



Talk 1

B3G/4G: Technology Trends and International Activities

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Introduction

- Mobile systems experience a paradigm shift roughly in a 10-year cycle. Now is the time to begin the conceptual work on the systems beyond 3rd generation.
- There has been a general downturn in communication and IT industry. Transition from a voice-oriented to data-oriented services is not smooth as expected. New applications that could attract significant traffic are hard to find.
- It can be expected that mobile access to Internet will outnumber of fixed access in a very near future.


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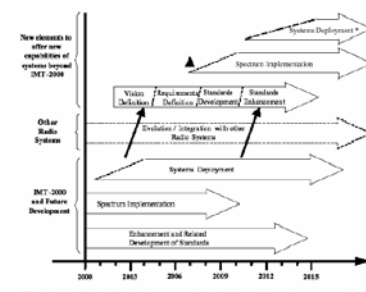
International Research Activities

- ITU-R WP8F
- Wireless World Research Forum (International)
- 4Gmobile (International)
- IEEE 802.20 (International)
- Mobile IT Forum (Japan)
- FuTURE (China)
- 4G committee (Korea)

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ITU-R WP8F (International Telecommunication union)



The diagram shows a timeline from 2000 to 2010. Key milestones include:

- 2000: ITU-R WP8F and Future Development
- 2001: Vision, Requirements, Standards, and System Deployment
- 2002: Initial time plan approved
- 2003: Revised plan
- 2004: Voted
- 2005: Spectrum implementation
- 2006: System Deployment
- 2007: Vision, Requirements, Standards, and System Deployment
- 2008: Spectrum implementation
- 2009: System Deployment
- 2010: System Deployment

- Source: ITUR radio communication study group 8.
- Initial time plan approved, October 2002.
- Revised, February 2003.
- Voted, June 2003.


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Wireless World Research Forum ([http:// www.wireless-world-research.org](http://www.wireless-world-research.org))

- Founded by Alcatel, Ericsson, Motorola, Nokia, and Siemens in early 2001.
- Objectives
 - To formulate visions on strategic future research directions, involving industry and academia.
 - To generate, identify and promote research areas and technical trends for mobile and wireless system technologies toward a Wireless World.
 - To contribute to the definition of international and national research programs.
 - Provide a global platform for discussion of results, exchange of view to initiate global cooperation towards systems **beyond 3rd generation**.
 - To contribute to making the wireless market a vibrant growing global market, providing new opportunities for success for all sectors.

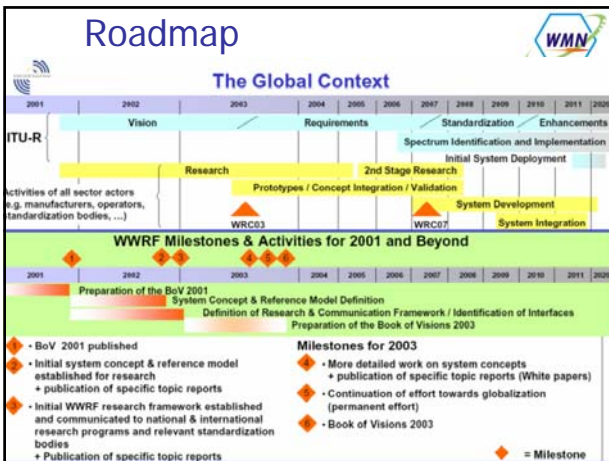
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- Strategies
 - To harmonize views on future market requirement, research topics for future systems.
 - To build collaboration between academia and industry and between converging industry sectors.
 - To jointly develop commonly agreed research.
 - To disseminate and input results to standard bodies in order to ease future standardization and hence develop global market for products and services.

