Your Open WiMAX Choice

WiMAX Certification Process and Update

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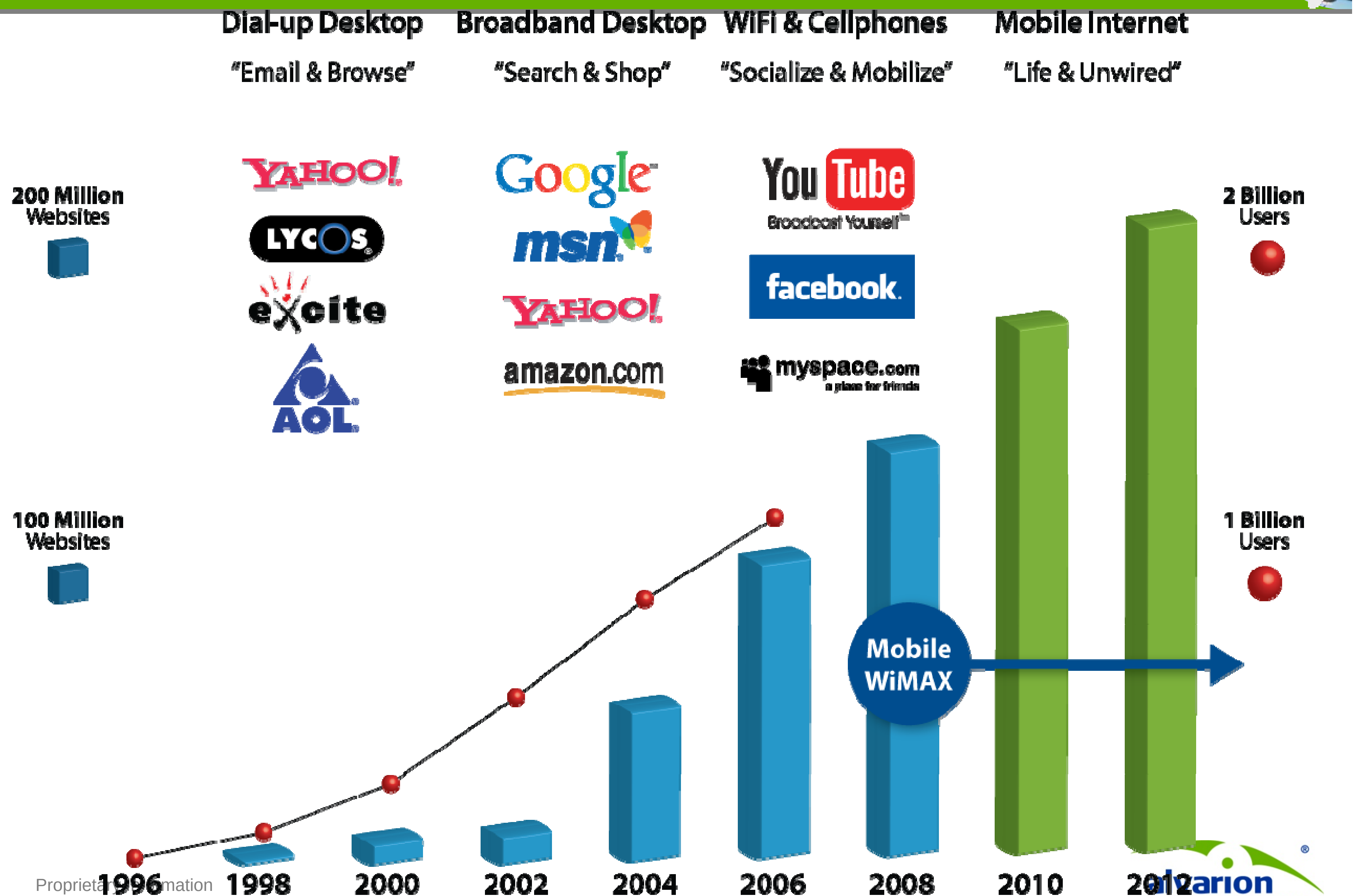
WiMAX Technology and WiMAX Forum

- **WiMAX Update**
  - **WiMAX - Mobile Internet**
  - **WiMAX Segments**
  - **WiMAX Ecosystem & Deployments**
  - **WiMAX Forum Certification Program**
  - **M-Taiwan Program and Application Lab**
  - **WiMAX at 700MHz**

Mobile Internet Evolution



Source: WiMAX Forum

The Strength of WiMAX

Technical Performance

- Lowest cost, all IP network
- IEEE standard equipment with many vendors
- Best available multi-megabit bandwidth
- Scalable device design-in & certification

New Business Model

- New Low cost embedded devices
- Low cost & flexible service plans
- New spectrum
- Open Internet access
- New activation & distribution models

> “Mobile WiMAX delivers 4x the throughput of other technologies at one tenth cost” - *Barry West, President 4G Business*

