

IoT — How Connectivity Drives Operational Intelligence

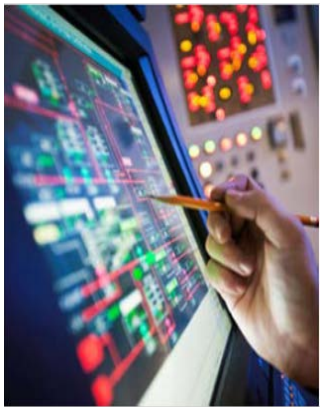
Life Is On | Schneider Electric

At Schneider Electric, our mission is to serve our customers by developing innovative products and solutions that simplify the lives of those who use them. We bring together our expertise and solutions to drive new possibilities for efficiency and savings.

As the global specialist in energy management and automation, we are committed to worldwide improvement in connectivity, sustainability, efficiency, and reliability and safety in five primary areas: in our homes, cities, industries, buildings and in the cloud.

Practical implications of IoT

The recent growth of Internet-connected industrial and personal devices has been referred to as the 'Internet of Things' (IOT) revolution. In fact, this trend is really an evolution that has been underway for quite some time. The key drivers which have accelerated the trend include a broader adherence to open standards (such as Ethernet) and technology breakthroughs in the area of data aggregation middleware. The benefit is new opportunities to drive business in a much more efficient manner. At Schneider Electric, our expertise has always been in facilitating increased business efficiencies, particularly in the areas of IOT-driven operational intelligence, energy management, and automation.



The intelligence that allows IoT devices to communicate in a bidirectional fashion is not a brand-new concept. Physical infrastructure electronic devices that are able to sense, generate, and transmit data have been around for nearly 50 years. In 1968 Schneider Electric invented the first Programmable Logic Controller (PLC). Today, we are helping to drive Industry 4.0 smart manufacturing standards. So the concept of remote control and automation of 'things' is quite familiar to us.

What is different for global enterprises, small/medium businesses, and homeowners is the amount of 'things' or electronic devices that are now being connected to the Internet and generating data. Since the cost of IP enablement is now so low, all sorts of devices

are free to participate in the more open IP-style network. Another important factor that is enabling faster IoT growth is the shift in human behaviour and the changing workforce. The desire to measure and compare the effectiveness of objects that humans interact with is leading to a rapid acceleration in data creation, and more visibility to that data.

ArcFM GIS

A powerful extension of ESRI's ArcGIS® platform, Schneider Electric ArcFM Enterprise GIS provides a graphical, data-rich environment, displaying the information utilities need for maximum reliability and efficiency. Developed as a complete enterprise solution for an entire organization, ArcFM GIS offers a map-centric, intuitive way to model, design, maintain and manage facility, and land based information.

And because geographical information is built into the map data, your asset changes and updates are more apt to operate appropriately under the conditions in the geography, reducing the chance of outages and increasing reliability for your customers.

ArcFM GIS is just one component in our Smart Grid Solutions Suite, a comprehensive toolset created to help you efficiently plan, design and reliably operate the grid. With capabilities that include data collection and monitoring, grid analytics, rules-based economic decision making tools, and the ability to integrate with traditional business software, the Schneider Electric Smart Grid Solutions Suite can help your utility transition into a next-generation energy provider.

For instance, a plant manager today has access to 10 times more information about his plant than he did 20 years ago. In addition, plant/shop operators now have access to data from other off- the-shop-floor systems. For example weather data can be used to predict crop growth, which can then be used to predict the need for fertiliser manufacturing over the upcoming 3 months. The fertiliser production plan therefore becomes more accurate.

IoT allows plants to now monitor new variables that, in the past, were cost prohibitive. Measurement of vibration on machinery and power consumption on all branches of the power system are some examples of how IoT can be cost effectively leveraged. These lower entry costs are leading to the explosion of new data — adding a more granular level of data on the existing assets.

The free-flowing yet structured management of the new data allows stakeholders within organisations to improve real-time energy and automation tracking in order to cut costs, and operate more safety, reliably, and efficiently. It also helps operators across the globe respond to rapid changes in market demand in inventive ways.

