Introduction

Over the past decade, Bluetooth has become an omnipresent commodity technology in consumer electronics peripherals. From mobile headsets to PC mice and keyboards, Bluetooth, coupled with other key Wi-Fi technologies, has helped free end users from hard-wired devices, enabling new flexibility and freedom within the wireless lifestyle. Still, the implementations of Bluetooth have been limited, due primarily to the associated high power drain.

Until recently, current Bluetooth peripherals were well-suited only to devices that are charged on a daily basis. Within consumers’ personal network of devices, however, there exists a huge market for low-power, short-range devices such as body sensors, medical devices, and thermometers.

Now, thanks to the Bluetooth SIG’s July 2010 formal adoption of Bluetooth Core Specification Version 4.0, with the hallmark feature of Bluetooth low energy (BLE), chip designers have the opportunity to take advantage of Bluetooth’s promise in an entirely new range of devices. BLE devices can potentially operate for a year using small batteries.

About Bluetooth Low Energy

BLE, the main feature of Bluetooth 4.0, operates in the same spectrum range (2402-2480 MHz) as classic Bluetooth, but uses a different set of channels. Devices can either be dual or single-mode. Dual mode devices will integrate BLE into existing Bluetooth designs and cater to both kinds of use cases, while single-mode BLE sticks to low power. BLE requires a hardware upgrade and cannot be made backward compatible with older devices. However, if the new device uses dual-mode Bluetooth 4.0, backward compatibility can be achieved.

Specifications Summary

Less than 20 mA peak current consumption is needed for transmit from a single-mode BLE device (Typically 15 mA). Sleep current is only 1 uA – but that may not happen often. The signal range for BLE runs up to 200 m and output power is about 10 mW at 2.4 GHz. Some Bluetooth Low Energy ICs are already sampling and will be available in commercial products before the end of 2011.

Use Cases That Will Benefit From Low-Power Bluetooth

Mobile devices
The integration of BLE technology into mobile products promises to open up a range of new applications. For example, the functions of classic single connection devices such as remote controllers and gaming accessories can be integrated with devices like mobile phones and tablets through the introduction of dual mode BLE into combination radios that feature integrated Wi-Fi, GPS, and, FM, and Bluetooth LE.

PCs and Accessories
Short range applications like keyboards and mice that utilize traditional Bluetooth technology will benefit from significantly increased battery life of a BLE implementation.

Healthcare and sports
This is one of the primary new use cases for Bluetooth low energy. Wireless thermometers and blood pressure meters can send data to the healthcare provider’s cell phone or computer and vital statistics like heart rate and blood sugar can be monitored continuously without user intervention.
By connecting these low-power monitoring devices a wireless and seamless health monitoring system for patients and health care providers can be achieved.

**Home automation**
BLE is a potential candidate technology for devices like intelligent washing machines or sprinkler systems that can be controlled wirelessly for home automation and smart energy management.

**The Marvell Solution**
Marvell continues to extend its technology leadership in developing a range of integrated silicon solutions specifically targeting mobile consumer electronic devices. Most recently, with the release of its Avastar™ family of wireless connectivity solutions, Marvell has incorporated proven Bluetooth technology that uses less than one fourth the power of comparable solutions, dramatically extending battery life for mobile products.

Marvell Bluetooth solutions are shipping today across multiple generations of handsets, portable media players, gaming platforms, and automotive telematics. Avastar builds on those designs to deliver a mature, first rate Bluetooth solution supporting the latest industry specifications with extremely low power consumption in active and standby modes.

Specific product examples include:

- **Avastar 88W8797**— The world’s first MIMO chipset that offers many technologies like WLAN MIMO/ BT/BLE/FM in a single chip. Supports the Bluetooth low-energy ecosystem, enabling communication with a new breed of mobile devices, including body sensors for personal health monitoring and remote controls for home automation and other applications.

- **Avastar 88W8766**— A low-cost, highly integrated 802.11n 1x1 + BT 4.0 combo solution that supports BLE specifically for laptops and notebooks.

For more information on Marvell products, visit [www.marvell.com](http://www.marvell.com).
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Ramya Chandrasekaran is senior technical marketing engineering for Marvell’s Emerging and Embedded Business Unit. Ramya has more than seven years of experience in the wireless technology market. After receiving her B.E. in Electrical and Communication Engineering from Madurai Kamaraj University in India, and her M.S. in Electrical and Computer Engineering from University of Florida, Ramya joined Marvell, where she worked as a senior applications engineer for four years. In her current role, Ramya is responsible for product management, definition of key technical features and program management across Marvell’s embedded wireless product line.