Cambium Networks™

ENABLING WIRELESS IIOT ARCHITECTURE

With Cambium Networks

OVERVIEW

The skyrocketing curve of computing has revolutionized contemporary life; Internet technology connects people to one another and the world, enabling rapid communication and information access. Industrial markets are gradually assimilating these changes, becoming more efficient as they learn to leverage wireless networking to streamline operations and facilitate decision-making.

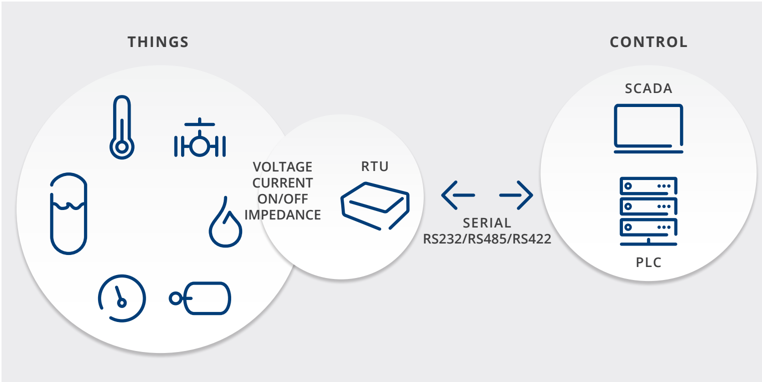
Currently, throughout industries such as water management, oil and gas, electricity, and transportation, workers collect data at timed intervals – rather than automated systems accumulating it in real time. Automated facilities are still only a sub-set of the potential population, but reliance on human intervention for data collection limits operational efficiency compared to the decision-making capabilities supported by a richer data pool.

The Industrial Internet of Things (IIOT), which enables machines to connect with one another over the Internet, presents a major development in data collection, intelligent decision making, and automation to positively impact efficiency, costs, and safety – but only if the remote elements are connected!

TRADITIONAL SYSTEM AUTOMATION

System automation emerged in the wake of computer technologies that support such applications as PLC (Programmable Logic Control) and SCADA (Supervisory control and data acquisition), which evolved over the past 30 years as methods of monitoring and controlling large processes. These technologies rely on sensors, machines, RTUs (remote terminal units), and PLC or SCADA, communicating with each other over short distances to enable local automation and control. Longer distance connection and centralized control is possible, but very costly.

The following diagram is an example of a traditional automatic control system.



Sensors measuring parameters such as temperature, tank levels, pressure, and flow rates represent the data in the form of electric voltage and current (e.g., 4-20mA), or electric impedance, all referred to as analog signals. Sensors can also generate results in an open/close dry contact format, referred to as a "discrete input". The discrete and analog inputs are fed into the RTU (Remote Terminal Unit), which translates the data into digitally readable format. The RTU– typically simple and run without any control logic – contains a SCADA slave. The SCADA master, or the PLC controller, contains the control logic and will query the RTU (SCADA slave) for data, which it then uses to make decisions about the machine's functions – such as causing a pump to turn on or valves to shut off. The control signals, when reaching the RTU, will be translated into voltage, current, or on/off (which closes or opens an electric circuit) thus able to act on the machine.

RTUs connect to the PLC & SCADA via serial lines such as RS232, RS485 and RS422.

In the vocabulary of IIOT, all of the sensors, machines, and even the control systems (SCADA & PLC) are called "things". The traditional machine automation relies on RTUs and serial lines to connect the "things".

While traditional system automation does work, it has limitations:

- **Cost of large scale centralized automation**
  Serial connection is limited by the distance that the signal can be transmitted. For example, maximum cable length for RS232 is typically only 50 feet (longer distance results noise and low signal quality). RS485, although a much longer cable length, is still only 4000 feet. System automation for utilities such as water or oil and gas can require tens of or even hundreds of square miles' coverage, which makes it very costly to centralize. IP networking was introduced to enable inter-site communication.

- **Cost and deployment time of trenching limits expansion**
  For connecting automation systems, the cost of trenching to install the cables is always a big part of the overall system cost. Breaking ground for trenching also results in longer system deployment cycle.

- **Low data speed of serial line inhibits feature rich applications**
  While the maximum baud rate of a serial line can be up to 230400, limiting the data rate over a serial line to 230kbps, practically, most serial lines are running at 19200 baud or less, providing a data rate of only 19.2kbps. Traditional SCADA systems require very little bandwidth from slave to master, but newer technology and feature rich applications can require much more. This shortcoming in serial lines is a tightening bottleneck for introduction of new applications.