XOHM

Source: WiMAX Forum

Primary Broadband Services

Primary Broadband: Mobile WiMAX Connecting Homes and Buildings

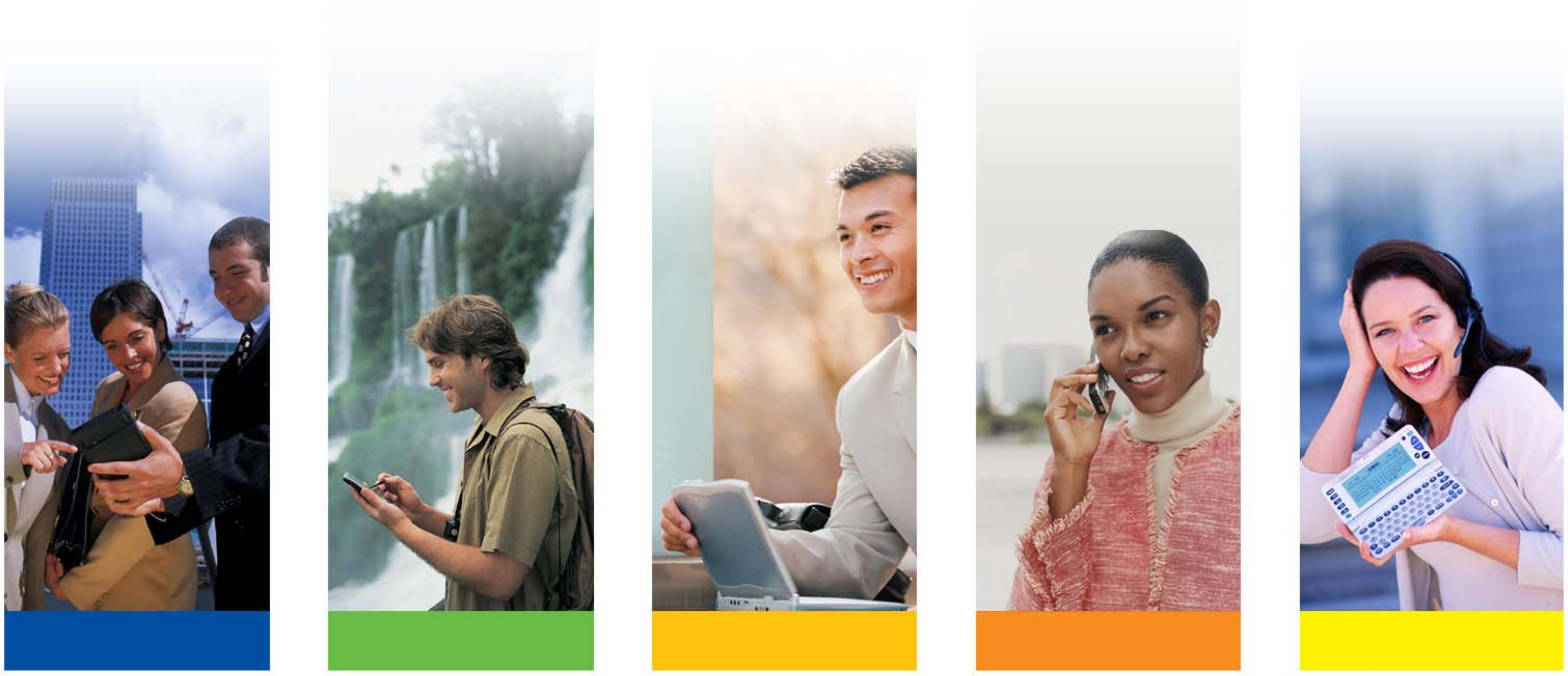
Bridging the digital divide

Promoting competitive challengers

Personal Broadband Services

Personal Broadband – Mobile WiMAX Connecting Individuals

Enjoy personal broadband services that are accessible anytime and everywhere



Government, Security and Municipal Broadband Applications

Versatile Broadband Services

Catering to a variety of customer applications

Municipality

Gas & Oil

Water Utility

Public Safety

Mining

Enterprise

WiMAX Industry Ecosystem

2006

WiMAX Certified devices for Fixed Services

2008

Portable WiMAX Certified™ Devices for Portable Services

2009

WiMAX handsets and mobile entertainment Devices

Content Providers / Ecosystem (28%)

Chip/ Component Suppliers (17%)

WiMAX Forum

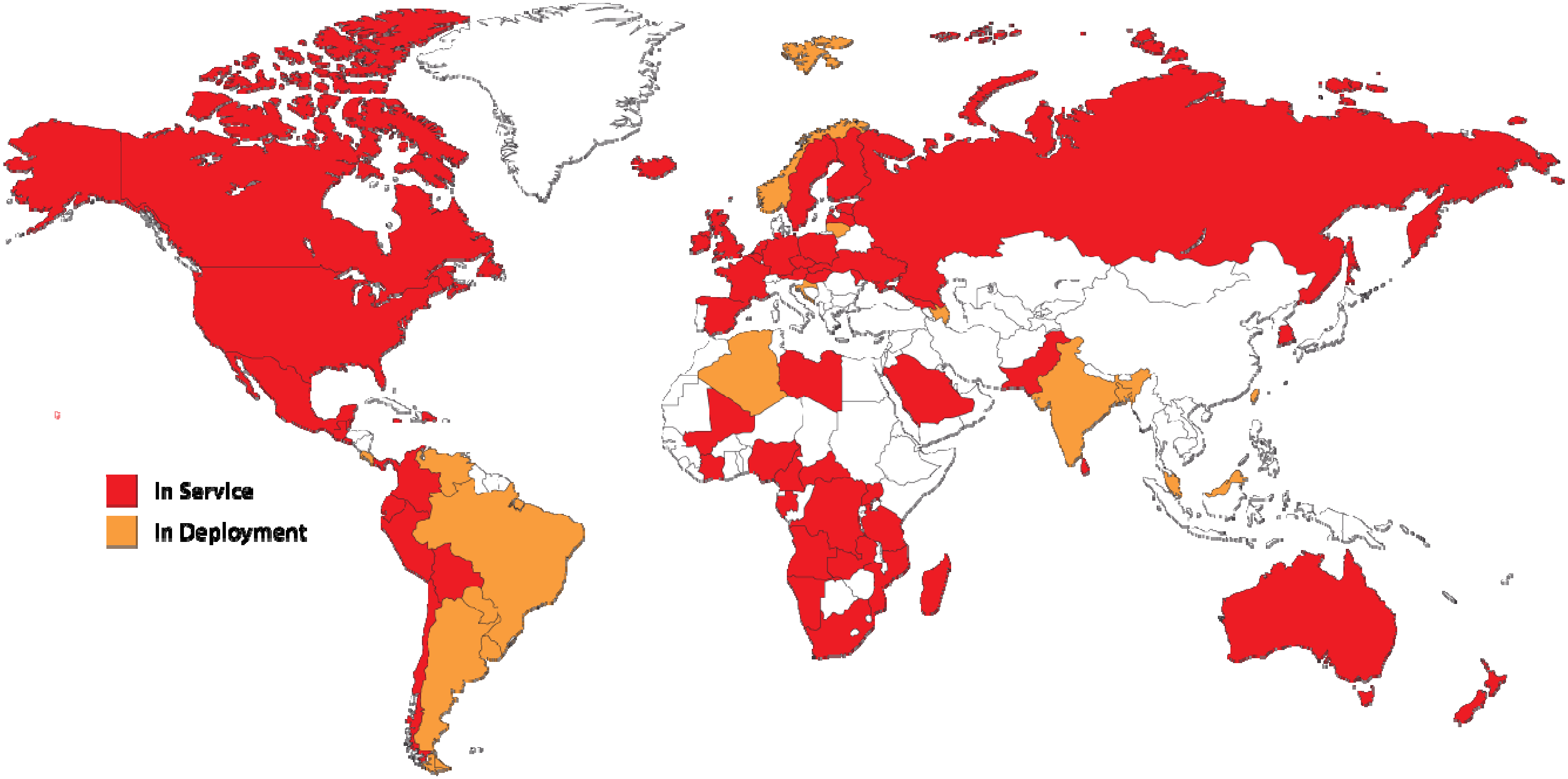
530 Members
Global Representation
28 WiMAX Forum Certified Products

