

Wi-Fi 6 and CHIP: The Real Plug and Play Smart Home

Introduction

The COVID-19 pandemic has more people working from home, and this has accelerated the adoption of the new Wi-Fi standard (Wi-Fi 6). Consumers are upgrading home networks with this new, higher speed Wi-Fi 6, and they are enjoying the additional key benefits of its distributed architecture – ease of setup for coverage all over the house and high capacity that serves the needs of all family members – from video conferencing in the home office, to binge watching a favorite show in the living room, to hours of online gaming in an upstairs bedroom.

Until now, smart homes have been serviced by multiple, competing standards – Wi-Fi, Zigbee, **Bluetooth®** Low Energy, Thread, etc. This fragmentation, split over multiple standards, has kept smart homes – and the IoT itself – from living up to its potential. CHIP brings Zigbee, Thread, Bluetooth and Wi-Fi into one overarching standard. This paper addresses why this will enable truly smart homes.

1 Wi-Fi 6 Distributed Architecture and Pods

Wi-Fi 6's distributed architecture brings a router and a set of satellites, or "pods," that can be strategically positioned in the home. These pods connect themselves automatically to the main router, the one that connects to the outdoor internet, via a protocol called EasyMesh™. The result is high speed Wi-Fi through the whole house. Gone are the days when proximity to the router is crucial for performance, and repeaters and/or powerline adapters are needed to cover the dead zones.

Although the term "pod" sounds rather simple, it could be a quite sophisticated device that can simultaneously do many other things. In fact, every non-mobile Wi-Fi device could function as a pod. A TV, a wireless speaker or smart assistants like Amazon's Echo Dot or Google Home can simultaneously execute their own function and serve as a pod for other Wi-Fi devices. This is all on the drawing boards.



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2 Connected Home Over the Internet Protocol (CHIP)

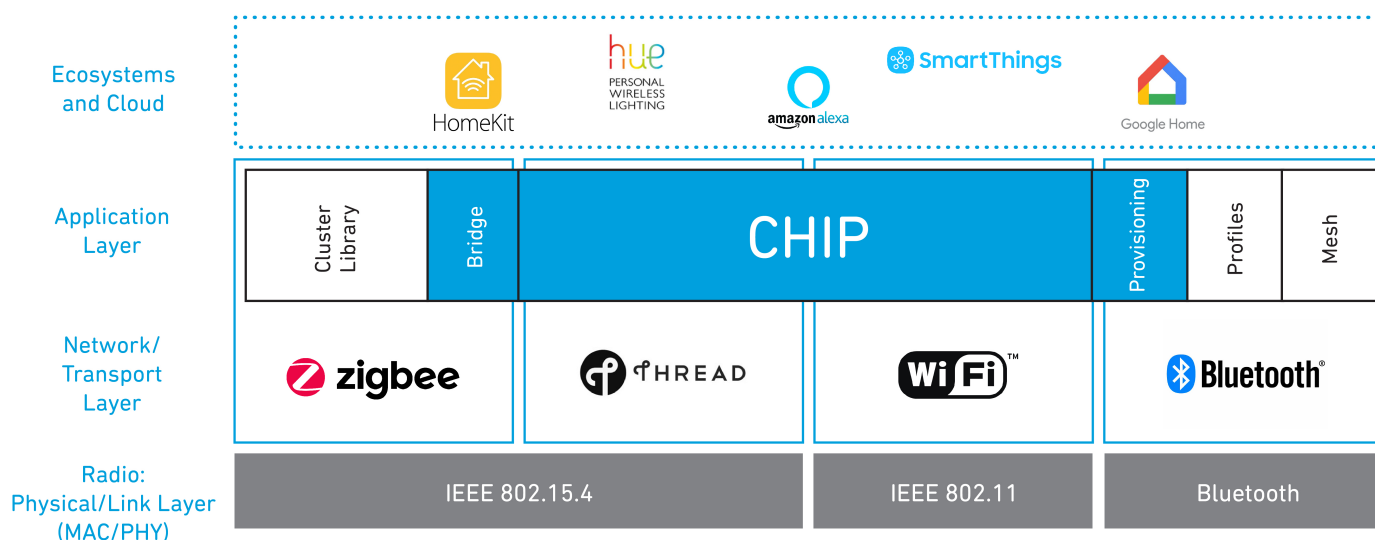
CHIP is a new standard for the IoT. CHIP's stated goal is to "simplify development for manufacturers and increase compatibility for consumers." By building on IP, CHIP aims to enable communication across smart home devices, mobile apps and cloud services by defining a specific set of IP-based networking technologies for device certification.

