

Advancing Broadband Wireless Through Open, Global Standardization

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Broadband Wireless Access**



Why Standards?

- **People often take the view that standardization is the enemy of creativity. But I think that standards help make creativity possible -- by allowing for the establishment of an infrastructure, which then leads to enormous entrepreneurialism, creativity, and competitiveness.**
 - **Vint Cerf, Internet pioneer**
 - *Fast Company, April 2000*

Why Standards?

Survey of about 600 people at BW World Forum (6 March 2000):

How important are standards to the long-term success of this industry?

Extremely important: 59%

Somewhat important: 30%

Business Case for Broadband Wireless Standards

“Subassembly and chip manufacturers simply cannot supply the performance ... at a price which is feasible for significant penetration into the consumer market today... LMDS may be closest to achieving this goal, but its *lack of a unified standard and lack of commitment to significant volumes will inhibit further price declines.*”

- “Millimeter Wave 1998” Allied Business Intelligence

Standardization Body

- **IEEE Standards Association**
 - **IEEE 802: LAN/MAN Standards Committee**
 - IEEE 802.16 Working Group on Broadband Wireless Access
- **802.16 Sponsorship**
 - **IEEE Computer Society**
 - **IEEE Microwave Theory & Techniques Society**

IEEE 802

The LAN/MAN Standards Committee

Wired:

- **802.3 (Ethernet)**

The Wireless Web, 802 Style:

- **802.11: Wireless LAN**

- **Local Area Networks**

- **802.15: Wireless PAN**

- **Personal Area Networks {inc. Bluetooth}**

- **802.16: WirelessMAN™**

- **Metropolitan Area Networks**

Why IEEE 802?

Datacom Standardization

- Global**
- Open**
- Industry-Driven**
- e.g. 802 is unchallenged in LAN**
 - 802 Ethernet standards published by ISO/IEC**

Limitations to IEEE Process

Weak on follow-through

- **compliance & interoperability testing**
- **marketing**

Consortia have filled this vacuum

802's Success: Examples

- **Nov. 1999: Total sales of Shared Hubs and LAN Switches grew 5% to \$3 billion in 3Q99, according to the Dell'Oro Group's quarterly report... Gigabit Ethernet port shipments, which grew 46% quarter over quarter, were driven by an average price decline of 20%.**
- **Feb. 2000 - According to the Dell'Oro Group's Shared Hub & LAN Switch 5-Year Forecast, the Ethernet Switch Market is predicted to grow to in excess of \$23 Billion by 2004, an average annual growth rate of 20% per year. A key driver of this growth is the expansion of the Ethernet Switch market from the LAN into the MAN/WAN.**

802.16 Members

- **Engineers**
- **IEEE 802.16**
 - **108 voting Members**
 - **38 near-Members**
 - **43 official Observers**
 - **Over 160 people at recent meetings**

802.16 Members From:

3Com Corp.
AT&T Wireless Services
Adaptive Broadband Inc.
Agilent Technologies
Alcatel
Analog Devices, Inc.
Aperto Networks
Belstar Systems Corp.
BreezeCOM
BridgeWave Communications, Inc.
Broadcom Corp.
Cabletron Systems
Canon Research Center America, Inc.
Carleton University
Centre for Wireless Communications
CircuitPath Network Systems
ComTier, Inc.
Communications Consulting Services
Conexant Systems, Inc.
Crosspan Network Access Technologies
E. A. Robinson Consulting, Inc.
Ensemble Communications Inc.
Gennum Corporation
Hardin & Associates, Inc.
Harris Corporation
Hughes Network Systems
Industry Canada
Infineon Technologies Corp.
Integrity Broadband Networks, Inc.
Intel Corp.
InterDigital Communications Corp.
Malibu Networks
Mitsubishi Electronics America, Inc.
Motorola Inc.
NEC America, Inc.
NIST

NTT
Netro Corporation
Nokia Networks
Nortel Networks
Nottingham Trent University
Oak Wireless
Philsar Semiconductor Inc.
RADWIN Ltd.
RF Solutions
Radiant Networks PLC
Radiocommunications Agency, UK
Rainbow Network Systems
Runcom Technologies Ltd.
SR Telecom Inc.
SciCom
SiCOM, Inc.
Siemens
SpaceBridge Networks Corp.
SpectraPoint Wireless LLC
Sprint
Technical Strategy Associates
Telaxis Communications Corporation
Telcordia Technologies
TelesciCOM Ltd.
Teligent, Inc.
Tioga Technologies
Transcomm Inc.
TurboNet Communications
U S WEST Advanced Technologies
University of Sheffield
Vyvo Inc.
WaveIP Ltd.
Wavtrace, Inc.
WestEnd
Wireless Facilities, Inc.
World Access Inc.

