



# The State of IMT-Advanced

2011 Taipei WiMAX Summit  
10 January 2011

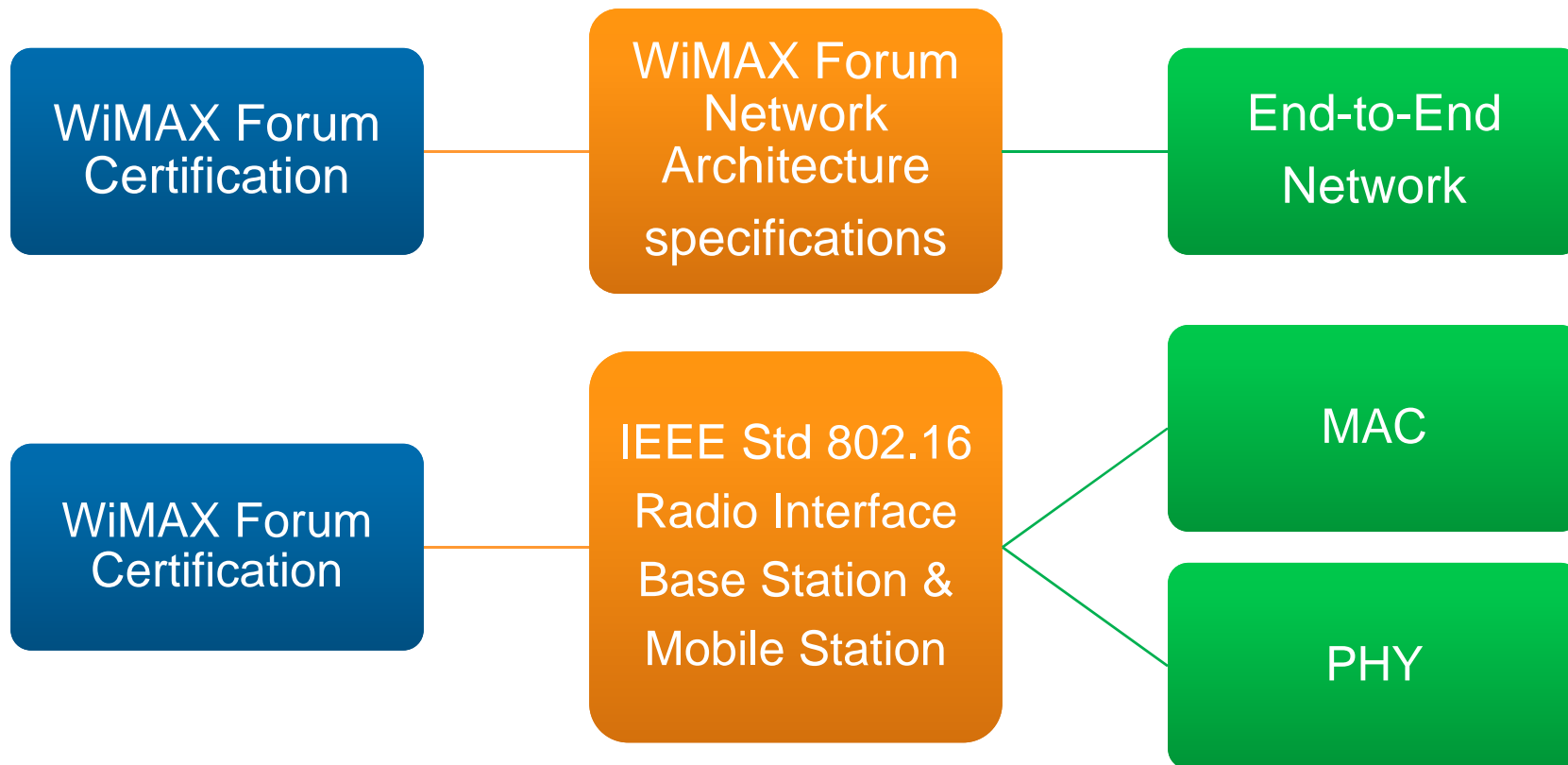
Roger B. Marks  
Vice President – Technology, WiMAX Forum  
Chair, IEEE 802.16 Working Group



