

## ZigBee compared with Bluetooth Low Energy

Within the communication and electronics industry there have been a lot of speculative predictions and hype that Bluetooth Low Energy (BLE) will eliminate the need for ZigBee. There are several arguments against this.

### The LAN versus PAN argument

Frankly, there are a lot of parallels with the past confusion between Wi-Fi and Bluetooth.

When Bluetooth was first announced, the marketing hype basically positioned Bluetooth as the solution for everything and definitely predicting “the end” of Wi-Fi (at that time still called: IEEE 802.11). Today we know that there are two distinct market segments: LAN and PAN. Suppliers have even done significant efforts to make the two technologies (both in the 2.4 GHz frequency range) peacefully coexist and work together, so when Wi-Fi and Bluetooth are in the same box, interference between them is avoided as much as possible.

In the near future, we expect to have a similar controversy with the rapidly emerging low power (sense and control) networks being resolved.

Within these low power networks, there also exist both Local Area Networks (LANs) and Personal Area Networks (PANs). LANs will be serviced by ZigBee (the name for IEEE 802.15.4 – spun-off out of IEEE 802.11 especially addressing the low power/ low duty cycle embedded systems) and PAN's will be serviced with BLE. ZigBee will be used to cover your house while BLE will cover devices inside a room.

### The LAN application argument – the Remote Control is a LAN

It is clear that remote controls can be positioned either way, as a LAN or as a PAN. Purely looking at the basic function of a remote control – talking to a single device – it is a PAN, and Bluetooth (or BLE) can do the job and there are implementations of this today.

However, a remote control can do a lot more than that. Two years ago, when the RF4CE Alliance (Panasonic, Philips, Samsung, Sony) sat together to build a new standard for RF wireless RC's (and to avoid the plethora of different proprietary IR devices that we are managing today), they evaluated all the feasible wireless technologies (including low-power Wi-Fi and BLE, Wibree at that time) and came to the conclusion that IEEE 802.15.4 best fit the requirements and they agreed on building a stack and a application profile layer on top of that.

This was called RF4CE (Radio Frequency for Consumer Electronics) and the RF4CE Alliance was born (note: only later the RF4CE Alliance was itself adopted by ZigBee for standard maintenance reasons).





The clear goal was not to be a PAN, but a LAN: to have the reach and coverage of the whole house. For example, the TV tuner can be a separate box in the cupboard, servicing multiple screens in the house (with IEEE 802.11n); the set top box can be in the closet, accessed by multiple remote controls, and... the remote control can become a standard platform for executing other functions: control lighting/dimming, or heating/air-conditioning, etc. It is clear that with this vision in mind only a LAN based technology (and not a PAN) will fit the requirements.

### **The technology argument**

Both radio technologies – Direct Sequence Spread Spectrum (DSSS) for Wi-Fi and ZigBee, and Frequency Hopping Spread Spectrum (FHSS) for BT and BLE – have a rich history and proven success track record. Both technologies also have their application spaces: Wi-Fi/ZigBee as a LAN and BT/BLE as a PAN. It is clear that there is no single fundamental reason that one technology has superiority over the other.

For example, the original IEEE 802.11 standard supported FHSS in addition to DSSS. The fact that Wi-Fi today does not support FHSS anymore is that DSSS was better capable of achieving higher bitrates, while staying within the spectrum rules of the FCC. Also, there are no fundamental cost differences between ZigBee and BLE. Both technologies can efficiently be implemented in silicon, and there is no clear difference in silicon size requirements.

However, based on the choice of the RF4CE Alliance for IEEE 802.15.4, the Alliance has been able to add specific stack and application capabilities to achieve other (CE) customer requirements, specifically in the area of channel agility and latency. The Alliance has also defined an application profile (called ZRC) to standardize remote control functionality and tightly coupled with the RF4CE stack.

Can this also be achieved with BLE? The answer is probably yes. However, it was not the choice of the RF4CE Alliance, which opted to standardize a LAN communication technology for the remote control application instead of a PAN technology.

### **The GreenPeak perspective**

GreenPeak's focus is on LAN's, ultra low power wireless LAN's for sense and control networks – with a battery life exceeding the life-time of the product.

BLE is also an interesting technology – however, it is not a LAN. It cannot provide the backbone of a network or communication system, and is relegated the outside edges. As a proven LAN technology, ZigBee is very complementary to the existing world of both Wi-Fi and BT/BLE, and the wireless world of opportunities is large enough to support them all.

### **Where does Low Power Wi-Fi play in this?**

One side comment on Low Power Wi-Fi (LPW), as this is also an interesting technology: it is both a LAN and low power, like ZigBee. However LPW is by far not as low power as ZigBee and it is also significantly more expensive. LPW's only claim to fame is that it can use existing infrastructure, which is a very thin advantage compared to the significantly higher cost that is incurred on every node in the network (and the number of nodes in a sensor networks can be very large). Actually, it may be foreseen that over time, the market will be flooded with Wi-Fi/ZigBee combo access points with an incremental cost that is quite negligible to the cost of a Wi-Fi only access point.



### Summarizing:

ZigBee and Bluetooth Low Energy are complementary and both required:

- ZigBee is LAN networking technology
  - o Coverage is a house
  - o Meshing capabilities to support essentially an unlimited number of nodes
  - o Applications are: sense and control networks
- Bluetooth Low Energy is a PAN
  - o Coverage is a few meters
  - o Star topology with limited number of nodes
  - o Applications are: body or peripheral networks
- ZigBee RF4CE is an application that overlaps the area of a LAN and a PAN
  - o CE companies and Operators intend to use Remote Control as a LAN platform
  - o Companies that intend to purely implement "remote control" can select BLE
- There is no significant fundamental cost difference between the two

Do you have comments or suggestions? I appreciate your feedback!

► [cees.links@greenpeak.com](mailto:cees.links@greenpeak.com)