A Guide to ZigBee Device Developers for the Smart Connected Home

Cees Link, CEO of GreenPeak Technologies

For decades, technology experts and home automation enthusiasts have been talking about and promising the emergence of the smart, connected home. They have foretold a home connected by multitude of sensors, monitoring applications such as HVAC, home security, and even the health of the inhabitants, and all controlled remotely over the web via a smartphone or a tablet. The individual components, the sensors, and the actuators, have been available for many years. The big problem was that they didn't talk to each other – there was no universal communication protocol that would enable them to easily be monitored and controlled from a single locus.

Over the last decade, the primary impetus for connected homes has been home system integrators and enthusiastic do–it-yourselfers. However, now that ZigBee has emerged as the dominant communications technology for the smart home applications, the glue so to speak, there has been an amazing growth in the interest in ZigBee.

Most of the world's cable and satellite operators, led by giant Comcast, are in the process of rolling out smart home networks that use the cable companies' set top box – the new home control box – as the centerpiece of the new connected home. The home's various sensors use ZigBee to connect the home control box which then in turn, connects to the Internet, allowing web controlled devices to access and control the sensors and smart devices in the home.

Once the home control box is in place, connecting a few basic services – then it is easy for the home owner to purchase and install additional add-on ZigBee devices and sensors. Just like with WiFi networks and devices, these ZigBee devices all talk the same language and can easily connect without requiring any special networking expertise.

ZigBee's successful standardization – in concert with its adoption and rapid roll out by many of the world's top cable and service operators, provides an excellent market opportunity for device developers who want to get into the smart, connected home marketplace.

So What Exactly is ZigBee?

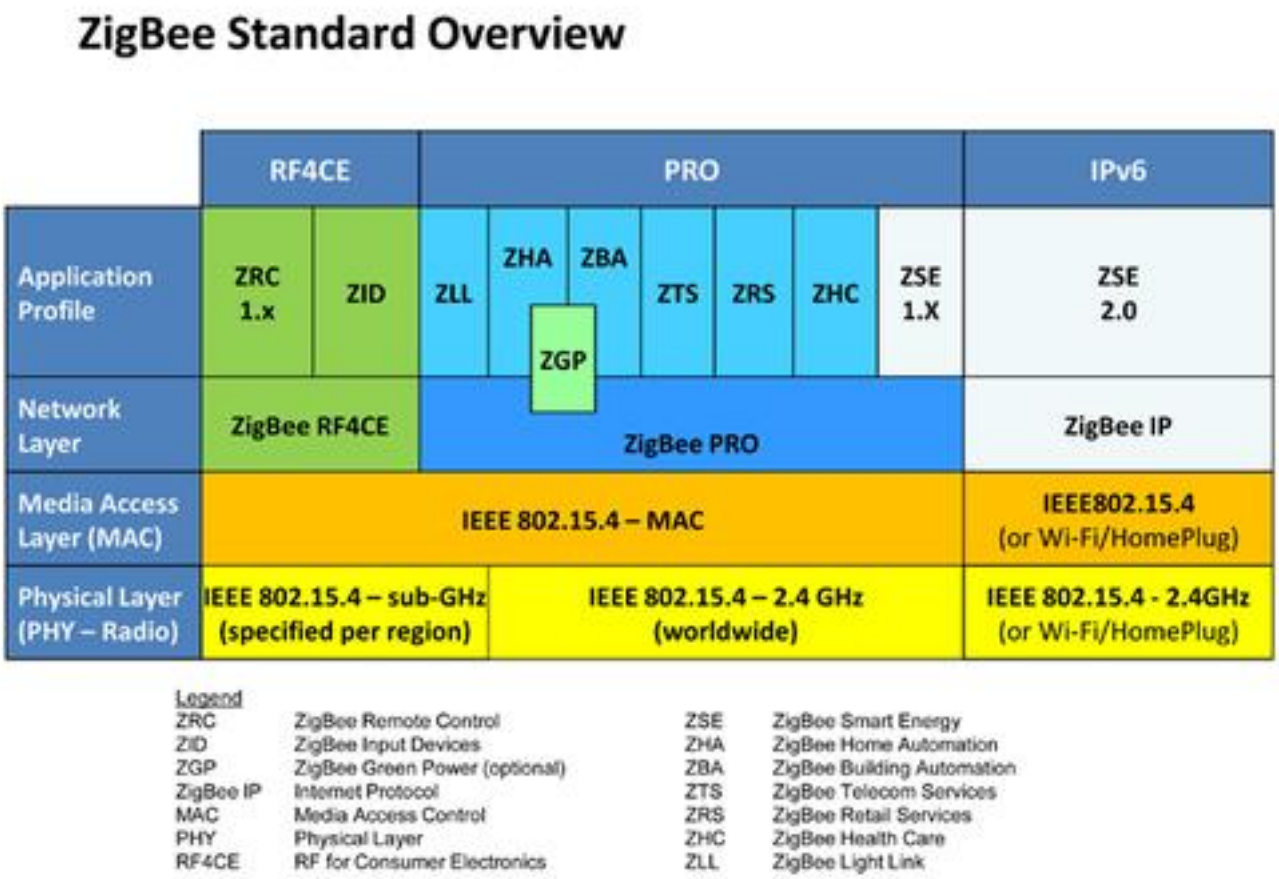
The ZigBee Alliance is an organization with more than 400 (paying and contributing) members that maintains and publishes the ZigBee standard for wireless communication for a wide variety of application domains (home/consumer, smart energy/grid, building automation, retail automation, and several others). All these ZigBee protocols have one element in common – they all use the same underlying

radio technology, the same 2.4GHz frequency band worldwide and comply with worldwide radio certification rules.