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- ## Working Groups
- WG1
 - Scenarios and analysis
 - Reference model
 - UI technologies and techniques
 - UCD process
 - WG2
 - Terminology (basic terms for WG2)
 - Business Model
 - Personalization
 - Ambient Awareness
 - Adaptability
 - Generic Service Elements
 - Enabling Technologies
 - WG3
 - Vision and roadmap
 - Research challenges and priorities
 - Architectural Principles
 - Network Component Technologies for Cooperative Networks
 - E2E Reconfigurability
 - WG4
 - Smart Antennas, MIMO systems
 - Ultra Wideband
 - New Air Interface (3 in this area)
 - Requirements and Technologies
 - Broadband Multicarrier
 - Mixed OFDM plus single-carrier
 - Ad Hoc Networking
 - Short Range Communications
 - Relay-based Deployment Concepts for Wireless and Mobile Broadband Cellular Radio
 - Wireless Internet
- New document Stable draft Stable version
 First draft Draft

- ## Visions of WRRF
- Cyberworld:** A world parallel to our real world created and sustained by the world's computers, wearable communication terminals and device-less interactions, where we can stay in touch with our agents, knowledge bases, communities, services and transactions.
 - Wireless world:** A set of technologies that will enable us to become permanent residents in the Cyberworld.
 - Radio Access
 - Connectivity
 - Services Platform
 - Cyberworld

Multi-Sphere Models for Cyberworld

- Level 1: The PAN (Personal Area Network):** Communication facilities will be contained in cloths and wearable items. On request they will start to discover and distribute a common virtual terminal over us.

- Level 2: The Immediate Environment :** TV sets should know what programmes we are interested in, toasters might want to deliver toast with the right level of toasting and fridges might want to tell us what we probably would like to re-order as we might run out of milk over the weekend.

- Level 3: Instant Partners such as Car:** For Relay Information, Entertainment on the Move

Level 4: Radio Access : Wide Area Coverage

Level 5: Interconnectivities: The value of communications technologies is to grow proportionally to the square of the number of the connected devices. It is crucial to maintain universal wireless interconnectivity, as in today's mobile Internet core networks.

Level 6: Cyberworld: A parallel world created and sustained by the world's computers, wearable communication terminals and deviceless interactions, where we can stay in touch with our agents, knowledge bases, communities, services and tractions.

Existing Wireless Access Environment

Mobility	Speed (Mbps)	Technology
Outdoor - Vehicle	0.1 - 100	GSM, IS-95, D-AMPS
Outdoor - Walk	0.1 - 100	UMTS
Outdoor - Fixed	0.1 - 100	WLAN (IEEE 802.11), HyperLAN2
Indoor - Walk	0.1 - 100	Bluetooth
Indoor - Fixed/Desktop	0.1 - 100	WBB-LAN
Indoor - Fixed/Desktop	100 - 1000	Local Area Network (LAN) - Hot Spots-high speed

Cooperative Networks

Services and Applications

IP-based Core Network

New Systems (4G)

2G/3G

Mobile Cellular

WLAN (IEEE 802.11, HyperLAN)

Distribution

Bluetooth Home RF

WPAN

BAN

Wired/Wireless Fixed Access

MMS/LMDS (IEEE 802.16a)

DAB/DVB/Satellite

Legend:

- Inter-system handover
- Intra-system handover
- CCC: common coordination channel

<http://4Gmobile.com>

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4Gmobile Forum

- **Mission:** To provide a technical forum to promote exchange of technology advancement resulted from academic and industry research and development efforts to facilitate the realization of the **4G** Mobile Vision.
- **Objective:** To define the Open Wireless Platform Architecture supporting the convergence of **broadband** wireless mobile and wireless access.

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Mobile Office Project



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What's 4G mobile technologies ?

- **Answers:**
 - a) Open Wireless Architecture (OWA)
 - b) Cost-effective and Spectrum-efficient High-speed wireless mobile transmission

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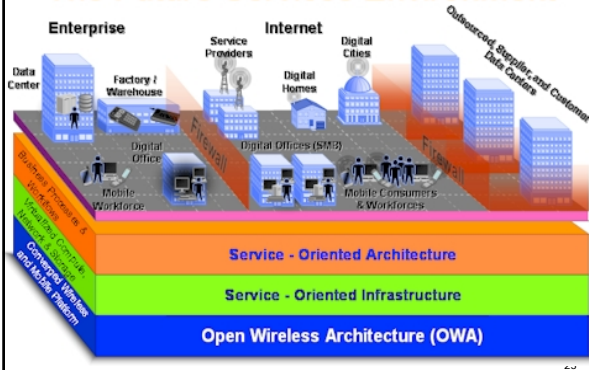
Working Groups (2006)

