Bluetooth Technology

Sadly, it appears that every technological innovation introduced into society is invariably attached with an added level of complexity to merely complicate and confuse our daily lives. Never before has installing a television or personal computer required this much configuration and patience. And to make things worse, each piece of equipment comes with its own set of specialized cables – none of which can be used with other devices and are coincidentally incredibly expensive to replace. Wouldn’t that be nice if history could forget about the universal remote control yet introduce a technology that could simplify all the electronic interconnections that crowd our world? Bluetooth provides this hope, and as will be discussed, pioneers the advancement towards a unified device interconnection and interoperability.

Bluetooth’s ability to establish a communicated interaction between electronic devices is not the first of its class, however, as it has its own technological precedents and origins. Conventional cables and wiring constitute the most rudimentary forms of Bluetooth’s technological and historical precedents, as they very crudely create a physical connection between electronic devices to transmit data and information. Because traditional cabling and wiring configurations require an uninterrupted physical connection between devices at all times in order to function properly, new technological innovations such as infrared and cable synchronization were more recently introduced as they aimed to alleviate the major inconvenience with obstructive wiring. Infrared technology uses light waves of low frequency undetectable to the human eye to transmit data between electronics such as computers and peripheral devices. The upside to
infrared is its reliability and low-cost implementation; however, it has the major disadvantages of being a “line of sight” technology and is usually able to connect no more than two devices. Cable synchronization, on the other hand, still requires a physical connection between the pieces of equipment, but only temporarily as the purpose of the connection is to very rapidly synchronize and match the information between the two devices, such as a PDA and computer. Clearly, both the infrared and cable synchronization alternatives have their advantages to conventional wiring; however, due to their equally limiting drawbacks, neither technology has been able to establish itself as the definite forerunner in solving the same problem more efficiently. Bluetooth intends to resolve this and is perhaps the most convincing of the previous technologies to succeed, while also presenting the best opportunity to evolve as a means to one day standardize and broaden the scope of device interoperability and communication. The inspiration for the name, Bluetooth, originated from King Bluetooth of Denmark in the 10th century who led the unification of Denmark and Norway into a single kingdom. This is also the motivation of the Bluetooth technology, as it too endeavors to unite and interconnect many, if not all, electronic devices.

Bluetooth is a short-range radio technology that is able to interconnect and create an “open dialogue,” so to speak, between any number of electronic devices within Bluetooth’s 10 meter range to transmit data and information. Unlike infrared, Bluetooth does not require a direct line of sight between the two communicating devices, yet it is able to establish a lasting and uninterrupted connection unlike that of the cable synchronization alternative. Bluetooth instead creates a Wireless Personal Area Network (WPAN), which is very similar to a Wireless Local Area Network (WLAN), except that
its functional range is much more localized due to its low-power, low-frequency configuration. The effective result is a short-range intranet that is created around the Bluetooth-enabled device that is configured to transmit and share specific information about the type of device it is, what properties about it or the user it should share, and how it should and can interact with another Bluetooth-enabled device, again depending on that device’s properties, user specifications and interoperability instructions. An example of an application of the Bluetooth technology is the synchronization and sharing of data between mobile phones, and even as simple as a wireless mobile phone headset. Perhaps the most compelling applications of the Bluetooth technology, however, are multi-player gaming and mobile internet access. Nokia’s recently released N-Gage gaming terminal and Nintendo’s popular GameBoy Advance handheld both utilize Bluetooth technology to allow the configuration of multi-player games between multiple pieces of that same hardware. Also, a Bluetooth-enabled mobile phone is capable of connecting PDAs and laptops to the internet in any location, as the user can use the mobile phone to dial into an ISP which then transmits its information from the mobile phone to the laptop through Bluetooth’s WPAN. Bluetooth’s incredible capability to interconnect multiple devices without interference lies within its “spread-spectrum frequency hopping” technique. Bluetooth-enabled devices broadcast at 79 individual, randomly selected frequencies within a specified range – but changing its broadcast frequency 1,600 times a second. Therefore, if a Bluetooth-enabled device does happen to transmit at the same frequency of another non-Bluetooth device, like a garage door opener, the interference will be only an infinitesimally small fraction of a second. Herein lays Bluetooth’s compatibility with a plethora of products, as Bluetooth-enabled devices broadcast at a wide range of
frequencies and are able to recognize and “strike up conversation” with another
Bluetooth-enabled device automatically when it comes within range of each other.

While Bluetooth was initially viewed as a wireless LAN technology purposed for
internal use within businesses and “hot spot” connectivity locations for consumers, its
technical deficiencies and problem areas subsided this idea. While Bluetooth was
introduced as early as 2000, key obstacles have delayed its adoptability among vendors
and consumers. While Bluetooth is growing popularity in Western Europe, as an
estimated 21.6 million Bluetooth-enabled mobile phones were sold in 2003 (Milanesi
2003, 1), it continues to have problems in with its interoperability, security and usability.
Bluetooth’s core dilemma is that it remains an open source technology available to
anyone yet does not have an interoperability body to set a standardization among the
industry to ensure that Bluetooth devices from different vendors work properly with each
other. As for now, no such body exists, and therefore, interoperability between Bluetooth
products from different vendors is not guaranteed. Because of this fact, companies are
slow to adopt this technology into their products, as the immediate usefulness of the
technology cannot be immediately realized until other products with Bluetooth
capabilities are readily available. As a tangent to the problematic of not having an
established interoperability body, security as well as configuration settings have not been
standardized. In fact, security standards do not even exist with Bluetooth, and even still
only some Bluetooth devices have a password protected signal. Because of this major
security hole, consumers and businesses may be especially worried when using a
Bluetooth-enabled device with particularly sensitive information that may be transmitted
and received by unwanted recipients. This may include your contacts in your mobile
phone, files on your laptop or PDA, or perhaps even passwords that can be captured from a Bluetooth-enabled wireless keyboard. Since we know that historically most consumer technologies were at once exclusively for enterprise uses before being released to the broader market, this may be the most compelling argument as to why Bluetooth’s security problems has hindered its ability to penetrate the enterprise market and lead to an eventual wide-spread adoption in the consumer market.

Despite Bluetooth’s shortcomings, the technology is undoubtedly the future means of interconnectivity and communication between intelligent devices as derivations and updates to the existing Bluetooth technology are made. Bluetooth has in a matter of months made amazing gains in the mobile phone industry, as many of the older problems with Bluetooth headsets have been solved or are being refined. Bluetooth-enabled headsets used to require an incredible amount of battery power and were cumbersome due to their weight and size – but now a new Bluetooth-enabled headset can last for almost eight hours of talk-time and come in a light and sleek design. Perhaps most importantly, the price of Bluetooth devices has dropped in price, which could be an early indication that it may be the next biggest technology in the consumer segments.