CHIP is more like a new aggregation standard than a new networking standard. Essentially, it brings together different elements of the existing IoT standards. Today, the IoT is serviced by multiple competing standards, representing different ecosystems – Wi-Fi, Zigbee, Bluetooth/Bluetooth Low Energy, Thread used in Apple's HomeKit, Samsung's Smart Things, Google's Nest, Amazon's Alexa, etc. This fragmentation, with different technology standards mixed in different ways over multiple standalone ecosystems, has kept the IoT from living up to its potential as consumers wait for one overarching concept. Without one, the smart home is just a set of incoherent, standalone, special purpose applications that are unable to use each other's data or availability.

Motions sensors are a good example, since many different applications use them. In today's fragmented application world, the motion sensor in the alarm system cannot talk to the one that turns on the lights or the one that triggers the heating/cooling systems.

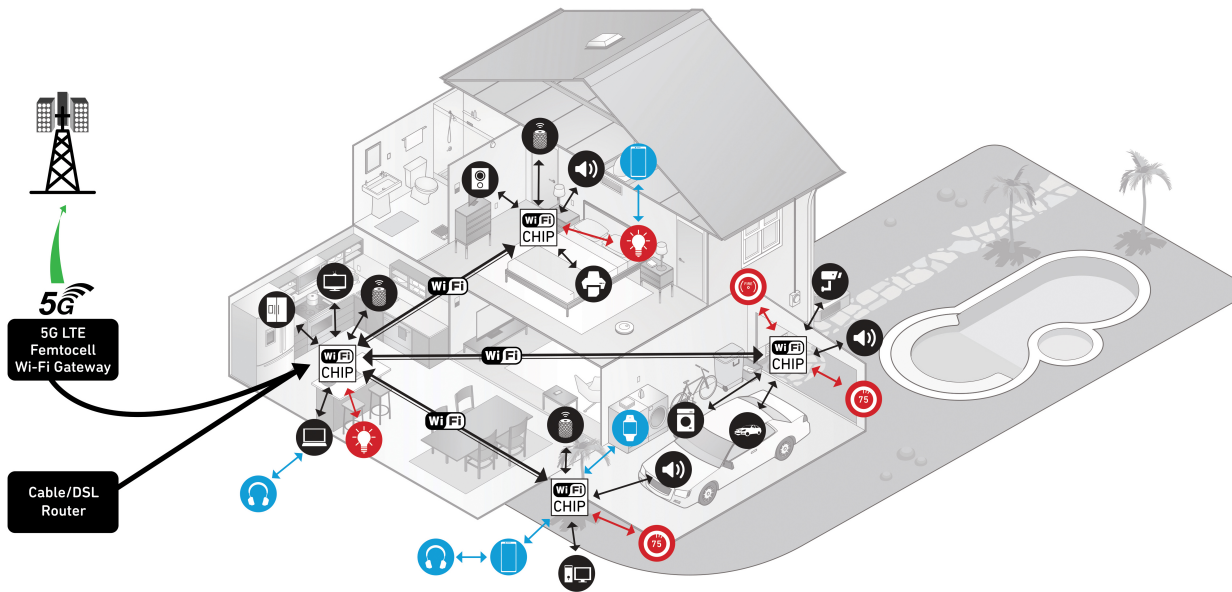
CHIP is the good news. It is a cooperation of the Zigbee Alliance and the Thread Alliance with Amazon, Apple, Google and Samsung, and it brings different components of Zigbee, Thread, Bluetooth and Wi-Fi into one overarching standard.

Figure 1. Networking ecosystems cohabitate: CHIP is an aggregation standard that brings together existing IoT standards.



3 How CHIP Connects All Smart Home Devices to the Wi-Fi Network

Figure 2. Plug and play: the promise of the IoT will be realized with CHIP certified devices connecting and sending data via the pods on a Wi-Fi mesh network. Consumer can select their 'things' based on brand preference or device performance and know they will work beyond the ecosystem or platform.



This CHIP standard will enable end-devices, the “things” of the IoT, to talk with the “pods” of the Wi-Fi 6 network – and via these pods, to talk to the internet. The sensor end-node data can go where needed. This concept makes Wi-Fi 6 and CHIP an ideal couple for total indoors connectivity.

