

ZIGBEE – AN INTRODUCTION



Most readers will be familiar with voice and data wireless technologies, such as GSM, Wi-Fi and Bluetooth. These technologies have in the main been developed for people to communicate, or to transfer data. Even Bluetooth, which was heralded as the new universal way for PC's to talk to devices such as printers, has been mainly used for audio links – a very common accessory on modern phone handsets. These wireless technologies all share one property – a relatively large amount of data is sent, at a relatively high data rate. Illustration 1 shows the different wireless technologies.

But what if you wanted to send tiny amounts of data? As an everyday example, what if your wall mounted light switch was not wired to the lights directly but instead used wireless communication? Of course, that has been possible to do for a while now – we all have seen garage door openers, and remote car fobs – examples of wireless point to point control. But these solutions are proprietary and follow no standards, other than using pre-assigned chunks of the wireless spectrum – the so-called ISM bands.

Zigbee brings a standards based approach to low cost, low power wireless networking. What benefits does a standardised approach bring? First of all – mass manufacture. The radio chips could be made in vast volumes (how many light switches are there in the world?), and that in turn would drive costs very low – which in turn makes the idea of putting a wireless chip in a light switch sensible in the first place! Secondly, the devices could begin to form networks, and this is where the power of Zigbee really begins to show. Back to the lights example – what if we are in an office and want one switch to control all the lights on one floor, but would only allow all the lights to be

switched off if no one was in the office? Simple – add a PIR detector. The beauty of Zigbee is that devices from different manufacturers will be able to work together, as long as all are compliant to the standard.

History

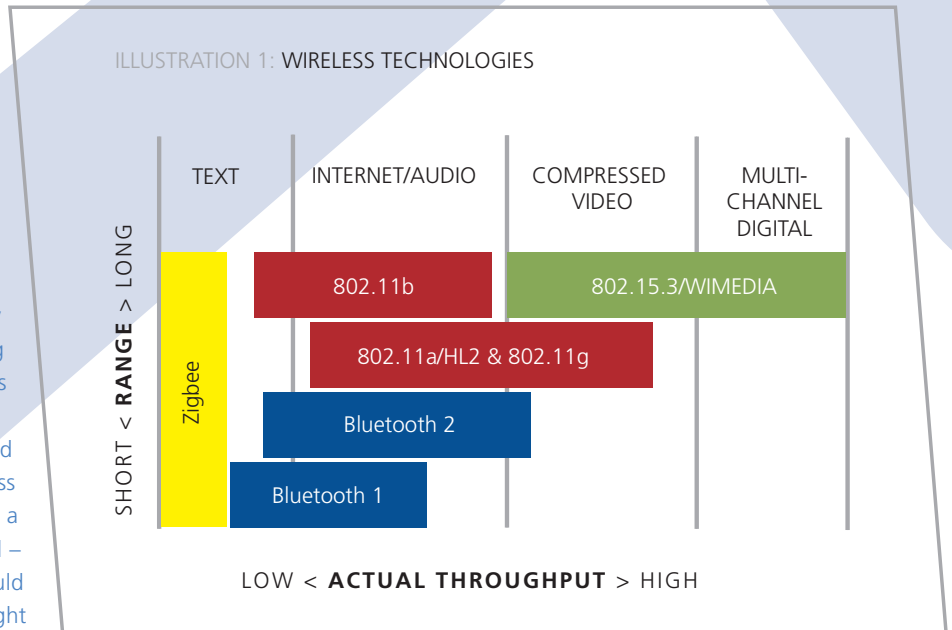
The idea of very low cost wireless networking sprung from a question: “What if radios and microprocessors were free?” This question spurred Robert Poor to launch the wireless mesh research project at MIT Media Labs in 1997. Commercial companies have now emerged from these research efforts, and we now have products available – radio chips and software protocol stacks. It was realised that this technology must be:

Illustration 2 shows one possible configuration of a mesh.

What makes Zigbee different?

In a word – Standards! Zigbee is standardised at two levels – the radio chips used must follow certain design rules, and the protocol layers that actually make the network function are defined and controlled by the Zigbee Alliance.

The Zigbee protocol defines three types of wireless nodes – Personal Area Network (PAN) coordinator, full function device and reduced function device. Full function nodes can form networks of any desired type (mesh, star, hybrid) whilst reduced function nodes can only connect to a full function node. PAN coordinators act as routers for the packets on the network –



- > Low cost
- > Easy to install (self installing if possible)
- > Reliable (fit and forget)

Only by meeting these aims would the technology become ubiquitous.

