



USB FEATURES

**Submitted by
SRINIVAS DUTTA**

**Master in Business Consulting
Summer Semester 2009**

**Under Guidance of
Prof. Dr. Eduard Heindl**

Declaration Note

It is to be declared that all the work done in this document is solely and explicitly done by myself. Any help that I have received in the preparation of the term paper itself has been acknowledged at the end of paper. Sources of all the images and diagrams have also been specified.

Srinivas Dutta

26th May , 2009

TABLE OF CONTENTS:

1. Introduction.....	5
1.1Definition	
1.2Features	
2. USB 2.0.....	7
2.1Features	
2.2Applications	
3 Certified Wireless USB.....	9
3.1 Features	
3.2 Applications	
3.3 Bluetooth Vs Wireless USB	
3.4 USB functions.....	12
3.5 Security	
3.6 Limitations.....	13
4. SuperSpeed USB 3.0.....	14
4.1 Features	
4.2 Applications	
4.3 Limitations	
5. How to save the planet with USB Gadgets?.....	15
6. Conclusion.....	19
7. References.....	20

OVERVIEW:

This paper is aimed towards providing a general understanding of Universal Serial bus (USB), the motivation behind the USB and different standards of USB is specified, emphasis has been made mainly on the features of USB and its applications in different versions. Finally a brief introduction on how a few items of USB gadgets can take a bit of the load off of Mother Earth i.e., in the form of Saving Power, Buying Eco-friendly Peripherals and Generating our Own Power has been explained.

INTRODUCTION

The motivation for the Universal Serial Bus (USB) comes from three interrelated considerations:

Connection of the PC to the telephone: The merge of computing and communication will be the basis for the next generation of productivity applications. The movement of machine-oriented and human-oriented data types from one location or environment to another depends on ubiquitous and cheap connectivity. Unfortunately, the computing and communication industries have evolved independently

Ease-of-Use: Today's combination of user-friendly graphical interfaces and the hardware and software mechanisms associated with new-generation bus architectures have made computers easier to reconfigure. However for the end user the PC's I/O interfaces, such as serial/parallel ports, keyboard/joystick interfaces, etc., do not have the attributes of plug-and-play

Port Expansion :The addition of external peripherals to PC become a constraint because of lack of port availability and lack of a bi-directional, low-cost, low-to-mid speed peripheral bus has held back the creative proliferation of peripherals such as telephone/fax/modem , scanners, PDA's, keyboards, mice, etc. Existing interconnects are optimized for one or two point products.

USB:

In September 1995 a consortium of companies including IBM, Intel, and Microsoft introduced USB Version 1.1, originally designed to connect then smart phones to PC's. It later became the de facto standard for connecting any external devices, because of its built-in power supply and relatively fast speeds with a unique one cable approach become a plug and play interface between PC and add on devices such as Hard drives, speakers, TVtuners, webcams etc. All these top at 12 Mbps, at which speed is only good for Mice and Keyboard. Today, Hi-Speed USB 2.0 which, in 2002, provides greater enhancement in performance up to 40 times faster than USB 1.1, with a design data rate of up to 480 MB/s, the goal of the new serial bus is to broaden the range of external peripherals that can be used on a computer and allowed PC and Macintosh users to share peripherals for the first time.

In 2005 USB is poised to get even better. Electronics manufacturers introduced products that cut the cords tethering USB peripherals to their hosts. The move to wireless USB is the new wireless extension in the latest Certified Wireless USB 1.0 standard which combines the speed and security of wired technology with the ease-of-

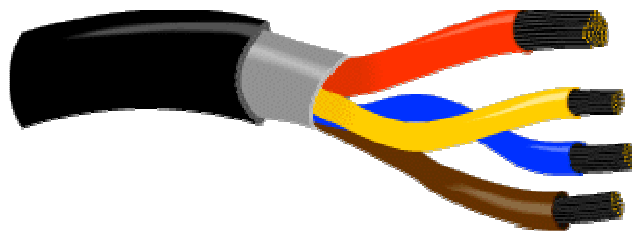
use of wireless technology. Wireless connectivity has enabled a mobile lifestyle filled with conveniences for mobile computing users. Supporting robust high-speed wireless connectivity. The next advancement in ubiquitous technology is SuperSpeed USB (USB 3.0) that will deliver over targeted 10 times the speed of today's Hi-Speed USB connections. The technology targets fast PC sync-and-go transfer of applications, to meet the demands of Consumer Electronics and mobile segments focused on high density digital content and media.

