What is Bluetooth?

Bluetooth is a chip technology enabling seamless voice and data connections between a wide range of devices through short-range digital two-way radio. The aim of this paper is to investigate Bluetooth technology specifications, current applications and the products in which the technology is currently available. This paper will also talk about the technology’s security strengths and weaknesses as well as its benefits.

Features

The features of the Bluetooth technology are:

i. Bluetooth separates the frequency band into hops, adding a strong layer of security.
ii. Up to eight devices can be networked in a piconet.
iii. Signals can be transmitted through walls and briefcases, thus eliminating the need for line-of-sight.
iv. Signals are omni-directional allowing devices to point in different directions.
v. Both synchronous and asynchronous applications are supported, making it easy to implement on a variety of devices and for a variety of services, such as voice and Internet.
vi. Governments worldwide regulate it, so it is possible to utilize the same standard wherever one travels.

Specifications

Bluetooth centers around a 9mm x 9mm microchip, which functions as an inexpensive and short range radio link. Bluetooth offers security for both stationary and mobile devices. The basic function is to provide a standard wireless technology to replace the multitude of propriety cables currently linking computing devices.
Bluetooth network arrangements can be either point-to-point or point-to-multipoint. Any unit in a piconet can establish a connection to another to form a scatternet. The baseband protocol combines circuit and packet switching. To assure that packets do not arrive out of order, slots can be reserved for synchronous packets. A different hop signal is used for each packet. Circuit switching can be either asynchronous or synchronous. Up to three synchronous data channels, or one synchronous and one asynchronous data channel, can be supported on one channel. Each synchronous channel can support a 64 Kb/s transfer rate, which is ample for voice transmissions. An asynchronous channel can transmit as much as 721 Kb/s in one direction and 57.6 Kb/s in the opposite direction. It is also possible for an asynchronous connection to support 432.6 Kb/s in both directions if the link is symmetric².

The Bluetooth radio chip functions at 2.45 gigahertz. It separates the 2.45 gigahertz frequency band into 79 hops one megahertz apart, starting with 2.402 and ending with 2.480. This spread spectrum is used to hop from one channel to another, pseudo-randomly, which adds a strong layer of security. Up to 1600 hops per second can be made. The standard frequency range is 10 centimeters to 10 meters, and can be extended to at least 100 meters by increasing transmission power².

![International Radio Frequency Allocation](image)

Fig.2 Bluetooth frequency ratio

Three error correction techniques have been defined: 1/3 rate forward error correction code (FEC), 2/3 rate forward error correction code FEC, and automatic repeat request (ARQ). The FEC methods are designed to reduce the number of retransmissions. However, the overhead significantly slows transmissions, so is generally not used in relatively error-free environments, with the exception of packet headers. The ARQ scheme requires that the header error and cyclic redundancy checks are okay. When they are, an acknowledgement is sent otherwise data is resent³.

Security is provided in three ways: through pseudo-random frequency band hops, authentication, and encryption. Frequency band hops complicate eavesdropping. Authentication allows a user to control connectivity to only devices specified. Encryption uses secret key lengths of 1, 40, and 64 bits. The quality of security is excellent for most applications⁴.
To be Bluetooth certified, a device must pass interoperability testing by the Bluetooth Special Interest Group (SIG), thus assuring that products meeting the specification will be able to interact with all other Bluetooth-certified products and with the Internet. SIG members are promoters of Bluetooth technology. Members of SIG include Agere Systems, Motorola Inc, Ericsson Technology, Microsoft Corporation, IBM Corporation, Nokia Corporation, Intel Corporation and Toshiba Corporation. To date, more than 1,200 companies have signed on.

Applications

Bluetooth technology is not restricted to personal computers. Other areas where this technology is used are the automotive industry, gaming and music industry, office equipment, medical applications, cell phones, PDA’s, Global Positioning systems and in a home environment. In total, there are 444 Bluetooth enabled products available for private and public use.

In the medical field there are currently eight products in use. BlueGiga Technologies uses the WRAP Multiradio Access Server available in Europe and North America. This device is a cutting edge wireless Bluetooth base station product family supporting WLAN, Ethernet and GSM/GPRS offering TCP/IP connectivity. This enables you to link equipment or mobile users to any services located in network or in the device.

In the automotive industry, Nokia has created the Nokia Wireless Car Kit CARK112. This product is controlled from a single, small button in which you can adjust volume, activate voice dialing, and answer and end calls. The kit will automatically mute the car radio when you answer a call and its wireless connection is based on the internationally recognized Bluetooth standard, the Nokia Wireless car Kit is compatible with a wide range of phones supporting Bluetooth technology from Nokia and other manufacturers. Best of all, once paired with your phone, the kit automatically activates the connection when you start the ignition. And the kit can be paired with up to eight phones, one at a time.

In the gaming industry, Tapwave has created the Zodiac-1 which combines a MP3 player, photo viewer, video player, PalmOS PDA, and 3D Graphics Game Console, all in a pocket size device. Bluetooth is used for multi-player gaming. Tapwave improved on the device, creating the Zodiac-2, which includes more RAM.

In the handheld department, Dell has created the Axiom X30, Executive Keyboard and GPS Navigation System all using Bluetooth technology to allow secure, wireless communication. The GPS Navigation System uses Bluetooth to into a wireless, portable, in-vehicle navigation system.

Bluetooth technology provides a standard wireless technology to replace the multitude of propriety cables currently linking computing devices. The
technology is compatible with Linux, Mac Operating systems and Windows allowing a wide range of users. It can be found in devices from cars to MP3 players. Bluetooth provides a secure connection to devices using hops and authentication and allows speedy communication. Finally, Governments regulate Bluetooth standard, allowing the technology to be used by anyone, anywhere.
Resources


