**WIBREE**

1. Abstract:

These connect to large devices like mobile phones or personal computers. No other existing wireless technologies will connect with small button cell battery devices so effectively. “Nokia introduced the new connectivity technology WIBREE”.

A Technology coming under **IEEE 802.15.4** Standard called Wibree technology. Wibree is a short-range wireless protocol optimized for low power consumption. Developed primarily by Nokia, the company has submitted Wibree as an open standard to promote adoption and interoperability. Wibree is intended to compliment Bluetooth communications in certain PAN applications where small, lightweight design makes standard Bluetooth communication unsuitable or difficult. For instance, Bluetooth-enabled wristwatches require relatively large transmitters and batteries, making the devices heavy and uncomfortable. Wibree-enabled wristwatches can use smaller transmitters and smaller batteries, increasing user comfort and reducing fatigue while extending battery life.
2. **Introduction:**

Wibree is an innovative digital radio technology that can soon become a benchmark for the open wireless communication. Working almost equivalent to the Bluetooth technology, this modern technology functions within an ISM band of 2.4 GHz and amid a physical layer bit rate of 1 Mbps.

Widely used in may appliances like the wrist watches, wireless keyboards, toys and sports sensors due to its key feature of very low consumption of power within the prescribed ranges of 10 meters or 30 feet using the low cost transceiver microchips, it can generate an output power of -6 dBm.

Conceived by the Nokia Company in 10-03-2006, it is today licensed and further researched by some of the major corporates that includes Nordic Semiconductor, Broadcom Corporation, CSR, Epson, Suunto and Taiyo Yuden.

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3. **Wibree:**

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3.1 **Evolution of WIBREE:**

In 2001, Nokia researchers determined that there were various scenarios that contemporary wireless technologies did not address. To address the problem, Nokia Research Center started the development of a wireless technology adapted from the Bluetooth standard which would provide lower power usage and price while minimizing difference between Bluetooth and the new technology. The results were published in 2004 using the name Bluetooth Low End Extension. After further development with partners, e.g., within EU FP6 project MIMOSA, the technology was released to public in October 2006 with brand name Wibree. After negotiations with Bluetooth SIG members, in June 2007, an agreement was reached to include Wibree in future Bluetooth specification as an Bluetooth ultra-low-power technology, now known as Bluetooth low energy technology.
3.2 The Wibree standard:

The Wibree is a wireless technology. It’s open standard based on the Bluetooth. The Wibree technology must have the same debit (1Mb/s) than the Bluetooth technology. All the specifications of Bluetooth and Wibree technologies are the same expect the power consumption of Wibree must be ten time inferior to the power consumption of Bluetooth. The frequency band is between 2.4 GHz and 2.4835 GHz. The channel bandwidth is 2 MHz. The modulation is GFSK (Gaussian frequency shift keying). This technology doesn’t replace the Bluetooth technology. The Wibree will use in the new type of object like sport sensors or toys.

3.3 What Wibree does:

Wibree’s main application is to provide an ultra low power radio within the 2.4GHz band. Low power is always determined in large part by the application – the longer a device is active, and the more data it transmits, the shorter its battery life will be.

Wibree is aiming to produce a radio that can transmit a small packet of data approximately every second for a year using a small button cell, such as a CR2430, with a capacity of around 280mAH. If the duty cycle is reduced to one transmission every 15 to 30 seconds, then the battery life effectively becomes the leakage life of the battery. This low power drain is achieved by designing a radio and protocol that lets the radio stay asleep for most of its life. It can wake up quickly, when it will broadcast its requirement to transfer data on a number of advertising channels across the spectrum. The receiving device, which is likely to contain a larger battery as it will be on for more of the time, will acknowledge the message and tell the first device which channel to send its data on. It will then acknowledge receipt of this data, at which point both can go back to sleep.

The whole process will take less than three or four milliseconds. Cost is a key advantage in Wibree existing within a Bluetooth chipset. But it’s not the only advantage of that symbiotic existence. Major concerns abut radio deployment in the 2.4GHz band is the growing level of interference that is likely to exist. That’s
already resulting in a resurgence of interest in Bluetooth for industrial applications because of its resilience to interference. Wibree provides the answer. Because the conversation between devices allows the responding device to select the radio channel to use, it introduces the concept of frequency agility, where the two radios can move to undisturbed parts of the spectrum for their data transmissions. In most cases, this receiving device will be a mobile phone, which is acting as a gateway. The same Bluetooth chip that contains the Wibree radio within the phone will be constantly scanning the radio spectrum as part of its adaptive frequency hopping requirement to see what spectrum is free. It makes perfect sense to share this information with the Wibree radio to give it the frequency agility that it needs to meet high reliability applications.