Universal Serial Bus Features:

- Individual USB cables can run as long as 5 meters; with hubs, devices can be up to 30 meters (six cables' worth) away from the host.
- A USB cable has two wires for power (+5 volts and ground) and a twisted pair of wires to carry the data.
- On the power wires, the computer can supply up to 500 milliamps of power at 5 volts.
- Low-power devices (such as mice) can draw their power directly from the bus. High-power devices (such as printers) have their own power supplies and draw minimal power from the bus. Hubs can have their own power supplies to provide power to devices connected to the hub.
- USB devices are **hot-swappable**, that means there is no need to shut down and restart the PC to attach or remove a peripheral. Just plug it in and go! The PC automatically detects the peripheral and configures the necessary software. This feature is especially useful for users of multi-player games, as well as business and notebook PC users who want to share peripherals.
- Many USB devices can be put to **sleep** by the host computer when the computer enters a power-saving mode.
- USB distributes electrical power to many peripherals. Again, USB lets the PC automatically sense the power that's required and deliver it to the device. This interesting USB feature eliminates those clunky power supply boxes.
- USB provides two-way communication between the PC and peripheral devices, making it ideal for many I/O applications.
- Multiple devices can connect to a system using a series of USB hubs and repeaters. A Root Hub with up to seven additional ports can be integrated into the main interface, or it can be externally connected with a cable. Each of the seven hubs on the Root Hub can in turn be connected to seven hubs, etc. to a maximum of seven tiers and 127 ports.

USB 2.0

Finalized in 2001, Universal Serial Bus (USB) 2.0 is a complete overhaul of the Universal Serial Bus input/output bus protocol which allows much higher speeds than the older USB 1.1 standard did. USB 1.1 supports a maximum throughput of 12Mbps (equivalent to 1.5MBps), which is now obsolete, but its speeds are being adopted into USB 2.0, and they are now called Original USB officially. Capable of a much faster speed of 480Mbits/second.



Inside a USB cable: There are two wires for power - +5 volts (red) and ground (brown) -- and a twisted pair (yellow and blue) of wires to carry the data. The cable is also shielded.

USB 2.0 Features:

- USB 2.0 has a raw data rate at 480 Mbps; it is rated 40 times faster than USB 1.1, which tops at 12Mbps.
- The transmission speeds of USB 2.0 make it the ideal technology for channeling data from various devices and other external components that need to communicate a lot of information to a PC.
- USB 2.0 is fully backward-compatible with USB 1.1. That means you can plug a USB 2.0 device into a USB 1.1 port and the device will work, but it will have a limited data throughput of 12Mbps. The same is true if you plug a USB 1.1 device into a USB 2.0 port.
- The goal of the new serial bus is to broaden the range of external peripherals that can be used on a computer.

Applications:

The original USB has an inherent problem to meet the bandwidth requirement of then current devices such as CD burners and hard drives etc . Today almost every possible peripheral has a USB 2.0 version ranging from a HDTV tuner, a micro hard drive to even

Video card/USB monitor. So, even if we buy a all-in-one HP multimedia PC with all the gizmos, we will still need something USB. The forty-fold jump from the original USB's 12Mbit/s has paved way for a number of improved devices in the market. Some of them are

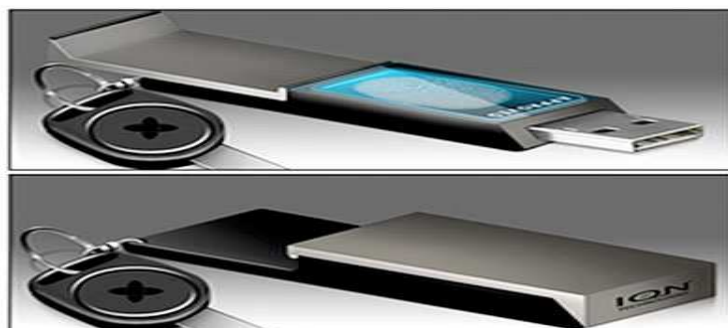
DISPLAYLINK: USB Monitors:

Why use the clunky old DE-15 analog monitor connector designed in 1987 and go through the pain of installing a graphics card to connect an additional monitor? There is an easier way: DisplayLink USB graphics.

