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Certified wireless USB is a quantum leap in ease-of-use

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The USB Implementers Forum (USB-IF) has adopted Certified Wireless USB as the wireless extension to USB. Using the WiMedia ultra wideband (UWB) protocol, Certified Wireless USB provides the same bandwidth as wired Hi-Speed USB. This bandwidth represents almost 500 times the throughput of other wireless standards, such as Bluetooth. Certified Wireless USB aims to bring to wireless products the simplicity, functionality, and intuitive user experience of wired USB. Products based on Certified Wireless USB technology are beginning to enter the market even now.

Wired USB is an extremely successful standard; literally billions of USB peripherals are manufactured worldwide. Unfortunately, this translates into billions of tangled wires. With Wireless USB, users can download pictures from a camera without digging out the memory card, upload songs to an MP3 player without a proprietary cable, and place a large printer where it's convenient rather than close enough for its cable to reach the computer.

The USB-IF embraced Certified Wireless USB with backing from Intel, Microsoft, NEC, HP and other industry leaders. As an industry standard, devices based on the Certified Wireless USB technology from various vendors interoperate just as wired USB devices do now. The same host/peripheral usage model is retained. This means that there is one host, a PC, which connects to multiple peripherals. This standard differs from networking standards, where peers connect to other peers through one or more paths. This difference allows for USB's ease of use and its affordability.

The WiMedia Alliance UWB specification defines the radio protocol used by Wireless USB. UWB transmits on a large swath of frequencies simultaneously. Wireless USB uses the frequencies from 3.4 to 5.0 GHz (also known as band group one). Using such a large spectrum allows for high data rates and immunity from narrowband interference. The disadvantage is that UWB operates in licensed spectra. To avoid interfering with existing broadcasts, UWB power must be kept below noise level (and must adhere to other requirements). This noise level limitation restricts WiMedia UWB's range to approximately 10 meters. All UWB devices require certification and approval from the appropriate governmental agencies, including the Federal Communications Commission.

WiMedia UWB uses a distributed reservation protocol (DRP). In a local group, each WiMedia device reserves time slots. This method allows different protocols (e.g., Certified Wireless USB, WiNet, Bluetooth 3.0) to coexist while sharing the same underlying UWB spectrum—using it at different times. WiMedia devices transmit and listen for beacon frames to detect nearby devices and the time slots they use. The group's reservation is dynamically adjusted to avoid collisions—even as new devices and groups come in and out of range. The Certified Wireless USB specification allows peripherals to either self-beacon or manage beacons as directed by the Wireless USB host.

Certified Wireless USB creates a high bandwidth wireless network approximately 10 meters around a host PC. Devices actively seek out neighbors, manage flow control, and negotiate transmission time slots. Wireless traffic is encrypted (AES-128) to mimic the natural security of a wired connection. Like USB 2.0, wireless USB transfers data at up to 480 Mbps, retains the same host/peripheral model, and operates with the same drivers. This means new wireless peripherals can use the same host drivers as their wired USB versions. However, unlike wired USB, Certified Wireless USB devices require association.

Association establishes a security relationship between a host and a peripheral and, in the process, prevents unauthorized hosts from accessing peripherals. Association is required only once. Once associated, the device remembers the host and can connect to it automatically when it is in range. Although a peripheral can be associated with more than one host, it can be connected to only one host at a time.

The USB-IF specifies two methods of association: cable and numeric. Cable association requires the user to connect a standard USB cable between the host and the peripheral. This is the only step. Once the host indicates successful association, the cable can be disconnected and never used again.

Numeric association is wireless. It requires the user to initiate numeric association by pressing a button on the peripheral and starting a wizard on the host. Some data exchange occurs. Once it does, the user confirms that the number presented by the host matches the number displayed on the peripheral.

All peripherals with a display must support numeric association. Peripherals with a wired USB port must support cable association. Hence, a wireless USB printer with a wired USB port and an LCD display can connect by using either association method, whereas Certified Wireless USB hosts must manage both methods.

The Certified Wireless USB specification provides details of two transitional devices that bridge wired USB to wireless USB. The Host Wire Adapter (HWA) is a dongle that plugs into the existing wired USB port of a PC. Plugging the dongle into the wired USB port of that particular PC adds wireless USB host capability to the PC. The Device Wire Adapter (DWA) contains ports for plugging in existing wired USB peripherals. The DWA wirelessly connects to the wireless USB host and then routes traffic to and from the wired USB peripherals. Most DWAs can attach to multiple-wired USB peripherals.

HWAs and DWAs are not point-to-point devices. HWAs can connect with native wireless USB peripherals, and DWAs can connect with integrated wireless USB hosts. These adapters are likely to be the first Certified Wireless USB end-user devices to be marketed.

Native Wireless USB peripherals are expected to begin entering the market in large quantities by the second half of 2008. They will most likely be PC peripherals with both wired and Wireless USB connectivity capabilities. However, since the USB-IF requires every device with a wired USB port to support cable association, designers cannot simply add Wireless USB. They must also modify their wired USB firmware to support cable association—and this modification may be a considerable undertaking.

One solution is to use a controller chip, such as LucidPort Technology's L800, a general-purpose Wireless USB peripheral controller. Connecting directly to a CPU or microcontroller's memory bus, the L800 is designed for integration into native Wireless USB peripherals. The L800 comes with connections for both Hi-Speed USB and Certified Wireless USB. Because the L800's wired USB port supports data transfer and cable association, the L800's driver can manage cable association without having to involve legacy USB code.

The USB-IF has implemented a certification procedure for Certified Wireless USB products. Devices are run through a gamut of tests to assure that they comply with the specifications. A set of interoperability trials analyzes compatibility between a variety of products and vendors. Different physical setups are used to confirm robust wireless reception. To ensure that Wireless USB products will work in the same environment as other WiMedia UWB devices, products based on the WiMedia Common Radio Platform must also pass a series of WiMedia checks. Only fully tested products that pass certification by the USB-IF are allowed to display the Certified

Wireless USB logo.

As Certified Wireless USB products and development kits become available, the USB-IF is resolved to create a positive end-user experience. The Certified Wireless USB specifications were written to ensure adequate bandwidth and security, as well as compatibility with wired USB. Its usage models were intentionally based on wired USB to promote simplicity and reduce user confusion. Certification procedures are in place to ensure that all products bearing the Certified Wireless USB logo work well together. The pieces are now in place for wide adoption of Certified Wireless USB.

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