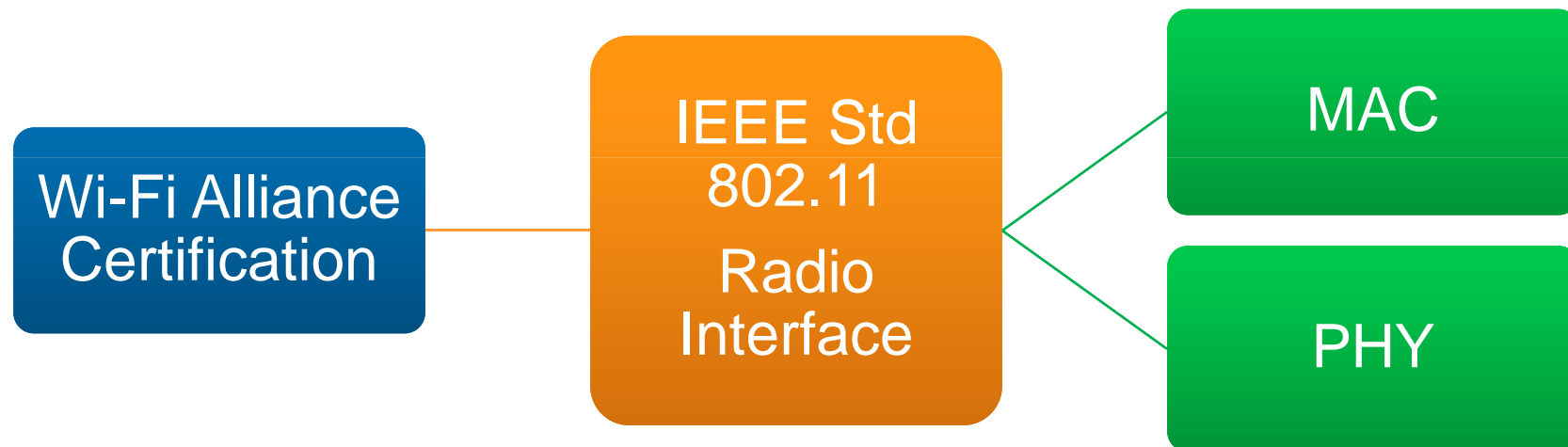
# IEEE 802.16 and the WiMAX Forum

- IEEE 802.16 Working Group
  - Open standards for broadband wireless access
- WiMAX Forum
  - Industry association
  - Certification of open standards
    - Certifying conformance to IEEE 802.16
- Cooperative coordination in many areas
  - Including ITU

# WiMAX Forum and IEEE 802.16



# Analogy: Wi-Fi and IEEE 802.11



# IEEE 802.16 is:



- A Working Group (WG):
  - The IEEE 802.16 Working Group on Broadband Wireless Access
  - Develops and maintain a set of standards
- The Working Group's core standard
  - IEEE Std 802.16: Air Interface for Broadband Wireless Access Systems
  - The WirelessMAN® standard for **Wireless Metropolitan Area Networks**

# IEEE Standard 802.16

- “Air Interface for Broadband Wireless Access Systems”
- Developed since 1999 by IEEE 802.16 WG
  - Evolves by amendments and revision
  - Originally fixed-only
  - Fixed non-line-of-sight OFDMA introduced in 2002
  - Mobile-enabled OFDMA introduced in 2005 (“802.16e”)
- Basis of WiMAX air interface certification
  - Base station (BS)
  - Mobile Station (MS): user terminal

# Worldwide Participation

- Current 802.16 WG Membership: 226 people
- Actively seeks worldwide applicability
  - Seeks worldwide participation.
  - Attendees from Australia, Belgium, Brazil, Canada, China, Egypt, Finland, France, Germany, Greece, Hong Kong, India, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Pakistan, Romania, Russia, Singapore, Spain, Sweden, Taiwan, Thailand, USA, UK, etc.
- Major coordination with ITU-R

