

WIBREE USING DIGITAL RADIO TECHNOLOGY

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ABSTRACT

Wibree is the first open wireless technology to specifically target connectivity between mobile devices such as smartphones or PCs and small, battery-powered devices such as watches, wireless keyboards, toys and sports sensors.” Indeed the list of potential applications and battery-powered peripherals that could now enjoy the benefit of the wireless revolution will only be limited by the imagination of designers, “comments Nordic Semiconductor’s CEO, Svann-Tore Larsen.

KEYWORDS:

Radio Technology, Svann-Tore Larsen, Zigbee Suunto and Taiyo Yuden, Broadcom, Epson Interoperability, Nordic Semiconductor Wi-max, Media Access Controller.

1. INTRODUCTION ON WIBREE

Now a day the wireless technologies are more in use and are widely evolving. Some of the technologies now in use are Wi-Fi, Wi-max, Zigbee, and Bluetooth. Out of which Bluetooth is most popular. These technologies are widely used to connect the large devices like mobile phones or personal computers. No other existing wireless technologies will connect with small button cell battery devices so effectively. So the Nokia introduced the new radio technology called Wibree.

1.1. What is Wibree?

Wibree is a digital radio technology (intended to become an open standard of wireless communications) designed for ultra low power consumption (button cell batteries) within a short range (10 meters / 30ft) based around low-cost transceiver microchips in each device. As of June, 2007 Wibree is known as Bluetooth ultra low power, in 2008 renamed Bluetooth low energy

Wibree is a new radio technology developed by Nokia. It consumes only a fraction of the power compared to other such radio technologies, enabling smaller and less costly implementations and it is easy to integrate with Bluetooth solutions. 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.^[1] 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.^[2] 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

2. HISTORY

Around 2001, the Nokia Research Center was looking at options for future personal wireless networking. The company realized that there was room for developing an ultra-low power, wireless technology that could interface cost-effectively with a large variety of existing and future devices, which, until now had not been effectively served by available existing technologies. Towards this end, Nokia decided to create a new open wireless protocol, and now, along with its partners Broadcom Corporation, CSR, Epson, and Nordic Semiconductor, is working to bring it to market.

While the Wibree protocol is currently under development and should be ready by mid 2007, the availability of the Wibree chip depends upon the semiconductor manufacturers' schedules. Wibree is similar in many respects to the now prevalent Bluetooth standard. Both use the 2.45 GHz band to transfer data and have a 1 Mbps transfer rate (although the newer Bluetooth 2.0 standard already incorporates a 3.0 Mbps transfer rate) and a range of about 10 meters (m). The two complementary technologies differ in size, price, and most of all power consumption. Wibree would use only a fraction of the power consumed by today's Bluetooth chips, resulting in a much longer battery life and more compact devices. While Bluetooth can be used to transmit audio and media files, Wibree is designed to extend this network by serving applications that transmit only small amounts of data and where size and cost are priorities. Many applications that were not cost-

effective using existing Bluetooth technology, such as wirelessly controlled toys, watches, medical and sports sensors, and a range of other applications that have not been conceived yet, might be developed using Wibree technology.



Nokia a eon phone concept - future mobile phones will include Wibree (Credit: Nokia)

FIG (1)

There will be two types of Wibree implementations –one based on the Wibree stand-alone chip, and another based on the Wibree-Bluetooth dual-mode chip - which will serve different purposes and be installed on different devices. Stand-alone Wibree chips would be implemented in small, low cost devices such as wireless mouse and keyboards, sensors, and toys. The Wibree-Bluetooth dual-mode chips would probably be implemented in future mobile phones, allowing users to benefit from both worlds – Bluetooth 2.0 high speed and Wibree's low power and extended ability to communicate with a new generation of smaller wireless devices.

Wibree didn't just appear from out of the blue this October. Although the current specification is still confidential a little digging produces a lot of its history and provides a good guide to its content. There is an irony in the fact that the origins of Wibree were the alternative proposal for the radio and Media Access Controller (MAC) for the 802.15.4 standard, which is now the basis of ZigBee and other short range radio networks.

3. BREWING WIBREE PANS



FIG (2)

Wibree, developed by Nokia, is an open-industry initiative for an ultra-low-power, RF technology operating in the 2.4 GHz band. It comprises a

physical layer, light weight protocol stack and application-specific profiles. It is designed to connect mobile phones and PCs to a range of coin-cell battery-powered devices that require battery lifetimes of years. Nordic Semiconductor has become one of the first members joining the Wibree open initiative and is member of the Wibree specification group. Other members include CSR, Broadcom, Epson, Suunto, and Taiyo Yuden. Specification work for Wibree is currently under way. The technology will be made broadly available to the industry through an open and preferably existing forum. According to the current estimate the first commercial version of the interoperability specification will be available during second quarter 2007. First volume products are expected end of 2007 or first quarter of 2008. The specification details a short-range RF communication technology featuring ultra low power consumption, a lightweight protocol stack and integration with Bluetooth. Wibree operates in the globally accepted 2.4 GHz ISM (Industrial, Scientific & Medical) band. It features a physical-layer bit rate of 1Mbit/s over a range of 5 to 10 meters. The specification features two implementations: dual-mode and stand-alone. In the dual-mode implementation, Wibree functionality is integrated into Bluetooth circuitry.

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.. Nordic Semiconductor is aiming to sample Wibree chips during the second half of 2007. 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.

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Bob Iannucci, head of Nokia's Research Centre, claims the technology is up to ten times more efficient than Bluetooth.^[5] Reportedly, it will have an output power around -6 dBm^[6]. Nordic Semiconductor is aiming to sample Wibree chips during the second half of 2007. 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.

5. THE WIBREE SPECIFICATION

GROUP

The Wibree specification group is an association of companies working together on the Wibree interoperability specification. This specification describes the protocol stack from the physical layer up to a set of profiles that supports specific usage models along with compliance and interoperability test procedures. Initiated and headed by Nokia, the group currently includes Nordic Semiconductor, CSR, Broadcom, Epson, Suunto and Taiyo Yuden.

All of these companies are contributing to the specification in their respective areas of expertise. The technology will be made available to the industry through an open and preferably existing forum, to be defined by the time the specification is finalized. According to the current estimates the first commercial version of the specification will be made available during second quarter of 2007. Although the current specification is still confidential a little digging produces a lot of its history and provides a good guide to its content. There is an irony in the fact that the origins of Wibree were the alternative proposal for the radio and Media Access Controller (MAC) for the 802.15.4 standard, which is now the basis of ZigBee and other short range radio networks. Back in 2001 two industry groups put forward proposals for the form of this radio. Nokia headed one of the groups and proposed a development that was handset centric. A major tenet of their design was that "it can be deployed with minor effort into devices already having Bluetooth, e.g. cell phones" with the added requirement that a "common RF section with Bluetooth must be possible". Their vision was also broader than that of the competing camp in that it envisaged a world of a trillion wireless, web connected devices. A key slide shows millions of connected laptops, billions of mobile phones and trillions of what could be interpreted as Wibree enabled devices

6. WIBREE IMPLEMENTATIONS

There will be two types of Wibree implementations: – one based on the Wibree stand-alone chip, and another based on the Wibree-Bluetooth dual-mode chip - which will serve different purposes and be installed on different devices.

6.1 STAND-ALONE WIBREE CHIPS

Stand-alone Wibree chips would be implemented in small, low cost devices such as wireless mouse and keyboards, sensors, and toys. The Wibree stand-alone chip is designed for use with applications which require extremely low power consumption, small size, low cost and where only small quantities of data are transferred. It's an ideal solution for small devices (like heart-rate monitors) that use only short data message and must have long battery life.

Examples of devices that would benefit from the Wibree stand-alone chip are: watches, sports and wellness devices and human interface devices (HID) such as wireless keyboards.

6.2. WIBREE-BLUETOOTH DUAL-MODE CHIPS

The Wibree-Bluetooth dual-mode chips would probably be implemented in future mobile phones, allowing users to benefit from both worlds – Bluetooth 2.0 high speed and Wibree's low power and extended ability to communicate with a new generation of smaller wireless devices. The Bluetooth-Wibree dual-mode chip is designed for use in Bluetooth devices. In this type of implementation, Wibree functionality can be integrated with Bluetooth for a minor incremental cost by utilizing key Bluetooth components and the existing Bluetooth RF

7. WIBREE V/S BLUETOOTH

Wibree differs from Bluetooth in several fundamental ways.

