UWB Pulse Transmission

At the destination of the communications circuit, the pulse code modulator converts the binary numbers back into pulses having the same quantum levels as those in the modulator. These pulses are further processed to restore the original analog waveform. When pulse modulation is applied to a binary symbol, the resulting binary wave form is called a *pulse code modulation* waveform. When pulse modulation is applied to a nonbinary symbol, the resulting waveform is called *M-ary pulse modulation* waveform. Each analog sample is transmitted into a PCM word consisting of groups of *b* bits. The PCM word size can be described by the number of quantization levels that are used for each sample. The choice of the number of quantization levels, or bits per sample, depends on the magnitude of quantization distortion that one is willing to tolerate with the PCM format. In North America and Japan, PCM samples the analog waveform 8000 times per second and converts each sample into an 8-bit number, resulting in a 64 kbps data stream. The sample rate is twice the 4 kHz bandwidth required for a toll-quality voice conversion

Ultra-wideband (also known as **UWB**, **ultra-wide band** and **ultraband**) is a radio technology pioneered by Robert A. Scholtz and others which may be used at a very low energy level for short-range, high-bandwidth communications using a large portion of the radio spectrum.[1] UWB has traditional applications in non-cooperative radar imaging. Most recent applications target sensor data collection, precision locating and tracking applications.[2]

Similar to spread spectrum, UWB communications transmit in a way which does not interfere with conventional narrowband and carrier wave used in the same frequency band.

Ultra-wideband is a technology for transmitting information spread over a large bandwidth (>500 MHz); this should, in theory and under the right circumstances, be able to share spectrum with other users. Regulatory settings by the Federal Communications Commission (FCC) in the United States intend to provide an efficient use of radio bandwidth while enabling high-data-rate personal area network (PAN) wireless connectivity; longer-range, low-data-rate applications; and radar and imaging systems.

Ultra wideband was formerly known as "pulse radio", but the FCC and the International Telecommunication Union Radio communication Sector (ITU-R) currently define UWB in terms of a transmission from an antenna for which the emitted signal bandwidth exceeds the lesser of 500 MHz or 20% of the center frequency. Thus, pulse-based systems—where each transmitted pulse occupies the UWB bandwidth (or an aggregate of at least 500 MHz of narrow-band carrier; for example, orthogonal frequency-division multiplexing (OFDM)—can gain access to the UWB spectrum under the rules. Pulse repetition rates may be either low or very high. Pulse-based UWB radars and imaging systems tend to use low repetition rates (typically in the range of 1 to 100 megapulses per second). On the other hand, communications systems favor high repetition rates (typically in the range of one to two gigapulses per second), thus enabling short-range gigabit-per-second communications systems. Each pulse in a pulse-based UWB system occupies the entire UWB bandwidth (thus reaping the benefits of relative immunity to multipath fading, but not intersymbol interference), unlike carrier-based systems which are subject to deep fading and intersymbol interference.

The significant difference between conventional radio transmissions and UWB is that conventional systems transmit information by varying the power level, frequency, and/or phase of a sinusoidal wave. UWB transmissions transmit information by generating radio energy at specific time intervals and occupying a large bandwidth, thus enabling pulse-position or time modulation. The information can also be modulated on UWB signals (pulses) by encoding the polarity of the pulse, its amplitude and/or by using orthogonal pulses. UWB pulses can be sent sporadically at relatively low pulse rates to support time or position modulation, but can also be sent at rates up to the inverse of the UWB pulse bandwidth. Pulse-UWB systems have been demonstrated at channel pulse rates in excess of 1.3 giga pulses per second using a continuous stream of UWB pulses (Continuous Pulse UWB or C-UWB), supporting forward error correction encoded data rates in excess of 675 Mbit/s.[4] Such a pulse-based UWB method (using bursts of pulses) is the basis of the IEEE 802.15.3a draft standard and working group, which has proposed UWB as an alternative PHY layer.

A valuable aspect of UWB technology is the ability for a UWB radio system to determine the "time of flight" of the transmission at various frequencies. This helps overcome multipath propagation, as at least some of the frequencies have a line-of-sight trajectory. With a cooperative symmetric two-way metering technique, distances can be measured to high resolution and accuracy by compensating for local clock drift and stochastic inaccuracy.

Another feature of pulse-based UWB is that the pulses are very short (less than 60 cm for a 500 MHz-wide pulse, less than 23 cm for a 1.3 GHz-bandwidth pulse), so most signal reflections do not overlap the original pulse and the multipath fading of narrowband signals does not exist. However, there is still multipath propagation and inter-pulse interference to fast-pulse systems which must be mitigated by coding techniques

Voice and Data Integrity:

Voice/data integration is important to network designers of both service providers and enterprise. Service providers are attracted by the lower-cost model-the cost of packet voice is currently estimated to be only 20 to 50 percent of the cost of a traditional circuit-based voice network. Likewise, enterprise network designers are interested in direct cost savings associated with toll-bypass and tandem switching. Both are also interested in so-called "soft savings" associated with reduced maintenance costs and more efficient network control and management. Finally, packet-based voice systems offer access to newly enhanced services such as Unified Messaging and application control. These, in turn, promise to increase the productivity of users and differentiate services.

Integration of voice and data technologies has accelerated rapidly in recent years because of both supply- and demand-side interactions. On the demand side, customers are leveraging investment in network infrastructure to take advantage of integrated applications such as voice applications. On the supply side, vendors have been able to take advantage of breakthroughs in many areas, including standards, technology, and network performance.