Service Providers (33%)

System Vendors (22%)

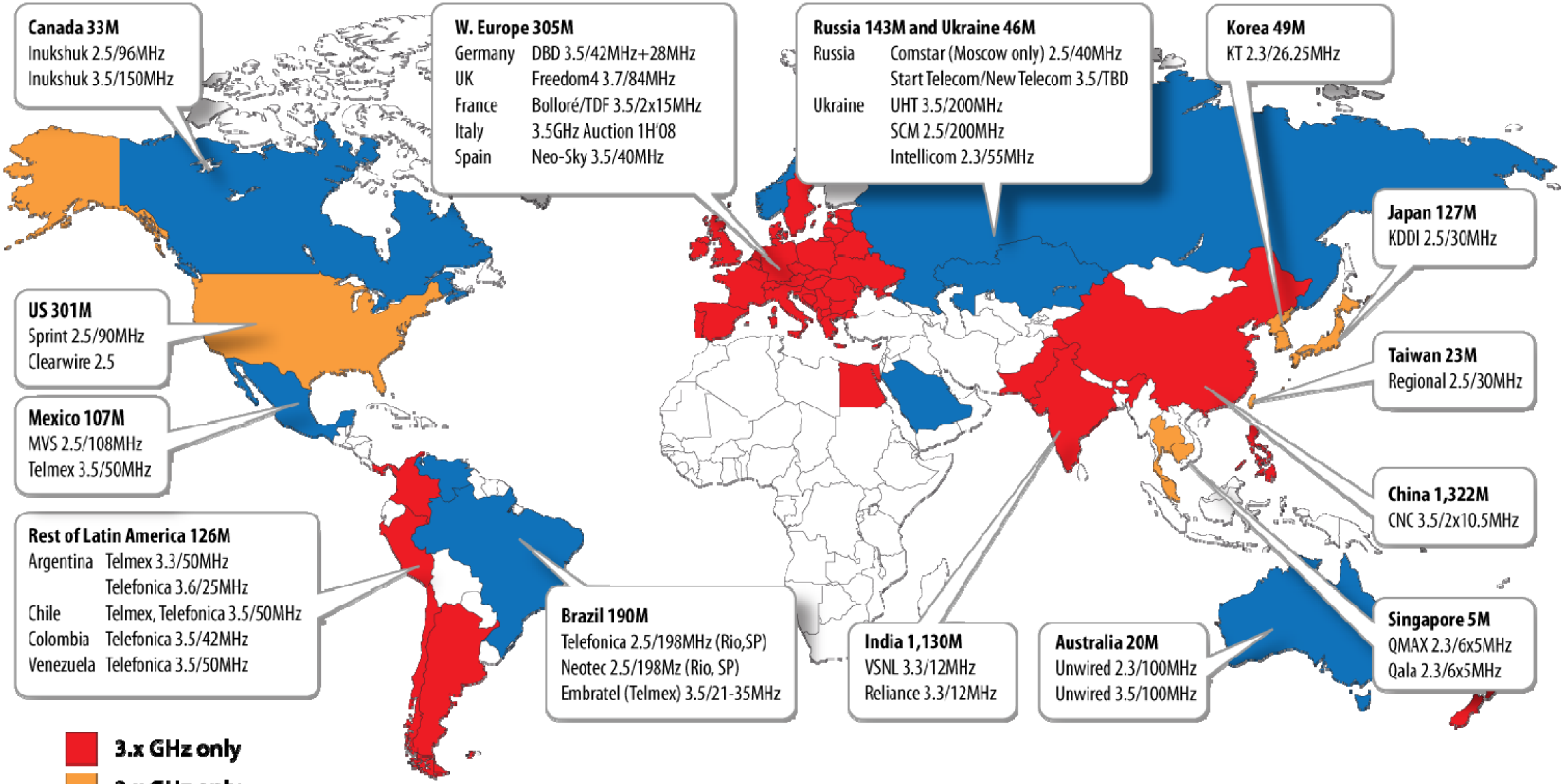
Consumer market demand drives WiMAX devices availability

260 commercial deployments in 110 countries


In Service
In Deployment

Source: Informa, WiMAX Forum

WIMAX can reach 4 Billion People



Canada 33M
Inukshuk 2.5/96MHz
Inukshuk 3.5/150MHz

W. Europe 305M

Germany	DBD 3.5/42MHz+28MHz
UK	Freedom4 3.7/84MHz
France	Bolloré/TDF 3.5/2x15MHz
Italy	3.5GHz Auction 1H'08
Spain	Neo-Sky 3.5/40MHz

Russia 143M and Ukraine 46M

Russia	Comstar (Moscow only) 2.5/40MHz Start Telecom/New Telecom 3.5/TBD
Ukraine	UHT 3.5/200MHz SCM 2.5/200MHz Intellicom 2.3/55MHz

Korea 49M
KT 2.3/26.25MHz

Japan 127M
KDDI 2.5/30MHz

US 301M
Sprint 2.5/90MHz
Clearwire 2.5

Taiwan 23M
Regional 2.5/30MHz

Mexico 107M
MVS 2.5/108MHz
Telmex 3.5/50MHz

China 1,322M
CNC 3.5/2x10.5MHz

Rest of Latin America 126M

Argentina	Telmex 3.3/50MHz Telefonica 3.6/25MHz
Chile	Telmex, Telefonica 3.5/50MHz
Colombia	Telefonica 3.5/42MHz
Venezuela	Telefonica 3.5/50MHz

