IEEE 802.16 Working Group Process, Status, and Technology

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Chair
IEEE 802.16 Working Group on
Broadband Wireless Access

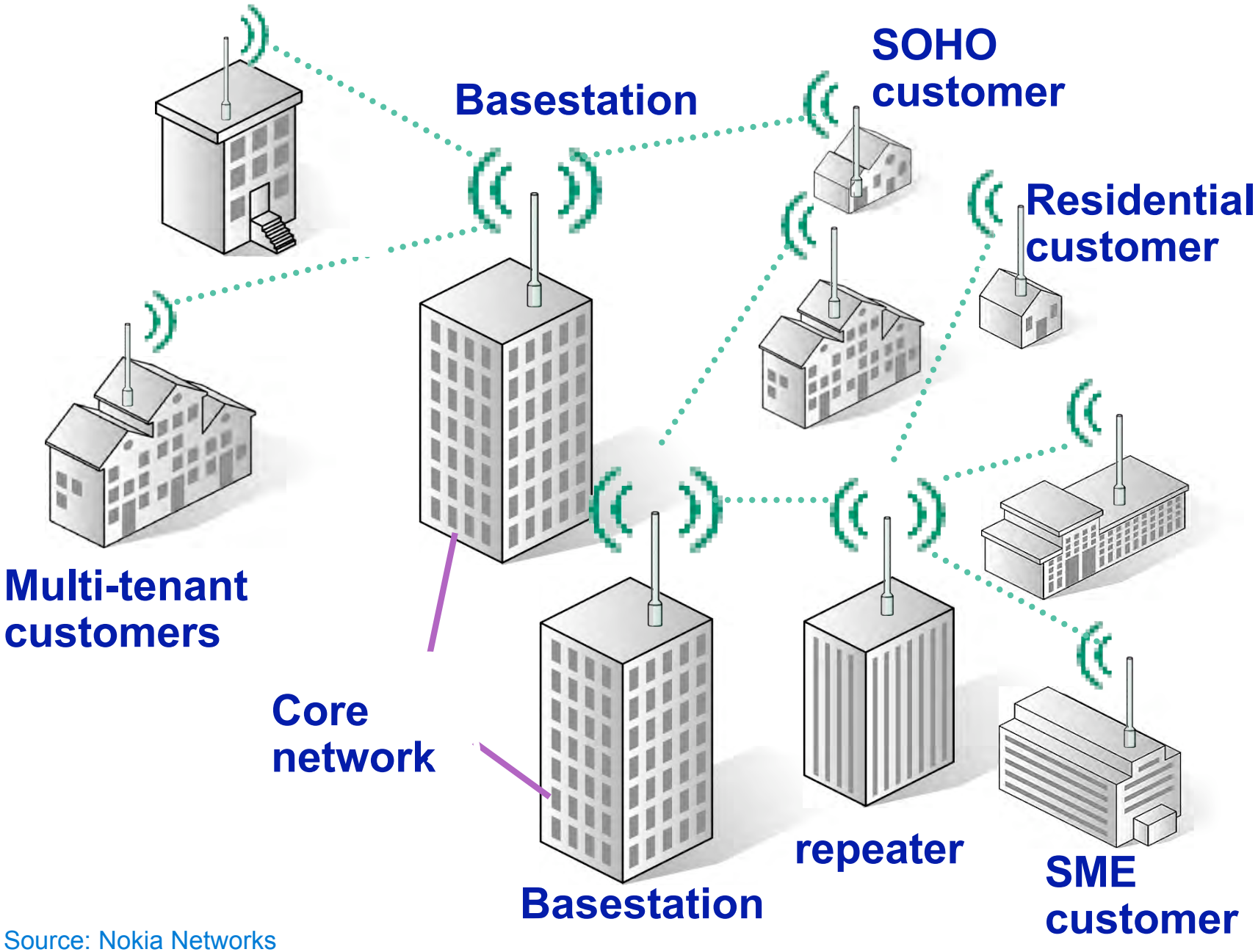
Broadband Access

- The "last mile" (or the "first few kilometers")
  - Fast local connection to network
- Business and individual customers demand it
  - Data, Voice, Two-way Video, Gaming, etc.
- Network operators demand it
- Many users are fixed (static)
  - High-capacity cable/fiber to every user is expensive
  - Construction costs do not follow Moore's Law
  - Most countries lack widespread fixed broadband access
- Many users wish to be mobile

Universal Access

- Most of the world's population has no access to broadband.
- Access to even telephone service is far from universal.
- Rather than create parallel telephone and broadband networks, a broadband network supporting voice may be more economical to deploy.