In that sense it’s probably the same type of understatement that has haunted Bluetooth; although Bluetooth is normally referred to as a short range technology for less than ten meters, the reality is that it is successfully used for many applications over hundreds of meters. Looking more closely at what we know about the parameters that will determine Wibree range, the first point is that it will share the radio and receiver of Bluetooth chips. The most recent generation of Bluetooth chips have receive sensitivities around -85dBm and can directly output at transmit powers of around +4dBm. With careful RF design that gives an open field range better than 200 metres.

3.4 Wibree – the marvelous world of wireless microdata:

The announcement by the Bluetooth SIG that they are embracing Wibree as an additional strand of the Bluetooth family of wireless specifications is a major step in its evolution. At its announcement, some commentators asked why we needed yet another wireless standard, particularly as its key feature is low power. The argument being that we already have low power radio standards, such as 802.15.4, ZigBee and Z-Wave.

Wibree offers low power – as low as any of the other contenders, but it does it in a way that sets itself apart from them. Its unique feature is that it cohabits with a Bluetooth radio in a new generation of wireless chips. To reduce cost it uses the same radio circuitry that’s already there for Bluetooth and
squeezes in a small, complementary protocol stack. These dual mode chips will cost at most a few cents more than today’s Bluetooth only chips. That means Wibree will quickly achieve a high penetration in mobile phones because it is riding on the back of an established technology.

There are two important things to realise about that symbiosis: firstly, Wibree deployment will happen quickly and happen in volume. Secondly, it means that every Wibree enabled mobile phone becomes a ready built, wide area gateway capable of transferring data from a peripheral Wibree device to a remote network or service. The sheer speed and scale of Wibree deployment in mobile phones in the next few years is the first step to its goal. It will provide the critical mass that product designers need to justify incorporating wireless connectivity into a new generation of products.

Low cost, Wibree only chips will find their way into a whole new range of accessories, such as watches and lifestyle devices. Dual-mode Wibree + Bluetooth chips will give added functionality to the phones themselves, which will become usable for location specific data searching and remote control. Most importantly, Wibree opens up a raft of new opportunities for mobile network operators. As each Wibree equipped handset is a mobile gateway for Wibree devices, operators will be able to offer new services, such as health monitoring. Such services provide a route to new revenue streams, as well as being a powerful tool for operators to increase customer loyalty and reduce churn. The important point to understand about Wibree is that it is going to build upon the volumes of mobile phones.

Unlike other low power standards it’s not starting from scratch, but will ride on an industry that already sells a billion devices every year. Wibree has the goal of enabling a multitude of products to connect to each and every one of these handsets. That adds up to a potential that is an order of magnitude greater than mobile phone sales. Unlike other short range standards, Wibree’s goal is not to ship mere millions, but tens of billions.
4. **Technical information:**

Wibree is designed to work side-by-side with and complement Bluetooth. It operates in 2.4 GHz ISM band with physical layer bit rate of 1 Mbit/s. Main applications include devices such as wrist watches, wireless keyboards, toys and sports sensors where low power consumption is a key design requirement. The technology was announced on 3 October 2006 by Nokia. Partners that currently license the technology and cooperate in defining the specification are Nordic Semiconductor, Broadcom Corporation, CSR and Epson. Other contributors are Suunto and Taiyo Yuden.

Wibree is not designed to replace Bluetooth, but rather to complement the technology in supported devices. Wibree-enabled devices will be smaller and more energy-efficient than their Bluetooth counterparts. This is especially important in devices such as wristwatches, where Bluetooth models may be too large and heavy to be comfortable. Replacing Bluetooth with Wibree will make the devices closer in dimensions and weight to current standard wristwatches.

5. **Power consumption:**

Chip manufacturers do not disclose power consumption data on data sheets. This specification item depends on the operational duty cycles. Therefore
the authentic data may be obtained just with experimental board set-ups and respective firmware test environment. Respective test environment specifications to normalize and directly compare the offered alternatives are not available (2008-10-19).

6. Bluetooth:

The name Bluetooth comes from the name of a king, King Harald Blatand (translated Harold Bluetooth) of Denmark and Norway from 935-940 A.D. He is known for his unification of previously warring tribes from Denmark (including Scania, present-day Sweden, where the Bluetooth technology was invented) and Norway.

Bluetooth is a proprietary open wireless protocol for exchanging data over short distances (using short length radio waves) from fixed and mobile devices, creating personal area networks (PANs). It was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth was intended to unify different technologies like computers and mobile phones. The name is inspired by the historical King Bluetooth, who united the Scandinavian countries. The Bluetooth logo merges the Nordic runes analogous to the modern Latin H and B: (Haglaz) and (Berkanan).

