IEEE 802.16 Working Group
Process, Status, and Technology

http://WirelessMAN.org

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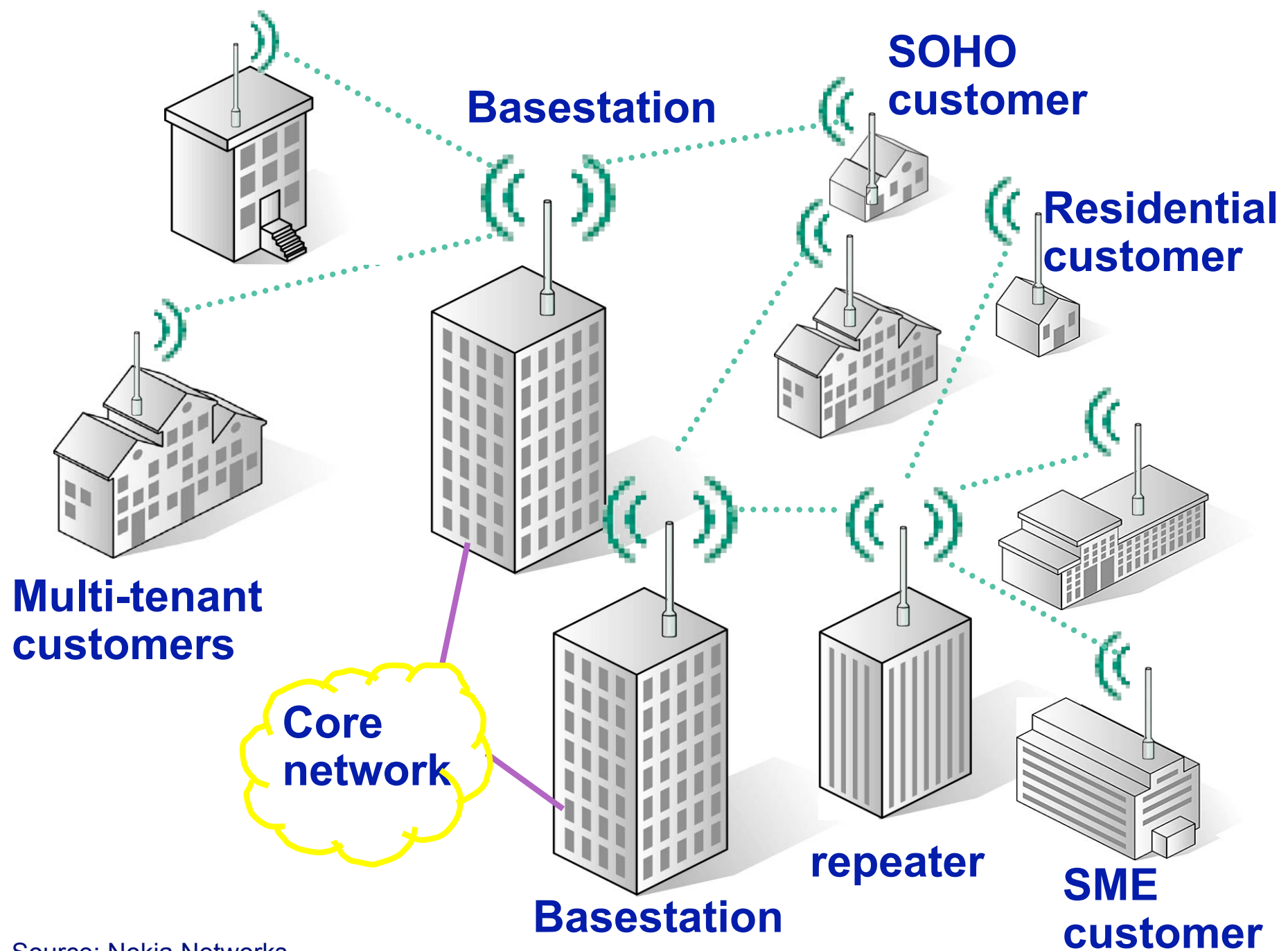
Chair, IEEE 802.16 Working Group