INDUSTRIAL INTERNET OF THINGS (IIOT)

The connection of traditional "things" with Internet Protocol (IP) commenced the age of IIOT, unleashing tremendous potential for flexibility in system deployment, new application features, improved operational efficiency, and cost savings.

Compared to traditional serial communications, IP connectivity offers significant improvements in reliability, data speeds, deployment distance, and implementation of network resiliency.

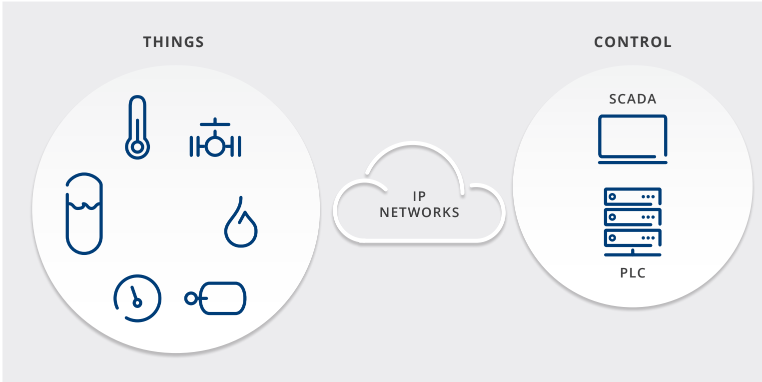
Standard IP communication interface simplifies system integration. Industrial users seldom need to deal with proprietary technologies that are controlled by certain vendors – more options available bring down cost.

Cost savings can also be achieved with predictive maintenance, improved safety, and other operational efficiencies.

Intelligent devices networked by IIOT allow industrial organizations to break open data silos and connect all of their people, data, and processes from the factory floor to the executive offices.

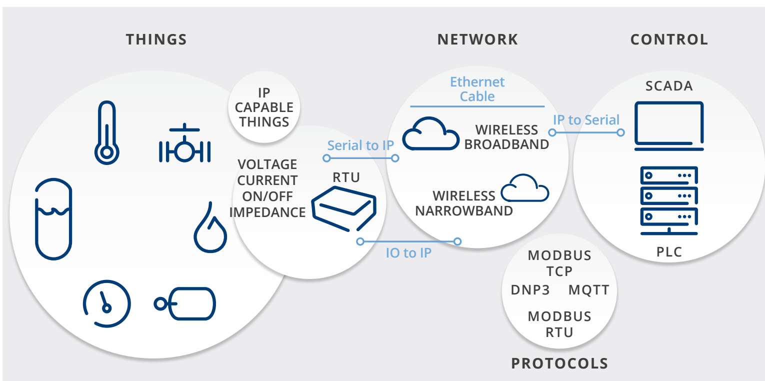
Business leaders can incorporate IIOT data into analysis of their enterprise's performance and make decisions accordingly.

The following diagram shows the architecture of an IIOT control network where all sensors and machines are IP capable, communicating with one another using protocols such as ModBus TCP, MQTT, etc.



The architecture above works for green field deployment, meaning that if an operator wants to move to IIOT, they would need to upgrade all their existing sensors and other controllable equipment (machines) to IP capable "things". This would be expensive. A more practical approach would be to reuse existing "things" by connecting them with IIOT adapters, and migrate to IIOT gradually.

The following diagram shows a migration plan towards IIOT architecture.



In this architecture, the serial interface from RTUs can be connected to "Serial to IP" adapters, which enables serial based IP accessibility via IP network. This approach can also be used for traditional SCADA master with serial interface.

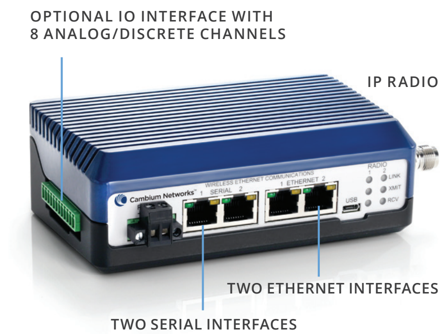
The "things" can also connect directly to "IO to IP" adapters, which convert analog input to digital data, and vise-versa. This allows the "things" to be IP accessible, and doesn't require an RTU.

Options for the IP transport cloud include existing Ethernet wireline network, wireless broadband, or wireless narrowband – depending on the deployment requirements and budget.