Outside of industry and business, consumers all over the globe are also interacting with sensors that communicate data. The popularity of wearable devices to measure human body calorie intake is an example of how 'things' are generating this new data.

IoT environments

On a global front, IoT technologies are driving new business models that facilitate a service-oriented culture, and new revenue streams are being created (such as the growth of 'prosumers', individuals or organisations that are rewarded by utilities for their adherence to load-shifting requests). Leading analysts such as McKinsey & Company

are predicting that IoT-enabled business will grow to $10 trillion annually by 2025. IoT will enable higher levels of collaboration, will change the way goods are produced, and will influence the way we travel, work, and convalesce in hospitals.

White Paper: IT/OT convergence and the Smart Grid

With billions of 'smart' IP-enabled devices now connected through IoT, the distinction between operations technology (OT) and information technology (IT) is rapidly blurring. This convergence of OT — the grid physical infrastructure assets and applications and IT —the human interface that enables rapid and informed decision-making —is implicit in a Smart Grid network.

To learn more about the dynamics of IT and OT integration and how utilities can leverage this convergence for smarter, more cost-effective, and more reliable operation, click here to get Schneider Electric's white paper **How the Convergence of IT and OT Enables Smart Grid Development** now.

The instrumentation built into physical infrastructures such as power grids, water distribution networks, and industrial sites is only part of the IoT equation. A new computing ecosystem has emerged that is built on five core pillars: connected devices, 'edge' computing networks, on-premise data centres, public clouds, and collocation facilities.

The ability to host and share all of the data that gets transmitted via the billions of input devices (computers, RFID readers, sensors, smart connected products, cell phones and other mobile devices) relies on systems that guarantee high availability. High-reliability power and cooling systems within data centres and networks represent the infrastructure core that keeps server farms across the globe up and running.

On the industrial front, new breakthroughs in 3D and Human Machine Interface (HMI) virtual reality allow human operators to successfully manage complex systems with minimal error. These new operational tools allow the human operator to focus more on the business added value decisions while allowing the machines to manage the processes where human intervention is no longer required. Factory equipment embedded with higher degrees of intelligence also allows physical assets to be run as close as possible to their physical limits without increasing the risk of unanticipated breakdowns.

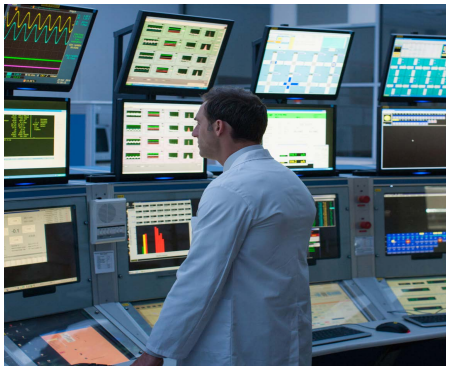
This operational intelligence will not only exist within data centres, factory floors, and headquarters locations, but also on the outer edges of networks where mobile computing and autonomous control thrives. This will allow for data-driven intelligence to be implemented in the field and the data processed locally, so that market conditions and other variables can be assessed in a more accurate manner.

Network architecture will expand to allow these 'edge' devices to be discovered and self-implemented in a central database to enable supervision while providing more local function and control. The higher level of data gathered enables the development of more sophisticated predictive models. This allows weakened physical assets to be discovered and proactively replaced, saving hundreds of hours and millions of dollars every year.

Edge computing also helps to address the issue of long-distance communications latency when organisations attempt to conduct business at accelerated rates. Consider the example of a shipper receiving goods from China on a dock in Florida, who needs to access information in a millisecond and who cannot afford to fall victim to latency problems.

Aspects of IoT architecture

The process of operational asset data management will always be complex and will require scalable tools across multiple data sources. An architect who designs such a network must anticipate the number of users (including machine-to-machine) that will use the system so performance does not deteriorate.