Outline

- Wireless Metropolitan Area Networks
  - Broadband Wireless Access
- IEEE Standards and IEEE 802
- IEEE 802.16 Working Group
- IEEE 802.16 Air Interface Standard
  - IEEE 802.16-2001:   Air Interface (MAC and 10 - 66 GHz PHY)
  - IEEE 802.16a-2003:   Amendment, 2-11 GHz (finished)
                          Licensed
                          License-Exempt
  - P802.16-REVd: revision
  - P802.16e: Mobile Enhancement

  - WiMAX Forum coordinating interoperability testing
  - Interoperability documentation in development
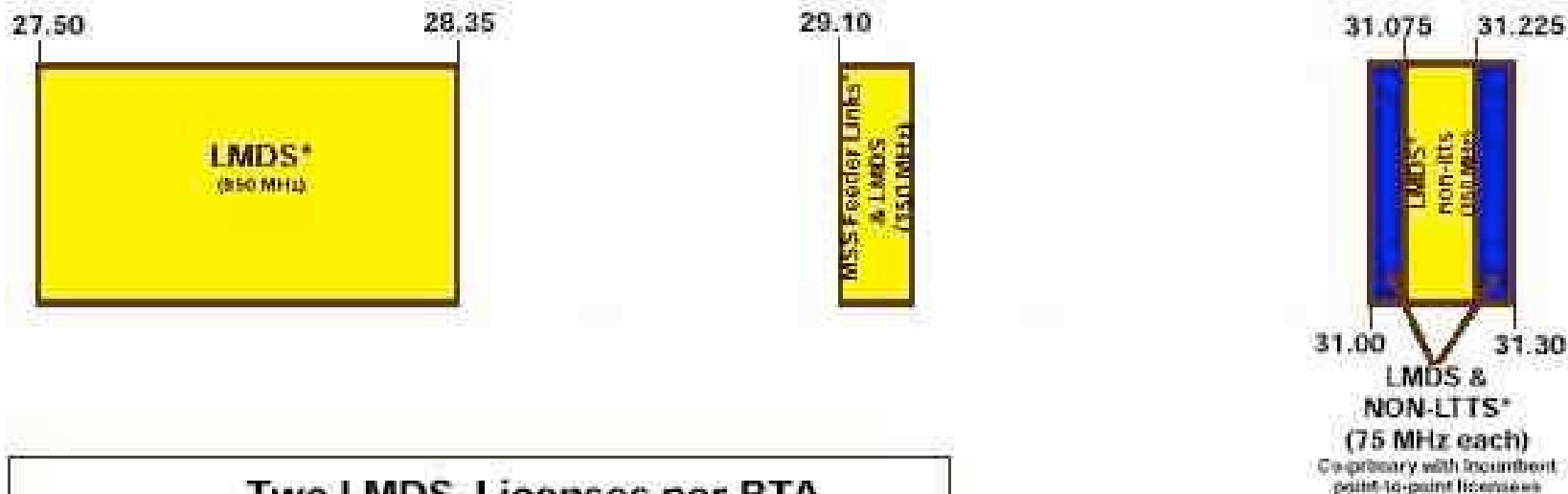
Broadband Access to Stationary Sites

- **The "first few kilometers"**
  - **Fast local connection to network**

- **Business and residential customers seek it**
  - **Data**
  - **Voice**
  - **Video distribution**
  - **Real-time videoconferencing**
  - **etc.**

- **Network operators seek it**

- **High-capacity cable/fiber to every user is expensive**
  - **Construction costs do not follow Moore's Law**

WirelessMAN: Wireless Metropolitan Area Network

Basestation

SOHO customer

Residential customer

Multi-tenant customers

Core network

Basestation

repeater

SME customer

Source: Nokia Networks

Centimeter-Wave Bands
for Wireless MAN

International
3.5 GHz; 10.5 GHz; etc/

U.S.: MMDS & ITFS
2.5-2.7 GHZ

Korea
2.3 GHz

Non-Line-of-Sight

License-Exempt Bands
for Wireless MAN

5.725-5.825 GHz
(U-NII)

2.4 GHz License-Exempt:
Wireless LANs

59-64 GHz

IEEE 802.16 History

- **Initial Development: 1998-1999**

- **Meet every two months:**
  - Session #1: July 1999

  - ...