The ability to self-install and reliability considerations led to the realisation that the ideal network topology would be a mesh network, with peer-to-peer communications.

any full function device can become a PAN coordinator. Reduced function nodes have the advantage of very low power consumption, and would be used in the light switch of our example. The Zigbee Alliance has learned the lessons of incompatibility from Bluetooth, and has defined Application Profiles, that will define how different types of device should work together.

Applications

The diversity of potential applications for Zigbee is truly vast. It may well be the technology that enables the machine-to-machine market (M2M) to fulfil its promise.

Predictions are that M2M is set to grow at near 100% rates over the coming years. To give a flavour of what we may see:

- > Energy management (lighting, heating, air conditioning)
- > Safety systems (strain gauge instrumented structures e.g. bridges)
- > Military (mesh sensor networks, chemical threat detection)
- > Agriculture (networks that detect frost, irrigation control)
- > Asset Management (temperature logging, container management)

What's in a name?

Inevitably everyone asks – why is it called Zigbee? It's certainly a catchy and memorable name – but what does it mean?

It has been suggested that the name evokes the haphazard paths that bees follow as they harvest pollen, similar to the way packets would move through a mesh network.

But the truth, as revealed to the author at a recent Zigbee Alliance roadshow by Alliance Chairman Bob Heile, is more prosaic – they needed to find an unused URL (no easy task these days) and combined at random likely sounding small words – zig and bee were the ones chosen.

The Potential

'Bigger than the Internet' – so says Bob Metcalfe (inventor of Ethernet). In terms of the quantity of devices that will be manufactured, almost certainly – billions will be manufactured. Even now, with Zigbee relatively unknown, hundreds of thousands of chips have been shipped, ramping to millions next year.

Will it have the same social and

economic impact that the Internet has had? No one knows right now – as with all enabling technologies the 'really good ideas' probably have not been thought of yet.

Summary

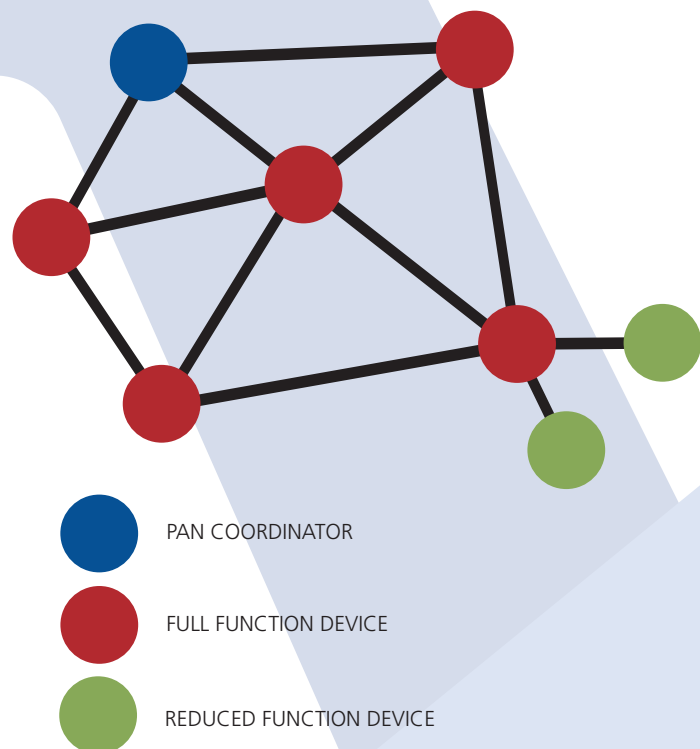
Zigbee has too much potential for any company to ignore. The technology will form part of the 'wireless ecosystem' and

ubiquitous nature of Zigbee technology will mean that many other exciting avenues of application remain to be explored.

Vic Bain is the Managing Director of Softedge Technologies Ltd.

www.set-ltd.com

ILLUSTRATION 2: MESH NETWORK



as such existing players in this space should be aware of it. Zigbee will in many cases form the end point of M2M networks. Product Development companies such as Soft Edge Technologies Ltd. have a role in facilitating and deploying this technology. Although the "killer apps" such as building lighting will be the domain of the big players (Philips are about to launch a system), the