DisplayLink USB graphics technology allows you to connect almost any kind of display via a standard USB 2.0 cable. The technology is designed primarily to be simple and easy to use: just install the DisplayLink software, plug in your DisplayLink device, and within a few seconds you've got a new monitor, docking station, or projector connected to your PC. There's simply no easier way to add a display to your PC or Mac.



Ennova Direct announces a biometric USB flash drive with interactive OLED display:



Ennova Direct Corporation announced A new USB flash drive, that has unique patented features with a built in cover that protects the flash drive's OLED screen. The OLED screen comprises an integrated biometric fingerprint scanner which changes color to indicate the success or failure of a match of the user's stored fingerprint. The OLED screen is also an interactive interface that allows the user to select specific files and initiate specific functions.

With USB flash drive memory capacities now reaching 64GB and higher, user's are now utilizing their USB flash drives as full external backup drives, making it even more important for users to secure the large amounts of personal data they are storing on their USB flash drives.

Certified Wireless USB:

Certified Wireless USB application is based on Wimedia's radio technology new to the consumer space. Ultra-Wideband which operates in the frequency range of 3.1 to 10.6 GHz.. This high-bandwidth, low power method of wireless data transmission enables secure, high speed connection required for the USB-like user experience. It combines the benefits of wired USB with the convenience of wireless technology. Enabling PC.s, peripherals, consumer electronics and mobile devices to connect using a common interface. . This technology was created by the Wireless USB Promoter Group: Agere Systems, Hewlett Packard, Intel, Microsoft, NEC Electronics, Philips and Samsung. Wireless USB has been designed for high-throughput, short-range communication.

Features:

- This technology delivers theoretical maximum signaling rates up to 480 Mbps at three meters and up to 110 Mbps at 10 meters. But it is reasonable to expect performance upwards of 50-100 Mbps at short range.
- This technology enables streaming video to multiple displays within a room without a video splitter and without video cables.
- Digital cameras would be able to store the captured images not just on large flash cards in the camera, but on much larger storage devices stored in a briefcase or in a jacket pocket. That same digital camera could then stream pictures and video to any wireless USB enabled display in the room.
- Because the maximum throughput of wireless USB promises to be significantly higher than the fastest Wi-Fi connections, richer and more interactive user experiences will be possible.

Wireless USB features can be expected to see in a variety of products, some of the Certified Wireless USB products in market are :

Belkin CableFree USB Hub Technology:

Belkin CableFree USB Hub Enables Instant Wireless Connectivity of USB Devices. Belkin brings the world's first wireless USB Product to the market, a new CableFree USB Hub, the industry's first USB Hub that does not require a cable to connect to the computer. This Hub allows people to place their laptop anywhere in the room while still maintaining wireless access to their USB devices, such as printers, scanners, hard drives, and MP3 players. The CableFree USB Hub's wireless functionality is enabled by Freescale Semiconductor's Ultra-Wideband technology. This product will be compatible with the more than 700 million USB devices estimated to be in the market today. According to market research firm In-Stat, the number of USB devices is forecast to increase to 2.1 billion by the end of 2009.

Dell Inspiron 1720 - First laptop on the market integrated with Wireless USB

Lenovo ThinkPad T61 and T62p - First Lenovo's laptop integrated with Wireless USB



Industry giants including Dell and IBM have come on board as early adopters of the new USB standard, which combines the data transfer rates of USB with the ease-of-use and cable-free nature of Bluetooth and WiFi. Dell is rolling out its new Inspiron 1720, a mobile media notebook that includes a built-in Certified Wireless USB chip. In conjunction with new lines of Certified Wireless USB routers launched by D-Link and IOGear, the 1720 can connect with 127 other devices and swap data at a blistering 480Mb/s (at 3 meters; speeds fall to a respectable 110Mb/s at 10 meters).

The other major Certified Wireless USB notebook launch is the ThinkPad T61. A more modest offering than the Dell, it still manages to be a wireless beast with support for standard WiFi, Bluetooth and USB out of the box. The 14.1-inch offering from Lenovo won't play Blue-ray discs, but it will get our basic jobs done in a compact, wire-free way.