802.16's Wide Open Process

- **Anyone can:**
 - **Attend meetings**
 - **Subscribe to email list**
 - **Read documents**
 - **Comment on documents**
- **Members can vote**
 - **Membership acquired by attendance**
- **Finalized through open “Sponsor Ballot”**

Process

- **Task Groups**
- **Call for Contributions**
 - **Specific topics for discussion at next meeting**
- **Receive and post written contributions**
- **Discuss and debate at meeting**
- **Adopt initial draft**
- **Revise in and out of meetings**
- **Adopt final WG draft by 75% vote**
- **Finalized through open “Sponsor Ballot”**

802.16 Projects

802.16.1: Air Interface, 10-66 GHz

- PHY Chair: Jay Klein, Ensemble
- PHY Editor: Jeff Foerster, Intel
- MAC Chair: Carl Eklund, Nokia
- MAC Editor: Glen Sater, Motorola

802.16.2: Coexistence

- Andy MacGregor, Nortel (Chair)

802.16.3: Air Interface, 2-11 GHz (licensed)

- Brian Kiernan, Interdigital (Chair)
 - Carl Bushue, Sprint (Vice Chair)

Wireless High-Speed Unlicensed MAN (study)

–WirelessHUMAN™

–Durga P. Satapathy, Sprint (Chair)

802.16.1 Development Plan

Document IEEE 802.16-99/05

http://wirelessman.org/docs/99/80216-99_05.pdf

802.16 Session History

IEEE 802.16 Sessions (1 week each):

#1: July 1999: 106 people became members

#2: August 1999: Functional Requirements

#3: September 1999: 802.16.1 Schedule

#4: November 1999

–heard 802.16.1 Proposals (19 PHY, 15 MAC)

#5: January 2000 (118 people)

–heard 2 Converged 802.16.1 Proposals

802.16 Session History (cont.)

#6: Mar. 6-9, 2000, Albuquerque (126 people)

- 802.16.3 group established**
- Wireless High-Speed Unlicensed MAN
(WirelessHUMAN™)**

#7: May 1-5, 2000, DC (158 people [+ETSI])

- Agreement for 802.16.1 merger**
- First 802.16.3 meeting (requirements)**
- First WirelessHUMAN™ meeting**
- agreement with ETSI BRAN**

802.16 Meeting Schedule

#7.5: May 30-June 2, 2000, Boulder, CO

- **Details of merged 802.16.1 proposal**

#8: July 10-13, 2000, La Jolla

- **802.16.1 to Final Task Group Review**

#9: September 11-15, 2000, Denver

- **802.16.1 to Working Group Letter Ballot**

#10: November 6-10, 2000, Tampa

- **802.16.1 draft completed**
- **802.16.2 draft completed**

Current 802.16.1 Proposal

Submitted by 35 participants from:

3Com

Adaptive Broadband Inc.

BreezeCOM

CircuitPath Network

Systems

**Communications Consulting
Services**

Crossspan (A Raytheon Co.)

**Digital Microwave
Corporation**

Ensemble Communications

Ericsson

iSKY

Lucent

Motorola

Newbridge

Nokia

Nortel

Oren Semiconductor Ltd.

SiCOM, Inc.

Siemens

Spacebridge Networks Corp.

SpectraPoint

TelesciCOM Ltd.

Vyyo

802.16.1 MAC Draft

- **protocol-agnostic**
- **Quality of Service support**
- **Sophisticated bandwidth allocation**
 - Semi-distributed option**
 - **Grant to user**
 - **Grant to terminal**

802.16.1 PHY Draft

- **QPSK, 16-QAM, or 64-QAM**
- **Duplexing options**
 - **Frequency Division**
 - **Time Division**
 - **Frequency Switched Division**

802.16.2 Draft

Coexistence

- **Transmitter parameter**
- **Receiver parameters**
- **Coordination**
- **Mitigation techniques**

802.16 Press Treatment

- ***Telecommunications* magazine (May 2000) chose "The 10 Hottest Technologies"**
- **“Air interface standards, currently being worked on in the IEEE's 802.16 committee to deal with issues such as interference and interoperability, could help change {the slow deployment of LMDS}, propelling broadband wireless to a \$7.4 billion market for services by 2003, according to the Strategis Group.”**

Primary 802.16 Liaisons

- **ITU-R**

- **ETSI BRAN**

How to Participate

-Attend meetings

-Read reflector

-Read documents

-Submit documents & comments

-Join sponsor ballot pool

Sponsor Ballot

- **Any member of IEEE Standards Association may vote on draft standards**
 - IEEE-SA costs \$10 on top of IEEE membership
- **Great opportunity**
 - Influence important results
 - Free access to valuable documents
- **For IEEE 802.16, sign up at**
<http://wirelessman.org>

Resources

– 802.16 Web Site

<http://wirelessman.org>

>350,000 downloads/month

>10,000 copies of 802.16.1 draft

–802.16 email reflector

>400 subscribers

– N-WEST News

<http://nwest.nist.gov>

SIIT2001

Second International Conference

on

Standardization and Innovation in

Information Technology

<http://www.siit2001.org>

University of Colorado

Boulder, CO, USA

October 3-5, 2001