7. Zigbee:

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

The ZigBee Alliance is a group of companies that maintain and publish the ZigBee standard. ZigBee is a low-cost, low-power, wireless mesh networking
proprietary standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.

- The ZigBee Alliance, the standards body that defines ZigBee, also publishes application profiles that allow multiple OEM vendors to create interoperable products.

7.2 Uses of ZigBee:

ZigBee protocols are intended for use in embedded applications requiring low data rates and low power consumption. ZigBee's current focus is to define a general-purpose, inexpensive, self-organizing mesh network that can be used for industrial control, embedded sensing, medical data collection, smoke and intruder warning, building automation, home automation, etc. The resulting network will use very small amounts of power — individual devices must have a battery life of at least two years to pass ZigBee certification.

Typical application areas include

- **Home Entertainment and Control** — Smart lighting, advanced temperature control, safety and security, movies and music
- **Home Awareness** — Water sensors, power sensors, energy monitoring, smoke and fire detectors, smart appliances and access sensors
- **Mobile Services** — m-payment, m-monitoring and control, m-security and access control, m-healthcare and tele-assist
- **Commercial Building** — Energy monitoring, HVAC, lighting, access control
- **Industrial Plant** — Process control, asset management, environmental management, energy management, industrial device control.

Wibree hardware in a wristwatch no larger than a standard quartz watch, with a comparable weight. In contrast, Bluetooth watches are heavy and bulky, making them inappropriate and even uncomfortable for everyday use.
7.3 Differences between Zigbee, Wibree and Bluetooth:

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<thead>
<tr>
<th>Characteristics</th>
<th>Zigbee</th>
<th>Wibree</th>
<th>Bluetooth</th>
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<tbody>
<tr>
<td>Range</td>
<td>10-75 mts</td>
<td>10 mts</td>
<td>10 mts</td>
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<tr>
<td>Throughput</td>
<td>20-250kbps</td>
<td>Less than 1 Mbps</td>
<td>Maximum 3 Mbps</td>
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<tr>
<td>Power Consumption</td>
<td>1 Year</td>
<td>Years</td>
<td>Few Days</td>
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<tr>
<td>Frequency</td>
<td>2.4 GHz</td>
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<tr>
<td>Co-existence with BlueTooth</td>
<td>No</td>
<td>Yes</td>
<td>N/A</td>
</tr>
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8. Wibree applications – small scale, big opportunity:

Wibree is all about small data transfers. These are the applications that send small amounts of information occasionally. That might be a TV remote control, a glucose monitor, flight information at an airport or a room thermostat. All in all, each application may only transfer a few tens or hundreds of bytes of data each day. It’s what I’ve termed microdata. It’s not a new concept, but prior to Wibree nothing has had the architecture to make it simple or the critical mass to make it happen. Instead most wireless technologies have been bogged down in complexity by trying to be good at the difficult things, such as meshes or video streaming or concurrent audio and data. Wibree is all about doing the little things simply. Looking at it anthropomorphically, Wibree’s not the technology for long term wireless relationships between devices, but rather the everyday “hellos”
“how are you”s, “how much is that” and "I'll have two of those, please". In terms of the wireless day, Bluetooth and Wi-Fi will cover the deep, meaningful conversations between loved devices; Wibree will be all of those other snippets of conversation that oil our everyday existence.

8.1 The long and short of it:

Don’t make the mistake of thinking that low power and long battery life mean that Wibree will be limited to short range applications. Wibree can transmit at powers up to 100mW. In mobile phones, where it shares the same transmitter and receiver with the Bluetooth chip it reside in, Wibree will typically transmit at around 2mW with a receive sensitivity of better than -86dBm. If the RF circuitry is well designed, that will give it an open field range in excess of 100 metres with very low battery consumption. Sensor applications that add a power amplifier ought to be able to exceed 1 km of open field range. While many Wibree applications will extend no further than the range of personal transactions within a room, there will be numerous applications that need to cover the house or office. The ability to deliver that range will help Wibree enable a very wide range of applications.

8.2 What’s microdata all about?

The best way to understand its versatility is to look at some applications that Wibree can enable. The first of these to come to market will almost certainly be phone-centric, least because Wibree is being championed by Nokia and other phone vendors. These headline applications include sending caller information to your watch display and collecting data from health and lifestyle sensors. They’ll start to deliver the first stage of that promise of tens of billions of devices. An important part of the design of the Wibree standard has been in making it inexpensive to manufacture and integrate – potentially half the cost of Bluetooth for a stand-alone Wibree chip. That low cost opens up a whole raft of
opportunities. It only needs a little thought to see how wide the potential from wireless microdata can be.