  - Session #31/May 2004: Shenzhen, China

- **Future Sessions**
  - Session #32/Jul 2004: Portland, Oregon, USA
  - Session #33/Sep 2004: Seoul, Korea
  - Session #34/Nov 2004: San Antonio, Texas, USA

The World Wants Access

- All over the world:
  - Users want access to networks
  - Network operators want access to customers

- Broadband Wireless Access flourishes where:
  - Many users are dissatisfied with their access
  - Network operators need to reach customers

The World Wants Standards

- In all fields of telecommunications, the world wants standards.

- Broadband Wireless Access is not isolated from this trend.

The World Wants 802.16 WirelessMAN™ Standards

- Have had attendees from Australia, Belgium, Brazil, Canada, China, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea (South), Netherlands, Norway, Pakistan, Russia, Singapore, Spain, Sweden, UK, USA

- Coordinated European efforts in ETSI

- Working with ITU-R, ITU-T

- Discussions with Korean TTA

IEEE 802.16 and ETSI

- **Over 50 liaison letters between 802.16 and ETSI**
  - (European Telecom Standards Institute)

- **ETSI HIPERACCESS**
  - **Above 11 GHz**
  - **ETSI began first, but IEEE finished first**
  - **Harmonization efforts, but no success**

- **ETSI HIPERMAN**
  - **Below 11 GHz**
  - **IEEE began first**
  - **Healthy cooperation**
  - **Harmonized with 802.16a OFDM**

BWA/802.16 Interest within China

"IEEE 802.16a Broadband Wireless Access (BWA) Standard Development and Internet Application": conference sponsored by BUPT and MII on 24 August 2001 in Beijing "on the specific topic of whether to use 802.16a as the Chinese national standard for fixed broadband wireless access at 3.5 GHz" (Prof. Liu Yuan An, Chair)

BWA/802.16 Interest within China (2)

802.16 and ITU

- **ITU-T:**
  - **SG15**
  - **SG9**

- **ITU-R:**
  - **WP 9B**

WiMAX Forum

- **WiMAX: Worldwide Interoperability for Microwave Access**
- **Mission: *To promote deployment of BWA by using a global standard and certifying interoperability of products and technologies.***
- **Principles:**
  - **Support IEEE 802.16 standard**
  - **Propose and promote access profiles for IEEE 802.16 standard**
  - **Certify interoperability levels both in network and the cell**
  - **Achieve global acceptance**
  - **Promote use of broadband wireless access overall**

  Developing & submitting baseline test specs
- **Over 100 member companies**

IEEE 802 LAN/MAN Standards Committee

Wired:

- **802.3 (Ethernet)**
- **802.17 (Resilient Packet Ring)**

Wireless:

- **802.11: Wireless LAN**
  - **Local Area Networks**
- **802.15: Wireless PAN**
  - **Personal Area Networks {inc. Bluetooth}**
- **802.16: WirelessMAN™**
  - **Metropolitan Area Networks**
- **802.20:**
  - **Vehicular Mobility (new in March 2003)**
- **802.21:**
  - **Handover (new in May 2004)**

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 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

IEEE 802.16 Air Interface Work

Complete Standards

Active Projects

IEEE Std 802.16
Publ: Apr 2002
MAC
10-66 GHz PHY

802.16c
Profiles
Publ: Jan 2003

802.16a
2-11 GHz PHY
Publ: April 2003

P802.16-REVd
Revision
Complete: May 2004?