Audio 995 Digital Wireless Stereo Headsets:



Convenient, Plug-and-Play Wireless Functionality

With this Audio 995 Headset, you can experience your digital music library, podcasts, internet calls, and more without being tied down to your PC. This high-performance headset has a roaming range of up to 40 feet, which easily lets you get up from your desk without having to interrupt your listening session. And the headset's convenient on-ear controls give you further freedom: directly from your headset, from wherever you are.

It couldn't be easier to get started using this headset: simply plug the wireless USB adapter into your PC's USB port and you're good to go -- no configuration, no software installation, no hassles.

Samsung WUSB + USB 2.0 LCD:



Samsung and DisplayLink seem to be getting along well as evidenced by the growing USB display line-up. Samsung showcased its latest USB monitors with some new

interesting twists. The new LD220 and LD190X are primarily targeted at notebook workaholics who want to connect additional monitor with their laptop. The duo answers the call for a more laptop-friendly solution, with ease of connectivity as well as power saving.

The 19" LD190X and 22" LD220, 'Stand-less' Monitors with USB features in addition to D-sub (VGA) whose primary connectivity is wired USB for the line-up, .The LD190X additionally features built-in Certified Wireless USB, and ships with a HWA dongle that shouldn't be needed as WUSB silicones start appearing on more laptops. This monitor reportedly uses 33% less energy than a typical 19 incher.

USB Functions:

- Wireless USB can connect devices such as printers, keyboards, and storage media to the computer in a "plug-and-play" fashion without cables. To achieve this, new hardware adapters and software drivers are required.
- Certified Wireless USB employs a wireless technology called Orthogonal frequency division multiplexing (OFDM) which was created by the WiMedia Alliance expressly for wireless USB. One of the key advantages to a UWB system is the low power consumption (great for portable devices) and wide frequency spectrum of operation.
- Certified Wireless USB allows up to 127 devices to connect directly to the host computer. Unlike wired USB, this is possible without hubs, because there are no wires.
- Wireless USB is an additional way to connect devices to a computer. Thus, traditional USB ports are here to stay, at least for the foreseeable future.
- The concept of Device Wire Adapters (DWA) and Host Wire Adapters (HWA) was created. HWAs are essentially "dongles" that physically connect to the computer via USB 2.0 or a Laptop's CardBus or Express Card interface, and provide Wireless USB host capability to any number of Wireless USB devices.

Security:

Certified Wireless USB is a very secure method of data transmission. Encryption is incorporated at multiple layers of the protocol, which forces a secure relationship to be automatically negotiated between each wireless USB device and the host computer using unique keys. This type of arrangement provides an extremely high-level of security to the data link, without passwords for the user to enter or forget.

The inherent low-power nature of the ultra-wideband radios used in Certified Wireless USB also plays a factor in the security. Since the maximum range is not more than 10 metres, the threat of data being stolen or read by others is limited to those who can be situated within close proximity to the wireless USB network.

Limitations:

Despite rapid advancements in wireless technology through the course of the computing industry, good old wired connections still enjoy speed and some security advantages over their wireless counterparts. There is simply no chance of an unwanted party connecting to your local USB storage device, for instance, when the cable is directly connected to your PC (provided your networking environment is properly secure).

Wired USB 2.0 and the new USB 3.0 will remain the device interconnect standard of choice for the foreseeable future. The issues of speed and distance pose significant challenges to any connection standard, but are always an order of magnitude more difficult to solve in a wireless environment. Also the issue of cost will likely always favor the wired USB solution over wireless USB. Interface chips simply are less complex in a wired world, and that allows the cost of products that contain them to be lower as well. For users who don't need the convenience and freedom that wireless USB offers, wired USB is here to stay.

