SILICON LABS

Connected Lighting Q&A

A Look at Emerging Technologies And Standards

Q&A: Smart Connected Lighting

The smart connected lighting market is gaining serious momentum. The high expectations consumers have had for the industry are starting to materialize, and access to lighting development kits to simplify efforts is increasing. Product marketing engineer Alex Koepsel recently sat down to address some of the pressing questions facing the market, including taking a look at the different technologies and standards emerging, some of the most common applications, and a look at some of the design challenges facing developers.

Roughly how large is the wireless lighting market today?

According to IHS Markit™ research data, the wireless lighting market is expected to increase from 17 million units shipped today to 52 million units in 2020. Other sources, such as Wireless Sensor Networks, are more bullish and forecast as much as 230 million units in 2020.

What's driving the market movement to wireless?

For home lighting applications, quality of life and convenience are the most valuable reasons; for commercial use—such as retail and hotel applications—aesthetics is important; and for industrial applications, the main driver is cost savings.

Is there one dominant wireless technology for lighting?

Based on the answer above, it's easy to see that there is not a one-size-fits-all solution. The right solution depends on the application and end-user requirements. For example, a family setting up lighting in their home would most likely prioritize ease of use and installation, while a multi-building manufacturing facility with thousands of lights and differently scheduled operational needs might require a more robust, secure system with scalable and long-range networking capability.

What are some popular examples of wireless technologies?

It depends on the specific environment and user needs, but some popular technologies are zigbee and Sub-GHz proprietary protocols, and others are growing in popularity, such as Thread and Bluetooth lighting. Presently, the zigbee PRO and its predecessor zigbee Light Link are the most widely used. Monitored by the zigbee Alliance, these specifications help to describe application-messaging protocols for lighting control and include mechanisms that make out-of-the-box operation simple, plus, for an engineering audience, make development simple. It's worth noting that the zigbee 3.0 specification announced in 2016 is expected to replace the current specification in 2017, and as a part of market rebranding, the technology is now referred to as zigbee™ with the former application libraries becoming an IoT-centric application layer now called dotdot™.

If Bluetooth is for streaming audio, why is this now being used in lighting?

Bluetooth has actually expanded beyond just audio streaming, and it's a popular technology because it connects to some of the most pervasive devices on the planet—smartphones. These newer and more user-friendly devices are perfect for setting up and controlling wireless lighting networks and offer some really cool applications, such as enabling light fixtures to send out Bluetooth low energy (BLE) beacons for advertising, geolocation, and other dual-purpose applications. That being said, Bluetooth lighting in scaled systems of many lights will most likely be joined by another wireless technology, due to the proven software and scalability of those accompanying technologies.

Why not use Wi-Fi?

Many people think of Wi-Fi because it is familiar and used all over the world, but Wi-Fi consumes a lot of power and has yet to have defined software for lighting—the "application layer" according to software developers. Having no app-layer or software toolbox to build from often adds months to a project development cycle. In addition, Wi-Fi hardware tends to be slightly higher cost than the alternative 802.15.4 solutions such as zigbee and Thread.

What factors go into deciding the right wireless technology?

A lot of factors come into play depending on your application. For example, systems can be as simple as a single on/off light switch or as complex as a fully featured lighting solution for a hotel/casino or manufacturing plant. Some considerations include the size and density of the network (how many lights or nodes will be controlled), the overall building environment, setup and installation requirements, installation budgets, and maintenance requirements.

What are the biggest challenges or obstacles to developing wireless lighting?

Some of the biggest challenges are cost pressures, time to market, and the associated learning curve of figuring out the wireless part of the design. For developers who are not well-versed in the inner workings of IoT (Internet of Things), it can be difficult. In terms of lighting specifically, an average zigbee light bulb has 15,000 lines of code. Compare that to a simple wired on/off light bulb that could be programmed on an MCU and can be coded in less than five minutes.

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Are there any plug-and-play solutions on the market (for developers to use)?

There are some application notes and white papers that have been made available by both lighting experts and semiconductor companies. There are also some hardware and software reference designs that exist, and a few are available for purchase as open-source designs that can help developers solve some of the more difficult networking challenges.

How do I pick which wireless protocol to use in my system?

This question is difficult to answer due to all the variables mentioned so far. One thing to consider, though, to reduce the risk of future obsolescence is to find a solution that is flexible and can support many protocols. Innovation in the semiconductor market space has enabled that capability, to simplify hardware designs with a single chip solution.

What about the networking software? Can I just license wireless lighting software to save myself time?

Some companies have addressed that question and made efforts to better enable developers with wireless lighting software (“stacks”). zigbee, mentioned earlier, is a mature solution and a few companies have developed “Golden Unit” approved stacks that are available through low-cost kit purchases. Silicon Labs, TI, and NXP are a few examples of providers. Because zigbee is a mesh technology, some of those companies are now extending their leadership into Thread and Thread stack offerings, which adds Internet (IP) addressing.

What is the best advice for development teams working on wireless lighting applications?

Like most complex engineering projects, it is critical to understand and translate the consumers' requirements as best as possible to design a great paper concept from the start. Then, from there, valuable resources are available to help cut development time and to deploy world-class wireless lighting products. I've seen engineering teams small and large take advantage of this. Examples of these resources include hardware reference designs, software design files, development plugin tools, networking debug tools, and training resources such as app notes. Overall, leveraging the expertise and solutions that other industry leaders are providing will make a huge difference.