# Internationalization of IEEE 802.16

- International Telecommunication Union (ITU)
  - organized under United Nations
  - membership by national governments
- Radiocommunications Sector (ITU-R)
  - private organizations hold memberships
    - Including WiMAX Forum, IEEE, companies
- 802.16 WG seeks “Internationalization”
  - though it is, in many ways, “international” to begin with
  - strategy since the beginning in 1999
  - ITU-R Liaison Group



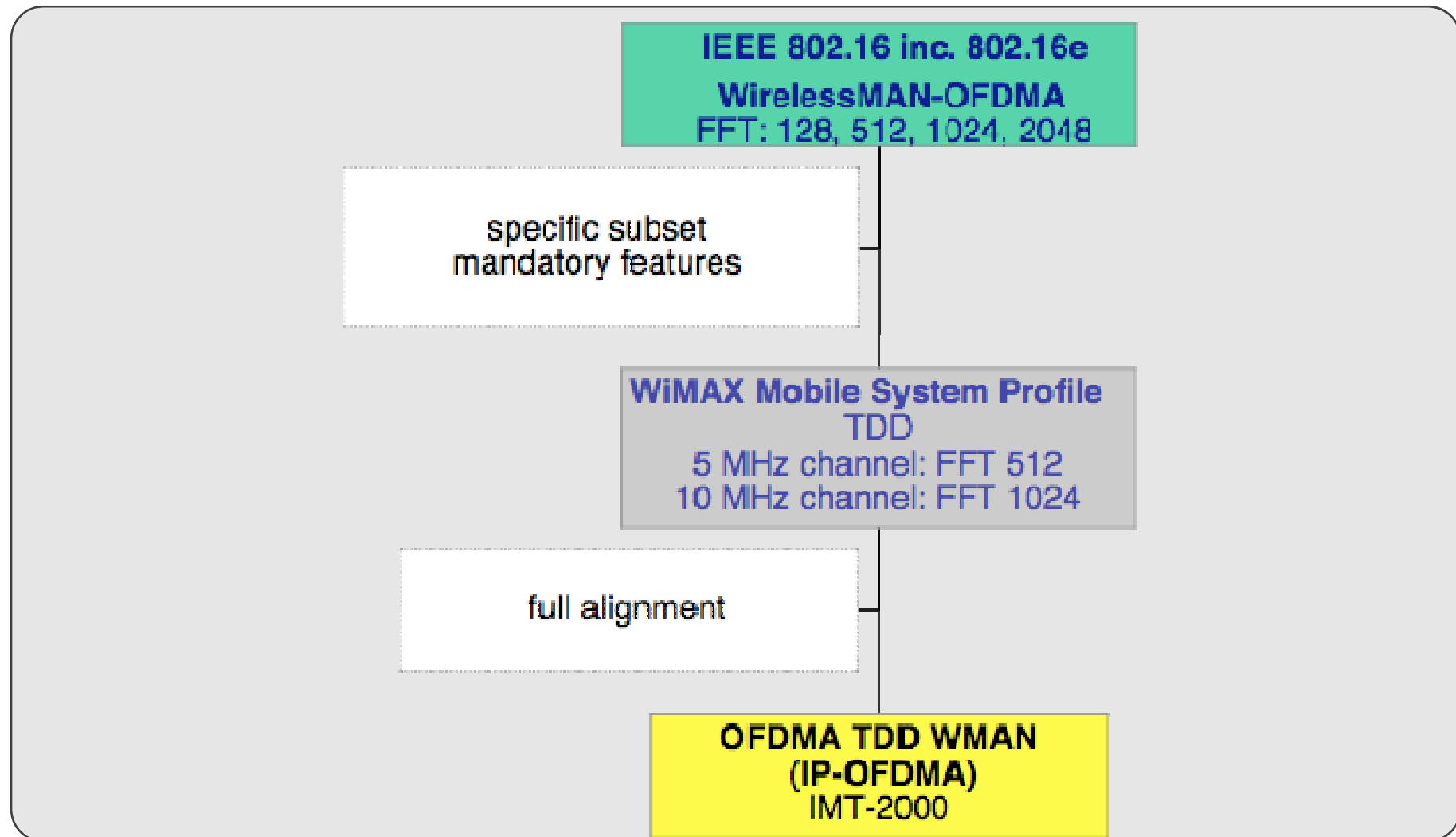
# IEEE 802.16, WiMAX Forum, and ITU

- IEEE: Member of ITU-R
  - “Regional and other International Organizations”
- Relevant ITU-R Engagement:
  - fixed wireless access
    - Rec. F.1763: IEEE 802.16 in the fixed service
  - land mobile radio:
    - Rec. M.1801 IEEE 802.16 in mobile service
  - IMT-2000

# IMT-2000: “International Mobile Telecommunications”

- Under ITU-R Study Group 5/Working Party 5D
  - known as Working Party 8F before 2008
- the international cellular standard since ~1998
  - significant impact on spectrum allocations
- Since 1998, 5 evolving terrestrial air interfaces
  - inc. 3GPP (W-CDMA) & 3GPP2 (cdma2000)
- M.1457-7 (Oct 2007) adds “OFDMA TDD WMAN”
  - Based on IEEE Std 802.16 (including 802.16e)
  - Implementation profile developed by WiMAX Forum
- M.1457-9 (2009) added FDD as well

# IEEE 802.16, Mobile WiMAX Profile, and OFDMA TDD WMAN (2007)



# COMMITTED TO CONNECTING THE WORLD

Global Adoption of WiMAX as the Broadband Internet Technology of Choice  
Anytime, Anywhere

“Last year’s World Radio Communication Conference, WRC ’07, was a landmark conference for successfully brokering international agreement on harmonized global spectrum allocations for IMT-based systems – and particularly for bringing WiMAX into the IMT fold.”

“WiMAX has tremendous potential – being a low-cost, easy to deploy, high-speed wireless broadband technology – as a platform for service delivery, and could help many countries bridge their broadband divide.”

– Dr Hamadoun Touré, Secretary General ITU

# "IMT" Spectrum

- IMT-2000 Identifications
  - 800/900 MHz bands
  - 1700/2100 MHz bands
  - 2500-2690 MHz
- World Radiocommunication Conference 2007
  - Identified additional spectrum