Another key architectural aspect will be data filtering. An organisation's systems cannot weigh down operators with nuisance alerts and superfluous data. Instead, operators must gain more visibility by designing rules to filter/group or even automatically process information without human intervention. New IoT capabilities build on this concept of selective intervention. While operators once spent hours delving into less serious threats to the network, they can now spend time adding greater business value.

Conducting business in an IoT world is both easier and more difficult than the traditional approach. On one hand, more data and enhanced functionality mean more informed and faster decision-making. On the other hand, more complexity has been added to the equation and the human brain of the operator needs sophisticated assistance to execute their tasks. This is why operators require better dashboards and graphics to present an overview of the situation, identifying where they should 'drill down' for more detail. The user interface of a mission-critical environment such as a utility distribution control centre must be configured in a simple manner so an operator can create his own environment. This allows the operator to become comfortable and efficient in making critical decisions.

Schneider Electric: Driver of Operational Intelligence

The behind the scenes complexity brought on by the increase of data flooding into systems has to be managed. Network, plant, and utility operators need to drive major process efficiencies. Schneider Electric plays a key role in helping industry stakeholders to leverage the operational intelligence that allows for successful process execution.

We service physical infrastructure through remote monitoring and offer new levels of service. Our five core IoT-driven competencies include the following:

- Business process efficiency (higher productivity and profitability)
- High asset availability and performance (predictive and condition based maintenance)
- Risk mitigation and safety (embedding safety into our product designs)
- Enablement of faster time-to-market (securing both centralised and edge applications)
- Sustainable growth (low CO_2 emissions products and systems).

Schneider Electric delivers solutions at each architectural layer: the core of connected field devices (sensors, drives, meters, PLCs, controls, switchgear), the platform layer (cloud services, middleware, physical infrastructure architectures), and the on-premise central control layer (remote monitoring, predictive analysis, simulation, cloud analytics).

All of these elements are designed within a balanced envelope of security (physical security and cyber security), and open protocols/open connectivity. These Schneider Electric IoT competencies have been developed over time as a result of millions of dollars invested in Research and Development and innovation.

Addressing security concerns

IoT is broadening the scope of where both power protection and security is needed, as entire chains of communication can be disrupted by the breakdown of a single device. Disruptions can occur from both inside and outside of an organisation.

On the security front, Schneider is involved in the development of security-certified products and standards and in the development of secure remote solutions and services. Schneider designs its software and systems according to the highest cyber security software engineering standards. In the utilities industry, Schneider Electric also offers services to utility architects to assess the state of vulnerability of their smart grids and control systems and recommends risk mitigation actions.

Operations complexity and retirement of operational experts

In many industries, operators will struggle to process the IoT driven higher volumes of information and will need to select operating options from an increased set of alternatives. However, not all changes that are affecting operator performance are technical in nature. The way people live and work, developing market conditions, and changes to the industrial ecosystem also play an important role.

The new generation of workers coming in will rely less on experience and rely more on information at their fingertips, information that has to be provided in a way that is familiar to newer ‘digital natives’ who rely on smart phones, tablets, and wearables to communicate. These changes will force plants to be more user-centric and less machine-centric.

To address this situation, Schneider Electric has developed operator training simulators (OTS) that leverage IoT technologies so that knowledge can be transferred and skills developed in a matter of months rather than years. OTS allows workers to experience and respond to simulated high-risk control room situations in a risk-free virtual-reality environment. Similar to the way airline pilots or astronauts train, simulators throw various ‘failure issues’ and problems at trainees to make sure that they are able to cope with malfunctions and upset conditions.

Repetitive trainings on various ‘what if’ scenarios enable employees to respond to those situations with better, faster decisions so that appropriate best-practice procedures become second nature.

Schneider Electric recognises that the importance of historical systems grows in an IoT world. History is often a predictor of the future. The historical, trending data is an important input to simulation (as are the environmental variables that help establish the basis for accurate forecasting). We have invested in developing systems that display simple past data trends so that comparisons can be made to present patterns. Future states of the system can be simulated using advanced calculations so that users can visualise the next few hours and anticipate several possible scenarios (weather related, switching alternatives for a utility, for example) in order for operators to maximise their situational awareness.

