Why Wi-Fi? Lunera's Strategic Choice for a Communications Standard

There are many standards and proprietary solutions used for connecting things to each other or to the cloud: Wi-Fi, Bluetooth, Zigbee, Active loWPAN, EtherCAT, NFC and RFID are just a few. For Lunera Smart Lamps, we made the decision to use Wi-Fi and BLE (Bluetooth Low Energy). This document provides an overview of why Lunera chose Wi-Fi instead of Zigbee.

Zigbee and Wi-Fi—An Overview

The best known standard of all, Wi-Fi, has its origins in the early days of cell phones and wireless experimentation of the 1980s.

Later, as the Internet grew, other industry standards like Ethernet came into being, and this growth encouraged developers to also adopt a similar standard for radio frequency communication. Boosted by big brands like Apple, Wi-Fi rose to become the go-to solution for short-range Wireless Internet.

Of course, technology as old as Wi-Fi evolves across many iterations. The latest version of this wireless standard still operates using the 802.11 series of standards, but it has evolved into a complex beast with "a," "g," and "n" variants, among others.

Wi-Fi is also unique in how it operates on both the common 2.4 GHz frequency and the lesser-used and potentially faster 5 GHz frequency in dual-band versions. With a range between 100 and 300 feet—and complex, hub-based network construction—Wi-Fi is the ideal solution for wireless Internet network and wireless broadband access points. But when it comes to communication beyond these Internet connections, other standards start to crop up.

Zigbee is a far simpler wireless standard first developed in the 1990s and completed in the early 2000s. While Wi-Fi spread via Internet access and laptop use, Zigbee was adopted for home device communication. With its low power and memory requirements, Zigbee was well-suited for devices such as home sensors and remote control applications.

Technically, Zigbee uses the 802.15.4 radio standard for direct communication based on very simple master/slave network nodes (typically star or mesh designs). In North America, it uses the 900-928 frequency range, usually 915 MHz in the United States.

There is signal overlap with both Wi-Fi and Bluetooth, and this can lead to interference when multiple wireless connections are present. The standard has a variable range, sometimes dwindling to Bluetooth levels of 30 feet at the most, and sometimes rising to Wi-Fi ranges based on the device in question.

Battery Life, a Non-issue

Zigbee-based networks consume 1/4th of the power consumed by Wi-Fi networks, making Zigbee's battery life a major plus over Wi-Fi. However, for Lunera's purposes, our smart lamps are always connected to line-power, so battery life wasn't a concern when making our decision.

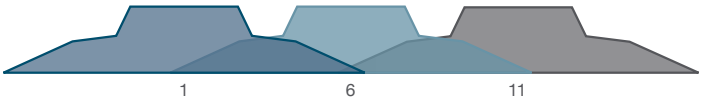
Seamless Interoperability

While all vendors rely on version 802.15.4, everyone uses some variation of this standard—and this can cause connectivity issues.

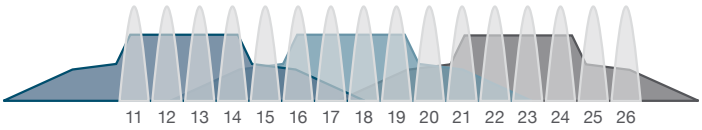
Wi-Fi, with just one dominant standard, doesn't have this problem. Lunera Smart Lamps work with any Wi-Fi router from any vendor.

Better Coexistence?

At a glance, Zigbee and Wi-Fi channel numbers may seem similar, suggesting there won't be any overlap. Unfortunately, that's not the case.



2.4 GHz Wi-Fi Channels

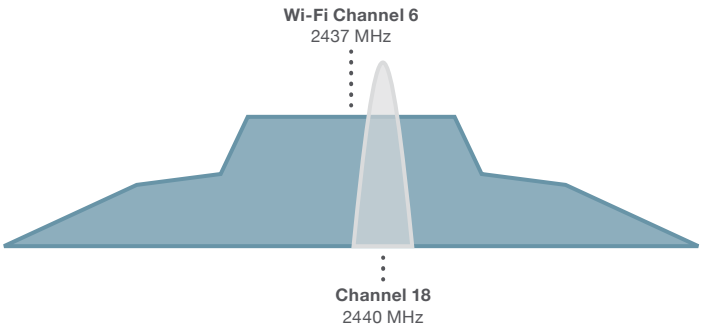


2.4 GHz Zigbee Channels

Wi-Fi's three non-overlapping channels (1, 6, and 11) use the exact same frequencies as Zigbee channels 11-22. And Zigbee channels 25-26 aren't immune either—they can be caught in Wi-Fi channel 11's sideband lobe. While Zigbee channel 26 is usually relatively unaffected by Wi-Fi, many Zigbee devices do not support it.