    - 450-470 MHz globally
    - 2300-2400 MHz globally
    - 790-862 MHz in much of world
    - 3400-3600 MHz in much of world
  - changed spectrum identification to "IMT"
  - includes "IMT-2000" and "IMT-Advanced"

# IMT-Advanced

- To develop “Beyond IMT-2000” recommendation
- “to be developed around the year 2010, capable of supporting high data rates with high mobility, which could be widely deployed around the year 2015 in some countries.”
- ITU-R Working Party 5D developed background materials
  - Announced in July 2008
- IEEE and WiMAX participated
  - contributed to defining the process and requirements
  - IEEE proposal based on 802.16m amendment project

# IEEE 802.16m Project

- amendment project, initiated December 2006
- Scope:
  - amend the IEEE 802.16 WirelessMAN-OFDMA specification to provide an advanced air interface for operation in licensed bands
  - meet the cellular layer requirements of IMT-Advanced next generation mobile networks
  - Target: 100 Mbit/s with high mobility
  - continuing support for legacy WirelessMAN-OFDMA equipment (i.e., backward compatibility)
- “WirelessMAN-Advanced” air interface

# WirelessMAN-Advanced Proposal for IMT-Advanced

- IEEE submitted detailed proposal on WirelessMAN-Advanced air interface in Oct 2009
- Two other entities submitted proposals of the same technology:
  - Administration of Japan
  - TTA (Korean SDO)
- All 3 included self-evaluation demonstrating that all IMT-Advanced requirements are met
- Nine worldwide experts groups conducted extensive technical studies that support results



# WirelessMAN-Advanced Accepted as IMT-Advanced

- ITU-R's Working Party 5D, in its meeting of 13-20 October, approved the "WirelessMAN-Advanced" technology of IEEE 802.16m as an IMT-Advanced technology.
  - "met all of the criteria established by ITU-R for the first release of IMT-Advanced" and was "accorded the official designation of IMT-Advanced."
- WP 5D accepted an offer from the three parties to have IEEE complete and submit the full detailed specification of the technology at the following WP 5D meeting in April 2011.
- WiMAX Forum has announced that WiMAX Release 2 will take advantage of the WirelessMAN-Advanced air interface.