Bluetooth Vs Wireless USB:

Bluetooth, initially developed by Ericsson, was quickly adopted by companies as Microsoft, Apple, Motorola, and Toshiba. It has since become a major standard for wireless device connectivity. Using wide-band, low-power radio waves to transmit data over short distances, Bluetooth has been used for wireless keyboards, mice, and other peripherals, cellular phones, PDAs, MP3 players, and some digital cameras. One of the benefits of Bluetooth is that it has a very low power consumption rate, especially when it comes to audio transmission. This has made Bluetooth the technology of choice for cell phone manufacturers looking to pair wireless headsets to their phones. Despite widespread adoption by many manufacturers, Bluetooth has been plagued by some nagging problems. Such as lack of interoperability between different manufacturers, Security, speed etc

USB tends to serve the same tasks that Bluetooth does (such as data communication with devices, and collecting input from devices such as keyboards and mice), but the most obvious difference between Bluetooth and Wireless USB is the speed, generally always the speed with Bluetooth is always less than 1 Mbps .Wireless USB, on the other hand, is rated for 480 Mbps at 5 meters. Both technologies are slower at further distances, but Wireless USB should always be faster than Bluetooth. Another obvious difference between Bluetooth and Wireless USB is security - Bluetooth devices are highly susceptible to signal-hijacking where as the security standard for WUSB is very strict and should result in a much more secure connection - this is very important for any application which may require the transfer of sensitive data or information. WUSB

can completely replace Bluetooth except for the fact that Bluetooth is already widely available, and few devices plan on supporting Wireless USB.

SUPERSPEED USB 3.0

Imagine if an entire Hard Drive movie can be uploaded to a laptop in just over a minute. Imagine downloading all the 100-plus MP3 files of an audiobook to a Audio player in seconds. How about getting the latest video from a camcorder to our desktop ready almost instantaneously, that's what the developers of the next-generation Universal Serial Bus technology are counting on .In 2007, Intel demonstrated SuperSpeed USB .Version 1.0 of the USB 3.0. It is the next major revision of the USB products. with about 6 billion devices sold, USB 2.0 provides sufficient bandwidth for a variety of devices and hubs to be connected. However, with today's ever increasing demands on data transfers with, terrabyte storage devices, high megapixel count digital cameras, high-definition video content and portable media players, 480Mbps is not enough. More over theoretical throughput of USB 2.0 connection is 480Mbps but it could ever come close to the 480Mbps, making maximum data transfer at around 320 Mbps.

USB 3.0 Features:

- Higher transfer rates (up to 4.8Gbps) , Increased maximum bus power and increased device current draw to better accommodate power-hungry devices.
- Full-duplex data transfers and support for new transfer types. New connectors and cables for higher speed data transfer
- An additional physical bus is added in parallel with the existing USB 2.0 bus that means a combined 8 connections in the connectors and cabling for higher performance.
- USB 3.0 utilizes a bi-directional data interface rather than USB 2.0's half-duplex arrangement, where data can only flow in one direction at a time. This all combines to give a ten-fold increase in theoretical bandwidth,
- More efficient use of power like, Link level power management, which means either the host computer or the device, can initiate a power savings state when idle

Applications:

In the near future USB 3.0 will enable applications like High resolution Webcameras, Video display solutions, such as DisplayLink USB video technology , video surveillance cameras , digital still cameras with USB interface ,Multi-channel audio interfaces etc.

With its promised 4.8Gbps speed, the standard will find its way into some products that previously weren't USB territory. Companies like Synopsys, PLDA, Symwave and now Gennum's Snowbush group have all revealed their plans and progress on the path

to getting USB 3.0 devices off the drawing board onto PCBs. The first releases will hopefully be hitting shelves in a little over 12 months, mid 2010.

Limitations:

High-bandwidth devices, such as video cameras or storage devices will likely be the first to migrate to SuperSpeed USB, but cost considerations, which in this industry are mainly driven by demand and volume, will restrict USB 3.0 implementation to higher-end products.

By 2010, computer motherboards should start to come equipped with USB 3.0 ports supplementing USB 2.0 ports. Adapter cards will likely play a large role in driving the installed base of USB 3.0 ports up, but as SuperSpeed-enabled ports become standard on new PCs, device manufacturers will be further motivated to migrate to the new standard.

How to Save the Planet with USB Gadgets?

The below mentioned USB gadgets are few items that take a bit of the load off of Mother Earth. These eco gadgets are organized into three sections: a) Saving Power b) Buying Eco-friendly Peripherals and c) Generating our Own Power. If we Want to feel like we are doing something (every little bit does count) without investing too much effort, Manufacturers are happy to oblige:

Saving Power:



Some electronic devices draw power even when they are turned off. To prevent this so called phantom power usage a new smart power strip called **CheckTap** has introduced.

