# Ultra-Wideband (UWB)

## Introduction

Ultrawideband is a wireless radio technology originally developed for secure military communications and radar that is now declassified. It is a high-speed, short-range wireless technology - nearly 10 times faster than 802.11b. It can be used for transferring digital content between devices in different entertainment and computing clusters in the home, such as digital video recorders, set-top boxes, televisions and PCs. UWB is designed to replace cables with short-range, wireless connections, but it offers the much higher bandwidth needed to support multimedia data streams at very low power levels. And because UWB can communicate both relative distance and position, it can be used for tracking equipment, containers or other objects.

While it has been used for a while by the military, UWB is now going through the necessary authorizations and developments for public and commercial use. Even thought the advancement of UWB has been somewhat slow, there's a possibility that UWB will become the "next best" technology for all types of wireless networks, including wireless LANs.

UWB chipsets are currently under development and testing by several companies, including Intel, Time Domain, XtremeSpectrum, Texas Instruments, Motorola, and STMicroelectronics and others. Intel is bouncing around the idea of implementing UWB technology into all of its chips.

Companies such as Sony and Panasonic hope to use UWB in their flat panel video displays, eliminating the need for wires while still broadcasting the highest quality images with full stereo sound. Other heavy hitting companies buying into UWB include Cisco and AT&T.

## Application of Ultrawideband

There are three overlapping target segments that could benefit from short-range wireless connections enabled by UWB: PC and peripheral devices, mobile devices, and consumer electronics. Many devices in each of these three segments frequently communicate significant amounts of data over very short distances with other complementary devices, usually by means of an interconnect cable. For example, a digital still camera, with a large storage capacity, typically requires a high-speed serial connection to the PC to transfer images. At the time of transfer, the distance between the PC and the camera is typically a few meters at most. UWB allows us to create a wireless link by enabling the necessary data rates in a radio suitable for cost-sensitive, battery-powered mobile devices, like a camera or PDA. Similar examples are smart phones, home entertainment centers, printers, handheld computers, camcorders, video projectors and MP3 players. By eliminating the need for a physical cable connection, a new level of user convenience and mobility is provided.

## How UWB Works

A traditional UWB transmitter works by sending billions of pulses across a very wide spectrum of frequencies several GHz in bandwidth. The corresponding receiver then translates the pulses into data by listening for a familiar pulse sequence sent by the transmitter. Specifically, UWB is defined as any radio technology having a spectrum that occupies a bandwidth greater than 20 percent of the center frequency, or a bandwidth of at least 500 MHz.

Modern UWB systems use other modulation techniques, such as Orthogonal Frequency Division Multiplexing (OFDM), to occupy these extremely wide bandwidths. In addition, the use of multiple bands in combination with OFDM modulation can provide significant advantages to traditional UWB systems.

UWB's combination of broader spectrum and lower power improves speed and reduces interference with other wireless spectra. In the United States, the Federal Communications Commission (FCC) has mandated that UWB radio transmissions can legally operate in the range from 3.1 GHz up to 10.6 GHz, at a limited transmit power of -41dBm/MHz. Consequently, UWB provides dramatic channel capacity at short range that limits interference.

**How will UWB impact the industry?**

UWB has the potential to eventually dominate every wireless "area network," from wireless personal area networks (WPANs) to wireless wide area networks (WWANs). In its current restricted state, UWB will most likely be the preferred technology for wireless personal area networks, replacing Bluetooth's 1-2Mbps bandwidth with 400-500Mbps data rates.

As far as WLANs are concerned, UWB is not in an immediate position to take over. This has to so with the power limitations imposed by the FCC, but even if the limitations are lightened some say that it could take at least five years before UWB will become a dominant player in the wireless LAN market.

There has been discussion of using UWB to provide cheap, fast, last mile wireless access systems, which would solve the interference issues that plague current spread spectrum-based Metropolitan Area Networks (MANs). These UWB systems could be set up in rural areas, bringing never seen before high-speed connectivity to those users.

Right now the best killer application for UWB is home multimedia networking systems, where high bandwidth is crucial. UWB can support multiple channel multimedia streaming of broadcast quality video, making it the preferred technology to use when setting up a wireless home multimedia network.

UWB could connect virtually every multimedia device in your home without using any wires. Digital cameras and camcorders could wirelessly stream images and video to your TV or PC, DVD players and TV's could stream videos throughout your home, and flat screen monitors could wirelessly connected to computers, DVD players, or any other source you desire. UWB will very likely revolutionize the home multimedia scene and eliminate the mounds of tangled wires found behind home entertainment centers.

**Other uses of Ultrawideband**

It is believed that many uses will be discovered but much depends on what the U.S. Federal Communications Commission (FCC) will allow. If the FCC relaxes its rules in the future, a wide range of wireless data communications devices could become available, such as wireless networks with far greater bandwidth than existing technologies like Bluetooth, 802.11a and 802.11b. The FCC's current rules allow only the following:

- Automotive collision-detection systems and suspension systems that respond to road conditions.
- Medical imaging, similar to X-ray and CAT scans.
- Through-wall imaging for detecting people or objects in law-enforcement or rescue applications.
- Construction applications, including through-wall imaging systems and ground-penetrating radar.
- Communications devices, such as high-speed home or office networking, provided that the devices are designed for indoor use; outdoor use is restricted to handheld devices engaged only in peer-to-peer operation.

**Restrictions on Ultrawideband**

Because UWB uses a wide swatch of frequency, there are concerns that it will interfere with existing communications.

Initially, the main concern about UWB was whether or not they would interfere with existing RF systems that provide essential military, aviation, fire, police, and rescue services. Because of this, the FCC spent two years evaluating the proposed UWB specifications and concluded that there will be no major interference. The Department of Defense reviewed the tests and issued statements that it was satisfied with the current restrictions being placed on UWB as well.

Concerns still remain, however, about the interference of higher-power UWB systems. The FCC says they will reevaluate UWB in the near future, and they will take a closer look at the issue of higher-power systems. Until then, you're limited to UWB products with somewhat short range propagation.

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