WirelessMAN: Wireless Metropolitan Area Network



Source: Nokia Networks

Point-to-Multipoint Wireless MAN: not a LAN

- Base Station (BS) connected to public networks
- BS serves Subscriber Stations (SSs)
- Provide SS with first-mile access to networks
  - SS can serve a building (business or residence)
  - SS can serve a Wireless LAN AP or cell base station
  - SS can serve a PDA, etc.
- Compared to a Wireless LAN:
  - Multimedia QoS, not only contention-based
  - Many more users
  - Much higher data rates
  - Much longer distances

Properties of IEEE Standard 802.16™

- Broadband
  - Up to 134 Mbit/s in 28 MHz channel (in 10-66 GHz air interface)
- Supports multiple services simultaneously with full QoS
  - Efficiently transport IPv4, IPv6, ATM, Ethernet, etc.
- Bandwidth on demand (frame by frame)
- MAC designed for efficient used of spectrum
- Comprehensive, modern, and extensible security
- Supports multiple frequency allocations up to 66 GHz
  - ODFM and OFDMA for non-line-of-sight applications
- TDD and FDD
- Link adaptation: Adaptive modulation and coding
  - Subscriber by subscriber, burst by burst, uplink and downlink
- Point-to-multipoint topology, with mesh extensions
- Support for adaptive antennas, space-time coding, MIMO
- Extensions to mobility (nearly finished)
- An element of 4G wireless.

Critical Issues for Broadband Wireless Access

- Access to spectrum on a technology-neutral basis
- Global industry developing technical standards to meet global needs

Centimeter-Wave Bands

Non-Line-of-Sight

International

3.5 GHz; 10.5 GHz; etc.

U.S.: Broadband Radio Service

~2.5-2.7 GHZ

Korea

2.3 GHz

License-Exempt Bands

5-6 GHz

2.4 GHz

59-64 GHz

Importance of Global Standards for Broadband Wireless Access Systems

- Reduced costs due to mass production
- Reduced operator risk
- Opportunities for roaming
- Stimulate adoption of technology
- Platform for technical innovation

- Global standards benefit the **users** and the **producers**.

LMDS Band Allocation
(Local Multipoint Distribution Service)

28 & 31 GHz Band Plan

Two LMDS Licenses per BTA

Block A - 1150 MHz:
27,500-28,350 MHz
29,100-29,250 MHz
31,075-31,225 MHz

Block B - 150 MHz
31,000-31,075 MHz
31,225-31,300 MHz

Legend

* - Primary Service
MSS - Mobile Satellite Service
NON-LTTS - Non-Local Television Transmission Service

Source: Federal Communications Commission

The World Wants 802.16 WirelessMAN™ Standards

- Attendees from Australia, Belgium, Brazil, Canada, China, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Netherlands, Norway, Pakistan, Russia, Singapore, Spain, Sweden, UK, USA
- Regional coordination
  - Europe, Korea, China
- International coordination with ITU

802.16 and ETSI

- Over 50 liaison letters between 802.16 and ETSI
  - (European Telecom Standards Institute)
- ETSI HIPERMAN
  - Below 11 GHz
  - IEEE began first
  - Healthy cooperation
  - Harmonized with 802.16 OFDM
- Cooperation on conformance tests

802.16 and Korea

- Liaison established between 802.16 and TTA (Telecommunication Technology Association) PG302
- Several meetings between Chairs of 802.16 and PG302 to address harmonization

802.16 & China

- Delegation of IEEE Standards Association Met with leaders of Standards Administration of China (Beijing, 18 May 2004)
- Met with leaders in Ministry of Information Industry and China Communications Standards Association (Shenzhen, 19 May 2004)

802.16 and ITU

- ITU-T:
  - SG15: network access technologies
    - Leadership meeting
    - Liaison letters
  - SG9: cable television networks
    - Leadership visits
    - Liaison letters
    - PDNR underway: broadband wireless extensions
      - 802.16 invited to contribute
- ITU-R:
  - WP 9B: fixed wireless access
    - Liaison exchanges
    - PDNR underway: broadband wireless recommendations
      - 802.16 has contributed invited input

Why IEEE 802®?

Telecom Standardization

- National
- Political

Datacom Standardization

- Global
- Open
- Industry-Driven
- 802 and IETF set the standards

Who are the Members?

