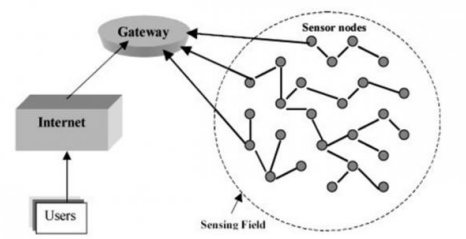
Evolution of industrial wireless sensor networks

November 10, 2017 // By Mark Miller, L-com Global Connectivity, Wireless Product Manager



Industrial automation powered by wireless sensor networks (WSN) is heralding the Industrial Internet of Things and Industry (IoT) 4.0. Key enabling cloud and wireless mesh networking technologies promise to bring multi-year battery life, IP addressability to machines and sensors, cloud-based provisioning and management systems, as well as fieldbus tunneling.

Though currently prevalent wireless standards, such as WirelessHART and Wi-Fi will likely account for the majority of the industrial wireless network technologies, upcoming low power wide area (LPWAN) technologies are likely to grow in value for current and future applications.

From hardwired connections to smart links

Unlike datacenter communications and interoffice interconnections with patch cords and plenum Ethernet cables, the backbone for industrial-based communication require cables that are resistant to a number of environmental aggressors including chemicals, oils, moisture, vibration, and abrasion. This has been necessary for the fieldbus- and Ethernet-based hardwired industrial links but industrial wireless sensor networks (IWSN) are poised to replace much of that costly infrastructure with hundreds to thousands of modular sensor nodes. There are a great variety of challenges to making this technology ubiquitous, for instance, the bit error rate (BER) of an industrial sensor node can stand between 10^{-2} to 10^{-6} [1] while IEEE 802.3 Ethernet standards call for performance between 10^{-10} and 10^{-12}.

For ultra-low latency time sensitive networking (TSN) applications such as factory automation with high speed robotic arms time synchronization protocols have to reliably achieve sub-millisecond cycles and sub-microsecond jitter for plant operations (e.g.: PROFINET IO). WSN technology is limited by the amount of energy available to small battery-powered sensors, a limited bandwidth, and computational power; complex schemes that are traditionally used such as network time protocol (NTP) are not viable due to these restrictions [3]. Furthermore, many factory automation, process automation, and building automation facilities traditionally leverage the Purdue Enterprise Reference Architecture (PERA) for integrating applications in manufacturing operations and control as well as business systems. Each layer of hierarchy is highly custom and optimized independently to meet the requirements of specific tasks, this makes interoperability with industrial IoT (IIoT) networks challenging thereby slowing the proliferation of this technology [4].

Still, the ability to add a level of abstraction between the hardware and software and the integration with internet protocol (IP) allow for scalable architectures to support a wide variety of industrial applications, this can allow for the economies of scale to arise much more rapidly than custom, proprietary systems. Additionally, the maintenance that comes with cables for interconnect is eliminated. In highly corrosive environments, the specially designed connector heads and cable jackets have to be inspected and maintained regularly to prevent network latencies and failures.

1 2 3 4 5 next

Design category: