Mr. Devang G. Chavda, Mr. Gaurav N Mehta, Mr. Jimish K. Desai, Mr. Nitin K. Nakum, Miss Ashita A Brahmwar / International Journal of Engineering Research and Applications (IJERA)
ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp. 400-403

WIBREE Technology with Bluetooth

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Abstract—
The number of computing and telecommunications devices is increasing and consequently the focus on how to connect them to each other. The usual solution is to connect the devices with a cable or sometimes using infrared light to make file transfer and synchronization possible. The infrared solution eliminates the cable but requires line of sight.

To solve these problems a new technology, Wibree radio technology complements other local connectivity technologies, consuming only a fraction of the power compared to other such radio technologies, enabling smaller and less costly implementations and being easy to integrate with Bluetooth solutions to connect a wide range of computing and telecommunications devices easily and simply without the need for connecting cables. Furthermore it can also be used to enable communication between several units, such as small radio LANs. This results in a multitude of possible future user scenarios. This article focuses on why this technology has got a large attention although it is in development, pro's and con's with respect to other technologies and lot's more.

Keywords— **Wireless Technology, Wi-Fi, Bluetooth, Zig Bee, HID(Human Interface Device), Router, LAN, WiMax, Wireless USB, VoIP (Voice over Internet Protocol).**

1. INTRODUCTION

Basics for choosing a Short Range Wireless Technology:

Wireless has already transformed the things we carry and the way we work in the wider area, most notably with our eager acceptance of the mobile phone, both as an extension of our personal communication and also as an object of desire. The question is which wireless technologies will appear in the plethora of electronics devices we currently buy. There is no easy answer – despite the claims that their marketing machines may make no one wireless technology is the universal panacea – each has its specific niche within the brave new wireless world. Most have specific areas of excellence and many overlap.

To choose which suits your need, you need to consider carefully what you want to achieve and the environment in which you wish to deploy it. Every application has its own, unique requirements, but the general list of these remains constant across most wireless applications:

- Range
- Data Rate
- Battery Life
- Security
- Cost
- Quality of Service
- Interoperability
- Qualification and Approval

The first two, range and data rate generally provide the first selection points regarding which are the likely contenders. Although most radio standards are capable of transmitting small amounts of data, those that are designed for higher data rates are usually inefficient if you only need to transfer a small number of bits of information. However, if you already have an infrastructure for a higher data rate standard, it may be more cost effective to continue to use that for your local M2M connections.

2. The Wireless Zoo

Apart from the well known Bluetooth format, which operates at a distance of up to 10 m (and the less common Bluetooth Class 1, which can broadcast up to 100 m) and can transmit up to 3.0 Mb/s, there are currently a host of other wireless technologies more planned for the next few years. The following is a list of some of the main technologies.

2.1 Wi-Fi

Initially conceived in the 1990's, this wireless protocol was developed for wireless local area networks (LANs) and is used to connect computers, mobile phones, VoIP (Voice over Internet Protocol) phones, game consoles, and even TVs and cameras. The range of Wi-Fi is also considerable and can exceed 100 m in some outdoor conditions. One of the main problems with Wi-Fi is its high power consumption, which is the result of the relatively long range and high data transfer rate of the technology. Wi-Fi is also relatively expensive and

has higher latency than some of the other wireless technologies.

2.2 ZigBee

ZigBee is the name of an alliance of companies formed around a standard approved in 2003 called 802.15.4. The ZigBee protocol promises to provide a long battery life (months or even years on a single battery charge) and to be a lower-cost alternative to Bluetooth for wireless sensing and control applications. The ZigBee alliance consists of a group of companies that includes Invensys, Honeywell, Mitsubishi Electric, Motorola, and Philips, to name a few. Its name comes from the zigzag flight path of bees, forming mesh networks between flowers. Members of the ZigBee alliance believe that mesh networking is the key to unattended wireless systems for smart homes as well as wirelessly-controlled sensors for medical uses and industry. ZigBee also displays very low latency (much lower than Bluetooth, for example), which is critical for certain applications such as heart sensors.

Many other technologies like WiMaX, Wireless USB, Radio Frequency Identification etc. are also in race with Wibree.

3. Wibree

Introduction will become the world's fastest growing technology

The recent announcement of the Wibree standard by Nokia seems to have caught the industry unawares. The initial response of many analysts and much of the media has been to categories it as yet another competitor in the 2.4 GHz space. One of the most important aspects of Wibree is that it envisages dual-mode chips that can support both Bluetooth and Wibree. This symbiotic existence is key to Wibree's success. There will also be single-mode Wibree chips that offer low power operation, which will enable a wide range of devices to talk to these dual mode chips. The bulk of Bluetooth chips shipped by 2008 will include Wibree dual-mode functionality, effectively for free; it means that by the end of 2009 there could be over 100 million Wibree enabled handsets in existence.

It is a strategy that means Wibree will redefine the speed at which a new wireless technology can be rolled out into the market. All existing records, both in consumer goods and wireless technologies are set to be overturned when Wibree leaves the starting blocks. Because of the fact that it will be integrated inside Bluetooth chips, it is likely to reach that one million shipment milestone in just one week. That combination of Wibree within a Bluetooth chip is vitally important in understanding its place and the role that it can fulfill. Because low power, personal Wibree devices will be able to communicate with handsets, it means that in time every mobile phone becomes a Wibree gateway to the mobile network. So every Wibree device can communicate with the internet, allowing information to be sent backwards and forwards. And because the data rates are low, the cost of this data transfer will be a negligible portion of the user's monthly phone contract. That paradigm change will enable a wide range of additional services that today are just too expensive for widespread deployment.

3.1Where Wibree came from:

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 that 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.

In the event, the IEEE committee chose to adopt the alternative proposal for the 802.15.4 standard. However, Nokia didn't stop work on their proposal. Over the intervening years it has developed and matured into what has now been announced to the world as Wibree.The original proposals are still available for public viewing on the IEEE site.

The name has also raised eyebrows. Like Bluetooth, it is a new word that tells us little of the technology. The "**Wi**" is the now obligatory prefix for "wireless", with Nokia claiming that the "**bree**" comes from the Old English word for a 'crossroad'. So we have "Wireless at the Crossroad", whichever takes your fancy; one thing is certain - Wibree will certainly herald a new era of personal wireless connectivity. And the engagement of the major Bluetooth silicon vendors will ensure that it will quickly appear in hundreds of millions of handsets.

3.2Wibree Technology:

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

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

3.3Wibree device architecture:

Wibree specification has been created by having two equally important implementation alternatives in mind, namely dual-mode and stand-alone. In the dual mode implementation the Wibree functionality is an add-on feature inside Bluetooth circuitry sharing a great deal of existing functionality resulting in a minimal cost increase compared to existing products. The dual modes are targeted at mobile phones, multimedia computers and PCs. The stand alone

implementations are power and cost optimized designs targeted at, for example, sport, wellness, and human HID product categories.
Example's for dual mode implementation and device which is standalone application.

3.4Wibree radio specification

Band with physical layer bit rate of 1 Mbps and provides link distance of 5-10 meters. Wibree radio specification enables dual-mode implementations to reuse Bluetooth RF part but also to guarantee ultra low power consumption for devices with embedded stand-alone implementation of the Wibree specification. Wibree operates in 2.4 GHz ISM Wibree link layer specification
Wibree link layer provides ultra low power idle mode operation, simple device discovery and reliable point-to-multipoint data transfer with advanced power-save and encryption functionalities. The link layer provides means to schedule Wibree traffic in between Bluetooth transmissions.

3.5Wibree host & profile specifications

Wibree is adopting the principle of profiles to define its most common application areas. In its initial release, these cover the watch, sensors and Human Interface Devices (HID). The receiving device doesn't need to be static for this scenario. A feature of the short time required to complete a data transfer means this profile can be used with moving receivers. If we consider a transmitter with a 100 meter range, a vehicle moving at 100 km/hr will be within range of the transmitter for around 4 seconds – more than enough time to pick up traffic information from a beacon. An increasing number of vehicles already have a driver display that is Bluetooth enabled – it's called their satellite navigation system. There's only a minimal incremental cost to Wibree enable it to receive additional messages from roadside transmitters. It makes Wibree a very interesting proposition to those developing ITS (Integrated Traffic System) applications.