P802.16e
Mobile Amendment
Start: Dec 2002
In WG Ballot

Additional IEEE 802.16 Work

Conformance

**IEEE Std 802.16/Conf01
10-66 GHz PICS
Publ: Aug 2003**

**IEEE Std 802.16/Conf02
10-66 GHz TSS&TP
Publ: 25 Feb 2004**

**P802.16/Conf03
10-66 GHz RCT
Approved: 13 May 2004**

**P802.16/Conf03
11 GHz PICS
New in March 2004**

Coexistence

**IEEE Std
802.16.2-2001
Publ: Sep 2001**

**Revision:
IEEE Std
802.16.2-2004
Publ: Mar 2004**

IEEE Standard 802.16:
The WirelessMAN-SC™ Air Interface
Published: 8 April 2002

IEEE Std 802.16-2001®

IEEE Standard for
Local and metropolitan area networks

Part 16: Air Interface for Fixed Broadband Wireless Access Systems

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

and the
IEEE Microwave Theory and Techniques Society

Approved 6 December 2001
IEEE-SA Standards Board

Abstract: This standard specifies the air interface of fixed (stationary) point-to-multipoint broadband wireless access systems providing multiple services. The medium access control layer is capable of supporting multiple physical layer specifications optimized for the frequency bands of application. The standard includes a particular physical layer specification applicable to systems operating between 10 and 66 GHz.
Keywords: fixed broadband wireless access network, metropolitan area network, microwave, millimeter wave, WirelessMAN™ standards

Point-to-Multipoint
Wireless MAN: not a LAN

- **Base Station (BS) connected to public networks**

- **BS serves Subscriber Stations (SSs)**
  - **SS typically serves a building (business or residence)**
  - **provide SS with first-mile access to public networks**

- **Compared to a Wireless LAN:**
  - **Multimedia QoS, not only contention-based**
  - **Many more users**
  - **Much higher data rates**
  - **Much longer distances**

Interoperability Testing for WirelessMAN-SC™

- IEEE P802.16c (Detailed System Profiles)
  - 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
- 10-66 GHz
  - PICS (01)
  - Test Suite Structure & Test Purposes (02)
  - Radio Conformance Tests (03)
- 04: <11 GHz PICS (new project)

Current Work

- **Revision of IEEE Std 802.16**
  - **Project P802.16-REVd**
- **Mobility:**
  - **Project P802.16e**

- **Compliance documentation**

- **New 802.21 (Handover)**

IEEE 802.16 Summary

- **The IEEE 802.16 WirelessMAN Air Interface, intends to address worldwide needs**

- **The IEEE 802.16 Air Interface provides great opportunities for vendor differentiation, at both the base station and subscriber station, without compromising interoperability.**

- **Compliance & interoperability tests are coming.**

- **Mobility is the next major enhancement.**

Free IEEE 802 Standards

- **Since May 2001, IEEE 802 standards have been available for free download.**
- **See:**

http://WirelessMAN.org

beginning six months after publication

- **IEEE Std 802.16, 802.16a, 802.16c are free**
- **IEEE Std 802.16.2-2001 is free**
- **IEEE Std 802.16/Conformance 01 is free**

IEEE Standard 802.16: Tutorial

IEEE Communications Magazine, June 2002

(available on 802.16 web site)

TOPICS IN BROADBAND ACCESS

IEEE Standard 802.16: A Technical Overview of the WirelessMAN™ Air Interface for Broadband Wireless Access

Carl Eklund, Nokia Research Center

Roger B. Marks, National Institute of Standards and Technology

Kenneth L. Stanwood and Stanley Wang, Ensemble Communications Inc.

Conclusion

IEEE 802.16 WirelessMAN standards are:

- **open in development and application**
- **addressed at worldwide markets**
- **engineered as optimized technical solutions**
- **significantly complete**
  - **With test spec documents in development**
- **being enhanced for expanded opportunities**

IEEE 802.16 Resources

IEEE 802.16 Working Group on Broadband Wireless Access

info, documents, tutorials, email lists, etc:

http://WirelessMAN.org