- Working Group 1 on Terminal Power Technology
- Working Group 2 on System Architecture
- Working Group 3 on New Air Interfaces
- Working Group 4 on RF and Antenna Technology
- Working Group 5 on Signal Processing
- Working Group 6 on Access Control
- Working Group 7 on Wireless Networks & Ad Hoc
- Working Group 8 on Operating Systems (OS)
- Working Group 9 on Spectrum Management
- Working Group 10 on Radiation and Safety
- Working Group 11 on Secured Applications
- Working Group 12 on Quality of Services
- Working Group 13 on Programmable Modules
- Working Group 14 on Inter-operability and Optimization
- Working Group 15 on General Convergence

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The Future Services Environment



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- With this technology, one integrated terminal with one global personal number can access freely any wireless air interfaces, and the radio transmission modules are fully software-definable, reconfigurable and programmable.
- The **All-IP** will be terminated at the wireless end-terminal to enable End-to-End direct signaling and QoS guarantee.

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- The network layer and the lower layers will be combined together to construct the common broadband wireless super-engine of this 4Gmobile - **Open Wireless Architecture**.
- Activities
 - 1st annual 4Gmobile, October 2003.
 - Annual summit: World Wireless Congress
 - WWC 2004, May 25-28, San Francisco

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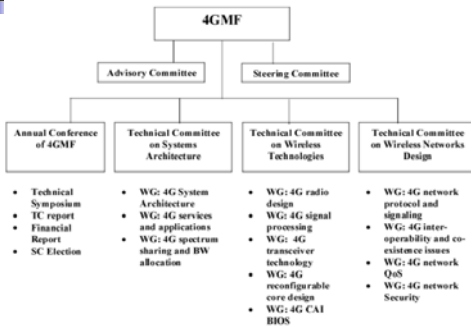
4GMF Deliverables

- Proceedings of Annual Conference of 4GMF.
- Annual Summary Book of Technical Reports
 - resulted from all Technical Committees. Specifications, air interfaces, protocols, system architectures and other similar guidelines related to fourth-generation mobile technologies that may be developed, adopted, published or otherwise made available to the public by 4GMF.

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Organization



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IEEE 802.20 : Mobile Broadband Wireless Access (MBWA)

<http://grouper.ieee.org/groups/802/20>

- Established in December 2002 and to be Done by December 2004.

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Objectives

- To develop the specification for an efficient packet based air interface that is optimized for the transport of IP based services.
- To enable worldwide deployment of affordable, ubiquitous, always-on and interoperable multi-vendor mobile broadband wireless access networks that meet the needs of business and residential end user markets.


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- **Scope:** to develop specification of physical and medium access control layers of an air interface for interoperable mobile broadband wireless access systems.
 - operates in licensed bands below 3.5 GHz.
 - optimized for IP-data transport, with peak data rates per user in excess of 1 Mbps.
 - supports various vehicular mobility classes up to 250 Km/h in a MAN environment.
 - targets spectral efficiencies, sustained user data rates and numbers of active users that are all significantly higher than achieved by existing mobile systems.

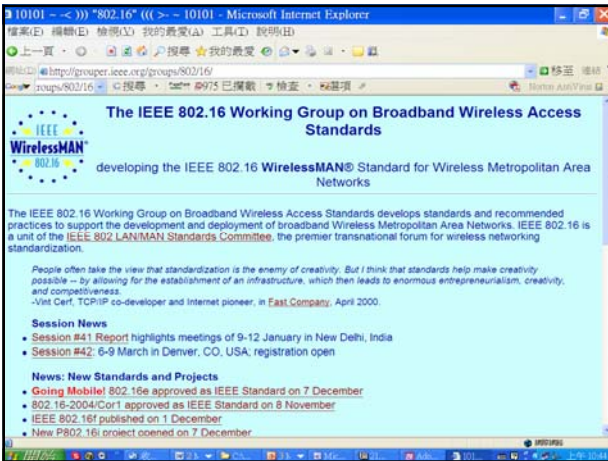
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- **Purposes:**
 - Enable worldwide deployment of cost effective, spectrum efficient, always on and interoperable mobile broadband wireless access systems in order to address user needs for:
 - Mobile and ubiquitous Internet access.
 - Transparent support of Internet applications
 - Access to enterprise intranet services
 - Transparent access to Infotainment and location services
 - Fills the performance gap between the high data-rate low mobility services currently developed in IEEE 802 and the high mobility cellular networks.