New levels of control for homeowners

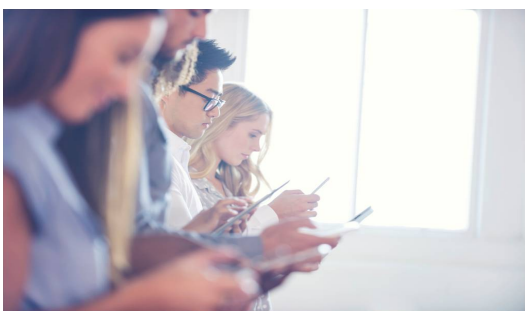
In homes we also pursue the operational intelligence concept. Schneider Electric has developed tools that can be engineered to adapt to the rhythm of the life of the occupant. We enable quick and easy personalisation of energy management and lighting settings, either through devices in the home or remotely, via apps on a smart phone. This means that switching lights on and off, controlling shutters, adjusting temperatures and even security management is no longer restricted to on-site push-buttons or touch panels. These home management systems are self-learning tools that note the behaviour of occupants and adjust environments accordingly, bringing a new level of comfort to living spaces while reducing electricity and fuel costs.

The power of Schneider Electric-based IoT solutions also extends to enabling utilities to better support their home customers. Utilities can leverage consumption data gathered from smart meters to help home customers better understand their energy consumption patterns and identify areas where they can save money on their energy bills.

In addition, should a utilities customer call to report an outage, the customer service representative can ping the meter to check its status and check other consumers’ meters in the same vicinity to confirm the kind of outage the caller is experiencing. He or she may then troubleshoot remodelling by acting on the smart meter. This two-way communication between the utility and the customer can also open the door to energy incentive programmes, where the customer is financially rewarded for shifting energy use to off-peak times.

A facilitator of sustainability

Corporate sustainability programs of the past were rarely successful due to difficulties in implementation and measurement. Schneider Electric’s IoT capabilities have helped to change all of that. You can’t fix what you can’t measure. By establishing robust smart monitoring of water and electricity assets, a baseline can be established to track how these resources are consumed. Sustainability plans



can now be built on accurate consumption data so that measureable improvements can be executed.

As machine-to-machine, machine-to-people, and people-to-people interactions occur with more frequency, tools need to evolve that help all participants make sense and good use of this avalanche of data. Schneider Electric has the tools and expertise in place to assure that “Life is On!” for customers and partners across the globe. We now have the technologies and expertise in place to realise our shared goals of growth in innovation, better operational performance, improved safety and security, and reduced environmental impact.

IoT Case Study

Green Mountain Power, Vermont, USA

Responsible for about 25 per cent of the power distribution in the state of Vermont, USA, Green Mountain Power realised in 2007 that it had outgrown its outage management response and restoration system. And with a customer-to-employee ratio of 485 to 1 — twice the industry average — everyone at Green Mountain acknowledged that the utility needed a more efficient process for handling outages. After researching various options, Green Mountain Power decided to implement the Schneider Electric ArcFM™ Enterprise GIS Solution and Responder OMS to handle outages more efficiently — locating outages faster to trigger the utility’s response. Responder’s intuitive graphical user interface represents outages on maps that dispatchers can quickly understand and greatly speed up the outage response time.

Responder OMS can receive thousands of calls during an outage event, automatically identify customer locations and log the incidents, and provide a Web-based, real-time incident management report — invaluable to utilities like Green Mountain with such a limited support team. With the combination of Interactive Voice Response in the call centre, Automated Vehicle Locator for crews, and the GIS and OMS, there has been a significant improvement in Green Mountain’s ability to more efficiently manage outage-related phone calls, identify their likely cause, and dispatch repair crews to restore power.

‘Even with a relatively small team, our utility has exceeded conventional service quality standards, including those set by Vermont regulations’, explained John Castonguay at Green Mountain Power. ‘With our continued investment in GIS open-architecture technology, we expect to meet even higher standards’.