An Update on Wireless Standards Activity

This report offers a brief summary of some recent activities in wireless system standards. The standards process is continuous—even established standards are updated and modified in response to changes in technology and marketplace. It is impossible to collect comprehensive data on all standards. This update is just a snapshot of a few standards we think are of current interest to our readers.

IEEE 802.15.4 WPAN Standard

IEEE 802.15.4 is the IEEE standard, covering Wireless Personal Area Networks (WPAN), which was approved and published in late 2003. It defines a physical layer (PHY) and media access controller (MAC) for applications in home networking, automotive networks, industrial networks, interactive toys and remote metering.

The standard provides for data rates of 250 kbps, 40 kbps and 20 kbps in a star or peer-to-peer configuration. It has dynamic device addressing and a fully handshaked protocol for transfer reliability. Frequency bands are 16 channels in the 2.4 GHz ISM band, 10 channels in the 915 MHz ISM band and one channel in the European 868 MHz band. Key attributes of 802.15.4 include:

2.4 GHz PHY
- 250 kbps (4 bits/symbol, 62.5 ksymbols/s)
- Data modulation is 16-ary orthogonal modulation
- 16 symbols are orthogonal set of 32-chip PN codes
- Chip modulation is O-QPSK at 2.0 Mchips/s

868 MHz/915 MHz PHY
- Symbol Rate
    - 868 MHz Band: 20 kbps
        - (1 bit/symbol, 20 ksymbols/s)
    - 915 MHz Band: 40 kbps
        - (1 bit/symbol, 40 ksymbols/s)
- Data modulation is BPSK with differential encoding
- Spreading code: a 15-chip m-sequence
- Chip modulation is BPSK:
    - 868 MHz Band: 300 kchips/s
    - 915 MHz Band: 600 kchips/s
- Transmit Power: at least 0.5 mW
- Transmit Center Frequency Tolerance: ± 40 ppm
- Receiver Sensitivity (Packet Error Rate <1%):
    - <-85 dBm @ 2.4 GHz band
    - <-92 dBm @ 868/915 MHz band

This standard is designed for very low power consumption, low cost and complexity, but with reliable data transfer. The specific implementations may vary from intermittent data (e.g. an appliance on/off controller) to continuous, but low rate data (e.g. a cordless mouse or a periodically polled sensor).

The application areas of 802.15.4 overlap with Bluetooth, Zigbee, Home RF and other short-range wireless data transmission systems.

The differences with Bluetooth are often described as market-based—Bluetooth products are mainly targeted to individual users, operating primarily in conjunction with cellular handsets, personal computers and PDAs. 802.15.4 is intended for a wider range of applications, including both larger networks and interfacing with devices that are not part of existing networks or systems.

Zigbee is designed for even lower power consumption and lower cost implementation. It also is designed for less flexible operation, emphasizing master-slave relationships in an environment such as an in-building HVAC control system. As part of the cost-savings, Zigbee specifies direct sequence spread spectrum (DSSS) rather than 802.15.4's frequency hopping (FHSS). 802.15.4 allows for data rates two to four times higher than Zigbee's 128 kbps.

The IEEE WPAN standard establishes a means for short-range wireless communications with the interoperability necessary for marketplace acceptance, with more flexibility than other standards that are focused on a narrower range of applications.

At least eight chip makers have announced products compliant with 802.15.4, which should encourage hardware developers to proceed with their planned short-range data products.

Ultra Wideband (UWB)

One of the points of contention among proponents of various ultra wideband transmission standards is the use of orthogonal frequency domain modulation (OFDM). IEEE standard 802.15.3a for multiband OFDM (MB-OFDM) was released as a draft specification in November 2003.

Multi-Band OFDM Alliance (MBOA), a UWB industry group, has stated that they will generate specifications based on the IEEE proposal, as version 0.9 in February 2004 and 1.0 in May 2004. Although the MBOA supports the IEEE process, it will be working in parallel to help speed time-to-market. The MBOA has nearly one hundred engineers from about 30 companies working within 8 technical subcommittees to define the specification.

There is concern that an OFDM-based standard would not comply with FCC regulations. Xtreme Spectrum, one of the pioneers in UWB development also has a proposal for the 802.15.3a wireless networking standard. The Xtreme Spectrum proposal uses a direct sequence code division multiple access (DS-CDMA) approach. To avoid another area of concern—IP licensing—Xtreme has said that it will offer "reasonable and non-discriminatory zero licensing" (RAND-Z) access to its intellectual property (IP) relevant to the standard.

802.16 Wireless Broadband

The 802.16 metropolitan area network (MAN) standard was released in april 2003, but continues to draw interest in product and system development, as well draw controversy on its role in the wireless landscape that also includes 802.11 technologies.

Current activities include draft releases of updates and amendments for the air interface, PHY and MAC layer details for the lower frequencies (2 to 11 GHz), plus protocol conformance and test suite definitions for the higher frequencies (10-66 GHz).

802.16 has evolved greatly from its initial 1999 focus on local multipoint distribution service (LMDS). It now includes features that overlap and/or complement portions of the 802.11 standard. For the under-11 GHz range, 802.16 can be characterized as "broadband wireless" that is aimed at infrastructure applications rather than the "last 100 feet" of 802.11 WLAN. The overlap occurs in applications where 802.16 is designed to the home rather than as a backbone with 802.11 as the individual access format.

The 802.16a standard specifies three physical layers for services: a single-carrier access method for special-purpose networks; a 256-carrier orthogonal frequency division multiplexed (OFDM) multicarrier PHY for mainstream applications; and a special OFDMa with 2,048 carriers, which can be used for selective multicast applications, and advanced multiplexing options.

The 802.16 Task Group C for 10- to 66-GHz frequency ranges continues to work on higher-frequency services evolving from LMDS and point-to-point 50- to 60-GHz radio. After some well-publicized failures of early LMDS efforts, 802-16-based broadband wireless access (BWA) is again starting to grow in investment and public awareness. Some 802.11-based wireless access providers have been sufficiently successful to be considered small-scale examples of the kind of service that BWA can provide where cable and DSL are not presently available.

802.16-based systems are getting lots of international attention. As with cellular telephony, the lack of wired infrastructure in many parts of the world creates potential markets for wireless distribution. China, Korea, Russia and several Eastern European countries have been mentioned as key places with an interest in wireless broadband distribution.

Digital Television in Europe

In conjunction with ETSI, CENELEC is undertaking the process of defining further standardization in interactive digital television. As directed by the European Commission, working groups have been identifying existing standardization initiatives at international, European and national levels, both formal and informal, and identifying gaps requiring further standardization work. Under its Framework Directive 2002/21/EC, the EU has laid down a tight timescale for the Commission to review the interoperability of digital TV interactive services. Following a consultation document scheduled for publication in December 2003, the Commission is due to deliver a formal assessment of the state of play regarding interoperability no later than July 2004.

CENELEC Adds New Members

Coinciding with the beginning of a new year, CENELEC now has four new members. The National Electrotechnical Committees of Estonia, Latvia, Poland and Slovenia joined CENELEC on this date. These four countries join now a list that includes the Czech Republic (member since 1997), Malta (2001) Hungary and Slovakia (2002) and Lithuania (2003), completing the enlargement to the East even before the target date. With the four newcomers, CENELEC will reach 27 members. One of the consequences of the enlargement will be the adoption, also from January 1st 2004, of the weighted votes agreed by the European Union in the Treaty of Nice. CENELEC hopes and expects Cyprus to become the 28th member before May 2004, completing this way the objectives set out by the European Commission.