The power strip connects to our computer via USB and software allows us to adjust the power savings to our needs. The software provides feedback on how much power we are saving and a virtual tree grows based on the carbon dioxide you don't dump into the environment to give you a visual image of how good you are doing.

TrickleStar, a relatively unknown Hong Kong company, claims to have the "world's first" power-saving device that can slash as much as 12% from our utility bills by

cutting standby power and that presumably can reduce the same amount on our electricity use.

The **TrickleStar** PC Standby Power Saver connects to a PC via a USB cable and continuously checks the power status of the computer. There's another power extension cable that daisy-chains to our regular power strip with all our peripherals plugged in. When the PC is switched off, the **TrickleStar's** current sensing circuitry will cut power to the peripherals. According to International Energy Agency (IEA), standby power costs U.S. \$4 billion annually.



Eco Button, a piece of green plastic that puts our Windows PC into energy-saving eco mode when we tap on its broad face. The USB-powered button comes with software that tells us how much energy and how many carbon units we have saved through its labor-saving practices.

Buying Eco-friendly Peripherals:

Here are a few items that have been specially constructed to reduce their impact on the environment by recycling, reducing or removing the materials or byproducts of the manufacturing process.



ATP introduced the **EarthDrive** an environment friendly drive. The **EarthDrive's** casing is made completely of bio-recycled plastics and is also recyclable. the fact that ATP has partnered with the American Global Forest Re-Leaf program to donate a

portion of the profits and help replant trees around the United States. The drive comes in sizes ranging from 1GB to 8GB and is waterproof, dust proof, and shock proof.



A drive combining both Turbo USB and green features. Today **Fabrik** introduced a new **SimpleTech [re]drive** that claims to be the world's most eco-friendly external hard drive using Turbo USB. The Turbo USB feature promises 25% more speed than normal USB 2.0. The **[re]drive** uses less power to save electricity and the housing is made from recycled aluminum and bamboo. The box the drive ships in is made from 100% recycled material. Software for automated backups is also shipped with the drive and it can save data online for added security.

Generating Power on Your Own:

Alternate energy sources are another way of reducing our footprint. The sun and motion can be converted energy to power devices reducing our need to plug-in but still keep us plugged.



The **nPower PEG** generates power through the kinetic energy of our walking. While it's a little on the weak side at 5.0V DC @ 200 mAmps it should be enough power to charge most devices via the convenient and nearly universal USB plug at least while they are off. Just toss it in your backpack and they estimate that with an hour of walking around that you will have generated enough power to bring a dead device back up to 80% charge.



More and more gadgets are coming to market that can be recharged via the ubiquitous USB port. This allows us to be able to recharge phones and other items from our computer, but what do you do when you are out camping or otherwise not around an AC outlet or USB port?

The small device looks like one of those personal fans for hot days, but it is actually a wind generator that can power our phone or other USB charging device. The generator requires a breeze from 9 MPH to 40MPH and charges its own internal Li-ion battery and puts out 5V for USB gadgets. 20-minutes of wind can power your ipod for 30-minutes or your phone for four-minutes.

CONCLUSION:

One of the reasons that USB implemented was to replace existing serial and parallel ports on computers. USB has several advantages for this application, which is why it has been included in most of the new PCs that have been shipped since Windows 98 was released. Since its introduction in the 90's, several different editions of USB standards had been released. Improving the features of the Standard. Today there are billions of USB devices that are being used throughout the world .Becoming the most used interface to connect devices, because of its greater performance and faster speeds around 4.8Gb/s from the new standard USB 3.0.Even though USB 3.0's top speed is 4.8Gbps, we may not have to wait for USB 4.0 to reach even faster speed. According to the sources, USB 3.0 was designed with transmission protocol to support speed of up to 25Gbps. But may we have to wait for few more years for the specified speed to achieve and for more advanced features of the USB device.

References:

- www.USB.org
- USB Explained, by Steven McDowell, Martin D.Seyer.
- WiMedia UWB: Technology of Choice for Wireless USB and Bluetooth, Ghobad Heidari.
- www.everythingusb.com
- No strings Attached ,IEEE Spectrum, April 2006
- USB, Specification book