There are many similarities between the ZigBee Alliance (addressing sense and control networks) with the WiFi Alliance (addressing high speed content sharing and distribution networks). Both standards follow the ISO layered model and are based on open IEEE standards (defining the bottom two layers of the model). Both WiFi and

ZigBee offer similar ranges and the ability to transmit through furniture, walls and floors. Both use the 2.4 GHz spectrum. The main difference between the two is that WiFi is building on the IETF for the network layers (TCP/IPv4/v6), where the ZigBee Alliance has taken the responsibility for standardization of the upper layers, up to the application level.

A complete overview of the ZigBee family of standards can be found in the picture below.



As previously mentioned, the ZigBee MAC and PHY layers have been defined as part of the IEEE 802.15.4 work. The three network layers in ZigBee are RF4CE, PRO and Green Power, where Green Power essentially is a feature of PRO. Also a fourth network layer has just been released (April 2013) for smart grid/utility applications: ZigBee IP (ZIP). These network layers are quite complementary.

RF4CE is intended for devices that require a lot of human interfaces (like keyboards, or remote controls), and low latency and low power are key characteristics. RF4CE also offers star-networking capabilities (point-to-multipoint).

PRO can be considered as “the backbone” network layer of ZigBee, where the key characteristic is mesh-networking with the capability to cover large areas with redundant connections and therefore reliable coverage. Green Power is a feature of PRO and supports ultra-low power devices that are powered by energy harvesters or (non-replaceable) batteries. These devices are part of the network, but usually they are only included in network activity when they have to be, and otherwise they are completely shut down.

Another way to look at this is as follows: ZigBee PRO is defined as a backbone network for the sensors and actuators in the home. These sensors are often battery powered, while the actuators (HVAC systems, security alarms, kitchen appliances) tend to be mains powered. RF4CE handles the (mostly battery powered) human input devices, while for the most simple devices, Green Power does the job, even allowing these devices to work without batteries – on energy harvesters. These networking technologies have been shipping for several years now and in large volumes available from different sources: they have been “industry proven” and there are many chip suppliers offering hardware and software implementations of these technologies.

There are also hybrid/bridging technologies available, where one chip (node) can support all three network layers at the same time. One example of the many useful applications for such a chip is a set-top box that is controlled by a remote control (keyboard) for typical TV functions (channel selection, volume, etc.) and at the same time, is part of the home sense and control network, allowing the remote control to serve other equipment in the home as well (lights, curtains, heating/air-conditioning, etc.).

This exists already as a proprietary solution from selected high-end brands, but standardizing this with ZigBee will make it mainstream and general accessible, as we are used to with WiFi today. The set-top box is connected to the internet and can also act as the gateway to monitor and control all the devices on the sense and control network via smart phones, remotely from any place in the world.

As mentioned, the fourth network layer, ZigBee IP has just been released. Based on its success in the data world IPv6, has been considered for ZigBee as well, but as the focus for IPv6 is on massive data volumes (and high data rates). This technology is currently focusing on Smart Energy/Smart Grid applications.

This is the Year of ZigBee.

GreenPeak, as well as the other ZigBee chip manufacturers, are shipping millions of chips every month to device developers worldwide. Led by the cable/satellite TV and broadband service providers, the smart, connected home is no longer just a dream, but a tangible reality, offering incredible product and marketing opportunities for device developers.

GreenPeak Technologies is a fabless semiconductor company and is a leader in ZigBee silicon solutions for the smart home. GreenPeak is privately funded. It is headquartered in Utrecht, The Netherlands and has offices in Belgium, USA, France, China, Japan and Korea.

GreenPeak won the prestigious 2012 Red Herring Top 100 Europe award and is recognized as a leader in developing new wireless technologies for consumer electronics and smart home applications, demonstrating rapid growth and adoption by major customers.

For more information visit www.greenpeak.com [1]

Cees Links is the Founder and CEO of GreenPeak

Cees [“case”] Links is a pioneer of the wireless data industry, a visionary leader bringing the world of mobile computing and continuous networking together. Under his responsibility, the first wireless LANs were developed which ultimately became house-hold technology integrated into the PCs and notebooks we are all familiar with. He also pioneered the development of access points, home networking routers and hotspot base stations, all widely used today.

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