1. Recent Bluetooth specifications, notably 2.0, are designed with an emphasis on throughput, or data transfer speed. Bluetooth 2.0 devices can exceed speeds of 350 kb/s under ideal conditions. This is about three times the maximum speed of planned Wibree devices, which transfer data no faster than 128 kb/s. The tradeoff comes to light in terms of power, space and weight savings. Current Bluetooth-enabled wristwatches must replace their large, specialty batteries on a monthly basis.
2. Bluetooth uses a frequency hopping technology to avoid interference from other devices operating in the same frequency. Wibree does not use frequency hopping
3. Bluetooth uses fixed packet length. This increases power usage as unnecessary transmission occurs. Wibree has a variable packet length and transmits only when necessary.
4. Bluetooth drains your cell phone battery as it needs quite a lot of power to remain active. Wibree aims to survive for a full year on a button sized battery. In contrast to Bluetooth, wibree goes into sleep mode when not transmitting. In sleep mode the radio will be off and will save a lot of power. Wibree devices wake up only when they want to transmit
5. The major usage difference between wibree and Bluetooth is the traffic characteristics. Bluetooth is useful when transferring files, using the hands free etc where the volume of data that needs to be transferred is considerable.
6. Wibree is used in areas where only short bursts of data need to be transmitted. Remotes, sensor data etc.

8. WIBREE V/S ZIGBEE

- Wibree is a PAN (Personal Area Networking) technology
- Zigbee is a mesh networking technology
- Wibree is more power efficient
- Zigbee has got more range
- Wibree's data transfer rate is 1 Mbps
- Zigbees Data transfer rate is 250 Kbps
- Wibree has got a star topology
- Zigbee has got a mesh topology
- Wibree uses Bluetooth radio and can co-exist with Bluetooth
- Zigbee needs its own special radio and has got no relationship with Bluetooth.

9. WIBREE APPLICATIONS

Imagine a wireless keyboard and mouse with battery lifetimes exceeding one year communicating with a PC without using a fragile dongle. Imagine a watch equipped with a wireless link communicating with both a tiny sports sensor embedded within the user's shoe and mobile phone. Imagine a range of personal devices communicating with mobile phones or PCs, but without the inconvenience of changing or charging batteries every week. Imagine no longer, because Wibree will make all of these applications – and many more – a reality.

Mobile phones equipped with Wibree will enable a range of new accessories such as call control/input devices, sports and health sensors, and security and payment devices with battery lifetimes of up to three years (depending on usage pattern). Wibree will also bring wireless connectivity to high-performance PC accessories such as mice, keyboards and multimedia remote controls with battery lifetimes of up to a year. And Wibree will add wireless connectivity to watches and sports sensors (for example, heart rate monitors) without significantly compromising battery lifetime.

Mobile Phone Accessories – Mobile phones equipped with Wibree technology will enable a range of new accessories such as call control/input devices, sports and health sensors, security and payment devices. These devices will benefit from the ultra-low power consumption of Wibree making possible compact, coin cell battery

operated devices with battery lifetimes up to 3 years (depending on the actual application).

PC Accessories – Wibree is designed to offer wireless connectivity to high performance PC accessories such as mice, keyboards and multimedia remote controls. The ultra-low power consumption of Wibree extends battery lifetimes to over a year. Nordic will build on its position as a leading provider of ultra-low power 2.4 GHz technology to encourage Wibree's adoption into PC accessories enabling the next generation of wireless mice and keyboards.

Watches – Imagine your watch equipped with a wireless link communicating with both a tiny sports sensor embedded in your shoe and your mobile phone.

10. MERITS & NEGATIVE ASPECTS

10.1 Merits

Wibree is the first wireless technology to solve the following needs in a single solution.

- Ultra low peak and average power consumption in both active and idle modes.
- Ultra low cost and small size for accessories and human interface devices (HID).
- Minimal cost and size addition to mobile phones and pcs.
- Global ,intuitive and secure multi-vendor interoperability

10.2 Negative Aspects

- Data transmission is very slow, i.e., only 1 megabit per second.
- Cannot be used in high bandwidth required applications.

11. CONCLUSION

Wibree will also dramatically extend the battery lifetime of existing wireless device such as keyboards, mice and remote controls. It's up to 10 times more energy efficient than Bluetooth. Nokia said it expected the first commercial version of the standard to be available during the second quarter of 2007. The firm said it expected dual Bluetooth-wibree devices such as mobile phones to hit the market within two years.

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