Cambium Networks' Wireless IIOT portfolio is ideal for this example of IIOT architecture.

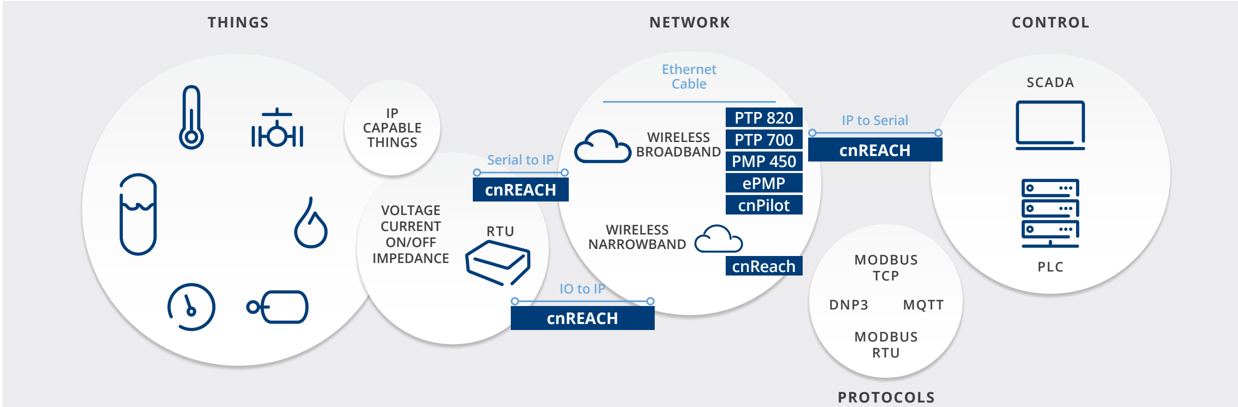
WIRELESS IIOT WITH CAMBIUM PORTFOLIO

The Cambium Networks cnReach product line with optional IO capability can be used as both "serial to IP" adaptor and "IO to IP" adaptor, and is available with or without the narrow band radio. cnReach IO expander can connect traditional "things" to existing IP networks, and cnReach radios can connect traditional "things" via wireless narrow band network to the IP cloud (for more information about cnReach visit **www.cambiumnetworks.com/products/iiot/cnreach**).



As a market leader in wireless private network solutions, Cambium Networks offers a broad range of highly flexible wireless products, capable of transporting data with capacity of multiple kbps (narrow band) to more than 1Gbps, from sub-GHz bands to 42GHz, from non-line-of-sight to LOS, and from range of 2 meters to more than 200 kilometers (for a complete product portfolio of Cambium Networks, visit **http://www.cambiumnetworks.com/products/**). This portfolio supports Wireless IIOT architecture for any deployment environment and budget.

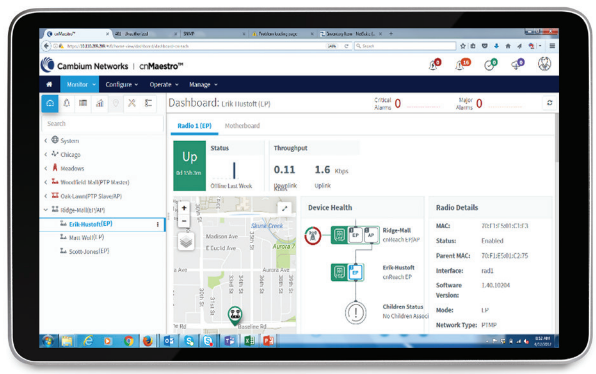
The following diagram shows an IIOT architecture featuring Cambium Networks solutions.



For operators with existing IP networks, the cnReach IO expander can be used to migrate the traditional “Things” to IIOT architecture. Operators can also deploy PTP820, PTP700, PMP450, etc. to transport the IIOT traffic if line-of-sight wireless broadband is feasible. In non-line-of-sight deployments, the cnReach narrow band radio can be used to enable the IIOT data transport.

Wireless IIOT architecture can significantly reduce both the time and costs of system deployment incurred by trenching cable.

Cambium Networks solutions support all stages of the establishment of wireless IIOT architecture, from pre-deployment planning with the free LINKPlanner tool, to cloud-based control of all network components from a single pane of glass with cnMaestro network management system.



CONCLUSION

IIOT delivers tremendous benefit to the industrial and manufacturing sector, and Cambium Networks empowers the IIOT upgrade of traditional industrial systems with reliable, cost-effective solutions.

Cambium Networks™

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