Brazil 190M
Telefonica 2.5/198MHz (Rio,SP)
Neotec 2.5/198Mz (Rio, SP)
Embratel (Telmex) 3.5/21-35MHz

India 1,130M
VSNL 3.3/12MHz
Reliance 3.3/12MHz

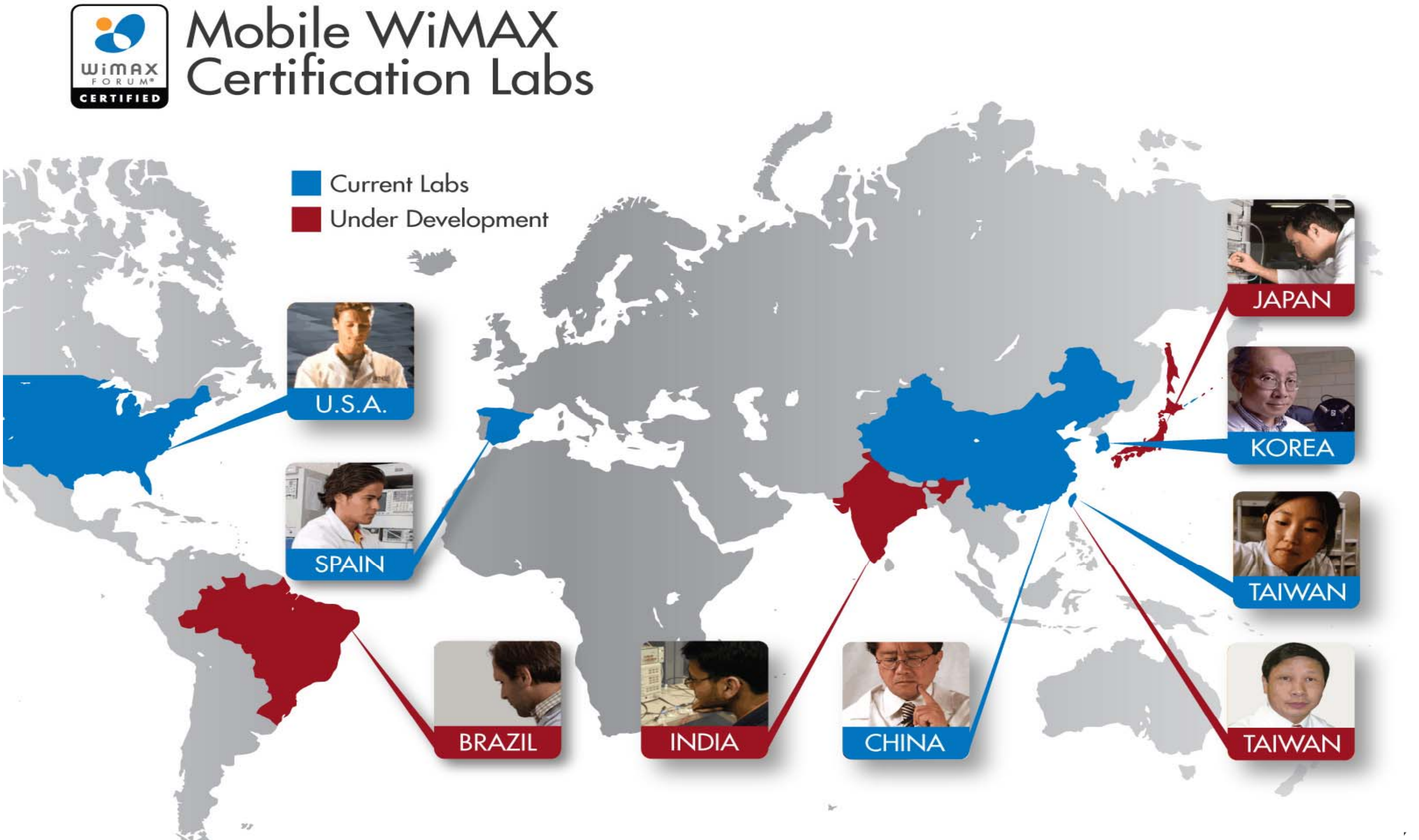
Australia 20M
Unwired 2.3/100MHz
Unwired 3.5/100MHz

Singapore 5M
QMAX 2.3/6x5MHz
Qala 2.3/6x5MHz

🟥 **3.x GHz only**
🟧 **2.x GHz only**
🟦 **Both 2.x/3.x GHz**

Source: WiMAX Forum

Certification Labs


Mobile WiMAX Certification Labs
WiMAX FORUM CERTIFIED
🟦 Current Labs
🟥 Under Development
U.S.A.
SPAIN
BRAZIL
INDIA
CHINA
JAPAN
KOREA
TAIWAN
TAIWAN

Source: WiMAX Forum

WiMAX Supports a Wide Variety of Devices

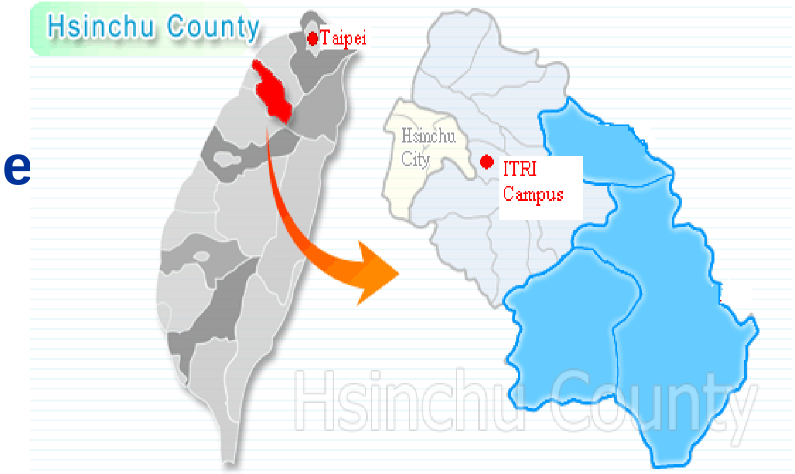
Fixed & Portable Devices

Business Devices

Entertainment devices

M-Taiwan WiMAX Applications Lab Opens in Taiwan

- First proof-of-concept lab endorsed by WiMAX Forum
- An open program to promote innovative applications
- Taiwan Lab serves as a model for proof-of-concept
- Lab at Industrial Technology Research Institute (ITRI) Campus in Hsinchu
- Alvarion solution used for test be