Each Wi-Fi 6 pod will be equipped with a Zigbee radio, or better yet, a standard IEEE 802.15.4 (IoT) radio, next to the Wi-Fi radio. This allows all smart home devices (motion sensors, temperature sensors, open/close sensors) to connect to the Wi-Fi network and to the internet. With the popularity of Wi-Fi connectivity, the number of pods in many homes is already growing significantly. Extending these pods with an IoT radio makes a lot of sense, and Wi-Fi 6 EasyMesh connectivity automatically takes care of the rest – connectivity throughout the home and with the cloud. Some Wi-Fi router companies are already including CHIP radios (IEEE 802.15.4) in their products, making them software-upgradable to the CHIP standard as soon as it is announced.

And here is more good news – CHIP end-devices themselves do not need to support meshing capabilities. With the full coverage Wi-Fi 6 provides, end-devices are always in range of a Wi-Fi pod. Because meshing capability can cause significant power consumption, non-meshing CHIP end-devices using Wi-Fi 6 meshing capabilities instead will use significantly less power and enable smaller, longer-life batteries. This also means that the cost and design complexity of these IoT end-devices will be significantly reduced, enabling smaller and less obtrusive end-devices.

4 What About Bluetooth and Bluetooth Low Energy Mesh?

So where does this leave Bluetooth and Bluetooth Low Energy Mesh? That has yet to be seen. One could argue that Wi-Fi pods can just as easily be equipped with a Bluetooth Low Energy radio instead of an 802.15.4 radio. While that is technically true, it is not the most practical solution, because Bluetooth itself is essentially a connectivity technology, not inherently suitable for networking.

In fact, many of the more sophisticated end-devices on the market today can “talk” via 802.15.4 and Bluetooth Low Energy simultaneously, but the way the applications are usually implemented is that an 802.15.4 radio is designated as the networking connection, and Bluetooth Low Energy is used for connecting to a smart phone for commissioning. The concept here is that a smart phone with Bluetooth Low Energy connected to a sensor functions as an interface, since sensors are usually small and do not have a screen or a keyboard. With the smart phone connected to the Wi-Fi network and the sensor with Bluetooth Low Energy connected to the phone, the sensor can be updated with setup and configuration information, like network security keys, after which the 802.15.4 connection to the Wi-Fi network pod is established, and the sensor Bluetooth Low Energy connection to the phone can be disconnected.

5 Yet Another Standard?

The last decade has included many IoT standards and initiatives, but none have dominated the IoT market. One reason is that IoT standards, as opposed to Wi-Fi, need application protocols to be defined. Value creation is often by application – for example, why is central door locking common in cars but not in houses? Also, large companies bet on a market that develops rapidly enough to launch into complete ecosystems, but that did not play out. Look at health monitoring devices – different devices had different advantages, but how can one brand’s weight scale work with another brand’s sleep monitor, step counter or heart rate monitor?

It has slowly dawned on providers that sharing communication standards and application protocols will allow consumers to choose favorite products without being locked into proprietary non-communicating ecosystems, a real plug and play scenario. The smart world – and common sense – is waiting for the interoperability that will benefit everyone. The real plug and play smart ecosystem.

Will this new smart world be backward compatible with the existing world? To a large extent it will be. Wi-Fi 6 is already fully backward compatible with Wi-Fi-5, etc. But will CHIP be backward compatible with existing Bluetooth and Zigbee devices? Not at the radio or networking protocol, which means that a new CHIP-based lamp, for instance, will not work in an old Zigbee network. However, both can work in cooperation with the Wi-Fi 6 network, and application integration will take place from there.

Summary

Look for an explosion of CHIP devices for Wi-Fi 6 on the market. In the perception of the consumer, everything in the home will be “Wi-Fi connected.” This will happen through the Wi-Fi 6 EasyMesh, and end-devices will talk to the Wi-Fi 6 network directly through a Wi-Fi radio (those end-devices with a keyboard and a screen) or via a smart phone setup and an IEEE 802.15.4 radio.

CHIP and Wi-Fi 6 will be an ideal combination, dramatically simplifying indoor/smart home networking and sensor connectivity via Wi-Fi meshing – and reaping the rewards in terms of reduced power usage and smaller, longer-life batteries, as well as simplifying the fragmented technology landscape.

About the Author



Cees Links is a Wi-Fi pioneer. Under his responsibility, the first wireless LANs were developed, ultimately becoming household technology integrated into PCs and notebooks. He also pioneered the development of access points, home networking routers, and hotspot base stations. He was involved in the establishment of the IEEE 802.11 standardization committee and the Wi-Fi Alliance. He was also instrumental in establishing the IEEE 802.15 standardization committee to become the basis for the Zigbee sense and control networking. Cees Links was the founder and CEO of GreenPeak Technologies, which is now part of Qorvo, and has become the General Manager of the Wireless Connectivity Business Unit. For more information, please visit www.qorvo.com.