- Telecom Standardization Bodies
  - Governmental Representatives
  - Companies
- IEEE
  - engineers

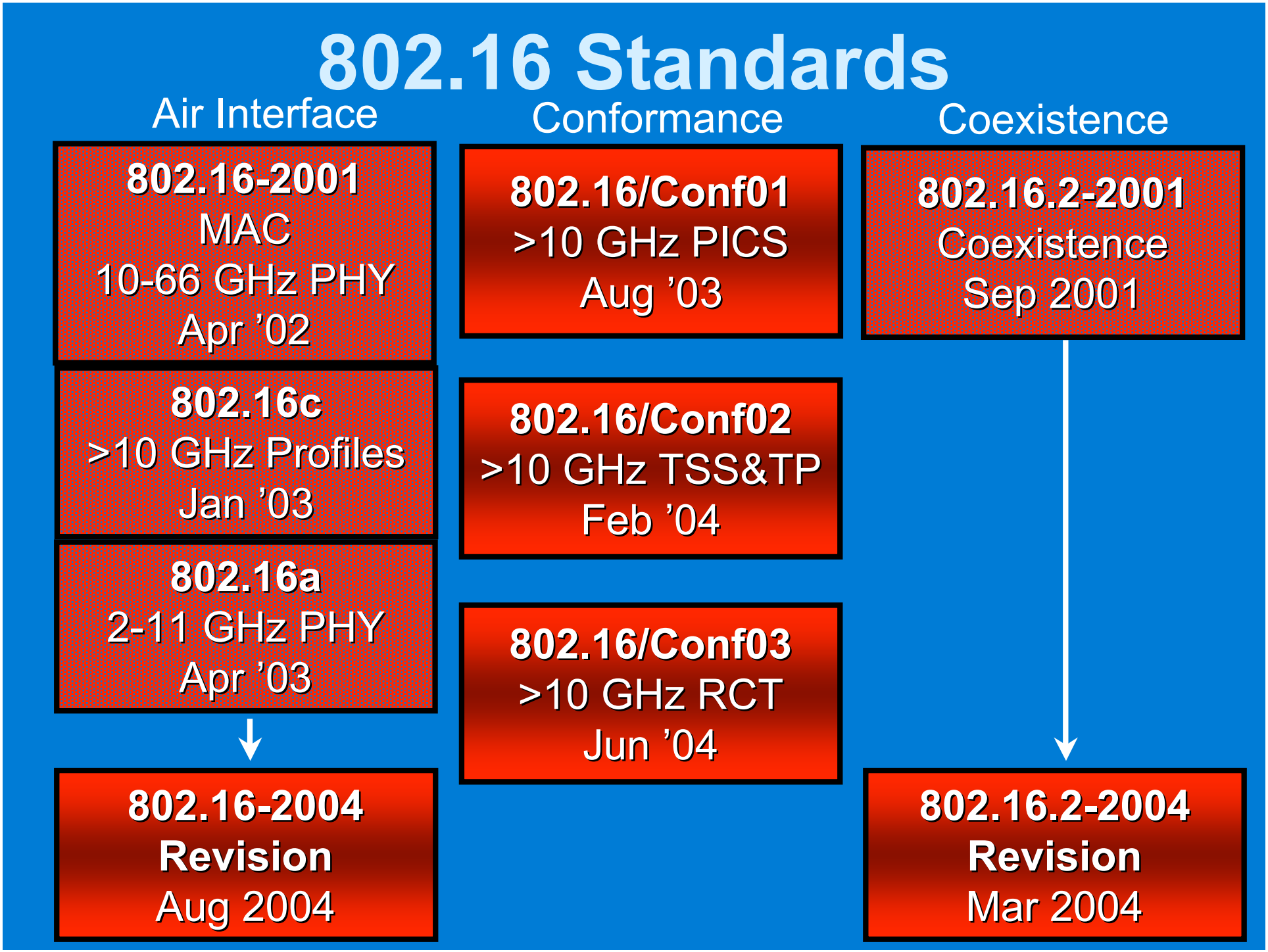
IEEE Standards for Broadband Wireless Access Systems

- Institute of Electrical and Electronics Engineers (IEEE)
  - Global, open process
  - Worldwide participation
  - Producing international standards
- IEEE 802.11™ (short-range: ~100 m):
  - Wireless Local Area Networks
  - Often called "Wi-Fi" for "Wi-Fi Alliance"
- IEEE 802.16 ™ (long-range: ~10 km):
  - Wireless Metropolitan Area Networks
  - Often called "WiMAX" for "WiMAX Forum"
  - or "WiBro" for "Wireless Broadband"