# WirelessMAN-Advanced Transpositions

- In the IMT-Advanced standard:
  - The WirelessMAN-Advanced air interface will be specified via IEEE Std 802.16 and the 802.16m amendment.
- Three SDOs authorized to develop “transpositions” of WirelessMAN-Advanced standard
  - ARIB (Japan), TTA (Korea), WiMAX Forum
  - Adoptions of IEEE standards.
  - Will be incorporated by reference into IMT-Advanced.
- IEEE convening meetings of the “WirelessMAN-Advanced Transposing Organizations” (WATO)

# IMT-Advanced Schedule

- 2010-10: approved two technologies for IMT-Advanced
- 2011-04: Review of detailed specifications of two technologies
- 2011-09: Transpositions due
- 2011-10: Final WP 5D agreement on IMT-Advanced standard
- 2011-11: Final Study Group 5 agreement
- 2012-02: ITU-R approval at Radiocommunication Assembly

# IEEE 802.16m Schedule

- Developed through refinement of multiple drafts
- Draft 10 currently under review in ballot
  - Final comment resolution this week
- Submit Draft 11 by 18 Feb for IEEE-SA approval
- Anticipating approval by IEEE-SA Stds Board on 31 March
- ITU-R Working Party 5D meeting starting 6 April

# Is IMT-Advanced = 4G?

- No.
- ITU-R acts through a formal process.
- The development of IMT-Advanced was authorized by resolutions of the Radiocommunication Assembly
- Resolutions ITU-R 56 and 57 (2007) specified the use of the unique name “IMT-Advanced” for systems beyond IMT-2000.
- The term “4G” is not used.

# ITU-R Working Party 5D View on 4G

- ITU-R Working Party 5D twice deliberated on the use of the term “4G” in conjunction with IMT-Advanced.
- Both times, the WP decided not to do so and recommend that ITU-R not do so.

# ITU Misunderstanding on 4G

- ITU, announcing IMT-Advanced update on 21 October, suggested that “IMT-Advanced” is the ITU’s name for 4G and is the “true 4G.”
  - This was a mischaracterization of the ITU-R position.
- On 6 December, ITU clarified its view:
  - From ITU perspective, 4G is “undefined”.
  - IMT-Advanced is considered as “4G”.
  - “4G” may be applied to forerunner technologies, such as WiMAX.
- Situation widely misreported by press.
  - e.g., widely misreported that IMT-Advanced has a target threshold of 100 bit/s

# When will 4G arrive?



# When ~~will~~ did 4G arrive?

- It's here. Now.
- The international community recognized the birth of the new generation on 19 October 2007.
- Rec. **ITU-R M.1457 Revision 7**. But:
  - Rec. ITU-R M.1457 specifies IMT-2000.
  - M.1457 Revision 7 introduces 4 OFDMA radio interfaces

# Rec. ITU-R M.1457 (IMT-2000)

Official Name	Common Name	Rev 0 - 6	Rev. 7
CDMA Direct Spread	3GPP UMTS FDD	CDMA	CDMA & OFDMA*
CDMA Multi-Carrier	3GPP2 CDMA-2000	CDMA	CDMA & OFDMA
CDMA TDD	3GPP UMTS TDD	CDMA	CDMA & OFDMA*
TDMA Single-Carrier	UWC-136		
FDMA/TDMA	DECT		
<b>OFDMA TDD WMAN</b>	<b>IEEE 802.16/WiMAX</b>		<b>OFDMA</b>

\*High-level reference to “Long-Term Evolution”; not full spec.

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# Resources

- IEEE 802.16 web site
  - <http://WirelessMAN.org>
- WiMAX Forum Web Site
  - <http://wimaxforum.org>