Hsinchu County
Taipei
Hsinchu City
ITRI Campus
Hsinchu County

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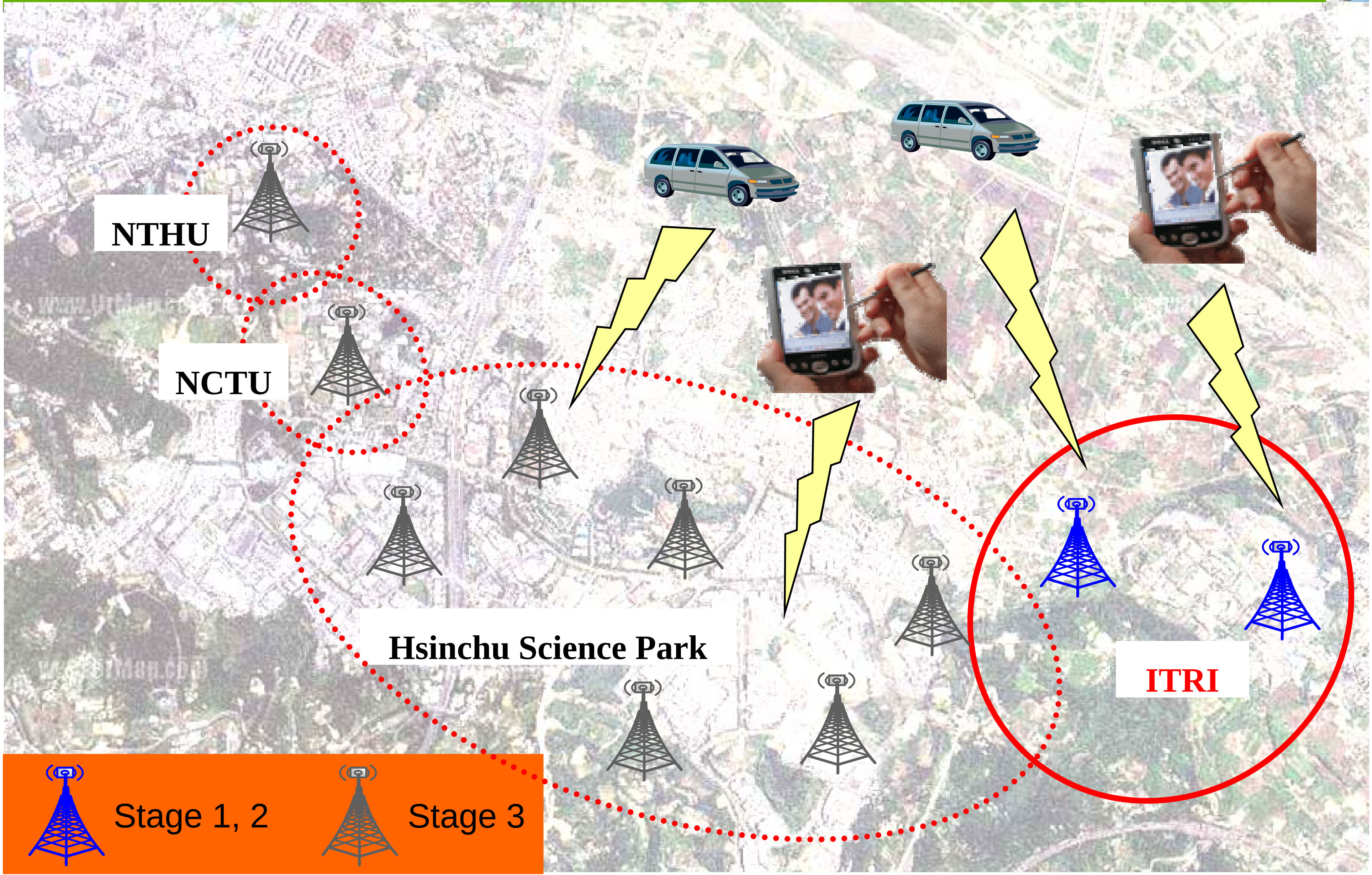
MTWAL Network Coverage


NTHU
NCTU
Hsinchu Science Park
ITRI
Stage 1, 2
Stage 3

WiMAX at 700MHz

- Major auction in US
- Allocation likely in many countries
- WiMAX Forum working on defining profiles for 700Mhz
- 700 MHz deployment is a good compliment to 2.5GHz and 3.5 GHz networks
- Deployment advantages in rural and low density regions
- WiMAX Ecosystem is gearing up to provide solutions in 2009

WiMAX Forum – Certification

802.16 Certification by WiMAX Forum (1)

- One of the main objectives of WiMAX Forum is certification of equipment
  - Before certification labs are ready, Plugfests are conducted to promote interoperability
  - Certification is developed for system profiles for specific band-classes
- A system profile is a list of 802.16 features where next to each feature is indicated whether it is mandatory or not.
- Band-classes are defined by the triplet:
  - Frequency, Duplexing Method (TDD, FDD, HD-FDD), Channel Bandwidth
- Certification is conducted for profiles and bandclasses that are supported by at least 3 manufacturers