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The IEEE 802.16 Working Group on Broadband Wireless Access Standards

developing the IEEE 802.16 WirelessMAN® Standard for Wireless Metropolitan Area Networks

The IEEE 802.16 Working Group on Broadband Wireless Access Standards develops standards and recommended practices to support the development and deployment of broadband Wireless Metropolitan Area Networks. IEEE 802.16 is a unit of the IEEE 802 LAN/MAN Standards Committee, the premier transnational forum for wireless networking standardization.

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.

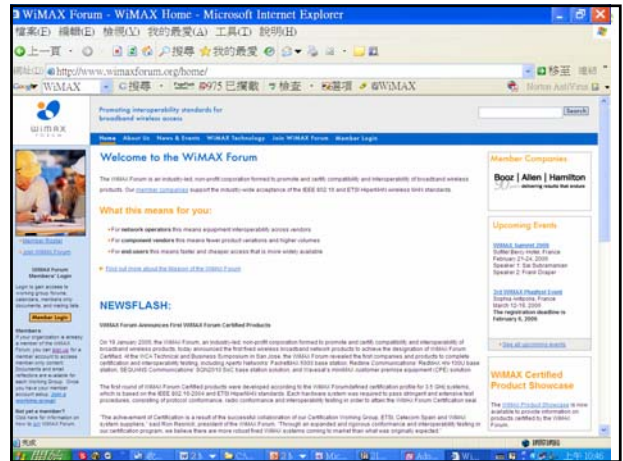
-Vint Cerf, TCP/IP co-developer and Internet pioneer, in *Fast Company*, April 2000.

Session News

- **Session #41 Report** highlights meetings of 9-12 January in New Delhi, India
- **Session #42** 6-9 March in Denver, CO, USA, registration open

News: New Standards and Projects

- **Going Mobile!** 802.16e approved as IEEE Standard on 7 December
- 802.16-2004/Cor1 approved as IEEE Standard on 8 November
- IEEE 802.16f published on 1 December
- New 802.16i project opened on 7 December



WiMAX Forum - WiMAX Home - Microsoft Internet Explorer

Presenting interoperability standards for broadband wireless access

Welcome to the WiMAX Forum

The WiMAX Forum is an industry-led, non-profit corporation formed to promote and certify compatibility and interoperability of broadband wireless products. Our www.wimaxforum.org reports the industry-wide acceptance of the IEEE 802.16 and 802.16E (referred to as 802.16 standards).

What this means for you:


- For network operators this means equipment interoperability across vendors
- For component vendors this means lower product volumes and higher volumes
- For end users this means faster and cheaper access that is more widely available

NEWSFLASH:

WiMAX Forum Announces First WiMAX Forum Certified Products

On 19 January 2005, the WiMAX Forum, an industry-led, non-profit corporation formed to promote and certify compatibility and interoperability of broadband wireless products, today announced the first four wireless equipment vendors products to achieve the designation of WiMAX Forum Certified. The U.S. Technical Specifications Group (TS-G), the WiMAX Forum's standard development group, and projects to complete certification and interoperability testing, including system interoperability (SI) tests, feature compatibility (FC) tests, and interoperability (I) tests, are now complete. The first four WiMAX Forum Certified products were developed according to the WiMAX Forum's certification profile for 3.1 GHz systems, which is based on the IEEE 802.16-2004 and 802.16E standards. Each hardware system was required to pass stringent and extensive test procedures, consisting of protocol conformance, radio conformance and interoperability testing in order to obtain the WiMAX Forum Certification seal.


The achievement of Certification is a result of the successful collaboration of our Certification Working Group (CWG), Certification System and Interop (CSI) teams, and our members, said Ron Perrele, president of the WiMAX Forum. "Through an expanded and rigorous conformance and interoperability testing in our certification program, we believe there are more robust fixed WiMAX systems coming to market than what was originally expected."



