing this dual control and management approach is the essence of value-focused IIoT.

Conclusion

The IIoT has been very technology-focused to this point in time which may lead industrial executives and professionals to back off and wait until the rhetoric settles down and some value adding applications evolve. This would normally be a very reasonable approach to technology-driven trends. But in the case of IIoT this may put industrial companies that are waiting at a severe disadvantage in the marketplace. Tremendous value can be enabled by the IIoT if an effective, value-focused asset performance control strategy and asset performance management approach is executed using IIoT technology. This approach can turn the automation platform into the profit engine of an industrial company. The value may be so significant that early movers may generate significant competitive advantage.

IIoT is real and can be very valuable. It is time to turn automation into the profit engine of industrial operations and businesses.

About the authors

Dr. Peter Martin is a recognized leader and innovator in automation and control. He has been a practitioner in the field for over 37 years; has authored three books, coauthored two, and been a contributing author for three more; and has published dozens of articles and papers in these disciplines. He holds or has pending multiple patents in the areas of real-time business measurement and control. He was recognized by Fortune as a Hero of U.S. Manufacturing, by Intech as one of the Fifty Most Influential Innovators in Control, and by Control as a member of the Automation Hall of Fame; he has also received ISA's Life Achievement Award. Peter Martin has a B.A. and an M.S. in Mathematics, an M.A. in Administration and Management, and a Ph.D. in Industrial Engineering, as well as a Masters and a Doctorate in Biblical Studies.

Other resources

New Industrial Automation System Topologies – White Paper

Igniting the Industrial Profit Engine – White Paper

Profitable Reliability – The next evolution of maintenance technology – White Paper

Profitable Safety – Improving Real Time Operational Safety to Jumpstart the Profit Engine.

Contact us:

For more information, please visit our **website**