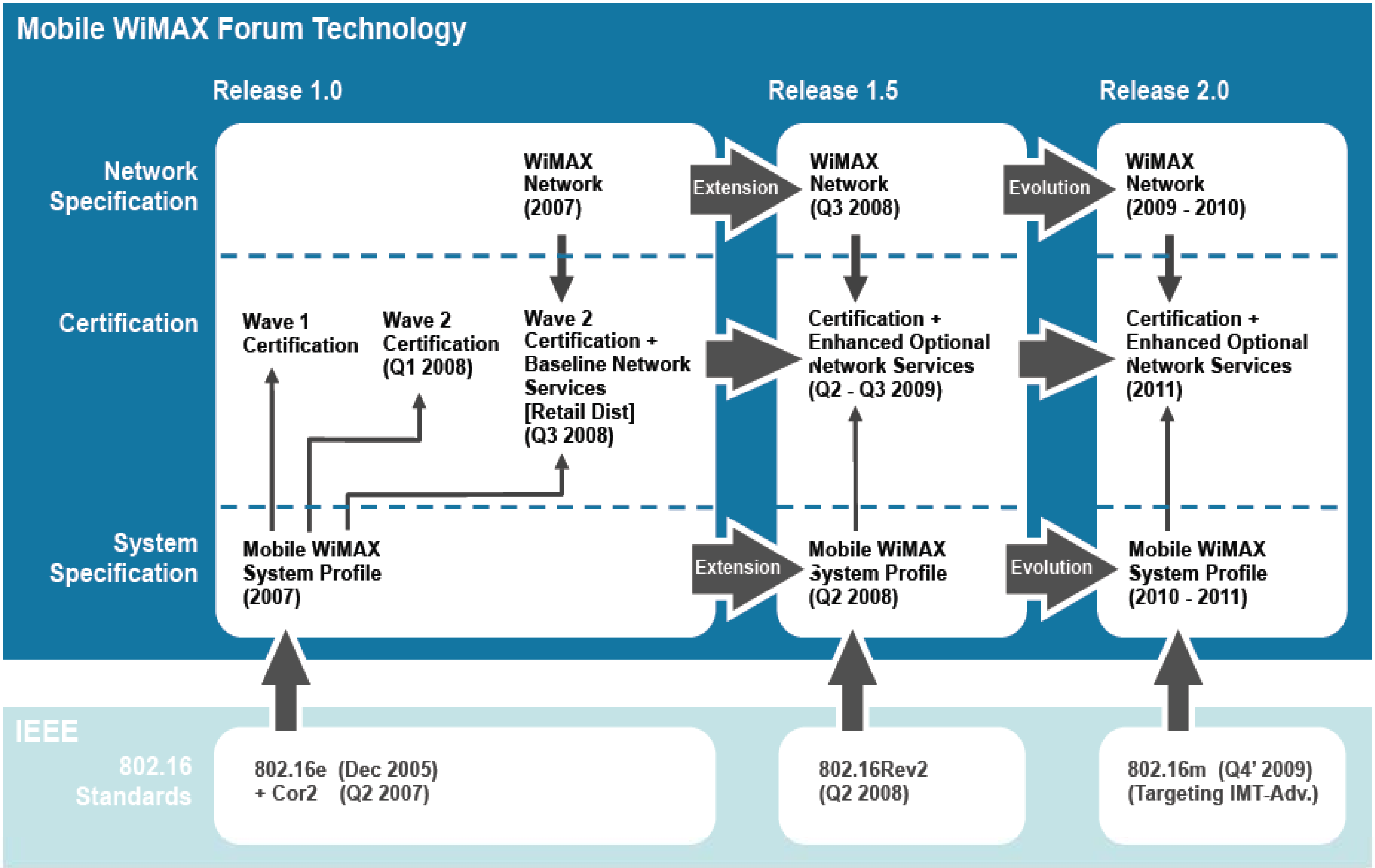
802.16 Certification by WiMAX Forum (2)

- Certification is comprised of three types of testing: PCT, RCT, MIOT
  - PCT – Protocol Conformance Testing: MAC
  - RCT- Radio Conformance Testing: Radio + PHY
  - MIOT – Interoperability Testing
- Certification is divided into “Waves”, as features are developed by manufacturers and testing scripts are developed
- For Mobile WiMAX each wave was further subdivided into phases to facilitate swifter service introduction

Mobile WiMAX Roadmap

Mobile WiMAX Release	Air protocol	Network Protocol	Main features	Certification Schedule
Release 1.0	802.16e-2005	NWG 1.0	TDD MIMO E2E IP network	Wave 1 – April’08 Wave 2 – start @June08
Release 1.5	802.16REV2	NWG 1.5	FDD (+ TDD) VoIP optimizations	H2’09
Release 2.0	802.16m	NWG 2.0	TDD + FDD Improved performance	2010-2011

WiMAX Forum Evolution Vision



Mobile WiMAX Forum Technology

	Release 1.0	Release 1.5	Release 2.0
Network Specification	WiMAX Network (2007)	WiMAX Network (Q3 2008)	WiMAX Network (2009 - 2010)
Certification	Wave 1 Certification Wave 2 Certification (Q1 2008) Wave 2 Certification + Baseline Network Services [Retail Dist] (Q3 2008)	Certification + Enhanced Optional Network Services (Q2 - Q3 2009)	Certification + Enhanced Optional Network Services (2011)
System Specification	Mobile WiMAX System Profile (2007)	Mobile WiMAX System Profile (Q2 2008)	Mobile WiMAX System Profile (2010 - 2011)
IEEE 802.16 Standards	802.16e (Dec 2005) + Cor2 (Q2 2007)	802.16Rev2 (Q2 2008)	802.16m (Q4' 2009) (Targeting IMT-Adv.)

A fully backward compatible evolution on standards and products

Projections, subject to change

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Certification Schedule of Mobile WiMAX Release 1.0

		Description	**Lead Operator**	**Band-class (Freq, BW, Duplex)**	**WiMAX Estimated dates**	**ALVR Estimated dates**	**Comments**
Wave 1	**Phase 1**	Very basic operation	KT	2.3GHz, 8.75MHz, TDD	Apr'08		Wave 1 does not include MIMO/BF For Korea WiBRO service ONLY H-ARQ - excluded from Phase 1
	Phase 2						Deleted by Board in Taiwan Oct'2007
Wave 2	**Phase 1**	MIMO Mandatory for MS	SPRINT	2.5GHz, 5MHz and 10MHz, TDD	Q2'08	June '08 - Oct. '08	
	Phase 2	MS has also BF Mandatory	SPRINT	2.5GHz, 5MHz and 10MHz, TDD	Q3'08	Q4'08 - Q1'09	Mobile WiMAX