System Characteristics

Characteristic	Value for 1.25 Mhz	Value for 5 Mhz
Mobility	up to 250 km/hr	
Sustained spectral efficiency	> 1 b/s/Hz/cell	
Peak user data rate (Downlink (DL))	> 1 Mbps	> 4Mbps
Peak user data rate (Uplink (UL))	> 300 Kbps	> 1.2 Mbps
Peak aggregate data rate per cell (DL)	> 4 Mbps	> 16 Mbps
Peak aggregate data rate per cell (UL)	> 800 Kbps	> 3.2 Mbps
Airlink MAC frame RTT	<10 ms	
Spectrum (Maximum operating frequency)	< 3.5 GHz	

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Relationship with Other Cellular Systems

Dimension	802.16e	802.20	3G
End-user	High data rate fixed wireless user with adjunct mobility service	Fully mobile, high throughput data user	Voice user requiring data services
	Symmetric data services	Symmetric data services	Highly asymmetric data services
	End-user devices for fixed subscribers (DPE) and PC Cards for mobile devices	End-user devices initially PC Card enabled data devices	End user devices, initially data enabled handsets
Service Provider	Support of low-latency data and real time voice services	Support of low-latency data services	Lack of support for low latency services
	Evolving of Fixed Wireless service providers and WISPs adding mobility as enhancement to service offering	Wireless Data Service provider – Greenfield start or evolving Cellular carrier	Cellular voice service provider evolving to data support
	Local/Regional mobility and roaming support	Global mobility and roaming support	Global mobility and roaming support

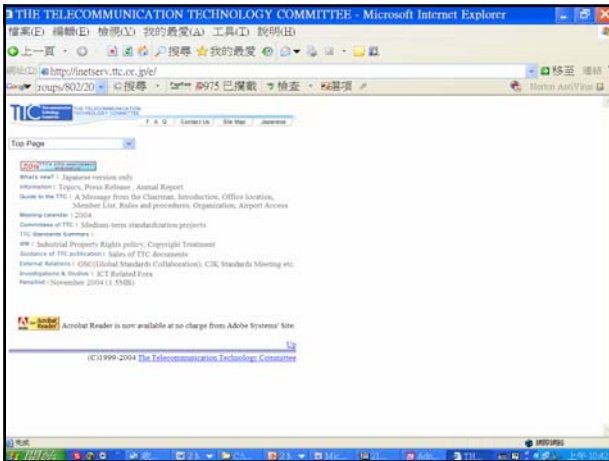
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Relationship with Other Cellular Systems

Dimension	802.16e	802.20	3G
Technology	Extensions to 802.16a MAC & PHY Optimized for and backwards compatible with fixed stations Licensed bands 2.4 GHz Typical Channel BW >5 MHz Packet oriented architecture Channelization and control for multimedia services with QoS High efficiency data uplinks and downlinks Low latency architecture	New PHY & MAC optimized for packet data and adaptive antennas Optimized for full mobility Licensed bands below 3.5 GHz Typical Channel BW < 5 MHz Packet oriented architecture Channelization and control for mobile multimedia services, Mobile-IP Based High efficiency data uplinks and downlinks Low latency data architecture	W-CDMA, cdma2000 Evolving of GSM or IS-41 Licensed bands below 2.7 GHz Typical Channel BW < 5 MHz Circuit oriented architecture—evolving to packet on the downlink Channelization and control optimized for mobile voice services, MAP/QoS based Medium efficiency data downlinks, low efficiency uplinks High latency data arch

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- ## Japanese Telecommunication Technology Council (TTC)
- http://www.ttc.or.jp/e
 - Mobile IT Forum (MAGIC)
 - Mobile multimedia
 - Any time, anywhere, anyone
 - Global mobility support
 - Integrated wireless solutions
 - Customized personal services
 - NTT DoCoMo VSF-OFCDM System (Variable Spreading Factor, Orthogonal Frequency and Code Division Multiplexing)
 - To Be Tried.
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- ## FuTURE: Future Technology for Universal Radio Environment
- Part of China's 863 Program for 10th 5-year plan (2001-2005)
 - Objective:** To establish a universal radio experience environment that can meet the future application demands and development trends towards years of 2005 to 2010,
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