Interference

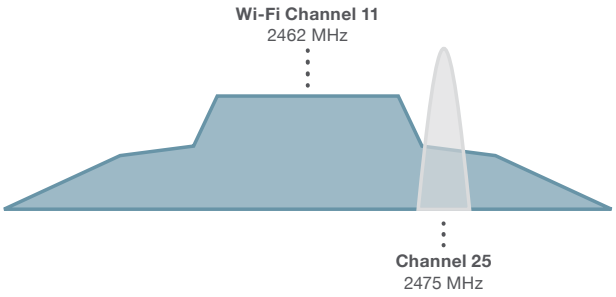
When a Wi-Fi network operates on the same channel as a Zigbee network, the Wi-Fi network will usually interfere with the Zigbee network.



Sideband Interference

An 802.11g/n signature in the spectrum has two components:

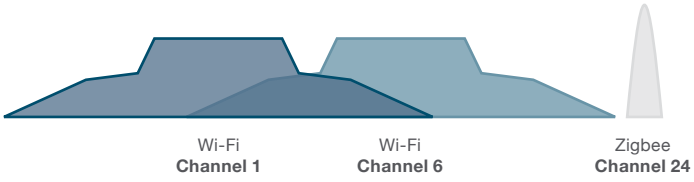
1. The 20 MHz "square" section that contains the data subcarriers
2. Sideband lobes on each side, which are a normal side effect



Sideband lobes are usually only visible when they are very close to the device that is actively transmitting (try doing a speed test or streaming an HD video). This is especially evident when a Zigbee access point and a Wi-Fi access point are in very close proximity with each other (like in the same communications closet).

No Need for Channel Planning

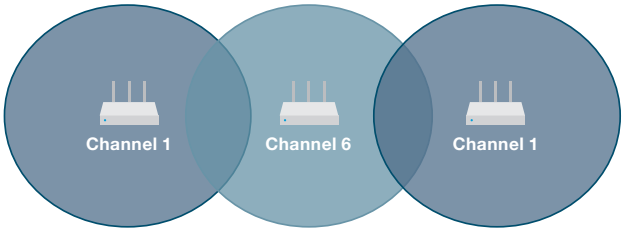
When deploying Zigbee and Wi-Fi networks in the same environment, channel planning for peaceful coexistence is key. Normally, there are three Wi-Fi channels to work with (utilizing 1, 6, and 11), but to make room for Zigbee, it is often necessary to give up channel 11.



This essentially creates a two-channel reuse plan, which isn't as efficient as a three-channel reuse plan, but it will work to make space for the Zigbee gear.

Higher Bandwidth

Zigbee has a low-channel bandwidth of 1MHz and has a data transfer speed lower than Wi-Fi's. Its maximum speed is just 250kbps, much lower than the lowest speed Wi-Fi offers.



A Two-channel Reuse Plan
This concept can be applied to just about any variation of two channels out of 1, 6, and 11 (e.g. 1 and 11, 6 and 11, 1 and 6) to make room for the Zigbee gear.

Bit Time

It can be defined as time taken to transmit one bit at a given data rate of transfer. Bit time in Zigbee is 4 micro seconds while in Wi-Fi it is only 0.00185 micro seconds.

Better Security

Zigbee protocols use Advanced Encryption Security (AES) methods for encryption and CCB-CCM methods for network security. While Wi-Fi-based networks use WEP, WPA and WPA2 protocols for network encryption and security.

Wireless Technology	Version	Frequencies	Max Data Rate
Wi-Fi	802.11a	5.0 GHz	54 Mbps
	802.11b	2.4 GHz	11 Mbps
	802.11g	2.4 GHz	54 Mbps
	802.11n	2.4/5.0 GHz	200 Mbps
	Wi-Fi Direct	2.4/5.0 GHz	250 Mbps
Zigbee	802.15.4	868 MHz 915 MHz 2.4 GHz	20 Kbps 40 Kbps 250 Kbps

Need for Additional Gateways

To connect Zigbee devices to the Internet requires the use of Zigbee-to-Internet Gateways throughout the facility—perhaps as much as a gateway for every 2,000-2,500 square feet. And this means more devices to manage, monitor and more potential IoT security risks.

Lunera Smart Lamps simply connect to the internet using the existing Guest Wi-Fi in the building.

About Lunera

Lunera is an IoT infrastructure company that delivers simple, affordable and valuable networked command and control solutions for commercial and industrial buildings through lighting.

Our Smart Lighting Platform of connected LED lamps and cloud-based software applications, is a universal IoT gateway infrastructure, enabling indoor GPS and real-time location-based services while, delivering coordinated energy management of lighting, HVAC and plug loads throughout a facility.

The Smart Lighting Platform architecture is built on open standard and is highly scalable. A robust set of applications are available in the expanding, cloud-based Lunera Applications Marketplace.

The Smart T8 lamp is based on LED light bulbs due to its low cost of deployment, immediate energy savings, ubiquity, density and always-on power. Lunera is redefining traditional LED lighting to catalyze change and realize a vision for location/context aware ambient computing at the edge.

https://www.lunera.com/smart-lighting-platform