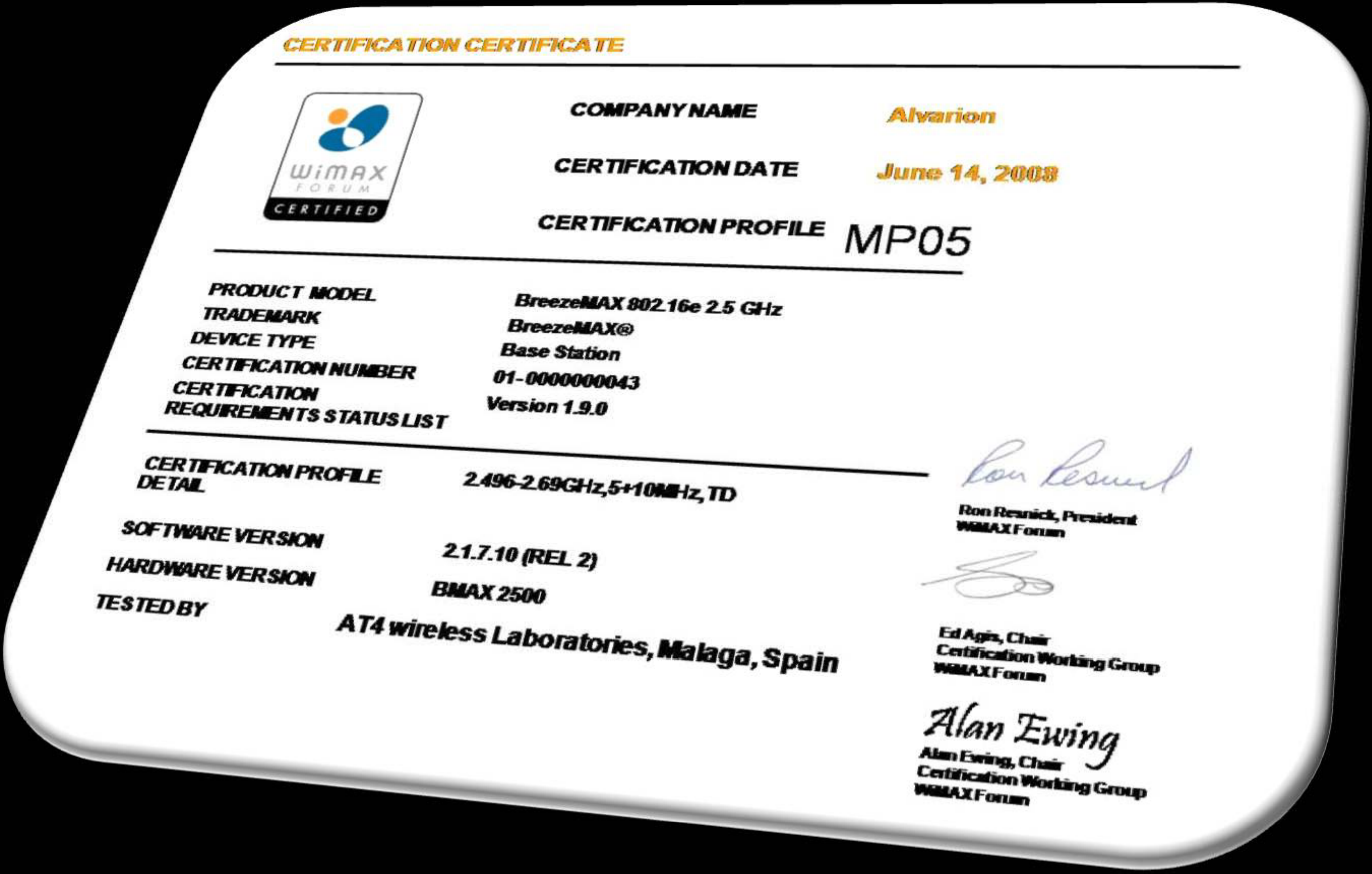
- **Wave 1 Phase 1 happened already (PR in April'08)**
  - **Limited to S. Korea**
- **Wave 2 Phase announced in Amsterdam in June 17, 2008**
  - **Alvarion CERTIFIED!**

What was certified recently?

- **Wave 2 certification includes 10 Mobile WiMAX MIMO 2.5 GHz products (MP05 certification)**
  - **4 Base Station products**
  - **6 ‘Subscriber Units’ (CPE’s)**
- **Who received Base Station certification?**
  - **Alvarion**
  - **Sequans**
  - **Motorola**
  - **Samsung**
- **Who received MS certification?**
  - **Intel**
  - **Zyxel**
  - **Airspan**
  - **Beceem**
  - **Samsung**
  - **Sequans**

MiMAX
MIMO WiMAX USB
Airspan
SAMSUNG
SAMSUNG
CMC73000
BECEEM
SAMSUNG
Mobile WiMAX

WiMAX Forum Certification for BreezeMAX 16e 2.5 GHz



CERTIFICATION CERTIFICATE

WiMAX FORUM CERTIFIED

COMPANY NAME	Alvarion
CERTIFICATION DATE	June 14, 2008
CERTIFICATION PROFILE	MP05

PRODUCT MODEL	BreezeMAX 802.16e 2.5 GHz
TRADEMARK	BreezeMAX®
DEVICE TYPE	Base Station
CERTIFICATION NUMBER	01-0000000043
CERTIFICATION REQUIREMENTS STATUS LIST	Version 1.9.0

CERTIFICATION PROFILE DETAIL	2.496-2.69GHz,5+10MHz,TD
SOFTWARE VERSION	2.1.7.10 (REL 2)
HARDWARE VERSION	BMAX 2500
TESTED BY	AT4 wireless Laboratories, Malaga, Spain

Ron Resnick

Ron Resnick, President
WiMAX Forum

Ed Agis, Chair
Certification Working Group
WiMAX Forum

Alan Ewing

Alan Ewing, Chair
Certification Working Group
WiMAX Forum

Wave 2 Phase 1 certification

- MIMO
  - MIMO (both UL and DL) is mandatory on MS side but optional for BST
  - Alvarion provided BST with DL MIMO and UL MIMO
    - To assist in MS certification
    - Alvarion certification includes the optional (at BST) MIMO features!