IEEE 802.16 History

- Project Development: 1998-1999
- Meet every two months:
  - #1: July 1999
  - …
  - #21/Sept 2002, Cheju, Korea
  - …
  - #31/May 2004: Shenzhen, China [228 people]
  - #32/Jul 2004: Portland, USA [332 people]
  - #33/Sep 2004: Seoul, Korea (~300 people)
  - #34/Nov 2004: Texas, USA
  - #35/Jan 2005: Sanya, Hainan, China

802.16 Standards



Active 802.16 Projects

Air Interface	Conformance	Management
P802.16e Mobile Done: Dec ’04?	**P802.16/Conf04** <11 GHz PICS	**P802.16f** MIB (fixed only) Start: Aug ’04
P802.16/Cor 1 Maintenance Start: Sep 04 Done: Jan ’05?		**P802.16g** Management Plane Procedures & Services Start: Aug ’04

IEEE 802 Process

- Call for Contributions
  - Specific topics for discussion at next meeting
- Receive and post written contributions
- Discuss and debate at meeting
- Create draft by 75% vote
- Working Group Ballot
- IEEE "Sponsor Ballot"
- Ballot Responses:
  - "Approve" (can include comments)
  - "Disapprove": indicate what needs to be changed to bring about an "Approve" vote

Participation in IEEE 802.16

- *Open process and open standards*
- Anyone can participate in meetings
- Anyone can participate outside of meetings
  - Subscribe to mailing lists and read list archives
  - Post to mailing lists
  - Examine documents
  - Contribute and comment on documents
  - Join the Sponsor Ballot Pool
    - Vote and comment on draft standards
    - Must join the IEEE Standards Association to vote
    - Producers and Users must both be in ballot group

Membership

- See <http://WirelessMAN.org/membership.html>

- 150 Members
- 56 Potential Members
- 76 Observers

- Working Group and Task Groups
  - Formal votes are by Members only
    - Member badge = Voting Token

- Registration for this session
  - 264 in advance

Attendance Books

- Two or more books
  - Pre-registrant names pre-printed
- Others: write in your name
- Add a business card if we don't know your current contact information
- Initial in appropriate box during appropriate session interval (not before or after)
- "participation" credit: 7 intervals

Contribution Procedures

http://WirelessMAN.org/submit.html

Submittals that violate the procedures will not be accepted!

IEEE 802 Rules: WG Operation

5.1.4 Operation of the Working Group

- **The operation of the Working Group has to be balanced between democratic procedures that reflect the desires of the Working Group members and the Working Group Chair's responsibility to produce a standard, recommended practice, or guideline, in a reasonable amount of time.**
- Robert's Rules of Order shall be used in combination with these operating rules to achieve this balance.

IEEE 802 Rules: Chair's Role

5.1.4.1 Chair's Function

- The Chair of the Working Group decides procedural issues. The Working Group members and the Chair decide technical issues by vote. The Working Group Chair decides what is procedural and what is technical.

- Note: 802.16 Chair delegates the power to make procedural decisions to the presiding Task Group Chair

IEEE 802 Rules: WG Domination

The Working Group Chair has the authority to determine if the Working Group is dominated by an organization, and, if so, treat that organizations' vote as one (with the approval of the Executive Committee).

<11 GHz PHY Alternatives: Different Applications, Bandplans, and Regulatory Environments

- OFDM (WirelessMAN-OFDM Air Interface)
  - 256-point FFT
  - Scalable to 128*
- OFDMA (WirelessMAN-OFDMA Air Interface)
  - 2048-point FFT
  - Scalable to 1024 and 512*
- Single-Carrier (WirelessMAN-SCa Air Interface)
  - Can use Frequency-Domain Equalization

*Awaiting approval of revised project plan on 23 Sept 2004.

Compliance Documentation (10-66 GHz only, so far)

- IEEE P802.16c (Detailed System Profiles)
  - specifies particular combinations of options
  - used as basis of compliance testing
    - MAC Profiles: ATM and Packet
    - PHY Profiles: 25 & 28 MHz; TDD & FDD
- Test Protocols: IEEE Std 802.16/Conformance0X
  - PICS (01)
  - Test Suite Structure & Test Purposes (02)
  - Radio Conformance Tests (03)

802.16 Summary

- The IEEE 802.16 WirelessMAN Air Interface, addresses worldwide needs
- The 802.16 Air Interface provides great opportunities for vendor differentiation, particularly at the base station, without compromising interoperability.
- The air interface is suitable for mobile subscriber stations, and enhancements for mobile use are nearly complete.
- Standardized network management functions will be defined.
- Compliance tests will be defined.

