BLUETOOTH BASICS

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INTRODUCTION

Bluetooth is a wireless communications specification named after the 10th century Danish King Harald Blatland, or “Bluetooth”. King Harald united the separate kingdoms of Denmark and Norway. The Bluetooth specification is intended to “unite” separate personal computing devices such as laptops, PDAs, palmtops, cell phones and peripherals, like printers for example. In short, Bluetooth is wireless technology intended for short-range radio links to replace cables. Its primary features are voice and data capabilities, robustness, low complexity, low power and low cost.

THE BLUETOOTH SPECIFICATION

L. M. Ericsson of Sweden invented Bluetooth in 1994. The Bluetooth Special Interest Group (SIG) was founded by Ericsson, IBM, Intel, Nokia and Toshiba in February 1998, to develop an open specification for short-range wireless communications. The group now consists of over 1900 companies.

Bluetooth is built around the notion of a Personal-Area Network or PAN. It operates in the 2.4GHz radio frequency band, offers 721Kb data rates, and has a range of approximately 10 meters. Application of Bluetooth technology has also been extended to offer wireless access to LANs, PSTN, the mobile phone network and the internet.

Since it operates in the 2.4GHz ISM band, the Bluetooth standard is targeted for worldwide approvals so that, anywhere in the world, any Bluetooth enabled device can connect to other Bluetooth devices in its proximity, regardless of manufacturer. According to the specification, Bluetooth devices communicate wirelessly in short-range, ad hoc networks called piconets. Each device can simultaneously communicate with up to seven other devices in the piconet. Also, each device can be a participant in several piconets. These piconets are established automatically as devices enter and leave the radio network.

As a specification, Bluetooth has some new and unique capabilities, but borrows heavily from prior standards, including Motorola's Piano, IrDA, IEEE 802.11, and Digital Enhanced Cordless Telecommunications (DECT). The Bluetooth SIG adopted Motorola's Piano to provide for "Personal-Area Networks," (e.g. piconets) to extend the original Bluetooth concept beyond simple cable replacement. Bluetooth voice transmission features are derived from the DECT specification. IrDA specifications give Bluetooth its object exchange capabilities. The IEEE 802.11 specification provided Bluetooth with the 2.4GHz ISM band, frequency-hopping spread spectrum (FHSS), authentication, privacy, power management, and wireless LAN potential.

APPLICATIONS

The broad foundation of the Bluetooth specification accounts for the wide interest in potential applications. These range from straightforward cable replacement to sophisticated networking applications. Examples:

- Wireless headsets for cell phones for hands-free, wire-free phone calls.
- PC Mouse using Bluetooth wireless connection to the PC.
- Wireless printing between a PC or handheld and a Bluetooth enabled printer.
- Wireless barcode scanner input for retail and warehousing.
- Automated synchronization of PDAs and PCs using Bluetooth.
- Ad hoc networking and file sharing between PCs, PDAs & laptops in a meeting.
- Automated cell phone dialing from a laptop's contact database with logging of the activity on the laptop.
- Internet access for Bluetooth enabled devices via the nearest Bluetooth enabled device on the Internet.
- Synchronize contact information between a cell phone, PDA, notebook, and desktop wirelessly.
- Collaborative work between several individuals with Bluetooth-enabled mobile computers in a meeting. With automatic synchronization enabled, everyone can see changes to the shared material on his or her own computer.

BENEFITS

The most obvious benefit from Bluetooth is the original goal of simple cable replacement between two devices. For many situations, this alone is compelling based on the physical elimination of inconvenient cables that take space, create clutter and limit device placement. In industrial and commercial applications, the presence of wires creates potential safety and task interference issues.

The wide range of device types and standard interface afforded by Bluetooth allows selection of devices optimized each for their particular function and ergonomics.

The multi-point capabilities of Bluetooth communications allows one interface to support communications with multiple devices: printers, scanners, scales, PDAs, other PCs, etc.

Bluetooth wireless networking, in general, provides a simple and fast path to ad hoc networks with minimal equipment and overhead.

CHALLENGES

Widespread adoption of Bluetooth still faces significant hurdles. First and foremost, there remain interoperability issues between products from different vendors. The Bluetooth specification has had a number of "holes" which left too much latitude between vendors' implementations. While the specification continues to be worked on by the Bluetooth SIG and the IEEE 802.15 task group, interoperability between products is still somewhat spotty. Testing is advised.

Secondly, as a wireless technology, there are concerns around security. Information could be intercepted by other devices. While the basic security and encryption capabilities of the specification are fundamentally sound, vendor implementations can vary.

There is potential for interference in HIGHLY congested areas.

Finally, there is significant competition from IEEE 802.11b wireless LAN technology which has seen tremendous market acceptance and price drops in the past two years. This technology has many of the same capabilities as Bluetooth, much greater speed and range and costs in line with early Bluetooth radios.

PROSPECTS

Cable replacement and Wireless Personal-Area Networks (PANs) represent the major opportunities for Bluetooth technology in the near future. For Bluetooth technology to achieve ubiquitous adoption, interoperability, security and interference issues must be addressed, vendors must bring more, and a wider array of products to market and chip pricing must become significantly less expensive.

To be fair, as with many emerging technologies, Bluetooth specifications and products will mature and eventually these issues will be resolved. Then Bluetooth adoption will grow exponentially.