**Microdata means Location**

How many times have you gone somewhere and wanted some basic piece of information? It might be the time and gate for your flight, where the goat’s cheese is in the supermarket, or where to find your mummy at the British Museum. Some of these can be answered by search engines and a mobile data subscription. Wibree enables the concept of free local searches.

The way it works is to install Wibree “servers” at each relevant location, with a simple information database in each. That database is typically going to be small and local as it only concerns itself with information about its search location. At the train station it will be the times and platforms of trains for that station and their destinations. In the supermarket it will be the aisle in which goods are located. At the museum it will be details of where the exhibits are on display.

Each Wibree location server will broadcast its presence, and any Wibree device with a suitable search application can choose to show all of the servers within range. It’s never likely to be a big list, but it will be information relevant to where you are.

The process doesn’t touch the mobile network, so there’s no charge. The phone only needs to accept minimal data and display downloaded text, so it’s fast. The database in the server is small and simple to structure as it only has limited, local information.

**Microdata means Health - The Ubiquitous Gateway**

Caring for an ageing population with an increasing incidence of long-term, chronic health issues is a problem facing most countries. There is a clear perception that electronic monitoring of health is a key part of any solution. That’s been recognized within the industry with the formation of specialist groups such as the Bluetooth Medical Devices Group, the Continua Alliance and the IEEE 11073 standards group.
Wibree is widely seen as a key enabler for these services. Where it scores over any other low power radio is in its unique ability to use the mobile phone as a gateway that can pass data from a personal medical device to a service provider. Some of the first Wibree devices being talked about are sports accessories, such as simple pedometers built into sports footwear. The technology will quickly migrate to personal health monitors, including weighing scales, blood pressure monitors and glucometers. These aren’t devices that need to send large amounts of data, but their usage model requires low power so that they can be small, battery powered and wearable.

The prospect of offering health related services is an exciting prospect for network operators. It’s one of the reasons that the GSM Association is welcoming Wibree as an evolution of the existing Bluetooth standard. It’s not yet clear where the services will reside – with mobile networks, insurers, national healthcare services, gyms or private medical companies. What is clear is that Wibree provides a wireless implementation with the accessibility that will enable a large-scale deployment of eHealth devices.

**Microdata means Control**

The concept of Home Automation has been around for over sixty years, yet still has not taken off. There are many reasons for that, including proprietary systems that won’t work with each other, cost and the fact that most of them are too complicated to set up.

As Wibree appears in these devices, the scope for remote control of other devices will appear. Gateway devices will also open up the possibility of remote access. Whether a large number of people will ever want to control their heating or white goods remotely is open to debate, but Wibree will be sneaking into the infrastructure of household goods for other reasons. Increasing concerns about energy and resource usage will require smarter washing machines and dishwashers that can talk to each other about how and when they’re working. The driver is likely to be flexible tariffs and government legislation, rather than consumer demand for the automated home. The day is coming when your utility company will decide when you can do your washing.
Wibree and Bluetooth:

There is one area which Wibree will revolutionise more than any other, which is wireless healthcare. Wireless devices will drive things like telemedicine, helping a global aging population stay fitter. That reflects a widespread understanding that healthcare needs to encompass remote monitoring in order to service the aging population. Depending on the application this goes by a variety of names, including eHealth, telecare, assisted living and wireless wellbeing. It encompasses everything from personal fitness plans to disease control and dementia monitoring.

9. Conclusion:

Taking all of these factors together, Wibree has the potential to transform consumer devices. It will solve the technology and monitoring issues that are currently hindering the adoption of wireless healthcare services and enable a whole new generation of lifestyle, monitoring and safety products. By making the mobile handset the gateway, it brings the network operators into the equation. And they have the resources to aggregate and enable service provision. Today Wibree is a Nokia solution. However, it is being supported by the major Bluetooth chip vendors including Cambridge Silicon Radio and Broadcom. That means it will reside within the chips in almost every brand of handset. It is unlikely that other phone vendors will not take advantage of its presence, not least because it offers the network operators an additional revenue stream. Its presence will make it very difficult for any other short range, low power wireless technology to gain traction in the handset, ensuring that Wibree is placed to own the wireless healthcare market. It may not become the accepted acronym, but Wibree will enable C2M - “Consumer to Machine” or “Consumer to Middleware” applications at a price point that makes them mass market. M2M is only just beginning to
deliver against its promises. Wibree may result in C2M delivering an even larger promise in a shorter timescale.

By the end of 2007 EZURiO expects to be able to provide the first modular products to allow developers to start work on Wibree designs for wireless healthcare. In the meantime we also expect to see networks engage in investigating the infrastructure requirements to provide the data services to support these applications.

10. References:

www.ieee.org
www.ezurio.com
www.wikipedia.com
www.wibree.com