3.6Experiments

As we all see, quite a few kinds of technologies are workable in 2.4GHz frequency, consisting of 802.11b, 802.11g, Bluetooth, Zigbee, as well as the forthcoming Wibree. Additionally, it is also quite likely other inference sources would occur in such a home or office environment, for example, micro-oven, wireless optical mouse, cordless phone and soon. The hottest point nowadays is how to handle all these working as efficiently as they could while affecting least interference with one another. Therefore, I did the subsequent experiment to roughly and simply demonstrate actually how bad or how little the interferences would be from different sources.

3.7Test environment

• As in fig.1, two rooms are next to each other, a wall obstruction separates the two rooms and with only a small door accessing from one room to another.
• The wireless Wi-Fi router (LINKSYS wireless G 2.4, with 802.11b backward supporting turned off) and a PC with wireless adapter, which plays as receiver here, in a same room with distance of 4 meters.
• A file with the size of 2 Gigabytes is transmitted from a LAN server to this test PC.
• Location 1 and 2 are used to locate the interference resource
• Interference resources: micro oven, Bluetooth, another working wireless router and 2.4GHz Wireless Optical Mouse, respectively.

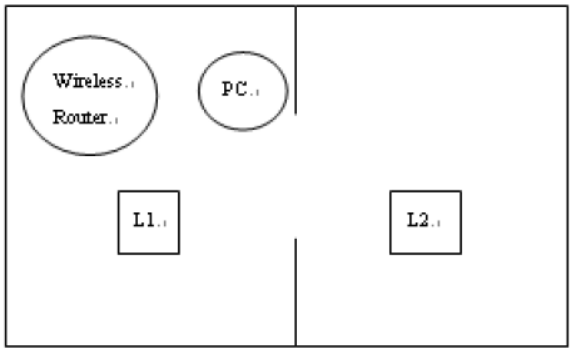

Figure 1: Experiment locations display

The result of this RI experiment is showed in Table. From the result, another simultaneous working Wireless access point nearby could significantly deduce the testing WLAN throughput and micro oven, which is followed after, also caused a fairly bad degradation. The other two RI sources, Bluetooth device and wireless mouse, had a much less impaction on the data throughput. In conclusion, interference sources are able to impact or even impact dramatically the performance of typical WLAN data traffic. Searching for the way to deduce the impaction from other 2.4GHz RI sources is obviously noteworthy.

3.8Result of IF experiment:

Interference	Location 1 test	% of baseline	Location 2 test	% of baseline
Without IF	10.7	--	--	--
Micro oven	3.8	35.5%	5.5	51.4%
Bluetooth	8.4	78.5%	9.4	87.9%
Wireless router	1.7	15.9%	2.8	26.2%
wireless mouse	8.4	78.5%	9.5	88.8%

4. Applications

4.1Sports

Many of us enjoy an active lifestyle. Wibree enabled products can provide a multitude of appealing applications, ranging from the measurement and consequent optimization of a professional athlete's performance during a work out session to the automatic selection of suitable music from your mp3 player to match your heart rate while bicycling to work.

4.2Healthcare

A healthy living is important to all of us. Whether monitoring your heart rate and blood pressure at home to improve your personal diet or being connected over-the-air to your physician while rehabilitating out of hospital, Wibree makes being healthy easier.

4.3Entertainment

Kids love toys, and so do many of their parents. Steer your little racing car clear of obstacles with your mobile phone; watch your little robot interact with that of your friend when they come close and tune up the volume to your favorite beat with your tiny mp3 player remote control. Wibree enabled toys and gadgets take play to the next level.

4.4Office

A growing number of us use a personal computer in our daily work or at home, and expect the best performance and ergonomics from the devices we use to interact with the computer. Moreover, work often travels with us and so it is important that we can set up a convenient working environment while on the move. Wibree ensures that your wireless keyboard, mouse and digital pen will work when you work.

5. Pro's and Con's with other technologies

5.1 Pro's

1. Integrate with Bluetooth Chips.
2. Operates on 2.4Gh Band.
3. Low power consumption.
4. Less cost.
5. Packets are transmitted with differential length.
6. (M)Any device can contact with any device.

5.2 Con's

1. Confined to 10m range.
2. Not suitable for large file sharing.
3. Data transmit rate is 1Mb/s.

Although there are con's present with first phase of Wibree Technology. More Research work is going on it to reduce the con's and to produce best Wireless Technology to the world

6. 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.

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 wireless industry 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.

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