Free IEEE 802 Standards

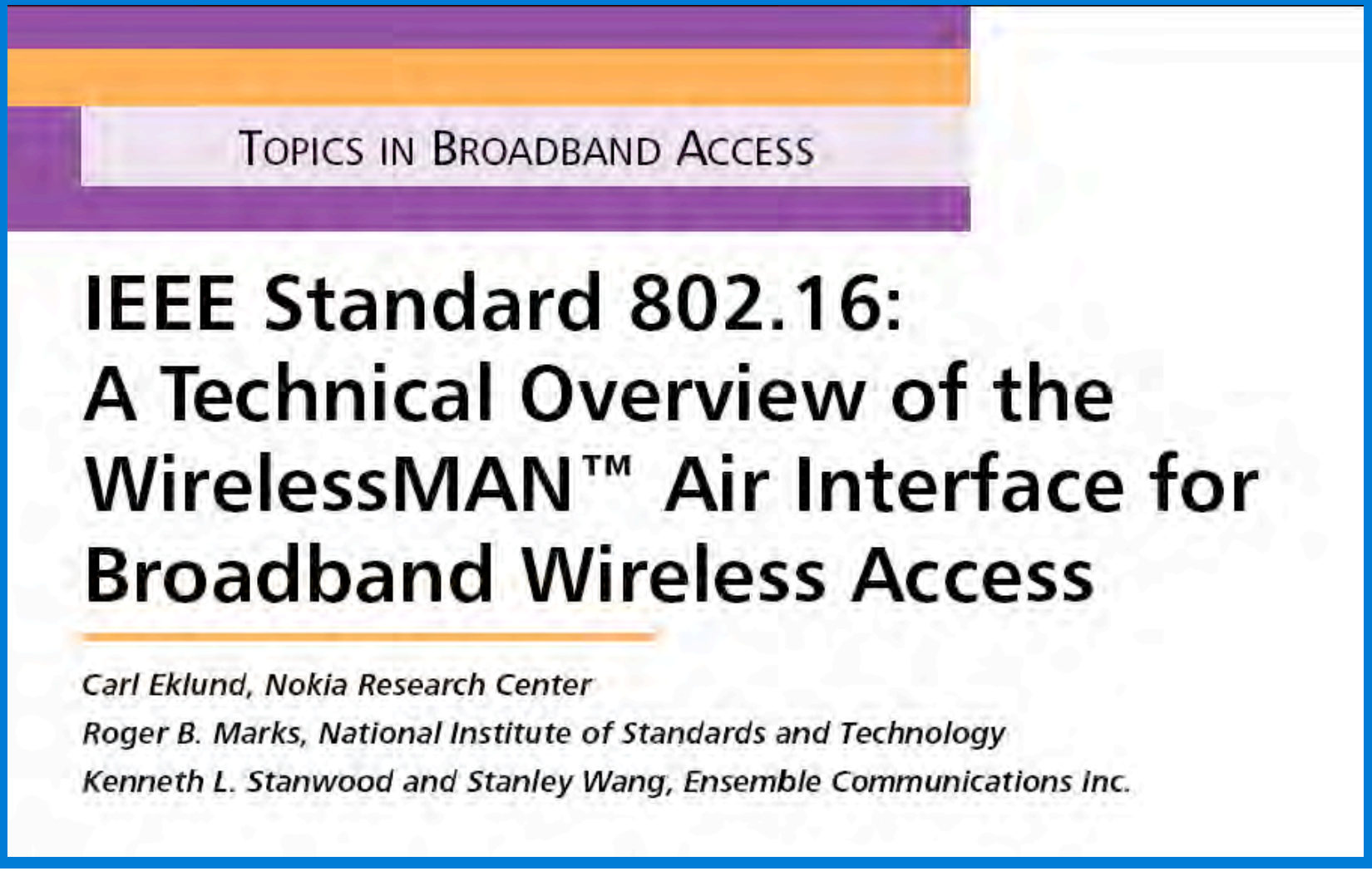
- Since May 2001, IEEE 802 standards have been available for free download, beginning six months after publication.
- See:

http://WirelessMAN.org

- You will find:
  - IEEE Std 802.16, 802.16a, 802.16c
  - IEEE Std 802.16.2-2001
  - IEEE Std 802.16/Conformance 01

IEEE Standard 802.16: Tutorial

IEEE Communications Magazine, June 2002
(available on 802.16 web site)



IEEE 802.16 Resources

IEEE 802.16 Working Group on Broadband Wireless Access

info, documents, tutorials, email lists, etc:

http://WirelessMAN.org