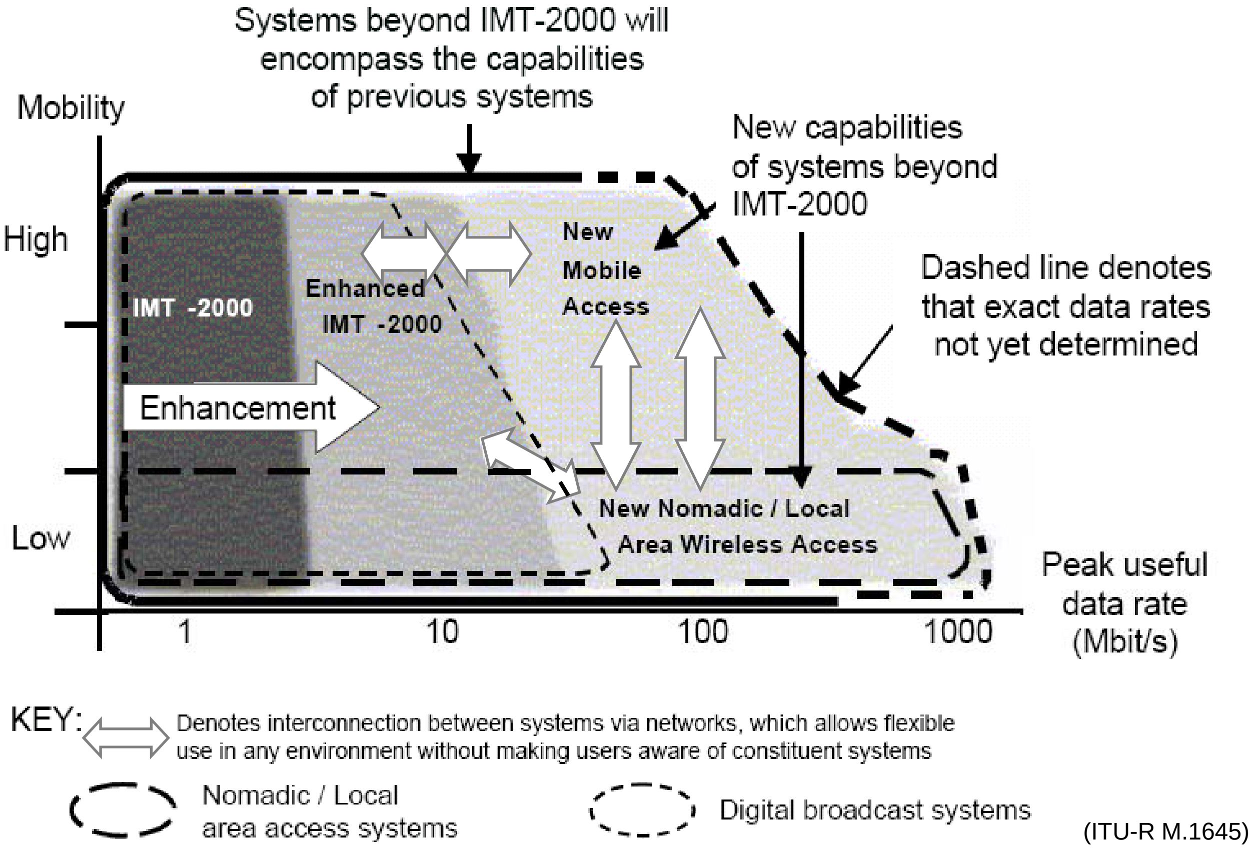
Certification Status – 2.5 GHz

- Certification has two processes
  - Validation of test equipment and of the test protocols
  - Certification of individual equipment vendors
  - Alvarion is participating in both processes
- Presently WF is continuing working on Validation and Certification of phase 2 of mobile WiMAX Wave 2
  - for 2.5GHz and 10MHz BW (5MHz as well)
- Goal to complete phase 2 of Wave 2 towards October’08
  - Though possibly may take till end of 2008

IEEE802.16m – targeting IMT-Advanced

IMT-Advanced

- **ITU is looking at next generation of mobile technology under the umbrella of IMT-Advanced**
  - 1 Gb/s stationary, 100 Mb/s mobile



Systems beyond IMT-2000 will encompass the capabilities of previous systems
Mobility
High
Low
New capabilities of systems beyond IMT-2000
Dashed line denotes that exact data rates not yet determined
IMT -2000
Enhanced IMT -2000
Enhancement
New Mobile Access
New Nomadic / Local Area Wireless Access
1
10
100
1000
Peak useful data rate (Mbit/s)
KEY:
Denotes interconnection between systems via networks, which allows flexible use in any environment without making users aware of constituent systems
Nomadic / Local area access systems
Digital broadcast systems

(ITU-R M.1645)

IEEE 802.16m Project

- Scope
  - Defines a 802.16 Advanced amendment to create a standard suitable for IMT-Advanced
  - Expects to significantly improve mobile performance more than 2-3X the current 802.16e capabilities
- Status/Schedule
  - IEEE 802.16m Project was started in Task Group m (TGm) in Jan 2007
  - TGm has developed a System Requirements Document (SRD)and an Evaluation Methodology Document (EMD)
  - TGm is developing a System Description Document (SDD) that is the architecture and design of the 802.16m air interface that expected to complete in Nov 2008
  - An initial IMT-Advanced candidate submission based on 802.16m SDD is planned for Jan 2009
  - The 802.16m standard is expected to be complete by March 2010

802.16 Evolution for IMT-Advanced

- Continuation project named 802.16m
- Targeted to meet the requirements of IMT-Advanced
- Backwards compatibility to 802.16e
  - 802.16e CPEs will work with 802.16m BSs
  - 802.16e BSs will be able to operate in 802.16m network
- Provides confidence to operators that 802.16 technology is future proof
- Provides security for current investments

4

Conclusions

Conclusion

- WiMAX enables a new open internet model
  - WiMAX provides superior performance than any other wireless technology available today
- WiMAX has global momentum
  - 260+ deployments
  - Thriving ecosystem
  - Major initiatives in US, Japan, India, Taiwan, Europe
  - 700MHz represents new opportunity
- State of the art certification program will drive economies of scale
- Certification
  - Wave 1 → Korea only, April’08
  - Wave 2 Phase 1 → MIMO, June’08
  - Wave 2 Phase 2 → MIMO+BF, EOY’08
- Long term technology
  - 16m – next generation air-protocol, backwards compatible to 16e and enhanced performance (2x)

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Your Open WiMAX Choice

Thank You